ALLIANCE DEFENDING
FREEDOM
FOR FAITH. FOR JUSTICE.

September 11, 2022

Miguel A. Cardona
Secretary of Education
U.S. Department of Education
VIA REGULATIONS.GOV

RE: Nondiscrimination on the Basis of Sex in Education Programs or Activities Receiving Federal Financial Assistance
Docket ID ED-2021-OCR-0166

The Rule Will Undermine Fairness in Women's Sports and Hurt Women and Girls' Privacy and Safety

Dear Secretary Cardona,

Fifty years ago, Congress acted to protect equal opportunity for women by passing Title IX. Now, by radically rewriting federal law, the Biden administration is threatening the advancements that women have long fought to achieve in education and athletics. Along with denying women a fair and level playing field in sports, this new rule seeks to impose widespread harms, including threatening the health of adults and children, denying free speech on campus, trampling parental rights, violating religious liberty, and endangering unborn human life.

Alliance Defending Freedom (ADF) submits these comments on the Notice of Proposed Rulemaking (NPRM) on Title IX of the Education Amendments of 1972, Docket ID ED-2021-OCR-0166. ADF is an alliance-building legal organization that advocates for the right of all people to freely live out their faith. It pursues its mission through litigation, training, strategy, and funding. Since its launch in 1994, ADF has handled many legal matters involving Title IX, the First Amendment, athletic fairness, student privacy, and other legal principles addressed by the Notice of Proposed Rulemaking.

ADF strongly opposes any effort to redefine sex in federal regulations inconsistent with the text of Title IX itself, or otherwise impair First Amendment rights, due process rights, or parental rights. ADF thus encourages the Department of Education to withdraw and abandon the NPRM.

These comments focus on the negative impact of the proposed rule on fairness in women's athletics and on female privacy. By redefining "sex" to include "gender identity," the proposed rule will open sex-segregated spaces like athletic teams, restrooms, locker rooms, dorm rooms and single-sex admissions programs to anyone who identifies as a woman, regardless of that individual's biology.

I. Redefining "sex discrimination" to include gender identity hurts female athletes.

Earlier this year in an Atlanta swimming pool, swimmer Lia Thomas won the woman's NCAA Division I Championships in the 500-yard freestyle—beating two former Olympians in the same race.[1] Watching an athlete triumph at the pinnacle of women's collegiate swimming should have been cause for celebration. But it wasn't.

Fifteen women were bumped down the scoreboard that day.[2] Emma Weyant was denied a first-place championship trophy.[3] Erica Sullivan was pushed to third place.[4] Brooke Forde was eliminated from the winners' podium.[5] And some women didn't get to compete in the finals at all.[6] Most news reports ignored these talented women, focusing instead on Thomas—the lone biological male who dominated the women's race. Women who felt uncomfortable with male nudity in the locker room were silenced.[7]

A championship event that *should* have exemplified the value of giving women equal opportunities instead showcased the harm inflicted on female athletes when even one male is allowed to compete in women's sports.[8] These harms—which are far greater than *de minimis*—will proliferate if the Department adds proposed section 106.10 (defining sex discrimination to include gender identity) and section 106.31(a)(2) (defining impermissible sex separation to include preventing

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[1] Both Emma Weyant and Erica Sullivan won individual medals in the Tokyo 2020 Olympic games. *See* International Olympic Committee, *Tokyo 2020 Swimming Women's 400M Individual Medley Results*, https://olympics.com/en/olympic-games/tokyo-2020/results/swimming/women-s-400m-individual-medley (last visited September 1, 2022); *Tokyo 2020 Swimming Women's 1500M Freestyle Results*, https://olympics.com/en/olympic-games/tokyo-2020/results/swimming/women-s-1500m-freestyle (last visited September 1, 2022).
[2] Women's NCAA Championships 500 freestyle results, https://swimmeetresults.tech/NCAA-Division-I-Women-2022/ (last visited September 1, 2022).
[3] *Id.*
[4] *Id.*
[5] *Id.*
[6] Women's NCAA Championships 500 freestyle preliminary results, https://swimmeetresults.tech/NCAA-Division-I-Women-2022/ (last visited September 1, 2022).
[7] *See* Exhibit 1, Concerned Women for America Title IX Complaint at 3-5.
[8] This comment uses the terms 'women,' 'girls,' and 'females' to refer to biological females and the terms 'men,' 'boys,' and 'males' to refer to biological males. It further uses the terms 'sex,' 'gender,' and 'gender identity' as set forth in *Doe ex rel. Doe v. Boyertown Area Sch. Dist.*, 897 F.3d 518, 522 (3d Cir. 2018).

participation consistent with gender identity) to the Title IX regulations. These proposed changes do not exempt athletics, and the Department has repeatedly taken the position in legal filings that Title IX does not protect female-only sports.[9] Claims that the Department's proposed regulations do not implicate athletics are simply false. The Department must grapple *now*—not later[10]—with the ramifications these proposed regulations will have in all areas, including sports.

Based on what we already know about the harm to women, the clear science of male advantage, the goals of Title IX, and alternative options, Alliance Defending Freedom strongly opposes the Department's proposed redefinition of sex to include gender identity. The Department should not adopt these proposed regulations.

A. Female athletes across the country and the world have experienced the devastation of losing to male athletes in women's sports.

From 2017 to 2020, two high school male athletes in Connecticut won a combined 15 state championships in girls' track and set 17 individual meet records.[11] One of those males had competed as a midlevel athlete on the boys' team for three seasons before switching to the girls' team and vaulting to repeated championship wins. Selina Soule faced these two males in her preliminary race at a state championship. The males took first and second, bumping Selina from advancing to the finals—and the New England Championships—by two spots.[12] Sprinter Chelsea Mitchell was an All-American long jumper who won many state championships in sprinting and jumping events. After two male athletes began competing in the women's category, she lost four championship titles to these males and never won a single race in which both of them competed. She lost to these males on more than twenty different occasions.[13] Selina described the experience as frustrating and demoralizing. Chelsea said it caused her anxiety and stress. When

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[9] *See, e.g.,* Statement of Interest of the United States, *B.P.J. v. West Virginia State Board of Education*, Case No. 2:21-cv-00316 (S.D. W. Va. June 17, 2021), ECF No. 42 (arguing that West Virginia's law limiting women's sports to females violated Title IX).
[10] *See* NPRM at 542-43 (claiming that this proposed rulemaking should not include comments on sports).
[11] *See* Exhibit 2, Declaration of Alanna Smith (Smith Decl.) filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF No. 286-1) ¶ 25.
[12] *See* Exhibit 3, Declaration of Selina Soule (Soule Decl.) filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF No. 286-1) ¶ 21.
[13] *See* Exhibit 4, Declaration of Chelsea Mitchell filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF No. 286-1) ¶ 14.

Chelsea's mother advocated for her daughter to school officials and even the Title IX coordinator, she was told that the girls have a right to participate, but not to win.

In Hawaii, a male athlete dominated varsity girls' volleyball in the 2019–20 season on the island of Maui. Female players were nervous and intimidated and would often 'duck and cover' or assume a defensive position rather than prepare to respond to his spikes because they were afraid of getting hurt. Girls competing against the male athlete felt demoralized and wondered whether they should bother playing because they knew the male athlete's team would beat them. The same male athlete also competed in girls' track, where one young woman said she was going to quit after the male athlete raced in her event.[14]

Male athletes have similarly displaced females at the collegiate level. Franklin Pierce University hurdler CeCe Telfer never made it to a championship event while competing for the men's team. But in 2018, Telfer began competing on FPU's women's track team after identifying as a woman. Telfer vaulted to NCAA championship victory, won an NCAA championship after placing first in the women's 400-meter hurdles, and also placed fifth in the women's 100-meter hurdles.[15] While Telfer's testosterone levels were too high to compete as a woman at the 2021 U.S. Olympic Trials, Telfer wants to compete at upcoming World Championships and the 2024 Olympic Summer Games.[16]

Female athlete Madison Kenyon was surprised during her first collegiate cross-country event of 2019 to race against a male athlete—one who had competed on the University of Montana's men's cross-country and track team for three years before switching to the women's team. Madison described feeling discouraged,

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[14] *See* Exhibit 5, Declaration of Darcy Aschoff (Aschoff Decl.) filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF No. 286-1).

[15] Notably, after completing a year of testosterone suppression to compete on the women's team, Telfer's performance times improved:

Event	**"Craig" Telfer**	**"CeCe" Telfer**
Indoor 200 Meter Dash	24.64s (2017)	24.45s (2019)
Indoor 60 Meter Hurdles	8.91s (2018)	8.33s (2019)
Outdoor 100 Meter Dash	12.38s (2017)	12.24s (2019)
Outdoor 400 Meter Hurdles	1:02.00s (2017)	57.53s (2019)

[16] Jill Martin, *Transgender runner CeCe Telfer is ruled ineligible to compete in US Olympic trials*, CNN (June 25, 2021, 1:08 PM), https://www.cnn.com/2021/06/25/sport/transgender-athlete-cece-telfer-trials-olympics-spt/index.html; Dawn Ennis, *Trans All-American CeCe Telfer Featured in Women's Sports Equality Campaign*, FORBES (Sept. 14, 2021), https://www.forbes.com/sites/dawnstaceyennis/2021/09/14/trans-all-american-cec-telfer-featured-in-womens-sports-equality-campaign/?sh=64e6e2d04c3c.

frustrated, and defeated as she lost to this athlete, June Eastwood, time and time again. She watched helplessly as Eastwood displaced literally *hundreds* of girls in cross-country races. But perhaps most painfully of all, she watched in disbelief as one of her teammates lost her bronze medal and place on the championship podium because Eastwood took first place in her teammate's event. She was heartbroken for her teammate.[17]

Similar stories of loss, frustration, and defeat are told by female athletes across the country, and even around the world[18] as the number of individuals who identify as transgender continues to rise sharply.[19] Mothers and daughters are both facing males in their sports.[20] Other mothers are advocating for their daughters, only to be silenced with the heartless retort that girls have the right to participate, but not to win.[21] Women and girls across the country are afraid to speak up, fearing retaliation, censorship, and lost scholarships. But the small and growing cadre of women who *have* found their voice want nothing more than to ensure that women's sports continue to exist so that future female athletes have real opportunities to compete, to earn scholarships, and to win on a fair playing field.

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[17] *See* Exhibit 6, Declaration of Madison Kenyon (Kenyon Decl.) filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF No. 286-1).

[18] Chuck Culpepper, New Zealand weightlifter Laurel Hubbard makes Olympic history as a transgender athlete, WASH. POST (Aug. 12, 2022), https://www.washingtonpost.com/sports/olympics/2021/08/02/laurel-hubbard-transgender-olympics-weightlifter/; Transgender Track Star Stirs Controversy Competing In Alaska's Girls' State Meet Championships, CBSNEWS.COM (June 8, 2016), https://www.cbsnews.com/newyork/news/transgender-nattaphon-wangyot-alaska-track/ (last visited September 1, 2022).

[19] Azeen Ghorayshi, *Report Reveals Sharp Rise in Transgender Young People in the U.S.*, The New York Times, https://www.nytimes.com/2022/06/10/science/transgender-teenagers-national-survey.html (last visited September 1, 2022).

[20] *See* Exhibit 7, Declaration of Cynthia Monteleone (Monteleone Decl.) filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF No. 286-1); *see also* Melissa Tanji, *Complaint filed over transgender MIL track athlete*, THE MAUI NEWS (Feb. 29, 2020) https://www.mauinews.com/news/local-news/2020/02/complaint-filed-over-transgender-mil%E2%80%88track-athlete/.

[21] *See* Exhibit 8, Declaration of Christina Mitchell filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF No. 286-1) ¶ 39, 41.

B. Female athletes are demonstrably harmed by allowing males into women's sports.

1. Female athletes lose fair competition.

Categories in sport exist to provide fair competition.[22] They control for physiological differences (like sex, age, and impairment) so that sports competition can reward "talent, strategy, training, and dedication."[23] In other words, categories—that by definition include some and exclude others—*promote* inclusivity. Without a Paralympic category, society wouldn't celebrate the remarkable achievements of the disabled. Without a featherweight category, heavy weightlifters would dominate.[24] And without women's sports, most women and girls wouldn't stand a chance against their male counterparts.

This doesn't mean that every man will beat every woman in a head-to-head competition. Instead, it recognizes that given comparable talent, training, and dedication, males will have a significant physical advantage over females. Categories in sport exist to ensure those male advantages do not eclipse athletic achievements that *should* depend on talent, strategy, training, and dedication.[25]

Males are, on average, bigger, faster, and stronger than females. These are inescapable biological facts, not stereotypes, "social constructs," or relics of past discrimination. As Justice Ginsberg wrote, "Physical differences between men and women . . . are enduring: '[T]he two sexes are not fungible'."[26] That means that when "males and females are not in fact similarly situated and when the law is blind to those differences, there may be as much a denial of equality as when a difference is created which does not exist."[27]

That's true in sports: males and females are not the same. In sports that involve speed, stamina, strength, and physique, males have a class-level advantage over females.[28] In fact, the male performance advantage is so large that females could not reasonably hope to succeed without sex separation in most sports. For

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[22] *See* Exhibit 9, Expert Witness Declaration of Tommy Lundberg (Lundberg Decl.) filed in *A.M. v. Indianapolis Public Schools*, 1:22-cv-1075 (ECF No. 36-7) ¶ 2.1.
[23] Exhibit 10, Expert Witness Declaration of Dr. Emma Hilton (Hilton Decl.) filed in *A.M. v. Indianapolis Public Schools*, 1:22-cv-1075 (ECF No. 36-6) ¶ 5.2.
[24] *See* Exhibit 11, Expert Report of William Bock (Bock Decl.) filed in *A.M. v. Indianapolis Public Schools*, 1:22-cv-1075 (ECF No. 36-7) ¶ 3.2.5 (noting the various categories in sport).
[25] *See* Exhibit 10, Hilton Decl., ¶ 5.3.
[26] *United States v. Virginia,* 518 U.S. 515, 533 (1996).
[27] *Yellow Springs Exempted Vill. Sch. Dist. Bd. of Educ. v. Ohio High Sch. Athletic Ass'n,* 647 F.2d 651, 657 (6th Cir. 1981).
[28] Exhibit 10, Hilton Decl. ¶ 4.1.

example, World Championship sprinter Allyson Felix is *the* most decorated female track and field athlete in Olympic history—surpassing even Usain Bolt in Olympic golds.[29] Yet in one year alone, 275 U.S. high school boys beat Felix's 400-meter lifetime best. Without a female category in sport, history wouldn't even record her name.

This example is borne out repeatedly in data across sports. For example, below are the best high school outdoor track times from 2019 in two events (data publicly available on Athletic.net)—the male and female times aren't even close:

2019 High School Outdoor 100m

Boy	Time	Girl	Time
Matthew Boling	9.98s	Briana Williams	10.49s
Micah Williams	10.21s	Semira Killebrew	11.24s
Langston Jackson	10.23s	Thelma Davies	11.25s
Joseph Fahnbulleh	10.23s	Tamari Davis	11.27s
Ryan Martin	10.26s	Taylor Gilling	11.32s
Kenan Christon	10.26s	Arria Minor	11.31s
Lance Broome	10.27s	Tianna Randle	11.32s
Tyler Owens	10.29s	Taylor Gilling	11.32s
Ryota Hayashi	10.29s	Kenondra Davis	11.36s
Marquez Beason	10.30s	De'anna Nowling	11.40s

2019 High School Outdoor 400m

Boy	Time	Girl	Time
Justin Robinson	44.84s	Kayla Davis	51.17s
Myles Misener Daley	45.62s	Jan'Taijah Ford	51.57s
Emmanuel Bynum	46.24s	Athing Mu	51.98s
Jayon Woodard	46.26s	Britton Wilson	52.06s
Alex Collier	46.33s	Ziyah Holman	52.12s
Jonah Vigil	46.43s	Kimberly Harris	52.16s
Zachary Larrier	46.49s	Aaliyah Butler	52.25s
Omajuwa Etiwe	46.51s	Caitlyn Bobb	52.79s
Sean Burrell	46.52s	Talitah Diggs	52.82s
Edward Richardson	46.55s	Aaliyah Butler	52.87s

[29] *Allyson Felix Biography*, https://olympics.com/en/athletes/allyson-felix (last visited September 1, 2022).

These physiological differences are reflected by everything from different fitness test standards for boys and girls,[30] to different equipment height and weight for men and women.[31]

The male athletic advantage isn't due to a masculine identity—identity is irrelevant to athletic performance. Nor is it due to superior resources or better training. (In fact, the performance gap between male and female Olympians narrowed and stabilized in the early 1980s, indicating that resources and training are not the source of the persistent athletic performance disparity.[32]) The male athletic advantage is due to the male body. Sports test physical bodies and physical capabilities. As a result, the only way to provide women and girls with fair competition is to protect females based on their physical bodies—their sex.

"[D]ue to average physiological differences, males would displace females to a substantial extent if they were allowed to compete" for the same teams.[33] Indeed, "the great bulk of the females would quickly be eliminated from participation and denied any meaningful opportunity for athletic involvement," without distinct teams.[34] That's why sports have been separated by sex for over 50 years in our country. Early Title IX regulations made clear that sex-separation in sport was an exception to the general nondiscrimination rule. Because without it, female athletes would be denied the opportunity to compete fairly, showcase their talents, and win.

If allowed to take effect, the Department's proposed changes would erode these protections for women. They would upend decades of advances in athletic opportunities for women and girls. And they would open up women's sports teams

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[30] *President's Challenge Qualifying Standards,* https://gilmore.gvsd.us/documents/Info/Forms/Teacher%20Forms/Presidentialchallengetest.pdf.
[31] The net height used for women's volleyball is more than 7 inches lower than that used for men's volleyball. Federation Internationale de Volleyball (FIVB), *Official Volleyball Rules 2017-2020*, https://www.fivb.org/EN/Refereeing-Rules/documents/FIVB-Volleyball_Rules_2017-2020-EN-v06.pdf.
• The hurdle height used for the high school girls' 100-meter hurdle event is 33 inches, while the standard height used for boys' high school 110-meter hurdle is 39 inches. USA Track and Field (USATF), *2020 Competition Rules*, https://www.flipsnack.com/USATF/2020-usatf-competition-rules/full-view.html.
• The standard women's basketball has a circumference of 28.5 to 29 inches and a weight of between 18 and 20 oz, while a standard basketball used in a men's game has a circumference between 29.5 to 30 inches and a weight of between 20 and 22 oz. International Basketball Federation (FIBA), 2*018 Official Basketball Rules*, http://www.fiba.basketball/OBR-2018-Basketball-Equipment-Yellow-Version-2.pdf; Women's National Basketball Association, *Official Rules 2020*, https://ak-static.cms.nba.com/wp-content/uploads/sites/27/2020/05/2020-WNBA-Rule-Book-Final.pdf.
[32] Valérie Thibault*, Women and Men in Sport Performance: The Gender Gap has not Evolved since 1983,* J SPORTS SCI. MED. (June 1, 2010), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3761733/.
[33] *Clark v. Ariz. Interscholastic Ass'n*, 695 F.2d 1126, 1131 (9th Cir. 1982).
[34] *Cape v. Tenn. Secondary Sch. Athletic Ass'n*, 563 F.2d 793, 795 (6th Cir. 1977).

to males with intrinsic biological advantages. Girls like Selina Soule, Chelsea Mitchell, and Madison Kenyon would face male competition in their sport—depriving them of a fair chance to compete. This harm is far more than *de minimis*.

2. Female athletes are exposed to unsafe competition.

These physical differences also matter for safety. Nearly two years ago, World Rugby issued guidelines excluding males from women's rugby because it concluded that safety and fairness could not be assured for women otherwise.[35] World Rugby went on to say that the women's category was created "to ensure protection, safety and equality" for those who do not benefit from biological advantages—namely, females.[36]

Female-only sports protect safe competition. In sports like basketball, volleyball, and soccer where physical contact with equipment or other players occurs, females are at greater risk of physical injury when competing against males.

Just ask women's mixed-martial arts fighter Tamikka Brents, who suffered significant facial injuries when she fought against a male who identified as female and fought under the name of Fallon Fox:

> I've fought a lot of women and have never felt the strength that I felt in a fight as I did that night. I can't answer whether it's because she was born a man or not because I'm not a doctor. I can only say, I've never felt so overpowered ever in my life, and I am an abnormally strong female in my own right.[37]

As former collegiate soccer player Lainey Armistead put it: "Males are generally stronger, fitter, faster, and have bigger stature than women, which gives them advantages of strength, speed, and size in soccer. They compete at a faster pace. They kick the ball harder. They have physical frames that are generally larger." Lainey should know: she regularly competed in pick-up soccer games with

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[35] World Rugby, *World Rugby approves updated transgender participation guidelines* (Oct. 9, 2020) https://www.world.rugby/news/591776/world-rugby-approves-updated-transgender-participation-guidelines.

[36] World Rugby, *Transgender Women Guidelines*, https://www.world.rugby/the-game/player-welfare/guidelines/transgender/women (last visited September 1, 2022); *see also Kleczek v. R.I. Interscholastic League, Inc.*, 612 A.2d 734, 739 (R.I. 1992) (sex "classifications … will help promote safety").

[37] Alan Murphy, *Exclusive: Fallon Fox's latest opponent opens up to #WHOATV* (September 17, 2014), http://whoatv.com/exclusive-fallon-foxs-latest-opponent-opens-up-to-whoatv/.

her brothers and other men. But even as an elite collegiate soccer player, she knew that she didn't stand a chance against these males if they chose to play "all-in."[38]

Girls know intuitively that they don't stand a chance against most males in head-to-head competition. On Maui, a male athlete dominated varsity girls' volleyball in the 2019–20 season. Female players were nervous and intimidated. They were afraid of getting hurt.[39] And their fears appear well-founded, as one female athlete is reported to have received a concussion due to this male's powerful spike.

Yet if the Department redefines sex discrimination and forces schools to categorize sports teams based on identity rather than biology, female athletes will face more dangerous competition.

3. Female athletes lose athletic opportunities.

As the Department notes on its website:

> Before the enactment of Title IX, most colleges and universities traditionally emphasized sports for male students, and the benefits and educational opportunities in athletic programs generally were limited for women. Title IX has helped focus attention on meeting the needs of women interested in athletics and helped education officials to recognize their responsibilities regarding the provision of equal athletic opportunity. The result has been increased involvement of girls and women in sports at all levels.[40]

When Title IX passed in 1972, there were approximately 250,000 girls playing high school sports in the U.S. By 2011, the number increased to more than 3.25 million (a number still below the number of high school boys competing in sports in 1972).[41] In college, women's numbers have grown almost as steeply, from 30,000 to more than 288,000 in 2017–18.[42]

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[38] Exhibit 12, Declaration of Lainey Armistead (Armistead Decl.) filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF 286-1).
[39] Exhibit 7, Monteleone Decl. ¶ 18.
[40] U.S. Department of Education, *Requirements Under Title IX of the Education Amendments of 1972*, https://www2.ed.gov/about/offices/list/ocr/docs/interath.html (last visited September 1, 2022).
[41] U.S. Department of Education, Office for Civil Rights, *PROTECTING CIVIL RIGHTS, ADVANCING EQUITY* 33 (2015), https://www2.ed.gov/about/reports/annual/ocr/report-to-president-and-secretary-of-education-2013-14.pdf.
[42] Doriane Lambelet Coleman et al., *Re-Affirming the Value of the Sports Exception to Title IX's General Non-Discrimination Rule*, 27 Duke J. Gender L. & Pol'y 69, 81–82 (2020).

That means that "[w]omen and girls today have the opportunity only boys and men had in the previous period to reap the widely recognized and highly valued benefits of being physically strong, of being on teams and developing the myriad skills associated with competitive sport, of attending college on athletic scholarships, and of high-end competitive experiences."[43] Research shows that girls who play sports have lower risk of disease, higher self-esteem, lower incidence of depression, and less risky behavior. Ninety-four percent of female CEOs played sports.[44]

According to some statistics, high school girls still have over a million *fewer* sports opportunities than boys, college women have over 200,000 fewer varsity sports opportunities than their male peers, and female athletes have over a billion dollars less in athletic scholarships.[45] But the Department's proposed rule threatens to further reduce opportunities for female athletes.

The male physique provides males with a competitive advantage. And that competitive advantage means fewer and fewer females will benefit from the athletic opportunities Title IX originally provided if the Department fails to protect women based on their sex. High school track star Selina Soule knows this personally. She faced two males in her preliminary race at a state championship meet. The males took first and second, bumping Selina from advancing to the finals. Not only did Selina lose the opportunity to compete in the final by one spot, but she also lost the opportunity to advance to an elite regional meet and compete in front of college scouts by two spots.

As Dr. Bernice Sandler—who has been called the "Godmother of Title IX"—cautioned when testifying in 1975 in support of regulations implementing Title IX, ignoring differences in male and female physiology would for many sports "effectively eliminate opportunities for women to participate in organized competitive athletics. For these reasons, such an arrangement would not appear to be in line with the principle of equal opportunity."[46]

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[43] *Id.* at 69, 72.
[44] *Why female athletes makes winning entrepreneurs*, ESPN W., https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/entrepreneurship/ey-why-female-athletes-make-winning-entrepreneurs.pdf. (last visited September 1, 2022).
[45] *Discrimination Against Women in College Sports is Getting Worse*, Champion Women Communications, June 23, 2020, https://titleixschools.com/2020/06/23/gender-gap/ (last visited September 1, 2022).
[46] *Review of Regulations to Implement Title IX of Public Law: Hearings before the Subcommittee on Postsecondary Education of the Committee on Education and Labor*, 94th Cong. 343 (1975), https://babel.hathitrust.org/cgi/pt?id=pur1.32754076276330&view=1up&seq=3&skin=2021.

If the Department proceeds with redefining sex—which will have the effect of opening girls' sports to males—then girls will inevitably lose spots on the team, positions on the field, and lanes in the pool. They will lose their rightful place on the winner's podium. And they will lose the opportunity to advance to more elite levels of competition. It only takes one male in women's individual sports to take the championship title. It only takes three males to eliminate women from the victory podium altogether.

4. Female athletes lose public recognition.

When males win women's athletic events, female athletes lose the recognition and publicity they deserve. Female athletes in the Ivy League and NCAA swimming Championships were left in the shadows instead of being recognized for their achievements—while Lia Thomas enjoyed the limelight.

Connecticut track athlete Chelsea Mitchell was the fastest girl in a women's 55-meter championship race but lost to two male athletes. Media dubbed her the "third-place competitor, who is not transgender." Chelsea did not make it into her high school record books as the first ever Canton high school female athlete be named a State Open Champion in a running event. She was not recognized as an All-State Athlete, invited to the All-State Banquet, or celebrated on a banner in her high school gym for her accomplishments in the 55-meter dash.[47]

Recognition matters to female athletes. It tells them that their hard work has paid off. It spurs them to train harder. It elevates their visibility to potential recruiters and coaches. And for some women, it can open doors to new financial opportunities, such as benefitting from their name, image, and likeness.[48] But when female athletes lose the recognition they rightly deserve to a male, they feel demoralized, deflated, and lose their competitive spirit as well as potential financial rewards.

5. Female athletes lose scholarship opportunities.

For many female athletes, athletic scholarships open the door to pursue higher education and the career of their dreams. Collegiate soccer player Lainey Armistead relied on her soccer scholarship to help pay for her education and avoid college loans.[49] Collegiate track runner Madison Kenyon relied on her athletic scholarship to allow her to continue her education at her school of choice.[50] In fact,

[47] *See* Exhibit 4, Mitchell Decl.
[48] Exhibit 12, Armistead Decl.¶ 27.
[49] *Id.* ¶¶ 12-13
[50] Exhibit 6, Kenyon Decl.

for many female athletes, competing for a collegiate scholarship drives them to train harder and push themselves to their limits.

But if males are allowed to compete against women and girls for athletic scholarships, females will lose the already fewer scholarship opportunities they have. Coaches, after all, have a mandate to *win*. And they will use scholarships to recruit the fastest, strongest, and most competitive players they can—even if that means awarding a women's scholarship to a male of mediocre ability.

6. Female athletes lose the drive to compete.

Title IX has "enhanced, and will continue to enhance, women's opportunities to enjoy the thrill of victory [and] the agony of defeat."[51] After all, "[a] primary purpose of competitive athletics is to strive to be the best."[52] And the "greater the potential victory, the greater the motivation to the athletes."[53] Thus, "[t]reating girls differently regarding a matter so fundamental to the experience of sports—the chance to be champions—is inconsistent with Title IX's mandate of equal opportunity for both sexes."[54]

And yet, when female athletes have pointed out the monumental unfairness of being forced to compete against males, they have been told that they have a right to participate, but not to win. Female athletes don't compete for participation trophies: they compete to win. The late nights and early mornings, forfeited spring breaks and time with friends, the challenging training and achy muscles—girls are motivated to make these sacrifices if they have a shot at winning.

But if the Department allows males in their sports and takes away their ability to win, many girls may decide that the hard work, sacrifice, and dedication necessary to be a female athlete just isn't worth it anymore.

When faced with two males in her sport, Connecticut high school track athlete Alanna Smith remembers feeling defeated before settling into her starting blocks—she knew she was competing for third place and beyond.[55] Other girls in Connecticut tried to switch from track to other events, feeling too disheartened to continue losing to the males. Collegiate runner Mary Kate Marshall similarly reports that while losing to another woman drives her to work harder, losing to a

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[51] *Neal v. Bd. of Trs. of Cal. State Univs.*, 198 F.3d 763, 773 (9th Cir. 1999).
[52] *McCormick ex rel. McCormick v. Sch. Dist. of Mamaroneck*, 370 F.3d 275, 294–95 (2d Cir. 2004).
[53] *Id.* at 294.
[54] *Id.* at 295.
[55] Exhibit 2, Smith Decl. ¶ 19.

male feels deflating and makes her think that "no matter how hard I try, my hard work and effort will not matter."[56]

7. Science supports sex-separation in sports.

Sports have for decades been divided into male and female categories[57] based on the scientific, common-sense understanding that human beings are a dimorphic sex.[58] More than 99.98% of human beings are either male or female, and all humans who do not suffer from a tragic genetic or developmental disorder are unambiguously male or female.[59] It is this simple fact of human biology that serves as the basis for sex-separated sports.

And yet the Department has provided no evidence that it has considered the science of male athletic advantage and female susceptibility to injury before redefining sex discrimination to include gender identity—a move that will abolish women-only sports.

a. Males have an athletic advantage.

"[S]cientists agree that males and females are materially different with respect to the main physical attributes that contribute to athletic performance."[60] According to developmental biologist Dr. Emma Hilton, the performance gaps between males and females are "detectable during childhood and cemented during puberty."[61]

The male advantage is conferred by "the accident of birth"[62] and is not achievable by "dedicated training, nutrition, or recovery habits."[63] The male advantage is, therefore, unfair over comparably fit, trained, talented, and aged females. The male athletic advantage exists in most athletic tests before puberty

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[56] Exhibit 13, Declaration of Mary Kate Marshall (Marshall Decl.) filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF 286-1) ¶ 13.
[57] Co-ed sports are not a concern here. If sports are advertised as co-ed, then the women and girls who compete in those sports are assuming the risk of competing against males.
[58] Exhibit 14, Declaration and Expert Report of Dr. Gregory A. Brown (Brown Decl.) filed in *B.P.J. v. West Virginia State Board of Education*, 2:21-cv-00316 (ECF 286-1) ¶ 1 (collecting sources).
[59] *Id.*
[60] *Re-Affirming the Value of the Sports Exception*, 27 Duke J. Gender L. & Pol'y at 92 (cleaned up).
[61] Exhibit 10, Hilton Decl. ¶ 2.1.
[62] *See Frontiero v. Richardson*, 411 U.S. 677, 686 (1973) ("sex" meant "an immutable characteristic determined solely by the accident of birth.").
[63] Ex. 9, Lundberg Decl. ¶ 4.6.

and is particularly pronounced in upper body strength. From puberty on, boys and men have a large and natural "doping" advantage over girls and women.[64]

Broadly, the male athletic advantage is conferred by a superior skeletal, muscular, and cardiovascular system.[65] Males have:

- Larger lungs and denser alveoli in the lungs, enabling faster oxygen uptake;
- Larger hearts and per-stroke pumping volume, and more hemoglobin per unit of blood, all enabling higher short-term and sustained levels of oxygen transport to the muscles;
- An increased number of muscle fibers and increased muscle mass (for example, men have 75%-100% greater cross-sectional area of upper arm muscle than do comparably fit women, while women have 60-70% less trunk and lower body strength than comparably fit men);
- Higher myoglobin concentration within muscle fibers, enabling faster transfer and "cellular respiration" of oxygen within the muscle to unleash power;
- Larger bones, enabling the attachment of greater volumes of muscle fiber;
- Longer bones, enabling greater mechanical leverage thus enabling males to unleash more power, for instance, in vertical jumps; and
- Increased mineral density in bones resulting in stronger bones, providing superior protection against both stress fractures and fractures from collisions.

The impact of male puberty is so pronounced that male athletic performance typically matches and then exceeds those of elite female athletes by 14-15 years old.[66] Female puberty, meanwhile, brings distinctive changes to girls and women that—while critical for healthy female fertility—measurably impede training and athletic performance, including increased body fat, wider hips and different hip joint orientation, and menstruation.[67] The menstrual cycle can impact

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[64] *See* Ex. 11, Bock Decl. ¶ 7.3.2 (noting the advantage males have by virtue of their male development is analogous to the advantage gained by male or female atheltes using exogenous testosterone or other anabolic agents).
[65] *See* Ex. 10, Hilton Decl. ¶ 2.1.
[66] Ex. 10, Hilton Decl. ¶ 4.2.
[67] *See* Ex. 14, Brown Decl. ¶ 50 (noting impact of female hormones, pelvis angle, hip structure); ¶ 57 (noting impact of increased body fat); *see also* Ex. 10, Hilton ¶ 4.5 (noting impact of female menstrual cycle).

"cardiovascular, respiratory, brain function, response to ergogenic aids, orthopedics, and metabolic parameters, and represents a barrier to athletic capacity not experienced by males."[68] Because of these inherent physiological differences, male athletes consistently achieve performance records 10-50% higher than comparably fit, trained, and aged females.[69]

As explained by Professor of Exercise Science Dr. Gregory Brown, these physiological differences confer marked advantages in sport:

- Males are stronger, with 60%-100% greater arm strength, 57% greater grip strength, and 25-60% greater leg strength;
- Males run 10%-13% faster;
- Males jump 15%-20% higher;
- Males throw 35% faster, and hit and kick faster and farther;
- Males exhibit faster reaction times;
- Males are 7% to 8% taller and heavier;
- Males have larger and longer bones, stronger bones, and different bone configuration;
- Males have larger muscle mass; and
- Males are able to metabolize and release energy to muscles at a higher rate due to larger heart and lung size, and higher hemoglobin concentrations.[70]

It's important to recognize that these physiological advantages are not undone by testosterone suppression. There is currently *no* scientific evidence that testosterone suppression negates the athletic advantage that males have over females.[71]

As Drs. Hilton and Lundberg detail, the data shows that following testosterone suppression, "strength, lean body mass, muscle size and bone density are only trivially affected."[72] Joanna Harper, a male athlete who identifies as female, recently published a literature review on the effects of testosterone

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[68] Ex. 10, Hilton Decl. ¶ 4.5.
[69] Emma Hilton and Tommy Lundberg, *Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage* (Feb. 2021), https://pubmed.ncbi.nlm.nih.gov/33289906/.
[70] Ex. 14, Brown Decl. ¶¶ 13-67.
[71] Ex. 9, Lundberg Decl. ¶ 2.3.
[72] *Id.*

suppression and found that "the small decrease in strength in transwomen after 12–36 months of [testosterone suppression] suggests that transwomen likely retain a strength advantage over cisgender women."[73]

As discussed *infra*, many sports organizations are abandoning the old testosterone suppression requirement because the science demonstrates that it does not promote fairness or safety for female athletes. But even that ineffective, unscientific standard imposed a small barrier to males in women's sports. Remarkably, the Department's proposed rule would allow *all* males who identify as female to compete in women's sports without medical intervention, forcing female athletes to compete against males that everyone agrees are, on average, bigger, faster, and stronger. Even the International Olympic Committee and the NCAA do not take such an extreme position.[74] That just underscores what everyone knows: women's sports cannot be separated based on gender-identity alone.

b. Females are more susceptible to injury.

Since males tend to be bigger and heavier, faster and stronger, it should come as no surprise that—by comparison—females are more susceptible to injury, especially when competing against males.[75] That's why World Rugby recently issued guidelines excluding males from women's rugby.

Emerging science shows that women and girls are more susceptible to injury, especially in two particular areas. First, female athletes are more prone to concussions and more severe outcomes.[76] When comparing the concussion rates in various sports—such as basketball, soccer, and baseball/softball—females had almost double the annual rate of concussions as males.[77] This dramatic statistical difference has been attributed to lower impact resistance in female neck muscles and more delicate brain structures.[78] Concussions raise serious long term health

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[73] Joanna Harper, et al., *How does Hormone Transition in Transgender Women Change Body Composition, Muscle Strength and Haemoglobin? Systematic Review with a Focus on Implications for Sport Participation*, Br. J. Sports Med. (2021), doi: 10.1136/bjsports-2020-103106 (published online ahead of print).

[74] Even with the NCAA's prescribed regimen of testosterone suppression, Lia Thomas still managed to beat two female Olympic champions in a single race. Both the NCAA and the IOC organizations have abandoned their previous policies for a "sport-by-sport approach." NCAA, *NCAA Transgender Student-Athlete Participation Policy*, https://www.ncaa.org/sports/2022/1/27/transgender-participation-policy.aspx.

[75] *See also* Exhibit 15, Declaration of Chad Carlson in *B.P.J. v. West Virginia Board of Education*, ¶ 43-56 (describing male sex-based advantages that lead to female vulnerability).

[76] Ex. 15, Carlson Decl. ¶ 58; *see also* Ex. 10, Hilton Decl. ¶ 4.6.

[77] Ex. 11, Bock Decl. ¶ 8.4.2.6.1.5.

[78] Ex. 10, Hilton Decl. ¶ 4.6.

implications and can have lifelong debilitating effects.[79] Females also tend to have greater cognitive impairment than males do when they suffer a concussion.[80] Females *already* have higher rates of concussion than males: the addition of male athletes into women's contact sports "will inevitably increase the risk of concussive injury to girls and women…."[81]

Second, girls and women are at a higher risk of Anterior Cruciate Ligament (ACL) injuries.[82] Some estimate that their risk is 150% to as much as 300% higher than it is for males.[83] But putting males into women's sports will increase further their risk of career-ending ACL injuries.[84]

8. Sport governing bodies are reestablishing sex-based categories in sport.

In light of these scientific findings, and the evidence of harm to women, national and international athletic governing bodies are moving away from allowing males to compete in the female category—regardless of medical intervention—and are reestablishing sex-based categories in sport.

The Department's proposed regulations would make U.S. secondary and collegiate sports an outlier among national and international sporting bodies. We are not aware of a single national or international sporting organization that has adopted a pure gender-identity standard—which is what the Department proposes by its new *de minimis* harm standard.

The International Olympic Committee and the NCAA allow some (but not all) males who identify as female to compete on women's teams.[85] But the most recent trend is towards more robust protection for female sport.

World Rugby was the first international sport federation to adopt comprehensive transgender eligibility rules.[86] In 2020, World Rugby issued

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[79] Ex. 10, Bock Decl. ¶ 8.4.2.6.1.2.
[80] Ex. 15, Carlson Decl. ¶ 64.
[81] *Id*. at ¶ 69.
[82] *Id*. at ¶ 70.
[83] Ex. 15, Carlson Decl. ¶ 72.
[84] Ex. 11, Bock Decl. ¶ 8.4.2.6.2.3.
[85] Even with the NCAA's prescribed regimen of testosterone suppression, Lia Thomas still managed to beat two Olympic champions in a single race. The NCAA and the IOC organizations abandoned their previous policies for a "sport-by-sport approach" that will become effective later this year. NCAA, *NCAA Transgender Student-Athlete Participation Policy*, https://www.ncaa.org/sports/2022/1/27/transgender-participation-policy.aspx.
[86] Ex. 11, Bock Decl. ¶ 7.4.1.1.1.

guidelines excluding virtually all males from women's rugby because of the injury risk to females.[87] That decision followed "a comprehensive and inclusive process . . . to understand whether it was possible to balance inclusivity with safety and fairness in light of growing evidence that the testosterone suppression required by previous transgender regulations does not significantly impact muscle mass, strength or power."[88] The evidence consistently shows that, "given the size of the biological differences" between men and women, the "comparatively small effect of testosterone reduction" over a 12-month period still "allows substantial and meaningful differences to remain."[89] And those differences have "significant implications for the risk of injury" to female players, thus justifying the new policy.[90]

In the fall of 2021, the UK Sports Councils performed a comprehensive assessment of male athletes in women's sport. After extensive consultation with experts and athletes, the Council concluded that "[c]ategorization within the sex binary is and remains the most useful and functional division relative to sporting performance."[91] It went on to note that competitive "fairness cannot be reconciled with self-identification into the female category…."[92]

In May 2022, the World Swimming Coaches Association (WSCA) released a position statement advocating to separate swimming divisions based on "birth sex" and potentially to create a new "Trans Division."[93] As the WSCA stated, "[c]ompetitive fairness cannot be reconciled with self-identification into the female category in a gender-affected sport such as swimming."[94]

In June 2022, FINA—the international governing body for swimming—released new guidelines that effectively ban males who have experienced any part

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[87] World Rugby, *Transgender Women Guidelines*, https://www.world.rugby/the-game/player-welfare/guidelines/transgender/women.
[88] World Rugby, World Rugby approves updated transgender participation guidelines (Oct. 9, 2020), https://www.world.rugby/news/591776/world-rugby-approves-updated-transgender-participation-guidelines.
[89] World Rugby, *Transgender Guidelines*, https://www.world.rugby/the-game/player-welfare/guidelines/transgender#SummaryforTransgenderWomen.
[90] *Id.*
[91] *The UK's Sports Councils Guidance for Transgender Inclusion in Domestic Sport*, 7 https://equalityinsport.org/docs/300921/Guidance%20for%20Transgender%20Inclusion%20in%20Domestic%20Sport%202021.pdf.
[92] *Id.*
[93] World Swimming Coaches Association, *Position Statement on Transgender Swimming*, https://perma.cc/D9VS-5ZH8.
[94] *Id.*

of male puberty from competing in women's swimming.[95] As FINA stated in its opening paragraph explaining the new policy:

> Because of the performance gap that emerges at puberty between biological males as a group and biological females as a group, separate sex competition is necessary for the attainment of these objectives. Without eligibility standards based on biological sex or sex-linked traits, we are very unlikely to see biological females in finals, on podiums, or in championship positions; and in sports and events involving collisions and projectiles, biological female athletes would be at greater risk of injury.[96]

Even more recently, in the summer of 2022, the British Triathlon, Rugby Football Union, and Rugby Football League all issued updated policies protecting the female category in sport—and relying on principles of fairness and scientific data to do so.[97] Even sporting organizations that do not completely ban males from women's sports generally require significant medical intervention—i.e. testosterone suppression—over an extended period of time before allowing males to compete in the women's category.[98]

The Department has provided no evidence that it has considered principles of fairness and the scientific data. It should follow the trend of the international

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[95] FINA, *Policy on Eligibility for the Men's and Women's Competition Categories*, 7-8, https://resources.fina.org/fina/document/2022/06/19/525de003-51f4-47d3-8d5a-716dac5f77c7/FINA-INCLUSION-POLICY-AND-APPENDICES-FINAL-.pdf.
[96] *Id.* at pg. 1.
[97] *See* Sean Ingle, *British Triathlon creates 'open' category for transgender athletes to compete at all levels*, THE GUARDIAN (July 6, 2022), https://www.theguardian.com/sport/2022/jul/06/british-triathlon-creates-open-category-for-transgender-athletes-to-compete-at-all-levels; PA Media, *Rugby codes ban transgender women from playing in women's union and league matches*, THE GUARDIAN (July 29, 2022) https://www.theguardian.com/sport/2022/jul/29/womens-rugby-union-and-rugby-league-block-transgender-players.
[98] *See, e.g.,* USA Swimming's 2022 Athlete Inclusion, Competitive Equity, and Eligibility Policy, https://www.usaswimming.org/docs/default-source/governance/governance-lsc-website/rules_policies/usa-swimming-policy-19.pdf (requiring testosterone suppression to 5 nm/l for 36 months); World Triathlon 2022 Transgender Policy https://www.triathlon.org/news/article/world_triathlon_executive_board_approves_transgender_policy (requiring testosterone suppression to 2.5 nm/l for 24 months); IUC Policy VII Transgender Athlete Participation, https://usacycling.org/about-us/governance/transgender-athletes-policy (2.5 nm/l for 24 months); International Powerlifting Federation, March 1, 2022, IPF Policy Statement for Transgender Athletes, https://www.powerlifting.sport/fileadmin/ipf/data/rules/IPF_Transgender_Policy_FInal.pdf (testosterone suppression to 2.4nm/l for at least 12 months).

sporting authorities and carefully consider how best to promote principles of fairness and inclusion for *all* athletes—including those born female.

C. The proposed rule creates a legal conundrum in states with women's sports laws.

Since 2020, eighteen states have passed laws protecting women's sports.[99] All of these states limit girls' teams to females only. And many of those laws include legal penalties for the school districts and athletic teams that fail to comply, and offer female athletes a legal remedy.[100]

In these states, the Department's proposed rule would place conflicting obligations on school districts: comply with the Department's reinterpretation of Title IX, or comply with state law. This exposes these schools to significant legal risk if they choose to protect their female athletes and provide them with fair and safe competition. Or it requires them to give up federal funding, an unconstitutionally coercive result.

(And, because of these laws, the proposed rule will cost taxpayers and private citizens millions of dollars in court costs, which the final rule must quantify.)

D. The proposed rule fails to give proper and fair notice of its effect on sex-separated athletics.

The Department included language that appears to punt the sports issue, but the proposed rule affects athletics because it redefines discrimination in all applications of Title IX. The government is essentially saying is that it likely will issue another rule focused on sports at some point int the future, even though this rule already affects sports.

The Department thus has failed to invite comment and give notice of its proposed rulemaking in a fair and open way because it has sought to deter comment on the key issue of this rulemaking: women's athletic opportunities.[101]

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[99] SAVE WOMEN'S SPORTS, https://savewomenssports.com/state-legislation (last visited September 1, 2022).

[100] A federal district court recently found that states have standing to sue the federal government when the Administration's new guidance documents redefining sex conflict with their state women's sports laws because it injures their sovereign interests. *See Tennessee v. U.S. Dep't of Educ.*, 2022 WL 2791450, at *9 (E.D. Tenn. 2022).

[101] NPRM at 542, 87 Fed. Reg. 41537. The notice states: "the Department plans to address by separate notice of proposed rulemaking the question of what criteria, if any, recipients should be permitted to use to establish students' eligibility to participate on a particular male or female

In this proposed rule, discrimination "on the basis of sex" would expand to include discrimination on the basis of gender identity (among other things): "preventing any person from participating in an education program or activity consistent with their gender identity would subject them to more than de minimis harm on the basis of sex and therefore be prohibited." Because school sports are considered "an education program or activity," the regulation requires that sports participation be based on gender identity.

But that requirement is not what the Department communicated in its press releases, fact sheet, and even in its notice to the public. Instead of inviting comment on this important and high-profile issue—something a federal judge recently chastised the Department for failing to do[102]—the Department has sought to duck public attention. It said that it would issue separate proposed regulations to address "whether and how" to amend the current regulations on sex-specific athletics and "the question of what criteria, if any, recipients should be permitted to use to establish students' eligibility to participate on a particular male or female athletics team." The Department further explains that it does not propose (at this time) to change current Title IX regulations, under which schools may "operate or sponsor separate teams for members of each sex where selection for such teams is based upon competitive skill or the activity involved is a contact sport." It then discouraged comments on "this issue," saying that they are beyond the rule's scope, and thus indicated that they will not be considered.

If the Department is acting in good faith and is not actually seeking to change the criteria for access to sex-separates programs and facilities, it must say so directly. It should say that its new discrimination provisions do not apply to athletics at all. Anything short of an explicit statement that athletes' gender identity does not determine participation in sex-specific school sports would be patently unfair to the public, who read the Department's notice and public materials to indicate that this issue was not up for comment at this time.

But nowhere do the proposed regulations explicitly state that participation in sex-specific sports must (or may) be based on biological sex. Instead, the rule does not say that schools can choose not to take gender identity into consideration. In other words, sex-separate teams can remain, so long as each student can choose

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athletics team. The scope of public comment on this notice of proposed rulemaking therefore does not include comments on that issue; those comments should be made in response to that separate rulemaking."

[102] *See Tennessee v. U.S. Dep't of Educ.*, 2022 WL 2791450, at *20-21 (E.D. Tenn. 2022) (finding plaintiffs were likely to succeed on the merits of their notice and comment claim).

their own sex-separated team based on gender identity. Only in that sense is the rule on athletics unchanged.

All the proposed rule is saying is that the proposed rule does not plan to change the wording of the specific section of the regulation (106.41) that addresses sports. But that sports section still prohibits sex discrimination in athletics and the overarching nondiscrimination change proposed to be made puts gender identity into sex, including athletics.

As one commenter noted, the Department's use of "whether" is illuminating. "The department's unwillingness to commit to a full-throated repudiation of men competing in women's sports hints that the proposed rule perhaps already addresses the issue. Because it does."[103] Because the rule expands the term "sex" to include gender identity, the proposed rule says, "under the proposed regulations … a recipient's education program or activity would include buildings or locations that are part of the school's operations. … A recipient's education program or activity would also include all of its academic and other classes, extracurricular activities, [and] athletics programs."[104] As this commenter has recognized, "[t]hus, the department has ensured that the sports issue will be decided in favor of biological men whether or not it engages in additional rule-making."

Make no mistake: this proposed rule is thus accomplishing changes to women's sports—and the Department's proposed rule misleads the public into thinking that it is not adopting these changes. The Department's goal is in poor faith: to avoid public comments and controversy, and to subvert the process of fair rulemaking and democratic accountability. As another commenter said, "The Education Department's failure to state its position outright and take the political backlash is cowardly."[105]

Given its misleading nature, the entire rule should be withdrawn and reproposed, with a new full supplemental comment period. Rather than shirk the duty to provide fair notice, the Department should start over and do any rulemaking the right way.

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[103] Sarah Parshall Perry, *Fox in the Henhouse: Biden's New Title IX Rule Puts Women in Danger*, THE HERITAGE FOUNDATION (July 5, 2022), https://www.heritage.org/gender/commentary/fox-the-henhouse-bidens-new-title-ix-rule-puts-women-danger-0.
[104] NPRM at 44, 87 Fed. Reg. at 41,401.
[105] Rachel N. Morrison, *Education Department's Fake Punt on Women's Sports*, NEWSWEEK (Aug. 9, 2022, 6:00 AM), https://www.newsweek.com/education-departments-fake-punt-womens-sports-opinion-1731743 (last visited September 1, 2022).

Furthermore, because the Department has suggested that this proposed rule does not address athletics—while actually transforming athletics—the Department has failed to engage in the close attention and scrutiny required for reasoned decision making. The Department has failed to consider the high costs of eviscerating women's sports, consider the true benefits of maintaining women's athletics, and consider the many alternatives to taking steps that would effectively end women's sports programs. The final rule thus must take account of all of these factors, including the costs, benefits, and alternatives outlined in this comment. Were the Department to do so and engage in the APA-required reasoned decision making, it would realize that sound law and good policy require abandoning the proposed rule and saving women's sports.

E. The Department should consider alternatives that protect fairness in women's sports.

Given the harm to female athletes of forcing them to compete against males, the physical differences between the sexes, and overall trend towards reestablishing sex-based categories in sport, the Department should demonstrate that it has considered other alternatives that accomplish its goals but do not harm female athletes.

First, the Department should consider making the male sports category an open category. Any student athlete—male or female—could elect to compete in this category. Because the category is open to all, it would eliminate alleged concerns about stigma or dignity harm to any athlete. Only biological females would be eligible to compete in the female category. In July 2022—after extensive research—the British Triathlon announced that it was taking this approach as a way to "reflect[] the needs of our sport, protect[] fairness in competition and serve[] our desire to make triathlon truly inclusive."[106]

Second, the Department should consider spurring schools to create more co-ed teams and sporting opportunities. In contexts where the science and data demonstrate that the male sex-linked advantages are less of a concern—such as in elementary grades, or in certain noncontact, noncompetitive sports—the Department should establish policies that create more co-ed teams. This step would eliminate concerns about stigma or dignity harm to any athlete. And even in sports

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[106] Niamh Lewis, *British Triathlon creates 'open' category for transgender athletes*, ESPN (July 6, 2022) https://www.espn.com/olympics/story/_/id/34200332/british-triathlon-creates-open-category-transgender-athletes (last visited September 1, 2022).

where fairness or safety concerns are present, females could decide whether or not to assume that risk.

Third, the Department could consider retaining male and female sports teams, but creating a third open category for any individual to choose to compete in. Only biological females would be eligible to compete in the women's and girls' category.

Any of these options would preserve the integrity of women's sports and ensure that the female athletes of tomorrow have fair, safe, and equitable competition as Title IX promised. These other options would also alleviate the Department's concern about how best to navigate sports for students who identify as transgender, nonbinary, or otherwise.

Women's sports do not exist as a platform for personal expression or identity affirmation. They exist to give females—based on their unique physiological makeup—the opportunity to showcase their talents and *win*. For these reasons, Alliance Defending Freedom opposes any change to the original text of Title IX and urges the Department to find a solution that does not disadvantage female athletes

II. Redefining "sex discrimination" to include gender identity hurts student dignity and privacy.

Every individual deserves to have their personal privacy respected. And they deserve the right to consent to opposite-sex nudity. These basic principles of human dignity are why we have separate changing facilities, shower areas, restrooms, overnight accommodations, and dorms for men and women, boys and girls.

As Justice Ginsburg wrote in response to the contention that the Equal Rights Amendment would cause restrooms to be opened to both men and women: "Separate places to disrobe, sleep, perform personal bodily functions are permitted, in some situations required, by regard for individual privacy. Individual privacy, a right of constitutional dimension, is appropriately harmonized with the equality principle."[107]

Toilets, locker rooms, showers, and other private facilities are not sex-separated to foster comradery or affirm identities. These private facilities are sex-separated to promote privacy, dignity, and an environment free of sexual harassment. The Department's proposed rule redefining sex discrimination to

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[107] Ruth Bader Ginsburg, *The Fear of the Equal Rights Amendment*, THE WASHINGTON POST, April 7, 1975.

include gender identity would effectively destroy the privacy for millions of students across the country.

A. Women and girls deserve to have their privacy protected, consent to male nudity, and decide when to sleep alongside males.

People have "a special sense of privacy in their genitals, and involuntary exposure of them in the presence of people of the other sex may be especially demeaning and humiliating."[108] That feeling is magnified for teens, who are "extremely self-conscious about their bodies[.]"[109] Their "adolescent vulnerability intensifies the . . . intrusiveness of the exposure."[110] Forcing minors to risk exposing their bodies to the opposite sex is an "embarrassing, frightening, and humiliating" experience.[111]

This is especially true of young women, as they attend to menstruation and feminine hygiene needs. Young women who have been forced to share restrooms, locker rooms, and other intimate spaces with males experience loss of dignity, anxiety, stress, humiliation, embarrassment, apprehension, and distress. "In light of the privacy interests that arise from the physical differences between the sexes, it has been commonplace and universally accepted—across societies and throughout history—to separate … public restrooms, locker rooms, and shower facilities" based on sex.[112]

Teammates of Lia Thomas described feeling uncomfortable changing in their own locker room—not because of Thomas's identity, but because of his male body: "It's definitely awkward because Lia still has male body parts and is still attracted to women."[113] Other female competitors felt "extreme discomfort" sharing a locker room with a male.[114]

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[108] *Fortner v. Thomas*, 983 F.2d 1024, 1030 (11th Cir. 1993) (citation omitted).
[109] *Cornfield v. Consol. High Sch. Dist. No. 230*, 991 F.2d 1316, 1323 (7th Cir. 1993).
[110] *Safford Unified Sch. Dist. No. 1 v. Redding*, 557 U.S. 364, 375 (2009).
[111] *Id*. at 366.
[112] *Grimm v. Gloucester Cnty. Sch. Bd.*, 972 F.3d 586, 634 (4th Cir. 2020), as amended (Aug. 28, 2020) (Niemeyer, J., dissenting).
[113] Shawn Cohen, *EXCLUSIVE: 'We're uncomfortable in our own locker room.' Lia Thomas' UPenn teammate tells how the trans swimmer doesn't always cover up her male genitals when changing and their concerns go ignored by their coach*, DAILY MAIL (Jan. 27, 2022), https://www.dailymail.co.uk/news/article-10445679/Lia-Thomas-UPenn-teammate-says-trans-swimmer-doesnt-cover-genitals-locker-room.html.
[114] Allie Griffin, *Lia Thomas competitor says she felt 'extreme discomfort' sharing locker room*, NY POST (July 27, 2022), https://nypost.com/2022/07/27/lia-thomas-competitor-riley-gaines-felt-extreme-discomfort-in-locker-room/.

As one Ivy League mother described her daughter's heart-rending situation:

> She also worked through how many towels to take in her bag into the locker room in case she needed to cover herself completely as she changed. All the girls knew Lia was still physically intact and had been using the locker rooms. …I asked my daughter what she would do if Lia was changing in there. And she said resignedly. I'm not sure I have a choice.
>
> I still can't believe I had to tell my adult-age daughter. "You always have a choice about whether you undress in front of a man." What messages that these girls have been receiving this year. How many of the other girls were feeling this? My heart was ripped apart. Damage far greater than the sports arena was now apparent to me.[115]

If there is one message the Department should help schools reinforce to young women, it is this: you *always* have a choice about whether to undress in front of a male. But the Department's proposed rule—in a cruel twist of misogyny—would deprive young women of that choice. They, like the Ivy League swimmers, would be forced into changing their clothes, or taking care of their private toilet and shower needs, in view of males. Such a policy would elevate the emotional desires of males over the needs of women and girls.

Young women also deserve the right to consent to male nudity. It is sexually harassing—traumatic, even—for females to be exposed to male nudity without their consent. In her expert report opposing males in women's sports, Champion Women CEO Nancy Hogshead-Makar recounts being psychologically traumatized by a violent rape, and the additional trauma she would have suffered if forced to undress in front of a male (however he identified):

> It was difficult to feel safe. I had a heightened need to control my environment and I went to elaborate lengths to feel safe. Among other insecurities, I was particularly aware of any risk of harm in my environment. I cannot imagine the psychological consequences if I had been required to change in front of biological males.[116]

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[115] Jonathan Van Maren, *Female swimmer says she has "no choice" but to change in locker room with male "Lia" Thomas,* THE BRIDGEHEAD (Mar. 7, 2022) https://thebridgehead.ca/2022/03/07/female-swimmer-says-she-has-no-choice-but-to-change-in-locker-room-with-male-lia-thomas/.

[116] *See* Exhibit 16, Expert Witness Declaration of Nancy Hogshead-Makar, J.D. filed in *A.M. v. Indianapolis Public Schools*, 1:22-cv-1075 (ECF 36-7) ¶ 47.

The Department cannot ignore the voices of sexual assault survivors. For many of these women, it takes an act of sheer will to enter a public space where they will encounter men. And they are traumatized at the mere thought of encountering a male in a space where they undress, attend to their private bodily needs, or sleep. A male's prerogative to live out his beliefs ends where it harms others—and that includes at the door of sex-separated spaces.

Women and girls also deserve the right to consent to sleeping in the same room as males. The Department's redefinition of sex discrimination would make it unlawful for girls and women to object to sharing a hotel room with a male peer on school trips, or object to sharing a dorm room. There is little that makes college women less safe than forcing them to sleep mere feet from males, behind closed doors.

Though the Department belittles concerns about privacy and safety as "unsubstantiated," the Department itself has recognized the importance of sex-separated private facilities in exempting toilet, locker room, shower facilities, and overnight accommodations from general prohibition on sex discrimination.[117]

Moreover, these are not fictional scenarios. Grotesque attacks on women's privacy are being seen in greater measure across the country. When it comes to safety, "the difference between male and female inmates … is obvious."[118] But that didn't stop New Jersey from agreeing to provide "housing in line with gender identity" following a lawsuit by the ACLU.[119] This resulted in a male inmate who identified as a female impregnating two female inmates.[120] And in California, a new law allowing incarcerated males to be housed in women's facilities resulted in over 300 males requesting transfer to women's prison, and sexual violence to the incarcerated women forced to share housing with these men.[121]

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[117] "A recipient may provide separate toilet, locker room, and shower facilities on the basis of sex, but such facilities provided for students of one sex shall be comparable to such facilities provided for students of the other sex." 34 C.F.R § 106.33. *See also Jeldness v. Pearce*, 30 F.3d 1220, 1228 (9th Cir. 1994) (finding that Title IX provides for sex-specific toilet, shower, and locker room facilities).
[118] *Oliver v. Scott*, No. 3:98-CV-2246, 2000 WL 968784, at *5 (N.D. Tex. July 13, 2000), aff'd, 276 F.3d 736 (5th Cir. 2002).
[119] ACLU of New Jersey, *Settlement of NJ Civil Rights Suit Promises Necessary Reform Affirming Transgender, Intersex, and Non-binary people in prison* (June 29, 2021) https://www.aclu-nj.org/en/press-releases/settlement-nj-civil-rights-suit-promises-necessary-reform-affirming-transgender (last visited September 2, 2022).
[120] Joe Atmonavage, *Transgender woman who impregnated 2 inmates removed from N.J.'s female prison*, NEWJERSEY.COM, https://www.nj.com/news/2022/07/transgender-woman-who-impregnated-2-inmates-removed-from-njs-female-prison.html.
[121] *See, e.g.*, Complaint for Declaratory and Injunctive Relief, *Chandler v. Cal. Dep't. of Cor. and Reh.*, No. 1:21-cv-01657, (E.D. Cal. filed November 17, 2021), *available at*,

Or take homeless shelters that house women who "have escaped from sex trafficking or been abused or battered, primarily at the hands of men."[122] When one women's shelter in Alaska declined to admit a male who identified as female, the municipality filed a complaint alleging it "had discriminated against [the male] on the basis of sex and gender identity."[123] A shelter in New York city took a different route and admitted a male, who was recently released from prison and had a "propensity for violence" toward women.[124] The male is currently standing accused of murdering a woman who was visiting him.[125]

B. The Department should consider alternatives that protect student dignity and privacy.

Sacrificing the privacy and dignity of women is too high a price to pay to affirm a male's beliefs about his identity—the balance of harms is clear. The Department must explore other alternatives. For example, the Department should promulgate regulations stating that private spaces must be offered by biological sex in order to preserve women's opportunities. Likewise, the Department should consider encouraging school districts to make multiple single-user facilities available so that any student who is uncomfortable using the toilet, changing, or shower facilities of their biological sex can have a private place to take care of their needs. The Department should evaluate how many federally funded schools already have single-user restrooms and facilities available for student or teacher use that would require no alteration to the physical facility. The Department should also undertake a cost-benefit analysis of altering some existing multi-user facilities into single-user facilities that would accommodate the privacy needs of every student. But under no circumstances should female private spaces be opened to all-comers.

The Department should also consider many other alternative policies, such as (1) delaying compliance dates; (2) applying the policy prospectively only; (3) grandfathering existing categories of single-sex housing; (4) exempting religious institutions, faculty, and students; or (5) crafting more specific privacy exemptions.

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https://static1.squarespace.com/static/5f232ea74d8342386a7ebc52/t/6196bf95316ee67aa2e827c5/1637269398161/Chandler+v+CDCR+Complaint_Case+No.+21-cv-1657.pdf.

[122] *Downtown Soup Kitchen v. Mun. of Anchorage*, 406 F. Supp. 3d 776, 781 (D. Alaska 2019).

[123] *Id.* at 784; see id. at 789–800 (enjoining municipality from enforcing public accommodations law against shelter).

[124] Rebecca Davis O'Brien & Ali Watkins, *How Did a Two-Time Killer Get Out to Be Charged Again at Age 83?* NYTIMES, HTTPS://WWW.NYTIMES.COM/2022/07/30/NYREGION/HOW-DID-A-TWO-TIME-KILLER-GET-OUT-TO-BE-CHARGED-AGAIN-AT-AGE-83.HTML (last visited September 2, 2022).

[125] *Id.*

C. The proposed rule will harm student housing and censor speech in student housing.

The Department must also consider and address the interplay of Title IX and the Fair Housing Act and the effect of its proposed rule on protected conduct in the context of educational housing.

Both laws regulate housing on most college campuses, and both laws should be correctly interpreted not to require colleges to place men in women's dorms. Permitting males to access female private spaces fails to accommodate girls. It instead discriminates against them by limiting their equal opportunities.

But the federal government now seeks to redefine sex discrimination in both laws to address gender identity. And prohibiting gender identity discrimination is actually a ban on single-sex housing, originally understood as housing separated by biological sex. Colleges must now place males who identify as female in female dorm rooms, and vice versa.

The Fair Housing Act and its regulations prohibit sex discrimination and prohibit speech expressing a policy of, or preference for, sex discrimination.[126] Congress enacted the Fair Housing Act (FHA) in 1968 to prohibit discrimination based on race, religion, and national origin in housing, and it amended the Act in 1974 to prohibit sex discrimination.[127] The FHA and its regulations prohibit "statement[s]" and "notice[s]" expressing a policy of, or preference for, discrimination in housing. 42 U.S.C. § 3604 (c); 24 C.F.R. § 100.50 (b)(4)–(5).1

The FHA applies to all "dwellings," even if the owner receives no government funds.[128] Courts and the government have long applied the FHA to college housing.[129]

Statutory context confirms that Congress did not prohibit student housing separated by biological sex. Sex was added as a nondiscrimination category to the FHA in 1974. Two years earlier, in Title IX of the Education Amendments of 1972, Congress said that Title IX does not prohibit "maintaining separate living facilities for the different sexes." 20 U.S.C. § 1686. In its ordinary meaning in 1974, sex means the biological binary of male and female.

For decades, courts unanimously held that the FHA does not address sexual orientation or gender identity.[130] As recently as 2020, the U.S. Department of

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[126] 42 U.S.C. § 3604; 24 C.F.R. § 100.50.
[127] 42 U.S.C. § 3604 (a) & (b); 24 C.F.R. § 100.50(b)(1)–(3).
[128] 42 U.S.C. § 3602(b); 24 C.F.R. § 100.20.
[129] *United States v. Univ. of Neb. at Kearney*, 940 F. Supp. 2d 974, 983 (D. Neb. 2013).
[130] *See, e.g., Smith v. Avanti*, 249 F. Supp. 3d 1194, 1201 (D. Colo. 2017) (rejecting argument that the sex stereotyping theory supports an FHA claim based on "status as a transgender" or "sexual

Housing and Urban Development (HUD) said that "to consider biological sex in placement and accommodation decisions in single-sex facilities" is "permitted" by the FHA.[131]

The FHA says nothing about undoing what Title IX allowed for student housing. In the FHA itself, Congress funds private college single-sex housing through HUD, even though it was commonly separated based on biological sex.[132] The FHA therefore cannot be interpreted to have prohibited separating student housing by biological sex.

For decades, regulations and guidances have allowed colleges to separate student housing by the biological binary of male and female.[133] HUD's own Title IX regulation characterizes sex this way: "[h]ousing provided by a recipient to students of one sex, when compared to that provided to students of the other sex, shall be as a whole" proportionate and comparable. 24 C.F.R. § 3.405 (emphasis added). It has said this since at least 1975.[134] The FHA did not overturn the longstanding practice that colleges separate student housing by biological sex.

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orientation or identity"). Many courts have rejected sexual orientation claims brought under the FHA. *Lath v. OakBrook Condominium Owners' Ass'n*, No. 16-CV-463-LM, 2017 WL 1051001, at *4 n.5 (D. N.H. Mar. 20, 2017); *Thomas v. Osegueda*, No. 2:15-CV-0042-WMA, 2015 WL 3751994, at *4 (N.D. Ala. June 16, 2015); *Thomas v. Wright*, No. 2:14-CV-01604-RDP, 2014 WL 6983302, at *3 (N.D. Ala. Dec. 10, 2014); *Ordelli v. Mark Farrell & Assocs.*, 2013 WL 1100811, at *2 (D. Or. 2013); *Miller v. 270 Empire Realty LLC*, 2012 WL 1933798, at *5 (E.D.N.Y. 2012); *Fair Housing Ctr. of Washtenaw Cty., Inc. v. Town & Country Apts.*, No. 07-10262, 2009 WL 497402, *3, n.1 (E.D. Mich. Feb. 26, 2009); *Swinton v. Fazekas*, No. 06-CV-6139T, 2008 WL 723914, *5 (W.D.N.Y. Mar. 14, 2008); *Smith v. Mission Assocs. Ltd. P'ship*, 225 F. Supp. 2d 1293, 1299 (D. Kan. 2002); *Neithamer v. Brenneman Property Services, Inc.,* 81 F. Supp. 2d 1, 4 (D.D.C. 1999). Even when parties conceded that the FHA prohibits sexual orientation in *Wetzel v. Glen St. Andrew Living Community, LLC*, 901 F.3d 856, 862 (7th Cir. 2018), the court warned that between the FHA and Title VII "there are some potentially important differences between the relationship that exists between an employer and an employee, in which one is the agent of the other, and that between a landlord and a tenant, in which the tenant is largely independent of the landlord," and consequently the court "refrain[ed] from reflexively adopting the Title VII standard" into all applications beyond "comparable situations." *Id*. at 863.

131 Making Admission or Placement Determinations Based on Sex in Facilities Under Community Planning and Development Housing Programs, 85 Fed. Reg. 44,811, 44,812 (Sept. 22, 2021).

132 *See* Tables 5 & 5a, pg. 228, Evolution of Role of the Federal Government in Housing and Community Development, Subcomm. on Housing and Community Development of the Comm. on Banking, Currency and Housing, 94th Cong. (Oct. 1975) (filed with Pub. L. 93-383 on Aug. 22, 1974), available on Westlaw under U.S. Government Accountability Office (GAO) Legislative History, Pub. L. 93-383—part 1.

133 45 C.F.R. § 86.32 ("A recipient may provide separate housing on the basis of sex."); HUD Occupancy Handbook, Chapter 3: Eligibility for Assistance and Occupancy, sec. 3-22.B.1 (citing 45 C.F.R. §§ 86.32 and 86.33), https://www.hud.gov/sites/documents/DOC_35645.PDF (last visited September 1, 2022).

134 Consolidated Procedural Rules for Administration and Enforcement of Certain Civil Rights Laws and Authorities, 40 Fed. Reg. 24,128, 24,148 (June 4, 1975) (promulgating 45 C.F.R. § 86.32).

In early February 2021, the federal government through HUD issued what it called a "directive" and "rule change" that redefined the Fair Housing Act's sex-discrimination provisions to include sexual orientation and gender identity.[135] Without notice or comment, the Directive ordered agency officials and external enforcement grantees to "fully enforce" this new standard immediately—and retroactively for one year—including against virtually all colleges' housing policies and speech. These laws impose crippling punishments for violations, including six-figure civil penalties, unlimited punitive damages, and even prison time.[136]

Just as the proposed rule by the Department of Education will transform student housing nationwide, HUD's Directive is a marked change that affects schools nationwide, such as the College of the Ozarks, a Christian undergraduate institution in Missouri.[137] Students need not be of a particular religion to study or live at the College, but they must agree to follow the College's religiously informed code of conduct. Under that code, sex is acknowledged at birth and based on biology, not gender identity, and students agree not to engage in sex outside marriage between a man and a woman. This code governs the College's single-sex residence halls, including communal showers, restrooms, dorm rooms, and roommate selection, as well as its pronoun usage and visitation policies. The College communicates these policies daily to 1,300 students. And because the FHA and its regulations prohibit "discriminatory" statements, the Directive censors the College's speech, banning it from saying that its student housing is or should be separated by biological sex, and coercing the College to adopt contrary policies. HUD now considers the College's housing policies and speech to be unlawful. By interpreting the FHA to address sexual orientation and gender identity, the government forces colleges to let males occupy female dorms—and qualify for roommate selection—when they claim a female gender identity.

Were schools like the College to comply with HUD's new mandate, or were Title IX to apply to colleges and universities as the proposed rule contemplates,

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[135] U.S. Department of Housing & Urban Development, Directive, Implementation of Executive Order 13,988 on the Enforcement of the Fair Housing Act (Feb. 11, 2021).

[136] The FHA provides broad enforcement mechanisms, including complaints, investigations, and lawsuits. *E.g.*, 42 U.S.C. § 3611–3614; 24 C.F.R. § 103.215, 180.671, 180.705; JA31–33. Its penalties include unlimited compensatory and punitive damages, 42 U.S.C. §§ 3612(g), 3613(c), and huge civil penalties: fines of $21,663 for a first violation, $54,157 for a second violation, and $108,315 for a third or continuing violation. 24 C.F.R. § 180.671. The FHA also provides criminal punishments, including prison time, if an incident involves the threat of force, such as if security staff enforce a prohibited housing policy. 42 U.S.C. § 3631. And anyone can file a complaint and trigger a government investigation, or bring a private lawsuit, so long as they "pose as renters," *Havens Realty Corp. v. Coleman*, 455 U.S. 363, 373 (1982). 42 U.S.C. §§ 3610(a)(1)(A)(i), 3613, 3614; 24 C.F.R. § 103.9, et seq.

[137] ADF, *College of the Ozarks v. Biden*, https://adflegal.org/case/college-ozarks-v-biden.

these schools would suffer immeasurable harm to religious exercise, free speech, and students' privacy interests. Abandoning any code of conduct and opening female private spaces to biological men jeopardizes their ability to function, harms students, and dissuades them from attending the school. They would also incur regulatory compliance costs of time, money, and speech were they to comply, because they would have to change their policies, statements, trainings, and signage, and even renovate their buildings. Conversely, if the colleges disregard the government's rewritten FHA, the Directive threatens "full enforcement." This includes investigations, enforcement actions, and litigation that could impose costly discovery and legal fees, millions in penalties and punitive damages, and criminal penalties against the colleges and their employees. Their liability under the Directive grows exponentially each day as they continue to speak about and apply their housing policies.

When the College sought relief in court, HUD confirmed that it considers the College's policies and speech unlawful under the FHA.[138] The government elaborated the many ways it believes the Directive applies to the College:

- The government said that to avoid liability the College must consider "accommodat[ing]" biological males who identify as females.
- The government said the Directive should not be enjoined because the College's students "might someday experience housing discrimination on the basis of sexual identity or sexual orientation."
- The government said the College's policies and speech could violate the Directive because a transgender student could be "denied housing" or experience "a hostile housing environment from college administrators on the basis of gender stereotype" because of the College's speech.
- The government said the College's policies could violate the Directive because "a cisgender student" "may experience housing discrimination when she brings transgender friends or family members to the dorm simply because those friends or family members do not conform to the college's views on sexuality."
- The government also questioned whether the College's opposition to compliance with the Directive is "really compelled" by its religion and whether its code of conduct is really "enforced," saying HUD investigations must be allowed to explore these issues.

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[138] *College of the Ozarks v. Biden*, No. 21-2270 (8th Cir.).

Marcia Fudge, the HUD Secretary, then testified to Congress that she believes the College's policies are illegal.[139] This view tracks the government's reinterpretations of other sex-discrimination laws. In federally funded single-sex housing not subject to the FHA, like emergency shelters, HUD prohibits gender-identity discrimination and has ordered that the "placement and accommodation of individuals in facilities that are permitted to be single-sex must be made in accordance with the individual's gender identity," not biological sex.[140]

Worse, the government condemned the College's speech as "indicat[ing] a discriminatory and unlawful preference"—and argued the College's speech is not protected at all under the First Amendment.

The Department of Education should expressly state whether it interprets Title IX the same way: to require this intrusive change to all college housing. The Department must address the application of its proposed rule with this level of specificity as to its impact, including on each point above, or else the regulated community will not have fair notice of what the rule requires. This particularly includes requiring girls to share rooms, dorms, restrooms, and more with males, including while sleeping and in states of undress.

The Department furthermore must evaluate these potential applications of its rule to student housing and address whether these costs are justified, and if so, on what basis. It should granularly break down the costs of the rule on student housing, including the costs on individual students. And it should address why and how it identifies higher benefits. It should also consider whether redefining sex in Title IX will cause other agencies to redefine sex in other statutes to avoid conflicts, and it should describe in the final rule how it proposes to coordinate enforcement of these laws on college housing, given the dual and overlapping enforcement structure of many civil rights offices and divisions across agencies.

The right course is for the Department to conclude that neither the FHA nor Title IX requires any of this, either as a matter of law or as a matter of a cost-benefit analysis. Congress did not unmistakably address sexual orientation and gender identity in the 1974 FHA, or in the 1972 Title IX, let alone unmistakably

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[139] Testimony of Marcia Fudge, U.S. House Comm. on the Budget, Hr'g on U.S. Dep't of Housing and Urban Development's Fiscal Year 2022 Budget at 29:06 (June 23, 2021), https://budget.house.gov/legislation/hearings/us-department-housing-and-urban-development-s-fiscal-year-2022-budget. Secretary Fudge claimed she would not violate free speech rights, but the government denies that the College has any free speech rights.

[140] 81 Fed. Reg. at 64,765, 64,767–68; Press Release, U.S. Dep't of Housing & Urban Dev., *HUD Withdraws Proposed Rule, Reaffirms Its Commitment to Equal Access to Housing, Shelters, and Other Services Regardless of Gender Identity* (Apr. 22, 2021), https://www.hud.gov/press/press_releases_media_advisories/HUD_No_21_069 (last visited September 1, 2022).

force colleges to allow males to live and shower with females. In fact, in a 1976 letter to the President of Harding College, OCR Acting Director Martin H. Gerry specifically denied that Title IX applied to sexual orientation: "We should, perhaps, note in this connection that Title IX does not address the question of homosexuality—it prohibits discrimination based on sex, not actions based upon sexual preference."[141]

Because Congress did not "in fact face[], and intend[] to bring into issue" this particular disruption of state and private authority,[142] any such interpretation violates the clear-notice canon.

The Department of Education should also expressly state whether it interprets Title IX and the Constitution the same way as HUD to make colleges' own speech about housing illegal, and to claim that colleges have no First Amendment rights in this area.

More broadly, the Department must address the reliance interests of public and private colleges, these free speech and religious liberty concerns, and any alternatives not only in the broad context of education but also *specifically in the context of college housin*g. "[A]gency action is lawful only if it rests on a consideration of the relevant factors."[143] Whether the agency action concerns a rule or concerns enforcement, it must address "legitimate reliance" on past policies or legitimate alternative policies.[144] The Department must consider these reliance interests and constitutional concerns in particular settings of student housing and in the specific circumstances for educational institutions, including how to accommodate the First Amendment rights of those individuals with religious objections, such as school employees, students, and visitors. Even if Title IX provides a religious exemption for schools, it provides no exemption for individual employees, students, and visitors. And secular schools and non-religious individuals have First Amendment interests in speech that must be considered. These effects on their free speech and religious freedom thus must be quantified now, both in their nature, number, and degree. Any failure of the Department of Education to "overtly consider" these privacy, free speech, and religious freedom reliance interests render it fatally flawed.[145]

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[141] Letter from Martin H. Gerry, Acting Dir., Office for Civil Rights, Dep't of Health, Educ., & Welfare, to Clifton L. Ganus, Jr., President, Harding Coll. 4-5 (Oct. 14, 1976), http://www2.ed.gov/about/offices/list/ocr/docs/t9-rel-exempt/harding-university-response-10141976.pdf.
[142] *United States v. Bass*, 404 U.S. 336, 349 (1971).
[143] *Michigan v. EPA*, 576 U.S. 743, 750 (2015) (internal citation omitted).
[144] *Dep't of Homeland Sec. v. Regents of the Univ. of Cal.*, 140 S. Ct. 1891, 1910–15 (2020).
[145] *Little Sisters of the Poor v. Pennsylvani*a, 140 S. Ct. 2367, 2383 (2020).

The Department of Education's proposed Title IX rule—like HUD's directive—causes tremendous upheaval for student housing, yet the proposed rule ignores colleges' interests in their single-sex housing policies and codes of conduct. The proposed rule also does not adequately consider possible exemptions or other statutory or constitutional protections of religious rights, including the First Amendment and the Religious Freedom Restoration Act (RFRA) for schools and individuals.

If Title IX and the FHA were read to prohibit sexual orientation and gender identity discrimination—which *Bostock* said its holding did not encompass—the Department still must consider these interests because that reading of these laws would be unconstitutional. The same constitutional claims would support relief against government enforcement of the statute and regulations. And so the same problems with the proposed rule must be considered now, even if the Department has statutory authority. The proper course is to provide for no rules that redefine sex and raise these conflicts, or, at a minimum, draft regulatory exemptions now.

And, upon consideration of these free speech interests in college housing, the Department should conclude that its regulations cannot affect and must expressly exempt protected expression in the context of student housing. Under the Free Speech Clause, the government may not restrict speech because of its content or viewpoint.[146] But the FHA and HUD regulations, whose enforcement the Directive modifies, prohibits speech "with respect to the sale or rental of a dwelling that indicates any preference, limitation, or discrimination based on [sex]."[147] It is possible that the Department of Education will interpret Title IX to impose similar restrictions. But that mandate, like HUD's directive, will prohibit a college's speech about having or preferring its own housing policies as it rents space to students. It likely will restrict a college's code of conduct for housing, under which sex is determined at birth and based on biology, not gender identity, and under which students agree not to engage in sex outside marriage between a man and a woman.

Consider statements the proposed rule (like the HUD Directive) would censor a college from making:

- Posting online its beliefs or code of conduct, including saying that its student housing and visitation are separated by biological sex, not gender identity;
- telling students in person or in applications about its code of conduct;

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[146] *Reed v. Town of Gilbert*, 135 S. Ct. 2218, 2227 (2015).
[147] 42 U.S.C. § 3604(c); 24 C.F.R. § 100.50(b)(4)–(5).

- posting signs that showers, restrooms, and dorm rooms in residence halls are separated by biological sex;
- arranging dorm rooms and roommates based on students' biological sex; and
- telling students that the college prefers its policies to the government's mandates.

At the same time, the proposed rule seemingly would allow statements made against the college's housing and conduct policies. A college can tell students it has, or prefers to have, single-sex housing based on gender identity, but a college cannot tell students the college has, or prefers to have, single-sex housing based on biological sex. A college must also adopt the government's policies, and it must answer, on inquiry, that it provides housing without regard to sexual orientation or gender identity. As discussed in other ADF comments, a college must also use a student's preferred pronouns based on gender identity under the anti-hostility and anti-harassment provisions.

Again, if the proposed rule does not have these effects on speech, and if the proposed rule allows these statements in housing, it should say so directly in the final rule.

But if the proposed rule causes these effects on speech in the housing context, and if the government does not disavow them, it will bring the proposed rule into conflict with the First Amendment. The Department thus should consider taking no action, withdrawing the proposed rule, grandfathering existing categories of housing, grandfathering existing facilities, delaying compliance dates for several years to allow the construction of new facilities, and other means to accommodate women and girls.

Of all these options, the right course is for the Department to withdraw the proposed rule and protect women and girls' equal opportunities, safety, and privacy.

Thank you for your consideration of these important concerns.

Christiana Kiefer

Christiana Kiefer
Senior Counsel
Alliance Defending Freedom

EXHIBIT 1

CONCERNED WOMEN for AMERICA

The Honorable Catherine E. Lhamon
Assistant Secretary for Civil Rights
U.S. Department of Education
Office for Civil Rights
400 Maryland Avenue, SW
Washington, D.C. 20202-1100

Submitted via electronic form:

March 17, 2022

Dear Assistant Secretary Lhamon,

Concerned Women for America (CWA), the nation's largest public policy organization for women, is filing this formal complaint with the U.S. Department of Education Office for Civil Rights (OCR) against the University of Pennsylvania (UPenn) for its egregious violations of the protections for women on the basis of sex secured a half-century ago in the landmark passage of Title IX of the Education Amendments of 1972. The infractions have not only occurred within the 180 days required but, to the detriment of current and future female student-athletes nationwide, it is ongoing.

On February 16-19, 2022, Lia Thomas (formerly Will Thomas), a Division I swimmer who is biologically male but rostered as a senior on UPenn's women's team and competed through the season displacing teammates in events and shattering pool, league, and national records, was allowed to compete in the Ivy League Championships (ILC) as a member of UPenn women's swimming team in direct violation of the prohibition against sex discrimination under Title IX. Thomas is currently competing in the National Collegiate Athletic Association (NCAA) National Championships (scheduled for March 16-19, 2022). Thomas is anatomically/biologically a male who should not be eligible to compete in women's sports, depriving anatomically/biologically female athletes of the opportunities afforded to them by law.

Predictably, Thomas has set records and crushed women's aspirations as a male-bodied athlete competing in women's sports.[1] Thomas' time in the 500-yard freestyle event at the ILC was 7.5 seconds faster than the second-place finisher, Thomas' teammate Catherine Buroker. It is undeniable that Buroker was deprived of the first place finish she earned in the women's category.

Despite the blatant injustice to female athletes, UPenn and the Ivy League doubled down on its celebration of a biological male who self-identifies as the opposite sex competing in women's swimming by awarding Thomas First Team All-Ivy honors in three events (200-, 500- and 1000-yd freestyle) and the single team athlete selected by UPenn for the 2021-22 Ivy League Women's Swimming and Diving Academic All-Ivy team.[2] All significant career-enhancing opportunities that female student-athletes were deprived of because of sex— because of their unique biological design as females.

As recent as 2020, Thomas was competing as a member of UPenn's men's swimming team. In 2021, just a year later, UPenn allowed Thomas to join the women's team after self-identifying as a woman. But Thomas is still anatomically a male, bearing all the biological advantages of male developmental physique.[3] By allowing a male to take a spot and compete on the women's swim team, depriving aspiring young women athletes of a fair and level playing field in competition, UPenn commits a grave injustice and violates the most fundamental principles of equity in Title IX's historic efforts to promote equal opportunity in sports in educational institutions.

It cannot be overlooked that UPenn's policy has a disparate impact on women, given the clear biological differences between the sexes.[4] Women unquestionably lose under these types of discriminatory practices, and the U.S. Supreme Court has long recognized such disparate impact to establish a *prima facie* case of discrimination.[5] To allow such a discriminatory policy to continue is to say that an educational institution could have an all-biological male swimming or even wrestling or boxing team, both in the men's and women's categories of competition, while remaining in full compliance with federal law, potentially eliminating all opportunities for

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[1] *Brooke Migdon*, "Lia Thomas wins 500-yard freestyle, sets pool record at Ivy League Championships," *The Hill* (*Feb. 18, 2022*), available at https://thehill.com/changing-america/respect/diversity-inclusion/594905-lia-thomas-wins-500-yard-freestyle-sets-pool.

[2] *Ivy | ESPN*, "Women's Swimming & Diving All-Ivy, Postseason Awards Announced" (Fev. 23, 2022), available at https://ivyleague.com/news/2022/2/23/womens-swimming-diving-all-ivy-postseason-awards-announced.aspx.

[3] Knox T, Anderson LC, Heather A, "Transwomen in elite sport: scientific and ethical considerations," *Journal of Medical Ethics* 2019;45:395-403, available at https://jme.bmj.com/content/45/6/395; David J Handelsman, Angelica L Hirschberg, Stephane Bermon, "Circulating Testosterone as the Hormonal Basis of Sex Differences in Athletic Performance," *Endocrine Reviews*, Volume 39, Issue 5, October 2018, Pages 803–829, available at https://doi.org/10.1210/er.2018-00020; Doriane Lambelet Coleman and Wickliffe Shreve, "Comparing Athletic Performances: The Best Elite Women to Boys and Men," Duke Law, available at https://law.duke.edu/sites/default/files/centers/sportslaw/comparingathleticperformances.pdf; Ian Janssen, Steven B. Heymsfield, ZiMian Wang, and Robert Ross, "Skeletal muscle mass and distribution in 468 men and women aged 18–88 yr," Journal of Applied Physiology 2000 89:1, 81-88, available at https://doi.org/10.1152/jappl.2000.89.1.81.

[4] Thibault, V., Guillaume, M., Berthelot, G., Helou, N. E., Schaal, K., Quinquis, L., Nassif, H., Tafflet, M., Escolano, S., Hermine, O., & Toussaint, J. F. (2010). Women and Men in Sport Performance: The Gender Gap has not Evolved since 1983. *Journal of sports science & medicine*, *9*(2), 214–223; Institute of Medicine (US) Committee on Understanding the Biology of Sex and Gender Differences; Wizemann TM, Pardue ML, editors. Exploring the Biological Contributions to Human Health: Does Sex Matter? Washington (DC): National Academies Press (US); 2001. 2, Every Cell Has a Sex. Available from: https://www.ncbi.nlm.nih.gov/books/NBK222291/.

[5] *See Dothard v. Rawlinson*, 433 U.S. 321, (1977).

female athletes in a program. Any interpretation of federal law facilitating such a result is anathema to Title IX.

Educational institutions have a responsibility under federal law to protect every student's right to learn in a safe environment free from unlawful discrimination and to prevent unjust deprivations of that right. This includes students who experience gender dysphoria, but it also includes female students, who make up over 50% of post-secondary students. Thomas has a place to compete in sports against other athletes according to the athlete's biological makeup as a male. As already mentioned, Thomas indeed competed in the men's team from 2018 to 2020, even while taking steps to embrace a new identity. There would be no injustice if Thomas retained a roster spot on the men's team. But to allow a male-bodied athlete to displace female student-athletes in the women's category based on inevitable biological advantages is a gross violation of Title IX. Thomas' own teammates have spoken out, saying, "Biologically, Lia holds an unfair advantage over competition in the women's category, as evidenced by her rankings that have bounced from #462 as a male to #1 as a female."[6]

The situation has devolved into a hostile environment for female athletes at UPenn at the hands of the UPenn swim coach and University administration. Female athletes are being forced to forfeit their rightful privacy and dignity in sex-specific locker rooms in direct violation of Title IX. Worse yet, they do not feel free to speak up in disagreement with the policy without creating adverse effects on their dreams of an athletic college career. Therefore, female athletes have been forced to speak up only on the condition of anonymity. One of Thomas' teammates spoke of the injustice towards her and her teammates to *OutKick*:[7]

> "Pretty much everyone individually has spoken to our coaches about not liking this. Our coach [Mike Schnur] just really likes winning. He's like most coaches. I think secretly everyone just knows it's the wrong thing to do," the female Penn swimmer said during a phone interview.
>
> "When the whole team is together, we have to be like, 'Oh my gosh, go Lia, that's great, you're amazing.' It's very fake," she added.

She later discussed the fear of speaking out for women's rights:

> "If we protest it, we're only hurting ourselves because we're going to miss out on all that we've been working for," Thomas' female teammate said, but she added that something needs to be done to protect biological women who've fought for an equal playing field in collegiate athletics.

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[6] Isaac Schorr, "Transgender Swimmer Lia Thomas Continues to Dominate, Break Records, at Ivy League Championships," *National Review* (Feb. 18, 2022), available at https://www.nationalreview.com/news/transgender-swimmer-lia-thomas-continues-to-dominate-break-records-at-ivy-league-championships/.

[7] Joe Kinsey, "Penn Trans Swimmer's Teammate Speaks Out as Lia Thomas Smashes More Records," *OutKick* (Dec. 11, 2021), available at https://www.outkick.com/outkick-exclusive-penn-trans-swimmers-teammate-speaks-out-as-lia-thomas-smashes-more-records/.

Another account to *NewsNation* expressed the frustration:

> "The first word that comes to my mind is insane," the swimmer told *NewsNation*. "I feel like it's something that's so basic that people have just somehow managed to twist and make [it] way more complicated than it should have ever been."[8]

The situation is untenable. Teammates say the female athletes feel uncomfortable changing in their own locker room, something Title IX specifically addresses.

> "It's definitely awkward because Lia still has male body parts and is still attracted to women," one swimmer on the team told DailyMail.com in an exclusive interview.
>
> Lia has told her teammates that she dates women.
>
> While Lia covers herself with a towel sometimes, there's a decent amount of nudity, the swimmer said. She and others have had a glimpse at her private parts.
>
> She stated that team members have raised their concern with the coach, trying to get Thomas ousted from the female locker room, but got nowhere.
>
> "Multiple swimmers have raised it, multiple different times," the UPenn swimmer said. "But we were basically told that we could not ostracize Lia by not having her in the locker room and that there's nothing we can do about it, that we basically have to roll over and accept it, or we cannot use our own locker room."[9]

What has happened at the University of Pennsylvania, Ivy League, and the NCAA is a complete failure of compliance obligation under Title IX. Female athletes are accorded rights on the basis of sex under the law and deserve protection, not intimidation and abuse. Federal law demands schools receiving federal funds comply with the laws on sex discrimination, not flout it.[10] OCR has a duty to protect women's rights under Title IX. The policies at UPenn have produced the very definition of a hostile work environment for its female athletes in their swim team. It can never be an acceptable practice for school coaches and officials to tell female

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[8] Bobby Oler, "Lia Thomas situation 'insane,' Penn teammate says," *NewsNation* (March 7, 2022), available at https://www.newsnationnow.com/prime/lia-thomas-situation-insane-penn-teammate-says/.

[9] Shawn Cohen, "EXCLUSIVE: 'We're uncomfortable in our own locker room.' Lia Thomas' UPenn teammate tells how the trans swimmer doesn't always cover up her male genitals when changing and their concerns go ignored by their coach," *Daily Mail* (Jan. 27, 2022), available at https://www.dailymail.co.uk/news/article-10445679/Lia-Thomas-UPenn-teammate-says-trans-swimmer-doesnt-cover-genitals-locker-room.html.

[10] UPenn is one of the federal government's most well-funded universities. *See* Evan Comen, Michael B. Sauter, Samuel Stebbins, Thomas C. Frohlich, "Universities Getting the Most Money from the Federal Government," *24/7 Wall St.* (March 22, 2017), available at https://247wallst.com/special-report/2017/03/22/universities-getting-the-most-money-from-the-federal-government/4/.

athletes to "suck it up" [11] when they complain about sexual harassment and these flagrant violations of their rights as biological women.

As the federal agency charged with enforcing federal civil rights laws that prohibit discrimination on the basis of sex in programs or activities that receive federal financial assistance in the educational context, OCR must act urgently against the University of Pennsylvania and generally as an ongoing matter of enforcement before this abject denial of biological impact and flagrant sex discrimination against female student-athletes affects more and more female students across the country.

OCR must ensure female students are not deprived of their rights under the law and denied recourse for sex discrimination. We plead for you to issue clear, decisive guidance to clarify the law and prevent colleges and university athletic programs from violating women's rights by allowing biological male athletes to compete in the women's category of sport. Protecting all female student-athletes from this type of injustice is the very essence of OCR's mission to ensure equal access to educational opportunities and benefits the law requires under Title IX.

We thank you in advance for your immediate attention to this matter,

Penny Nance
President and CEO
Concerned Women for America

Mario Diaz, Esq.
General Counsel
Concerned Women for America

[11] "It is definitely uncomfortable and has been expressed to our coach and members of the athletic department that people are uncomfortable with it," the teammate said. "We were basically told to, 'suck it up.'" Dan D'Addona, "Lia Thomas Teammate: Situation is 'Unfair' and NCAA is 'Discriminating Against Cisgender Women'; Locker Room Discomfort," *Swimming World* (March 9, 2022), available at https://www.swimmingworldmagazine.com/news/lia-thomas-teammate-situation-is-unfair-and-ncaa-is-discriminating-against-cisgender-women-locker-room-discomfort.

EXHIBIT 2

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON,

Plaintiff,

v.

WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA,

Defendants

and

LAINEY ARMISTEAD,

Defendant-Intervenor.

Case No. 2:21-cv-00316

Hon. Joseph R. Goodwin

DECLARATION OF ALANNA SMITH

I, Alanna Smith, declare as follows:

1. I am an eighteen-year-old senior at Danbury High School in Danbury, Connecticut.

2. Though I am an elite female track athlete, I have personally experienced the devasting impact of competing against—and losing to—male athletes in my sport.

3. Though I only competed against these athletes during my freshman year of high school, they still impacted my placements, public recognition, medals, records, and how I physically and mentally prepared for competition.

Athletic Background

4. I was born into a family of athletes. My dad is a Major League Baseball Hall of Fame relief pitcher. My mom ran track in high school and still runs recreationally. One maternal uncle played professional football. Another played professional baseball. My twin brother is a three-sport athlete.

5. Sports was a big part of my world from a very young age, as I attended my dad's MLB games and events and ran with my mom. Having a twin brother who is naturally athletic helped instill a competitive drive in me, because as a little girl I loved to beat him in foot races at every opportunity.

6. The sports legacy that surrounds me was not something I consciously thought about—it just became a part of who I am. And without thinking about it too seriously, I knew I had the potential to excel athletically.

7. It wasn't until I started running with mom and developing endurance and strength that I considered competitively running track. So, in middle school, mom enrolled me in the local middle school track program. Between 2015 and 2018, I tried shot put, the long jump, the 55-meter dash, the 100-meter, 200-meter, 400-meter, and 800-meter races.

8. As I tried different track and field competitions, I realized that I enjoyed and excelled at running shorter distances. That's when I knew I wanted to concentrate on the 100-meter, 200-meter, and 400-meter distances. I wanted to run and get it over with!

9. During middle school, I became a three-peat 100-meter Connecticut State Champion. In eighth grade, I was also the 400-meter state champion.

10. My freshman year of high school I was a varsity cheerleader in the fall and winter and made it to the 2019 Connecticut High School Coaches Association All-State cheerleading team.

11. After cheerleading finished, I started outdoor track in the spring of 2019. I was nervous. The first few practices were hard. I felt that my teammates had high expectations based on my middle school track performance. And it didn't help that the first few track meets were outside in cold or rainy weather, courtesy of New England.

12. But I won. And it felt amazing. I had proven to myself, the coaches, and my teammates that I could be a contributor to a winning season.

13. As my freshman season played out, I set personal, conference, state and regional facility records; improved my personal strength and technique; and accomplished personal goals. I contributed to the Danbury High School sweeping the 2019 outdoor FCIAC, Class LL, State Open, and New England Regional Championship competitions, and received numerous honors such as The Ruden Report Player of the Week, The Ruden Report Player of the Year, the 2019 All-FCIAC First Team in the 100-meter, 200-meter, 400-meter, 2019 CHSCA All-State Girls' Outdoor Track, and was a recognizable component of the 2019 CHSCA Connecticut Team of the Year award.

14. Excelling on the track and setting personal records gives me a sense of personal achievement and confidence that carries over into all parts of my life. I love training, I love competing. Competing against girls like myself who work hard is rewarding. I compete to be the best, to be the fastest, to be a champion.

Competition Against Males

15. In spite of my focused, diligent practice and training, my success on the track has been limited by biological males competing in the girl's high school track in Connecticut.

16. I first competed against a male at the New York Relays in April 2019. My team was invited to attend, along with teams from approximately seventeen other states. I knew going in that there would be a male athlete named Terry Miller from another Connecticut school in my race, and I was upset. I knew I wouldn't win, and I knew we girls were competing for second place and beyond. As expected, Terry won the 100-meter dash. I placed fourth. Had Terry not competed in that race I would have been recognized as third place.

17. I learned later that Terry had competed for three seasons in Connecticut boys' high school track before switching to girls' track.

18. Later that season, I found out I would be racing against Terry Miller and a second male athlete, Andraya Yearwood, in the 100-meter dash at the 2019 Connecticut State Open that.

19. After learning this news, I thought "I don't stand a chance to win." I felt defeated before I even got set in my blocks. Terry was in the lane next to me in the 100-meter finals, and I assumed going in that Terry would win. Terry was disqualified from the race due to a false start. I felt badly for Terry as an athlete, but I could tell the rest of us girls were a bit relieved that the race would now be a little more fair.

20. Also at the 2019 Connecticut State Open, I raced Terry Miller in the women's 200-meter dash. Terry placed first. Because of a male in my race, I was pushed from second place to third place.

21. Thus, at the 2019 State Open, I had one fair race: the 400-meter dash. I won that event.

22. From the State Open Championship, I advanced to the New England Regional Championship meet, which is quite an accomplishment for any athlete, but especially a freshman.

23. I won the 400-meter title at the New England Regional Championships. It was exhilarating, not only because I won, but because my race was free of male athletes. It was a level playing field.

24. The 200-meter dash was a different story. I would have also been runner-up in the 200-meter and received a silver medal and earned my team more overall points, but Terry Miller placed first and pushed me down in the rankings to third. Third place is nothing to be ashamed of if it is won fair-and-square, but my race was anything but fair.

25. My story is not unique. Girls across Connecticut have experienced similar displacement, loss of recognition, and even championship title losses solely because my state allowed two biological males to compete against biological females. Between 2017-2020, these two male competitors won 15 women's state championship titles and set 17 new meet records in track and field. These statistics are in the back of my mind no matter how hard I train and how well I perform

26. Even though the males have graduated now and are no longer competing against us girls in Connecticut, we still feel the effects of their participation. For example, in the 2022 Connecticut indoor track and field season—long after Terry Miller and Andraya Yearwood graduated—I ran a 6:96 time in the 55m dash. This would have set a new Connecticut girls' state record. But back in 2019, Terry Miller set a record of 6.95 in the 55m dash, eclipsing my best time. If not for Terry competing in the girls' category three years ago, I would have been

recognized for my accomplishment—setting a new record for female athletes in my state.

Fairness in Women's Sports

27. It has taken me years to develop the personal confidence and sense of belonging I now feel on my track team. The addition of males to girls' sports fills me with a sense of defeat before I even set up in the blocks. I deserve the opportunity to be confident, to be running against girls who have the same biological makeup that I do.

28. The addition of males in girls' sports is frustrating and disappointing to me. So often I go to the blocks and know that I am the fastest girl on the line. But I also know that my best effort will not be enough when I'm faced with a competitor who is bigger, faster, and stronger than me simply because he was born male.

29. I want to make sure that female athletes of today and tomorrow do not have to face the same sense of defeat, disappointment, and lack of support that I have felt. So many girls across my state believe the situation is unfair but are afraid to stand up and speak out for fear of retaliation from coaches, schools, the media, and strangers.

30. I am proud of all female athletes who stay strong and do their very best when rules and laws put unfair challenges in their way. I am proud to be a voice for female athletes who are surrounded by unfairness in their sport.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Alanna Smith

Alanna Smith
Dated: 04/12/2022

EXHIBIT 3

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON, *Plaintiff*, v. WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA, *Defendants* and LAINEY ARMISTEAD, *Defendant-Intervenor*.	Case No. 2:21-cv-00316 Hon. Joseph R. Goodwin

DECLARATION OF SELINA SOULE

I, Selina Soule, under penalty of perjury, declare as follows:

1. I am a nineteen-year-old resident of Boca Raton, Florida, in Palm Beach County and have personal knowledge of the information below.

2. I am a sophomore and female athlete at Florida Atlantic University (FAU) in Boca Raton, Florida. Competing in track and field is my passion.

Athletics Background

3. Sports are a huge part of my family. Both of my parents were multi-sport athletes. My dad competed in track, cross-country, baseball, and football. My mom was a competitive runner and figure skater, and now coaches figure skating.

4. My mom first coaxed me onto the ice rink at Rockefeller Center when I was just three years old. At age five, I started taking figure skating lessons. During elementary school, I began entering figure skating competitions—something I continued through my sophomore year of high school.

5. Figure skating was something my mom and I did together. We spent a lot of time on the ice, as she not only helped me learn to skate but even skated with me at times. By age thirteen, I was a volunteer figure skating coach helper, which turned into a paid coaching position at age fifteen. I continued coaching figure skating until I moved away for college.

6. The axel jump—a figure skating showstopper!—is my favorite figure skating element. Figure skating is not only a beautiful, graceful sport, but it is athletic too. It requires strength, speed, balance, and skill to execute those jumps and spins.

7. But I remember one thing very distinctively about figure skating: I did not like the scoring. Scoring was subjective; it was harder to clearly measure my achievements. (This is one reason I love track. My race times clearly show how fast I run so scoring is objective, not based on the subjective opinion of an individual judge.)

8. My mom introduced me to running when I was just five years old. I began running in our community's summer mile-long "fun runs" with my mom. Even at that young age, I knew two things with certainty: I loved to run, and I hated running long distances!

9. When I was around eight years old, my mom signed me up for my first Hershey Track and Field meet that was held in our town in the spring. It was the first time I set foot on a track—and I loved it. I realized that I was fast, and that I enjoyed competing to win. Running became my passion. And I enjoyed some success in the Hershey events as I competed there in

third through sixth grade. For example, I qualified twice for state level meets. In sixth grade, I won all three of my events.

10. After the Hershey events, I competed in the Nutmeg State games, the largest amateur multi-sport sporting event in my home state of Connecticut. These meets were ones my mom and I could do together. My favorite memory of the Nutmeg games was that my mom taught me how to long jump just a couple weeks before my first competition. And I went on to *win* the long jump that year for my age category.

11. But my freshman year at Glastonbury High School in Connecticut was my first school opportunity to compete in track and field. It was my first time on a school team with organized team practices and workouts—and I loved it.

12. Track and field competitions involve a variety of races and events. In track there are sprints, middle distance races, long-distance races, relay races, and hurdle races. And field events include long jump, triple jump, high jump, pole vault, shot put, discus throw, javelin throw, and hammer throw.

13. I am a short-distance sprinter and long-jumper. During high school, I competed in the 55-meter dash, 100-meter dash, 200-meter dash, the 4x200 and 4x100-meter relays, and the long jump. I also ran the 300-meter dash a handful of times.

14. When I joined my high school track team in my freshman year, I quickly became the school's best long jumper. And after only a few competitions, I became the permanent starter for the 4x200-meter relay.

15. I am proud of my high school athletic accomplishments. I was a ten-time All-Conference Honoree recipient, a five-time state title holder, three-time All New England award

recipient, a four-time National qualifier, and set five new Glastonbury high school records (including one that was previously set in 1976).

16. Track means everything to me. It is my passion and my happy place. When I run, I set aside everything else in life and just run.

Facing Male Competition in Girls' Track

17. But my high school track and field experience was not without frustration. During all four years of high school, I had the deflating experience of competing against male athletes in the girls' category.

18. The first time I competed against a male athlete in the girls' category was during my freshman year of high school at the May 2017 Middletown Invitational in the 200-meter dash. The gun went off at the start of the race, the male athlete left most of us girls in the dust. I knew immediately that this was not right and that girls would miss opportunities to succeed. Just days later, that same male went on to win the 2017 Connecticut Interscholastic Athletic Conference (CIAC) Class M Women's outdoor track championship in both the 100-meter and the 200-meter sprints.

19. The losses happened again and again. During my sophomore year, another male athlete joined girls' track and I had to face two male competitors at the 3rd Greater Bristol outdoor track and field invite in the 200-meter dash. The males took first and second; I crossed the finish line third. Had the males not been competing in the girls' category, I would have won that race.

20. These two males, Terry Miller and Andraya Yearwood, impacted my placement at statewide championship meets. At the 2018 CIAC State Open Championship in the Women's Outdoor 100-meter dash, the males again took first and second. Because of their participation in

Armistead App. 0043

the women's category, I was bumped down to sixth place when I should have earned fourth place.

21. But one of my more painful memories of loss involved the 2019 Connecticut State Open Championship. I missed qualifying for the state championship 55-meter final by just one spot, and the chance to qualify for the New England Regional championship by just two spots. The top two spots were taken by males. If not for those two male competitors in my race, I would have had the opportunity to compete in the championship final and for a coveted spot at the New England Regional championship.

22. While I was in high school, these two males collectively won 15 Connecticut women's state championship titles in girls' high school track and field and set 17 new individual meet records.

23. It is demoralizing and frustrating to compete against someone who has unfair physical advantages over you, because no matter how hard I train or how hard I try, there is nothing I can do to overcome that disparity. We girls train to win; not to win second place or receive a participation trophy. Some girls I know were so demoralized by the experience of losing to males that they abandoned certain track events and changed sporting events entirely. Other times coaches tried to convince girls to change their events just so the girls would have a chance to succeed.

24. Because of male competition, I have lost opportunities to compete at world class tracks. I have lost opportunities to compete in front of college coaches and scouts. I have lost opportunities to win titles and public recognition of my achievements. I have lost opportunities to win recognition and event points for my school.

25. And the heartbreaking thing is that my story is not unique. Many other girls across the state of Connecticut lost out on similar opportunities.

26. It felt so unfair. I knew I had to stand up. My parents and I reached out to school administrators and coaches. We reached out to CIAC officials to ask for a policy change. But no one would listen to us. Instead, they silenced us.

27. My parents and I were left with no other option but to file a federal lawsuit to protect the integrity of women's sports under Title IX. It was a huge step, a scary step. But someone needed to speak out for girls in Connecticut. That lawsuit is still ongoing.

Competing in Women's Collegiate Athletics

28. It was my dream to run track in college. Despite the unfairness of my high school track experience, I hoped to put that experience behind me and have a fresh start and level playing field in college.

29. After visiting several colleges, I decided to attend the College of Charleston in South Carolina. I attended the College of Charleston in 2020-21 for my freshman year. However, it was a tough school year with COVID and at the end of the year, I re-visited my options.

30. I received an offer to run for Florida Atlantic University, and I immediately knew that was the right fit for me. My dream has always been to attend college and run in Florida, and I finally have the opportunity to fulfill that goal. And I had always hoped to end up somewhere warm with lots of sunshine, so competing in Florida was a dream come true.

31. FAU has a NCAA Division I track and field team and competes in the East Division of Conference USA.

32. Being part of the team is quite an honor. And there are many additional side benefits to being a collegiate athlete: access to top-tier coaching, facilities, and equipment;

consultation with nutritionists and dieticians; paid travel to games, academic support services; medical and wellness care; access to psychologists; access to the NCAA Student Assistance Fund; team gear and apparel; and the opportunity to make money on my own name, image, and likeness.

33. For example, the Florida Panthers, a professional ice hockey team, recently announced that they were sponsoring FAU female athletes and giving us an opportunity to partner with them. I do not yet know all that will entail, but we receive tickets to home games, team apparel, the opportunity to partner with their brand. As athletes, we also have the opportunity to make money on our name, image, and likeness by appearing in ad campaigns for brands like Nike and Adidas.

34. At the end of the 2021-22 academic year, I will still have four more years of NCAA eligibility due to COVID.

35. My teammates and I train hard to win. We weightlift, complete running drills, and run sprints time and time again. It takes incredible work and dedication to win a race determined by hundredths of a second. I have trained much of my life striving to shave mere fractions of seconds off my race times.

36. I had to make many sacrifices over the course of my athletic career to play the sport I love. I have missed school dances and spring breaks, family events and holiday trips, and friends' birthdays and vacations. I have given up weekends and free time. I stayed late after school for practice. And the commitment to track has only increased during my time spent training in college.

37. But I make these sacrifices because I want to be the best that I can be. I want to win—not just for myself, but also for my teammates. And the motivation to win is what compels me to train as hard as I can.

38. I love my sport. I get on the track and I can let everything in my life go and I can be free to focus on running. It's exhilarating to see all the training and hard work pay off on the track.

39. But track has taught me more than just how to run fast down the track. I have also learned life skills. It has taught me physical and mental toughness. I have learned perseverance and good sportsmanship. I have learned that hard work pays off. And that making sacrifices to excel at something reaps future benefits. It opened new financial opportunities, personal development opportunities, and even academic opportunities. And it has given me something to strive for.

40. I am currently majoring in criminal justice with the goal of being a lawyer. But I always have my eyes on the track, and I would love to go pro after college if the right door opens.

Fairness in Women's Sports

41. When I heard that Florida's legislature passed the Fairness in Women's Sports Act in late April 2021 to protect the integrity of women's sports, I enthusiastically supported it.

42. In fact, it was my incredible honor to be invited to attend the bill signing ceremony in early June 2021 because my own personal story had played such a role in motivating lawmakers to pass a bill protecting Florida's female athletes. Little did I know at the time that Florida's Fairness in Women's Sports Act would later protect me, too, as I start competing for a public university women's team in Florida.

43. When that law was later challenged in federal court, I decided to speak up for girls who are afraid of retaliation from the media, school officials, and coaches and filed a motion to intervene in the lawsuit. I fear that too many women feel pressured to remain silent about their real views. And if someone does not speak up for women, I fear that we could see the end of women's sports. There will be boys' sports and co-ed sports. But women's sports as we know it will be gone.

44. I know from my own past experience in high school that males competing in women's sports takes away opportunities from women—whether that is a spot on the team, a spot on the podium, an athletic scholarship, the ability to benefit from her likeness, or recognition and awards—and it defies the entire purpose of having separate women's sports.

45. Woman have fought hard for many years to have equal athletic opportunities. I want to make sure that girls in the future can continue to compete in the sports they love. If girls do not have equal opportunities, I fear they may choose not to be involved in sports at all if they feel they cannot win or possibly even get physically hurt competing against a stronger, faster male.

46. I believe that ensuring an equal playing field for women to be champions in their own sport is a women's rights issue. But this isn't just about fair play and winning for me. I want to protect the fairness and safety of women's sports for female athletes everywhere. I want to ensure that future generations of women have access to the same equal athletic opportunities that shaped me and my love of sports.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Selina Soule

Selina Soule

Dated: 4/13/2022

EXHIBIT 4

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON, *Plaintiff*, v. WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA, *Defendants* and LAINEY ARMISTEAD, *Defendant-Intervenor*.	Case No. 2:21-cv-00316 Hon. Joseph R. Goodwin

DECLARATION OF CHELSEA MITCHELL

I, Chelsea Mitchell, declare as follows:

1. I am a nineteen-year-old graduate of Canton High School in Canton, Connecticut, and a sophomore student athlete at the College of William and Mary in Williamsburg, Virginia.

2. As an elite female athlete, I had the deflating experience of competing against and losing to male athletes in the girls' category throughout all four years of my high school career. I personally lost four state championship titles, two All-New England awards, medals, points, placements, and publicity due to an unfair state athletic policy that permits males to compete in girls' sports in Connecticut.

3. I hope that by sharing my experience, no other female athlete will have to face the heartache and loss that I did.

Athletic Background

4. Sports are a big part of my family. My sisters and I each started playing organized sports in kindergarten and later became multi-sport athletes. My oldest sister was captain of her high school soccer and track teams and went on to run collegiate track. My younger sister plays high school soccer and runs track, and also played lacrosse and basketball for a time. And I played basketball until eighth grade. I was the leading scorer on my varsity soccer team and a four-year starter. And I am a short distance sprinter and long-jumper.

5. My dad dedicated 15 years to coaching our soccer and basketball teams. My mom was our number one cheerleader, driving us to and from games, and volunteering her time so that we could play the sports we loved.

6. I started running track in middle school. My older sister ran it, and I decided to give it a try. I loved it: the competitiveness, how it makes me feel, and the opportunity to win.

7. I'm quite proud of my high school athletic achievements, which include:

- High School All-American for Long Jump, 2020 – NSAF (top 6 nationally)
- Girls Outdoor Track Athlete of the Year, 2019 – Connecticut High School Coaches Association
- Bo Kolinsky Female Athlete of the Year, 2019 – Hartford Courant (soccer and track)
- New England Champion in 100m
- 3 State Open Championships – 55m, 100m, Long Jump
- 8 State Championships – 55m, 100m, 200m, 300m, Long Jump x3, 4x100 relay
- 20 Conference Championships
- Hold the Conference Meet Records in all my events – 55m, 300m, LJ, 100m, 200m, LJ
- MVP award for track every season of high school career.
- Most goals scored in school history for girls' soccer.
- Most championship titles in school history for any athlete, male or female.

- Being the only female in school history to win a State or New England Championship in track and field. Thirteen different male athletes have won titles.

8. I am proud of what I've accomplished. But it hasn't been easy.

9. I have made a ton of sacrifices to compete—giving up what many would consider the "normal" teenage life by watching what I eat, skipping the parties, and going to bed early. I spend several hours a day at the track and in the weight room. Track meets are all-day events that start early and end late. I usually train or compete six days a week, with Sunday often my only day off when we are in-season. I do all of this to strengthen my body and improve my technique in hopes of running just a few tenths of a second faster or jumping just a few inches farther.

10. I do not mind the early mornings and long, tiring days when I know the competition is fair. Because when the competition is fair, I know I have a decent shot at winning. But my high school experience was anything but fair.

Males competing in Connecticut girls' track

11. During my freshman year of high school, my mom informed me that a male would be competing in the girls' category.

12. Later, we learned that the Connecticut Interscholastic Athletic Conference (CIAC) —the athletic association that set the rules for school sports in Connecticut—had passed a policy allowing biological males who identify as female to compete in the girls' category.

13. From the Spring 2017 outdoor track season through the Winter 2020 indoor track season[1]—six track seasons—I competed against biological males in my track and field athletic events due to the CIAC policy.

[1] The Spring 2020 outdoor season was cancelled due to the global COVID-19 pandemic.

Armistead App. 0012

14. Over the course of my high school career, I competed head-to-head with male athletes 27 times. I never won a race in which both male athletes were running.

2016-2017 Freshman Year

15. I first competed against a male in girls' track and field as a fourteen-year-old freshman at the Spring 2017 State Open Championship.

16. On the way to this meet, I was instructed by my coach to respond "no comment" if asked about the issue of males competing in the female category.

17. In the 100m final at the 2017 outdoor State Open, I placed 7th overall. The top six receive a medal and qualify to advance to the New England Regional Championship: one of those top six spots was taken by male athlete Andraya Yearwood:

Table 1: 2017 CIAC State Open Women's Outdoor Track 100m Results (June 5, 2017)[2]

Place	Grade	Sex	Name	Time	High School
1*	12	F	Caroline O'Neil	12.14s	Daniel Hand
2*	12	F	Kathryn Kelly	12.36s	Lauralton Hall
3*	9	M	Andraya Yearwood	12.41s	Cromwell
4*	11	F	Tia Marie Brown	12.44s	Windsor
5*	12	F	Kiara Smith	12.59s	Jonathan Law
6*	11	F	Kate Hall	12.62s	Stonington
7	9	F	Chelsea Mitchell	12.69s	Canton
8	12	F	Tiandra Robinson	FS	Weaver

* Qualified for the New England Championship.

18. If not for Yearwood's participation in the girls' category, I would have medaled and had the honor of advancing to the prestigious regional championship as a freshman.

[2] AthleticNet, https://www.athletic.net/TrackAndField/meet/306453/results/f/1/100m, last visited June 2, 2020.

2017-2018 Sophomore Year

19. During my sophomore year, I learned that Andraya Yearwood's school was reclassified to the Class S division for indoor track events—which was the same class as my school.

20. This news was upsetting for me because I would now be racing against a male competitor at both the Class S championship and the State Open championship.

21. At the February 10, 2018, indoor Class S Championship in the 300m, I was knocked out of advancing to the State Open by just one spot—a spot was taken by Andraya.

22. As a competitive person, I often check Athletic.net, a website that lists high school track rankings. One day, I noticed a new girl, named Terry Miller, at the top of the charts. Terry was running times better than I ever hoped to run. But my coach told me later that it must be some mistake—perhaps Terry was entered in the wrong race. Terry had competed as a boy for the previous three seasons.

23. On April 27, 2018, at the first invitational race of the Spring 2018 outdoor season, I was seeded in the 100m in a lane beside not just one, but two male athletes: Terry Miller and Andraya Yearwood.

24. I distinctly remember seeing Terry look over to Andraya and say: "You and me, one and two." At fifteen years old, I felt extremely intimidated to run against bigger, faster, and stronger male competitors.

25. But Terry was right. I should have won that 100m race; but instead, Terry and Andraya took first and second place, while I placed third.

26. Similarly, at the Spring 2018 outdoor State Open Championship, Terry won the women's 100m event by a wide margin, while Andraya finished second.

27. But for CIAC's policy, I would have won second place statewide:

Table 2: 2018 CIAC State Open Championship Women's Outdoor Track 100m Results (June 4, 2018)[3]

Place	Grade	Sex	Name	Time	High School
1*	10	M	Terry Miller	11.72s	Bulkeley
2*	10	M	Andraya Yearwood	12.29s	Cromwell
3*	11	F	Bridget Lalonde	12.36s	RHAM
4*	10	F	Chelsea Mitchell	12.39s	Canton
5*	11	F	Maya Mocarski	12.47s	Fairfield Ludlowe
6*	10	F	Selina Soule	12.67s	Glastonbury
7	12	F	Tia Marie Brown	12.71s	Windsor
8	11	F	Ayesha Nelson	12.80s	Hillhouse

* Qualified for the New England Championship.

28. Bridget Lalonde beat me by just three-hundredths of a second, but I was so relieved that she did. Emotionally, it was less of a loss to be denied runner-up status than to be denied a first place State Open Championship—a feat almost unheard of for a high school sophomore.

29. At the 2018 outdoor New England Regional Championship, I placed seventh in the 100m. Only the top six medal and receive the All New England award—one of those top six spots was taken by Terry.

30. Had I earned the title of All New England, I would have made Canton High School history as the first Canton female athlete to win this prestigious award.

2018-2019 Junior Year

31. In the fall of my junior year, I learned that male athlete Terry Miller transferred to Bloomfield, another Class S school.

32. I was devastated, fearing that with two males competing in my division, my chances of ever winning a state championship in sprints were now over.

[3] AthleticNet, https://www.athletic.net/TrackAndField/meet/334210/results/f/1/100m, last visited June 2, 2020.

33. I trained harder than ever, spending countless hours to shave mere fractions of seconds off of my times. I never missed a practice, squeezed in extra workouts where I could, and saw my race times consistently drop.

34. But it was not enough. And my fears of losing championship after championship were realized in the Winter and Spring 2019 seasons.

35. At the February 7, 2019, indoor Class S State Championship, Terry finished first in the 55m. I placed second. But for the CIAC's policy, I would have been named the Class S State Champion in the 55m.

36. The February 16, 2019, indoor State Open Championship saw similar results and a similar impact. Terry and Andraya finished first and second respectively in both the preliminary and final Women's 55m races, each time defeating the fastest girl by a wide margin. I placed third in the final.

37. But for CIAC's policy, I would have won the 2019 State Open Championship in the 55m dash:

Table 3: 2019 CIAC State Open Championship Women's Indoor Track 55m Preliminary Results (February 16, 2019)[4]

Place	Grade	Sex	Name	Time	High School
1*	11	M	Terry Miller	7.00s	Bloomfield
2*	11	M	Andraya Yearwood	7.07s	Cromwell
3*	12	F	Cori Richardson	7.24s	Windsor
4*	11	F	Chelsea Mitchell	7.27s	Canton
5*	12	F	Kate Shaffer	7.27s	Conard
6*	12	F	Ayesha Nelson	7.29s	Hillhouse
7*	12	F	Maya Mocarski	7.34s	Fairfield Ludlowe
8	11	F	Selina Soule	7.37s	Glastonbury
9	10	F	Kisha Francois	7.41s	East Haven

* Qualified for the women's 55m final.

[4] AthleticNet, https://www.athletic.net/TrackAndField/meet/352707/results/f/1/55m, last visited June 2, 2020.

Table 4: 2019 CIAC State Open Championship Women's Indoor Track 55m Final Results (February 16, 2019)[5]

Place	Grade	Sex	Name	Time	High School
1*	11	M	Terry Miller	6.95s	Bloomfield
2*	11	M	Andraya Yearwood	7.01s	Cromwell
3*	11	F	Chelsea Mitchell	7.23s	Canton
4*	12	F	Kate Shaffer	7.24s	Conard
5*	12	F	Ayesha Nelson	7.26s	Hillhouse
6*	12	F	Maya Mocarski	7.33s	Fairfield Ludlowe
7	12	F	Cori Richardson	7.39s	Windsor

* Qualified for the New England Championship.

38. Instead, I was not named State Open Champion in the 55m, I received a bronze medal instead of a gold medal, and I did not make Canton High School history as the first ever Canton female athlete to be named a State Open Champion.

39. However, after the 55m race, I returned to the finals of the long jump, which had no males competing. While listening to them announce Terry as the winner and new meet record holder in the 55m, I won the long jump event to solidify my place in the Canton record books as the first Canton indoor track athlete—male or female—to be named a State Open Champion.

40. State Champions are recognized as All-State Athletes, an award listed on college applications, scholarship applications, and college recruiting profiles. State Champions are invited to the All-State Banquet, and get their name celebrated on a banner in their high school gym. I did not receive any of these awards for the 55m. But I was able to receive these awards for my long jump championship.

41. After the State Open Championship, I was repeatedly referred to in the press as the "third-place competitor, who is not transgender." I was the fastest biological girl in the 55m race at the State Open Championship, but the press did not mention my name—I felt invisible.

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[5] *Id.*

42. At the March 2, 2019, indoor New England Regional Championship, Terry took first and Andraya took third place in the 55m dash. I missed medaling and being named All New England Champion by just two spots—two spots that were taken by male competitors.

43. Following Terry Miller's sweep of the CIAC's Indoor Class S, State Open, and New England titles in the 55m dash and 300m, Terry was named "All-Courant girls indoor track and field athlete of the year" by the Hartford Courant newspaper. This felt like an injustice to my fellow female athletes.

44. In the Spring 2019 outdoor season, I competed against both Terry and Andraya in the Class S Championship. At this event, I ran the fastest biological female times in the 100m and 200m across all state class meets.

45. But because of the CIAC's policy, being the fastest biological girl just was not good enough to experience the thrill of victory. Instead, at the 2019 Class S Championship, Terry placed first in the 100m and 200m, while I placed second in both events. I won the long jump and received a state title. But because of the CIAC's policy, I took home only one state title instead of three.

46. The trend continued at the 2019 outdoor State Open Championship as Terry easily won the women's 200m race. But for CIAC's policy, Cori Richardson would have won the state championship, Alanna Smith would have finished runner-up, and Olivia D'Haiti would have advanced to the New England Championship:

Table 5: 2019 CIAC State Open Championship Women's Outdoor Track 200m Final Results (June 3, 2019)[6]

Place	Grade	Sex	Name	Time	High School

[6] AthleticNet, https://www.athletic.net/TrackAndField/MeetResults.aspx?Meet=364088&show=all, last visited June 2, 2020.

1*	11	M	Terry Miller	24.33s	Bloomfield
2*	12	F	Cori Richardson	24.75s	Windsor
3*	9	F	Alanna Smith	25.01s	Danbury
4*	11	F	Chelsea Mitchell	25.24s	Canton
5*	12	F	Nichele Smith	25.38s	East Hartford
6*	12	F	Bridget Lalonde	25.55s	RHAM
7	12	F	Olivia D'Haiti	25.63s	Kolbe-Cathedral

* Qualified for the New England Championship.

47. But I did receive one opportunity to compete on a more level playing field. At the Spring 2019 State Open Championship in the 100m, Terry, the top-seed in the race, false-started and was disqualified. This opened the door for me: I was able to relax, focus on my race, and win. I set a personal record of 11.67 seconds, made Canton High School history as the first sprinter to be a state open champion in any sprint event, medaled, received significant media publicity, and advanced to the New England Regional Championships.

48. I went on to win the New England Regional Championships in the 100m dash and was named All New-England. Here, too, I made Canton High School history as the first female to win a New England Championship.

49. Thereafter, I was awarded Track Athlete of the Year by the Connecticut High School Coaches Association, and the Hartford Courant named me 2019 All-Courant Girls Outdoor Track and Field Athlete of the Year and the Bo Kolinsky Female Athlete of the Year (across all sports).

50. My new personal record, State Open Champion and All New-England awards put me in a much better recruiting position for college scholarships—all because a false start that prevented a male from competing against me in the women's division leveled the playing field.

2019-2020 Senior Year

51. A similar scenario played out in the Winter 2020 season. At the indoor Class S Championship 55m race, Andraya Yearwood—the top seed in the race and the individual ranked

number one in the state for the women's 55m dash—false-started and was disqualified. That false start opened the door for me to not only win the CIAC Class S Championship in the 55m dash, but also to advance to the 2020 Connecticut State Open Championship in the 55m event and win.

52. To my disappointment, the 2020 Spring outdoor season—the final track season of my high school career — was cancelled in light of the global COVID-19 pandemic.

53. It feels defeating to know that records at my high school, CIAC, AthleticNet, MySportsResults, CT.Milesplit.com, and others do not reflect the four state titles and two All New England awards I should have earned. It is upsetting to know that the meet records of many great female athletes before me have also been wiped from the books.

54. Competing against males makes me feel anxious and stressed. And stress has a negative impact on my athletic performance.

55. I try to stay positive, to take support from family and friends, but it is hard when I know that I must compete against those who have a biological advantage because they were born male.

56. I hope that future female athletes will not have to endure the anxiety, stress, and performance losses that I have while competing under a policy that allows males to compete in the female category.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Chelsea Mitchell

Chelsea Mitchell
Dated: April 13, 2022

EXHIBIT 5

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON,

Plaintiff,

v.

WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA,

Defendants

and

LAINEY ARMISTEAD,

Defendant-Intervenor.

Case No. 2:21-cv-00316

Hon. Joseph R. Goodwin

DECLARATION OF DARCY ASCHOFF

1. I am a 2 year resident of Lehi, Utah, and have personal knowledge of the information below.

2. As a former collegiate athlete, high school varsity volleyball coach, and mother of two competitive high school volleyball players, I have observed the mental and psychological toll on female athletes of being forced to compete against a male.

Athletic Background

3. Volleyball runs in my family. My mom played as a youth, I competed in college, and now my daughters are star high school volleyball athletes with dreams of competing in college.

4. I began playing competitive volleyball as a freshman at Delta High School as a middle blocker. During my senior year, my volleyball team won the 1995 Utah State Championship, and I was awarded MVP (most valuable player) for our team.

5. Throughout my sophomore, junior, and senior years of high school, I also played club volleyball.

6. I was recruited and given a scholarship to play varsity volleyball at Dixie State College (now Dixie State University), an NCAA Division I school. From 1996 to 1997, I played for Dixie State College.

7. After my sophomore year of college, I transferred to Hawaii Pacific University, an NCAA Division II school, where I was also offered a volleyball scholarship. From 1998 to 1999 during my junior and senior years of college, I played volleyball for Hawaii Pacific University.

8. In 1998, during my junior year of college, my Hawaii Pacific volleyball team won the NCAA Division II Nationals Championship. This was the highlight of my volleyball career.

9. In 2016, my entire Hawaii Pacific University volleyball team was inducted into Hawaii Pacific's Hall of Fame to honor our 1998 Nationals Championship.

10. I continued to play volleyball recreationally after college. My two daughters, Ajah and Jahslyn, have said that one of their earliest memories is watching me play recreational volleyball at a park across the street from our home. I would bring my daughters with me, and Ajah would beg whoever was on the sidelines not playing volleyball to pass the ball with her.

11. Both of my daughters went to volleyball summer camp at young ages, and eventually began competing in school and club volleyball.

12. As my girls reached high school, I started coaching their school and club teams.

13. In 2015, I coached Lanakila club volleyball for the 14 and under team, and in 2016 I coached Lanakila club volleyball for the 12 and under team, respectively.

14. From 2018 to 2020, I also coached girl's Hawaiian Style Volleyball, a competitive club volleyball team on Maui. In the 2018-2019 season, I coached the girls' 14 and under team, and in the 2019-2020 season I coached the girls' 16 and under team.

15. I served as assistant girls' varsity volleyball coach at Maui High School during the 2018 and 2019 seasons. Maui High School competes in the Maui Interscholastic League of the Hawaii High School Athletic Association.

My Daughters' Experience Competing Against a Male Athlete

16. The 2019-2020 volleyball season was my girls' final volleyball season at Maui High on our beloved island of Maui. Ajah was a sophomore and a team captain, and Jahslyn was a freshman. The Maui High team was a young team in a building season.

17. Ajah and Jahslyn worked so hard to develop their volleyball skills to become their best. They attended summer camps, participated in daily practice during high school season, and then continued to play volleyball year-round with highly competitive national club teams. These teams travel nationally and practice 2-3 times per week.

18. But despite my daughters' hard work, the 2019-2020 varsity girls' volleyball season was unusually tough: they were forced to face a male athlete on another team.

19. Both of my daughters knew this athlete, Jhene Saribay, from summer volleyball camps because training is co-ed. From what I learned, this male competed on the Kamehameha boys' volleyball team for several years, and only recently switched to competing on the girls' team.

20. My daughters heard rumors from other girls on the Maui High team that this male athlete was planning to play on the Kamehameha High girls' varsity volleyball team, but at first they didn't believe it.

21. I first heard about the situation from the Maui High head coach. Initially I thought it was a joke: this could not be happening. But it was. And our coach's hands were tied—the Maui High athletic director made clear that our head coach could not make waves about this situation, or he would lose his job. Other parents at Maui High were upset but were not willing to act.

22. My daughters competed against this athlete 3 times and their volleyball team lost every match.

23. Based on my observations as a mother and assistant coach at my daughters' volleyball games, this male athlete dominated Maui varsity girls' volleyball in the 2019-2020 season. He dominated playing time. He jumped higher. He spiked the ball harder and faster and further. From my perspective, he was one of the best hitters on Maui, despite his average stature.

24. The girls, on the other hand, were nervous and intimidated by the male on the other side of the net. They seemed mentally defeated before stepping onto the court. They would often "duck and cover" or assume a defensive position rather than prepare to respond to his spikes. My daughters said they were afraid of getting hurt. My daughters' teammates told us that they felt demoralized. Some wondered why they should even bother playing in matches against Kamehameha that season, because they knew the male athlete's team would beat them.

25. Volleyball is a very physical sport. And a male competing in girls' volleyball is a safety issue. I'm concerned that one of my daughters could be hurt, or that a male could take away their scholarship opportunities to compete in college.

26. Both of my daughters love the friendships they built through volleyball, as well as the comradery and competitive nature of the sport. They grew stronger and more powerful in hitting and jumping. They gained self-confidence and poise. I am proud of their hard work and drive to be the best they can be at their sport. Volleyball is all about testing your limits—how high you can jump, fast you can run, hard you can swing—and knowing that males have an advantage makes it hard for girls to compete.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Darcy Aschoff

Dated: 4-19-22

EXHIBIT 6

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON,

Plaintiff,

v.

WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA,

Defendants

and

LAINEY ARMISTEAD,

Defendant-Intervenor.

Case No. 2:21-cv-00316

Hon. Joseph R. Goodwin

DECLARATION OF MADISON KENYON

I, Madison Kenyon, declare as follows:

1. I am a twenty-year-old resident of Pocatello, Idaho, and have personal knowledge of the information below.

2. I am a junior and female athlete at Idaho State University in Pocatello, Idaho, where I compete in women's cross-country and track. Running is my passion.

Athletics Background

3. Athletics has been my world from a very young age. Both of my parents were high school athletes, so competition—especially among my siblings—was like the air I breathed growing up.

4. I first kicked a soccer ball at age three, and I was hooked. That first encounter with a ball led me to compete for 15 years on various club soccer teams.

5. Through playing soccer, I learned both that I am fiercely competitive and that I love to run.

6. Admittedly, I hated running at first, because it is hard work. But the more I ran, the faster I got and the more I enjoyed it.

7. In 6th grade, that love of running and competition led me to try cross-country—a sport I have competed in every fall since. In my freshman year of high school, I also started running track.

8. Running is my happy place. I love pushing my body to its limits, spending time outdoors, and doing it all with a sense of camaraderie and fun alongside some of my closest friends.

9. I'm proud of my accomplishments. In high school, I set five different school records, and as a sophomore was even voted unanimously by our coaches for the honor of "athlete of the year."

Competing in Women's Collegiate Athletics

10. I decided to attend college at Idaho State University (ISU) because it is a big university nestled in a small town with plenty of opportunities for outdoor activity and track competition. The athletic scholarship I received from ISU has not only helped finance my athletic career but has also helped finance my dream of becoming a nurse someday. I am currently pursuing a degree in nursing.

11. As an ISU freshman in the 2019-2020 academic year, I made the cross-country team and competed in the 4-kilometer (2.49-mile), 3-mile, 5-kilometer (3.12-mile), and 6-kilometer (3.73-mile) events. I was thrilled.

12. But that enthusiasm turned into confusion when, at the start of the fall 2019 cross-country season, I was informed that I would be competing against a male athlete.

13. At first, I was incredulous that any biological male would be allowed to compete in the women's category. This couldn't be happening.

14. So I researched the student. I found out that June Eastwood competed on the University of Montana's men's cross-country team for three years, before switching to compete on its women's cross-country team. I also learned that while competing as a man, Eastwood ran times in at least one event that was faster than the NCAA collegiate women's record. My heart sank.

15. So as I got into position at the starting line of my first ever collegiate cross-country race, I faced a hurdle I never expected to encounter: a male athlete.

16. In the 2019 cross-country season, I lost to Eastwood three times:

a. 2019 Montana State Cross-Country Classic in the 3-mile event.

b. 2019 Big Sky Cross-Country Championships in the 5k event.

c. 2019 NCAA Division I Mountain Region XC Championships in the 6k event.

17. In all three races, Eastwood not only beat me by a significant margin, but also bumped me down to a lower placement than I would have received had I only competed against other women. That may not seem like a big deal to some, but placements matter to athletes. I want to know that I earned my placement fair and square. Fair competition pushes me to better myself and try harder; unfair competition leaves me feeling frustrated and defeated.

18. It was discouraging. My heart sank as I watched Eastwood placing and medaling in the women's cross-country races in meet after meet.

19. Cross-country athletes, like me, usually also compete in indoor and outdoor track. So, during the winter 2020 indoor track season, I competed in the 3k (1.86-mile), the mile, and the distance medley relay events.

20. Again, I raced this male athlete during the indoor track season. At the 2020 Stacy Dragila Open Women's Indoor Mile, Eastwood took 2nd place and I took 8th. Eighth place is nothing to be ashamed of if won fairly—especially as a freshman competing in a race dominated by juniors and seniors—but the competition is not fair when one of the athletes in the women's category is a male with the strength and speed advantages that come from male physiology.

21. And at the 2020 Indoor Big Sky Championship I, along with three other ISU teammates, competed in the distance medley relay against Eastwood's relay team. A distance medley relay is made up of a 1200-meter leg, a 400-meter leg, an 800-meter leg, and a 1600-meter leg. Montana State's relay team was in 6th place before Eastwood began the final 1600-meter leg of the race. During Eastwood's leg, Eastwood advanced Montana's relay team not one or two, but *four* positions to finish in 2nd place. My team took 5th, though we would have placed 4th if not for Eastwood's participation. We lost not only a placement, but team points as well.

22. Also at the Big Sky Championship, I watched in disbelief as one of my teammates lost her bronze medal and place on the championship podium because Eastwood took first place in my teammate's women's mile event and bumped her to fourth place. It was heartbreaking to watch.

Fairness in Women's Sports

23. I believe that allowing males to enter women's sports defeats the entire idea of fair competition. Sex segregation in sports helps maintain fair competition so that no athlete has an unfair advantage over another. And it helps ensure that if women like me work hard, we have a shot at winning.

24. I am studying nursing and plan to enter the medical field. In my biology coursework, it is clear that the biological differences between male and female are not matters of personal opinion, or features that can be changed or chosen. I *am* female, not because I chose to be female, or identify as female, but because every cell in my body is marked with XX chromosomes and my entire body developed in alignment with those female markers.

25. But you do not need to be a medical expert to understand this. I know from everyday experience that since the boys in my class went through puberty, the males around me are generally bigger, faster, and stronger than the females, simply because they are male. Even the rules of sport implicitly acknowledge this. For example, men's cross-country races are longer than women's cross-country races.

26. In March 2020, Idaho became the first state in the country to pass a law to protect women's sports. H.B. 500, the Fairness in Women's Sports Act, protects women's sports by ensuring that only female athletes compete in sports designated for women or girls. I intervened in a lawsuit to help defend that law because I want my races to be fair and a test of skill and hard work. I do not want to wonder whether I am training countless hours for inevitable defeat, or whether I will even have a chance to win against a physically advantaged male athlete.

27. I fear that if we are no longer allowed by law to recognize the objective existence of women, that it will be a huge loss to women's rights.

28. Sports was like the air I breathed growing up, and I want my kids to have that same experience. And as hard as my teammates and I work to be competitive, I do not want to see women's sports fade away as a separate category because males compete in women's divisions, and women give up trying to compete because they do not think they can win. I fear that we will soon effectively have men's sports and co-ed sports, but no dedicated category for females only.

29. And I do not want to see women lose their legal protection and progress under the law because we can no longer identify what a woman is.

30. To my knowledge, June Eastwood has graduated. But I learned through my involvement in defending Idaho's Fairness in Women's Sports Act that another male, Lindsay Hecox, wants to compete on the women's team at Boise State University—a university that my team competes against. And if Title IX and Idaho's law aren't upheld, other males will almost certainly follow.

31. I believe everyone should be able to compete, but it must be done fairly. It is not fair for women's competitions to be open to male athletes. And women's sports itself will lose its meaning, and its specialness, if males can be redefined as females.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Madison M Kenyon

Madison Kenyon

Dated: April 14, 2022

EXHIBIT 7

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON, *Plaintiff*, v. WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA, *Defendants* and LAINEY ARMISTEAD, *Defendant-Intervenor*.	Case No. 2:21-cv-00316 Hon. Joseph R. Goodwin

DECLARATION OF CYNTHIA MONTELEONE

I, Cynthia Monteleone under penalty of perjury, declare as follows:

1. I am a forty-six-year-old resident of Lahaina, Maui County, Hawaii, and have personal knowledge of the information below.

2. I am a mother, a coach, and track and field athlete for Team USA. Both my daughter and I have had the frustrating experience of competing against a male athlete in our sport.

My Competition Against a Male Athlete

3. In September 2018, I competed at the World Masters Athletics Championships in Malaga, Spain. I was eager to put my hard work to the test. And it paid off: I took bronze in the W40 400, along with USA golds in the 4x100 and 4x400.

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4. But I was shocked to find out that one of my competitors was a biological male from Colombia who had just recently started identifying as female. The athlete had a much larger build than any of the female athletes.

5. I began to ask questions as to the fairness of this issue. The European officials stopped the track meet, conferred, and decided that the race had to continue and urged me to file a complaint with the Team USA managers.

6. Not only did the Team USA managers refuse to file a complaint or inquiry, they warned that for my own safety, I should not speak up about this issue.

7. My freedom of speech is important to me. I will not be silenced. I continue to defy this directive and speak up because I see firsthand the harm being done to my fellow female athletes.

8. This is not about being a sore loser—I beat the male athlete by just a few tenths of a second. This is about fairplay for all women. The same male athlete just a year later beat my USA teammate in the hurdles for a place on the podium at the 2019 World Masters Athletics Championships in Poland.

9. I see the psychological and emotional heartbreak of women. After training so hard to be the best that they can be at their sport, and spending so much time away from their families, they are devasted to see that sacrifice wasted because they were beaten by a biological advantage that no amount of training or sacrifice can overcome.

10. Many of the girls I coach suffer from anxiety over having to compete against male athletes. We all know the powerful scientific neurotransmitter connection between our minds and our bodies: When you *think* you can win, you have a better chance of doing it. It's proven.

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11. Science and common sense tell us that male and female bodies are different. No amount of testosterone suppression can change the amount of myonuclei in a male body, making it easier at any point in their life to build more muscle than the female sex. Not only that these cellular level advantages dictate that male bodies will be more powerful with faster twitch fibers than those of the female sex.

12. Women are not just hormones. Our athletic performance is impacted by our cycle, birth control, and pregnancy—something no male who identifies as female has to address.

13. As a masters athlete, I am especially concerned because female hearts shrink as we age, while the male hearts enlarge, all of this despite any "hormone treatment."

My Daughter's Competition Against a Male Athlete

14. But it was not just on the world stage that I experienced the demoralizing trend of males displacing females in their own competitions; it was also on my home island of Maui, Hawaii.

15. A year and a half after my experience in Spain, my daughter, Margaret, lined up for her very first high school track meet. I had watched proudly as my strong and determined girl did all the right things – made personal, difficult sacrifices to train her body to be as fast and fit as possible for her first race.

16. Yet all her hard work seemed for naught as she raced against a male-bodied athlete who had just transferred from the boys' volleyball team to the girls' team the season before. The athlete breezed right by Margaret to win first place, pushing her into second place.

17. My daughter lost her very first race to this athlete who ran so fast in the first 100 meters of the 400-meter race that the individual could have set a state record.

18. The Maui athletic community is small and tightknit. I learned that this biological male had grown up wrestling and had just injured a girl during volleyball, giving her a concussion with a powerful spike. This individual was casually trying out track and had trained only two weeks before running next to my daughter who had trained all year.

19. This athlete also raced against the girls I coached. One senior girl was crying because she told me she knew there was nothing she could do to win the conference championship that she had dreamed of winning since she was a freshman. She told me, right after that male athlete raced, that she was quitting track, even though I told her she had what it took to possibly run in college. She turned to me and asked, "What's the point, if it's not fair?"

20. COVID cancelled the rest of our season, but these horrible memories were never cancelled from my mind. We must consider the mental and physical health and safely of the biological female athletes and provide an equal and level playing field for them to achieve all of the opportunities the male sex has.

21. We must not hold the feelings and mental health of one group as more important than another. The mental health of our daughters, granddaughters, sisters, and teammates matter.

22. All of the lessons I teach as a coach about hard work paying off: these lessons fall apart when a mid-level male athlete doesn't have to work as hard and can beat our hardest working, most talented females.

23. In 2019 in Hawai'i, about 350 out of 700 male athletes ran faster than the fastest female in Hawai'i. Quite literally, a mediocre boy could beat the best girl. Tens of thousands of high school boys could run faster than the most decorated Olympian in history, Allyson Felix. If we do not protect women's sports, our girls will see their athletic dreams crushed.

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Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Cynthia Monteleone

Dated: April 19, 2022

EXHIBIT 8

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON, *Plaintiff*, v. WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA, *Defendants* and LAINEY ARMISTEAD, *Defendant-Intervenor*.	Case No. 2:21-cv-00316 Hon. Joseph R. Goodwin

DECLARATION OF CHRISTINA MITCHELL

I, Christina L. Mitchell, under penalty of perjury, declare as follows:

1. I am a forty-eight-year-old resident of Canton, Connecticut, in Hartford County, and have personal knowledge of the information below.

2. I am the mother of three female athletes. My daughters are now ages twenty-three, nineteen, and fifteen and have competed in soccer, basketball, and track. Our family life has been centered around sports since the girls were just little, spending most nights and nearly every weekend at the soccer field, in the gym, or at the track.

Family Athletics Background

3. I ran track and played basketball in high school. My husband played many sports and was the star of his high school basketball team. We have a competitive spirit that we have

passed on to our girls. Whether it's board games, March Madness brackets, or a pickup game of soccer in the yard, our family enjoys a good competition.

4. My husband volunteered his time as a youth soccer and basketball coach for the town of Canton for fifteen years. He would race home from his office job to try and make it to the field or gym in time for practice. Some seasons he coached two of our daughters' teams, which meant practice four nights a week and four games each weekend. It was exhausting but he loved every minute of it.

5. I volunteered on the Board for the Canton Youth Soccer Association for eight years. As registrar, I had to enforce strict age categories for the teams. Kids were allowed to "play up" on an older team but were never allowed to "play down" on a team for younger kids. Soccer teams were also separated by sex beginning in first grade. Boys' teams were designated as co-ed so that girls who wanted to sign up for the boys' team could "play up". Girls' teams were restricted to females in the registration system.

6. When my oldest daughter reached high school, I turned my volunteer efforts to the Canton Athletic Booster Club. I worked to get a concession stand built and stadium lighting installed at the high school track and field. In 2017, I was presented with the Dubuc Service to Canton Award in recognition for my years of volunteer service to the school and community.

7. All three of our daughters have excelled at sports. Our oldest daughter, Emily, was a varsity soccer and track athlete in high school. She was captain of both teams in her senior year and went on to compete on the women's track team in college.

8. Our youngest daughter, Kennedy, is a sophomore in high school and competes in soccer and track as well. She plays outside defensive back in soccer and her team made it to the

state championship this year. She is a long jumper and sprinter in track. She hopes to continue with one of these sports in college.

9. Our middle daughter, Chelsea, has proven herself as an exceptional athlete. Like her sisters, she had success in both soccer and track in high school. As a little girl on the soccer field, you could see her natural ability to run – she could come from 20 yards behind and beat anyone to the ball. When she got to high school, she added a heavy dose of hard work to that natural gift and made the most of it on the track.

2017 Outdoor Track Season – Freshman year

10. In April of 2017, the outdoor season of track and field in Connecticut was just getting started and Chelsea was ranked among the top sprinters in the state. She was coming off the indoor season where she set school records in the 55m and 300m at her very first meet.

11. There was one other freshman posting times in the top ten, Andraya Yearwood. I soon learned from an article in the Hartford Courant that Yearwood was a male identifying as female and running for Cromwell. I was confused by the piece, which seemed to celebrate this, and found it hard to believe that the schools, coaches, and state officials would allow it to continue. I saw it as a clear violation of women's rights under Title IX.

12. Chelsea worked hard that season and placed 2nd at the Class S state championship in all three of her events - the 100m, 200m, and 4x100 relay. The top five in each event advance to the State Open Championship to compete against the top twenty-five athletes in the state. Making it to the State Open is a huge accomplishment and Chelsea had qualified in all three events as a freshman. We were very proud and excited for her.

13. I knew that one of the other twenty-five competitors at the State Open would be Andraya Yearwood. The CIAC had allowed Yearwood to compete at the Class M state

championships and take the girls' title in the 100m and 200m races. One of the girls who placed second, Kate Hall, was interviewed following the race – "I can't really say what I want to say". The silencing of the girls had begun.

14. I had shielded Chelsea from much of the news up to this point, but the night before the race we felt we needed to prepare her for what she would face the next day. I told her there would be a boy who identified as a girl in her race and that she had to try to focus on herself and block out the rest. We knew that this would be a blow to her mental game but didn't want her to be surprised by it at the start line.

15. Chelsea's first race against a biological male was on a really big stage. The State Open is held at New Britain stadium, one of the biggest outdoor tracks in Connecticut. It is always packed with spectators and many college coaches attend to see potential recruits in action.

16. For me, it was my first time watching this unfair policy play out in person. As someone who has now watched my daughter race against males more than twenty times, I can attest to how difficult it has been every single time. The girls are forced into a race that they know is rigged against them. They are told to be quiet and be a good sport. They watch as officials casually ignore the foundational principle of sport – fair play. They see the media there, waiting to celebrate the travesty and daring the girls to speak against it. The message to these girls was very clear – nobody cares about your rights. As a woman it was infuriating and as a mom it was heartbreaking. I can only imagine what it felt like to be one of the girls in the race.

17. The 2017 Outdoor State Open was Chelsea's first tangible loss to a biological male. She took 7th place in the finals of the 100m. She missed advancing to the New England Championship by one spot. Yearwood had placed 3rd.

18. In a stroke of luck, one of the six automatic qualifiers to New England, Caroline O'Neil, had to decline her spot. We got the call later that night that as the 7th place finisher, Chelsea could go and compete. We were so grateful.

19. A few days later at the New England Championships, I watched as Yearwood's 2nd place finish in the 100m again took something tangible from female athletes. Madison Post from Maine didn't make the finals. Katya Levasseur from New Hampshire missed the top six and lost out on the All-New England designation. Kyla Hill from Massachusetts took home a 3rd place medal instead of silver. The ripple effect of Connecticut's policy had spread to our neighboring states.

2018 Indoor Track Season – Sophomore Year

20. I hoped that common sense would prevail, and this would work itself out before the next season. It didn't. Yearwood took home the 2018 Indoor Class S State Championship title in the 55m and placed 2nd in the 300m. Chelsea recorded another lost opportunity due to the policy as she missed advancing to the State Open in the 300m by one spot. Patricia Jurkowski should have taken home the 55m title and other girls lost opportunities to advance to finals or score points for their team. With every race, the list of female sprinters impacted by the policy grew longer. I knew I couldn't remain silent about it any longer.

21. Following the 2018 Indoor State Championships, I began to advocate for a change in policy. I first spoke to the Assistant Superintendent of Canton Schools, Dr. Jordan Grossman. I asked if he thought the Board of Education could help, but he advised against taking the issue to them. Instead, he gave me the name of the CIAC Executive Director so I could follow up with them directly.

22. I went to work on a letter to the CIAC asking for a solution to protect the rights of the female athletes in our state. I included the Canton principal, athletic director, coach, and assistant superintendent on the email. The CIAC replied that they were unwilling to consider changing the policy and listed various reasons. I addressed each reason with my own points – I was thorough and respectful – but I received no reply.

2018 Outdoor Track Season – Sophomore Year

23. The night before the first big meet of the outdoor season, we realized that a second male was competing in girls' sprint events. It was hard to believe at first, I remember thinking that surely this wasn't really happening. Terry Miller had competed for three seasons on the boys' team. Looking at the race results online, it was clear that Miller was an average runner that hadn't even qualified to compete at the boys' state championships just a few weeks earlier. After switching to the girls' team, Miller was suddenly ranked first in the state. I reached out to Chelsea's coach immediately. It seemed it was true; this was really happening.

24. The two male athletes took first and second in the 100m race the next day – Chelsea finished 3rd. With two males competing, it was clear that the number of lost opportunities for Chelsea and female sprinters across the state would now be double.

25. I again wrote to the Canton athletic director and principal to let them know that there were now two male athletes competing in girls' track. I asked them to urge the CIAC to change the policy before more harm was done but nothing changed.

26. Miller swept the sprint events at the Class M championship, taking three state titles. Yearwood was close behind. Girls were sidelined, missing finals and advancement to the Open. Anyone who tried to speak out was quickly silenced. Chelsea was thankfully in Class S

and took home three state titles of her own. But she would again head to the State Open to compete against males.

27. The State Open was a circus. Miller and Yearwood took 1st and 2nd in the 100m. The media was out in full force, waiting to ask the first female finisher how she felt about taking 3rd place. We were glad Chelsea took 4th and didn't have to deal with the emotions of being the one to lose a state title and her banner in the gym. Bridget LaLonde was the unlucky girl this time. Other girls lost points for their team, medals, and opportunities to advance to the New England Championship. The list of females impacted was very long at this point.

28. There was more of the same at the New England Championship. The top six athletes from Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, and Connecticut were there to compete for the title. It was a sunny day at a beautiful track and field facility at the University of New Hampshire, an incredible experience. But a cloud hung over the event as the female athletes were again denied a fair race.

29. I watched as Miller swept the 100m and 200m races at the New England championship. Chloe Alfieri, a senior from Massachusetts, took second place in both events. Miller was interviewed after each win, as is customary for the champion. Chloe missed out on those titles and that recognition. It was awful to watch.

30. Chelsea took 7th place in the 100m. The top six are given the All-New England designation, so it was another tangible loss that she directly felt. Athletes set goals for themselves—they don't expect to achieve the top spot right out of the gate. It is a progression. Being named All-New England was the goal she had set for the day and she hadn't reached it because they allowed a male to compete in her race.

31. Following the New England Championship, I called my state senator, Kevin Witkos. He urged me to seek help from the school administration, as he did not agree with the CIAC that Connecticut law required this policy. He felt that if asked by member schools, CIAC could change the policy and restore fairness for the female athletes.

32. I immediately followed up with an email to Canton school officials including Chelsea's coach, the athletic director, the principal, the assistant superintendent, and the superintendent. I asked them to contact the CIAC and urge a change in policy. Nobody responded to my email.

33. At the end of June, Senator Witkos reached out to me and said that he would work with the Connecticut Speaker of the House to draft a letter to the superintendents of all schools, but not until after the November elections, five months away. That letter never happened.

34. In July, I scheduled an in-person meeting with the principal, Drew DiPippo. I asked what the process was to formally request a change in CIAC policy. He said he would look into it and let me know. He noted that there would be a new CIAC Executive Director starting in August and that perhaps the policy would be revisited. I never heard back from him on the process to request a change.

35. During the fall, we learned that Terry Miller had transferred to a Class S school. Chelsea cried as I drove her home from soccer that night. She knew that meant she would now face males not just at the State Open, but at the Class S championship as well. In her mind, it meant she would never win another state championship race.

2019 Indoor Track Season – Junior Year

36. A few weeks before the state championships arrived, I drafted another letter to CIAC Executive Director, Glenn Lungarini, to again ask for fairness for female athletes and a

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change in policy. The CIAC responded that they would not consider my request for a rule change because I was just a parent. I soon learned there was a new "gender committee" commissioned by the CIAC that would make a recommendation in the summer. It was an endless game of shifting responsibility and delaying any meaningful discussion.

37. As the championships drew near, I dreaded what was to come. I had watched many other girls lose the state title they deserved. This time it was Chelsea's turn. As a junior, she was stronger, more experienced, and her times had improved significantly. She was the fastest female in the 55m at both the Class S championship and the State Open. But Miller went home with both of those titles. Jillian Mars was the fastest female in the 300m – she too was robbed of her titles. And, of course, more girls lost the chance to advance to finals, or the Open, or the New England Championship. Female athletes lost out on podium spots and medals and points for their team. Chelsea lost out on another All-New England designation after finishing 8th at the championship in Boston.

38. The list of girls who had been directly harmed was pages long by now, but the CIAC did not care. They showed so little regard for the rights of the female track athletes in our state it was staggering. The coaches and administrators remained silent, no doubt fearful for their jobs. But there was one girl who was not afraid to speak up, Selina Soule. We watched her bravely tell her story on national television one night and knowing that we weren't alone in our fight made all the difference.

39. I asked my principal to schedule time for me to meet with CIAC director, Glenn Lungarini. As we sat in the principal's office at Canton High School and I shared the list of the girls who had been directly harmed by the policy, it became clear that they had no intention of changing anything. I expressed my concerns that the CIAC policy was violating the rights of my

daughter and the other female athletes under Title IX. Mr. Lungarini's response was that my daughter had only the right to participate, not to win.

40. The CIAC director was not interested in alternative solutions or fairness for females. He did not seem at all bothered that the CIAC's unwillingness to address the issue had placed all of these kids directly in the center of a highly controversial international political debate. He tossed about slogans like "transwomen are women" and his arguments lacked any logical consistency or regard for the rights of females. I left feeling angry but resolved to advocate for Chelsea and all of the girls being harmed.

41. Following that meeting, I asked to meet with our school's Title IX coordinator, Lori Devito. I called the State of Connecticut's Title IX Coordinator, Dr. Adrian Wood, to discuss my options for filing a Title IX complaint. I spoke with an attorney, Robin Cecere, at the Connecticut Department of Education. I called the Office of Civil Rights for the U.S. Department of Education in Boston. Multiple times I was told by these government officials that girls have the right to participate, not to win. I began to believe it must be part of the talking points being circulated on this issue or in some presentation somewhere. It certainly didn't stem from any regulation or case law on Title IX that I had found.

42. I contacted the Canton Board of Education and the topic was added to the agenda for their next meeting. I was given three minutes to speak about something that had been impacting us for two years. I followed up with more emails to the Board of Education but would seldom get a reply. The one-way dialogue was not an effective means of discussion.

43. I continued to send research papers and information to Glenn Lungarini at the CIAC. He abruptly notified me that he would no longer receive my emails because I was just a parent. Everything would have to come from a member school. I went back to the Board of

Education and asked them to contact the CIAC to request a public forum be held so that parents could bring their concerns forward. Canton Superintendent, Kevin Case, assured me he would ask for one, but it never happened.

44. I emailed my state representative, Leslee Hill, and my state senator, Kevin Witkos. I contacted two female coaches from the Connecticut High School Coaches Association (CHSCA) to ask for their help requesting a rule change. In all of these cases, I explained the devastating impact this was having on female athletes in our state. And yet, at the end of the day, not a single person would help us get the policy changed.

2019 Outdoor Track Season – Junior Year

45. The Outdoor season added more names to the list of girls impacted by the policy. It was Chelsea's fifth season competing against males. My efforts to convince school and state officials to fix the policy had failed. I felt sure that nobody was going to take steps to change things unless their hand was forced.

46. The state championships should have been an exciting day, but I dreaded watching the injustice play out again. I understood how demoralizing and disrespectful it was to these girls and felt sickened by the whole thing. Chelsea lost the Class S championship in the 100m and 200m to Miller– her tally was now at four state titles lost to biological males. She headed to the State Open expecting more of the same.

47. It was her third year in a row competing against males in the 100m at the State Open. None of us were looking forward to watching males break the female records, take home the title, and give their post-race interviews. This year would be different though.

48. In what I often describe as a gift from above, there was a false-start in the 100m by Miller. Chelsea saw the playing field leveled a bit, and she was going to make the most of it.

Her win in the 100m that day was extraordinary for so many reasons and I will be forever grateful she had that moment. What unfolded at that stadium was emotional not just for us, but many in the crowd. We had so many strangers come up and hug her and tell us how happy they were for her. She ran a time that is still her personal best, even three years later.

49. Other awards and opportunities flowed from her success that day, and I often think of how sad it would have been if that false start hadn't happened and she had never had those experiences. It shouldn't need to be said, but girls shouldn't have to hope for a false start to get their chance at fair competition.

50. I continued to pursue opportunities to advocate for the girls. I had a meeting with Connecticut Deputy Attorney General Peggy Chapple and three other members of the AG's office. I met with Governor Lamont's General Counsel, Bob Clark. I spoke with several state lawmakers and asked them to pass legislation. I wrote letters to my U.S. Representative, Jahana Hayes, and my U.S. Senator, Richard Blumenthal. And while some were sympathetic to our position, they were unwilling to do anything to help.

51. I also looked for support from well-known feminist organizations such as Women's Sports Foundation, National Women's Law Center, and National Organization of Women. It was just unbelievable to learn that these organizations did not support our advocacy for fairness in women's sports. They issued statements to publicly say so. They completely ignored the impact it was having on our female athletes and seemed shockingly uneducated about the harm that will flow from eliminating sex-based rights in law. Thankfully, many other women's organizations are taking their place and stand with us in this fight.

Armistead App. 0032

2020 Indoor Track Season – Senior Year

52. After years of asking school, state, and federal officials for help, we did what we felt was our last resort. Two days before what would end up being Chelsea's final state championships, we filed a federal lawsuit. Chelsea was taking a public stand for herself and other female athletes. We hoped that this might finally make a difference and that what she went through wouldn't have to happen to anyone else. It took a great deal of courage, and I was very proud of her.

53. Since then, many more people are aware of her story. We have submitted testimony on both state and federal legislation. Several states have successfully passed laws to protect female sports and many more are now debating the issue. She has bravely given interviews and told her story in national publications. There was a time when she was afraid to speak out, and I was afraid for her future if she did. But we are no longer afraid.

54. We will continue to fight for policy and laws to be based on facts about science and biology, not ideology. We will exercise our right to speak out on issues that affect us without fear. We hope that in the end, the sex-based rights of females will be acknowledged and respected and fairness will be restored in our sports.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Christina Mitchell

Dated: April 12, 2022

EXHIBIT 9

1:22-cv-1075

A.M., by her mother and next friend, E.M., Plaintiff.

v.

INDIANAPOLIS PUBLIC SCHOOLS; SUPERINTENDENT, INDIANAPOLIS PUBLIC SCHOOLS, in her official capacity, Defendants.

Expert Witness Declaration

Tommy Lundberg, PhD

1. Introduction and overview of qualifications

1.1. My name is Tommy Lundberg. I am currently employed as a lecturer in the Division of Clinical Physiology at Karolinska Institutet (Stockholm SWE), one of the top ranked medical universities in the world [1].

1.2. I have been asked by the Defendant's counsel to provide written expert testimony on issues relating to classification by sex in sport, the participation of transgender athletes in female athletic categories, and the effects of testosterone suppression in transgender girls/women.

1.3. Prior to writing this declaration, I have read the plaintiff's complaint, the declarations by James D Fortenberry and E.M, the IHSAA Gender Policy, and the Indiana House Enrolled Act 1041.

1.4. This statement is based on my own and others' scientific findings and knowledge, and on my own professional opinion, which is based on my disciplinary training and research experience and does not necessarily reflect that of my employer. Where the literature is of particular relevance to the statement, I have provided direct references in the text.

1.5. My research focuses on physiology, with special emphasis on exercise physiology. I teach anatomy, physiology and exercise physiology in various courses at Karolinska Institutet, both at undergraduate and postgraduate level.

1.6. I obtained my MSc degree (pass with distinction) in Exercise Physiology from Loughborough University in 2009. In May 2014, I received my PhD degree in Sports Science from the Mid Sweden University, examining the influence of aerobic exercise on skeletal muscle adaptation to resistance training.

1.7. In 2017, I received the Swedish Central Association for Sport Promotion (SCIF) prize for most prominent young researcher in Sport Science in Sweden.

1.8. In September 2021, I was awarded the title Docent in Physiology at Karolinska Institutet. The title Docent is a nationally recognized expression of scientific and pedagogical competence [2].

1.9. I have authored 34 peer-reviewed publications and received 1270 citations (Google Scholar). My h-index is 16 [3]. Two of these publications were of particular relevance to the topic of transgender in sport:

*Wiik A, **Lundberg TR***, Rullman E, Andersson DP, Holmberg M, Mandić M, Brismar TB, Dahlqvist Leinhard O, Chanpen S, Flanagan JN, Arver S, Gustafsson T. Muscle Strength,*

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[1] https://ki.se/en/about/ranking-and-karolinska-institutet
[2] https://staff.ki.se/docent
[3] https://scholar.google.com/citations?hl=en&user=jXX7Qa4AAAAJ

*Size, and Composition Following 12 Months of Gender-affirming Treatment in Transgender Individuals. J Clin Endocrinol Metab. 2020;105(3):dgz247. Journal impact factor: 5.605 *Corresponding author*

and

*Hilton EH and **Lundberg TR*.** Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Med. 2021; 51, 199–214. Journal impact factor: 11.140 *Corresponding author*

1.10. The former of these publications concerns a research project aimed at clarifying the effects of cross-sex hormone treatment for adults who suffer from gender dysphoria due to an incongruence between their gender identity and the sex identified at birth. In this study, we thoroughly examined the effects of 12 months of testosterone suppression on changes in muscle size and strength in transgender women and transgender men.

1.11. The latter publication is a review paper examining the longitudinal effects of testosterone suppression in transgender women and the presumption that this suppression removes the male athletic performance advantage.

1.12. In 2020, I was invited by World Rugby to give evidence to the Transgender Working Group, which had been tasked with reviewing the rules for the inclusion of transgender women in female categories in international competitions [4].

1.13. I have been invited by the Swedish Sports Confederation and the Swedish Football Association to present scientific evidence pertaining to inclusion of transgender athletes in sports.

1.14. I am very familiar with the sports environment at all levels. I was an elite football (soccer) player myself in the Finnish Premier League. I have worked as a sports director for the Åland Islands Football Association. I have also advised the Swedish Ice Hockey Federation and the Swedish Football Association on exercise physiology.

1.15. An extended version of my CV is attached as Appendix 1.

1.16. I have testified previously in a deposition in March 2022 (JayCee Cooper v. USA Powerlifting & USA Powerlifting Minnesota, 62-CV-21-211, State of Minnesota District Court).

1.17. I will derive no personal, social, or academic benefit from the opinions expressed in this declaration.

1.18. I am compensated at an hourly rate of $300 for my time in preparing this report and providing any testimony.

[4] https://www.world.rugby/news/561370

2. Summary of expert witness declaration

I declare five primary professional opinions that I justify in the report:

2.1. Biological males outperform comparable biological females in almost all sports and athletic competitions. These sex differences are evident in childhood, adolescence, and adulthood. Before puberty, these differences are smaller and not always consistent. During and after puberty, the sex differences are so large that it would be highly unlikely that girls could win school competitions or gain equal opportunities if they competed against boys in sports where strength, stamina and/or physique are important.

2.2. The reason for this sex difference is primarily due to differences in male physiology compared to female physiology.

2.3. There is currently no scientific evidence that suppression of testosterone in transgender girls/women who have undergone male puberty negates the athletic advantage that biological males have over females.

2.4. The suppression of male puberty (by "puberty blockers") in transgender individuals has not yet been studied in terms of outcomes in strength, muscle mass, or other athletic indicators.

2.5. Categorization by biological sex is a feasible and defensible classification in school athletic competitions.

3. Relevant background on sex and gender identity

3.1. Humans, like most other species, have two sexes, referred to as male and female. The male sex is defined as the adult phenotype with the corresponding physiology and reproductive system that produces the smaller gamete (sperm). The female sex is defined as the adult phenotype with the corresponding physiology and reproductive system that produces the larger gamete (the egg) [5]. Biologically, therefore, there are two sexes – male and female.

3.2. Gender identity refers to a person's self-perceived sex/gender. It is increasingly accepted and recognized in society that gender identity does not always match one's sex as determined at birth, allowing individuals to more freely question or redefine their gender identity [6].

3.3. Gender dysphoria refers to the discomfort caused by the discrepancy between gender identity and biological sex.

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[5] Lehtonen J, Parker GA. Gamete competition, gamete limitation, and the evolution of the two sexes. Mol Hum Reprod. 2014 Dec;20(12):1161-8.

[6] T'Sjoen G, Arcelus J, Gooren L, Klink DT, Tangpricha V. Endocrinology of Transgender Medicine. Endocr Rev. 2019 Feb 1;40(1):97-117.

3.4. The term "transgender" is used as an umbrella term to describe individuals whose gender identity differs from the sex identified at birth. Transgender boys/men are individuals who were observed female at birth but self-identify as boy/male/man. Transgender girls/women are individuals who were observed male at birth but identify as girls/female/woman. There are no objective criteria by which a person is designated as transgender. It is primarily a decision made by individuals who experience gender incongruence.

3.5. Therapy for transgender girls/women may include testosterone suppression and estrogen therapy to lower or maintain testosterone levels in the female range.

3.6. Since no therapy can completely alter the reproductive system (including, for example, chromosomes, ovaries, uterus, testes, prostate) to support production and delivery of the opposite gamete type, biological sex cannot be changed. The goal of hormone treatment in transgender girls/women is therefore to use medication to produce feminine and less masculine physical characteristics, or, in the case of testosterone suppressing agents, sometimes to stop/delay the male puberty.

4. Sex and sports categorization

4.1. Some transgender individuals want to compete in the sport category that best fits their gender identity.

4.2. Most sports have separate competition categories for boys/men and girls/women. The main reason for this is the difference in body phenotype (body characteristics) between males and females. This difference accelerates during puberty and results in average differences in strength, stamina, and physique that are so great that athletic competition is not considered meaningful for girls/women if they must compete against boys/men.

4.3. In sports, we reward exceptional physical and psychological attributes that come from genetic factors, dedicated training, and optimized nutrition and recovery habits. Because there is a strong genetic component in determining the body phenotype and trainability of some of the rewarded physical abilities in sports, not everyone can become a world champion. These unique traits that underlie exceptional athletic performance are part of the athletic concepts of "talent" and "natural "endowment", and are not considered an unfair advantage, but something that should be rewarded [7].

4.4. In sport, there is an overriding principle of competitive fairness, which is typically included in the concept of Fair Play. To maintain fairness, no one should be given an advantage that is considered unfair. From the earliest days of formal athletic competition, governing bodies have established

[7] Coleman DL. Sex in sport. Law Contemp Probl. 2017;63–126.

rules of competition and categories of competition in order to facilitate safe, fair and meaningful competition.

4.5. Common examples of rules to protect fairness include the prohibition of doping and clear rules on the shape, format and size of the various sports equipment used. Examples of categorization to prevent unfair advantage in sport include age categories in youth sports, weight categories in some sports, disability categories in Paralympic sports and, most relevant to the current case, the provision of separate sex categories.

4.6. The main reason for protecting the female category in sport lies in the differences in performance between boys/men and girls/women caused by the superior physical attributes underpinning athletic performance. Although both boys/men and girls/women may have exceptional genetics, physical attributes, and psychological abilities, the best girls/women in most sports are outperformed by thousands of boys/men because of this male advantage that no female can ever benefit from. Being male is conferred at birth, is not achievable by dedicated training, nutrition, or recovery habits, and therefore should not be rewarded more than being female in sports. For this reason, the male performance advantage is considered an unfair advantage over equally talented and superbly trained female athletes.

4.7. It is important to recognize that the presence or absence of an unfair advantage cannot be judged on the basis of the final outcome of the contest. A poor male athlete will not beat the best female athletes even though he has the typical male performance advantage. So, if you have an advantage that is not allowed in a particular sport, or an advantage that is not allowed in a particular category, you have an unfair advantage, regardless of the size of that advantage and regardless of the final result in competition with that advantage.

4.8. Another consideration that justifies sex categories in sports is athlete safety. In sports where collisions and combat may occur, sex categories (and sometimes weight categories) are used not only to maintain fairness but also to protect athletes and reduce the risk of injury.

5. Sex differences in sport and its causes

5.1. In a paper I co-authored with Dr Emma Hilton from the University of Manchester, we examined the performance differences between adult males and females [8]. We concluded that the performance advantage of men over women is typically 10-50% depending on the sport. These statistics are easy for anyone without expertise to observe and verify, as the competition transcripts of most sports are readily available online. I therefore feel it is unnecessary to provide further overwhelming evidence

[8] Hilton EN, Lundberg TR. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Med. 2021 Feb;51(2):199-214.

of the typical male performance advantage and will focus specifically on younger boys and girls later in the report.

5.2. The explanation for the large difference between male and female athletic performance lies in the underlying biological factors that explain performance in most sports, namely strength, stamina and physique. These biological differences have been extensively studied in the scientific literature and provide compelling evidence for the underlying biology that explains the differences in athletic performance between men and women.

5.3. To illustrate these differences, I have reported with Dr. Hilton in the above-mentioned review that adult males have 45% higher lean body mass, 33% higher lower body muscle mass and 40% higher upper body muscle mass, 54% higher knee extension strength, and 30% higher maximum cardiac output. We have also noted that many male junior athletes outperform adult female elite athletes by the age of 14-15, demonstrating that many adolescent elite male athletes are better than adult female elite athletes within a few years of the onset of puberty.

5.4. As Handelsman, Hirschberg, and Bermon have justified in a thorough review of the literature [9], average sex differences in athletic performance are accentuated during puberty, when circulating testosterone concentrations increase in males, resulting in circulating testosterone 15-20 times higher than in children or females of any age. This is also supported by the dose-response relationship between testosterone administration and increases in muscle mass and strength demonstrated in experimental studies [10]. Higher testosterone levels in adolescent boys result in, for example, more muscle mass, greater muscle strength, less body fat, higher hemoglobin concentrations, larger hearts, and an overall larger stature than in adolescent girls.

5.5. Sport performance differences between males and females before puberty are often considered relatively small. Nevertheless, pre-pubertal performance differences are not negligible and could be mediated to some extent by genetic factors and/or activation of the hypothalamic-pituitary-gonadal axis during the neonatal period, sometimes referred to as "mini-puberty". For example, increased testosterone levels during mini-puberty in males aged 1-6 months may be correlated with a faster growth rate and an "imprinting effect" on BMI and body weight [11].

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[9] Handelsman DJ, Hirschberg AL, Bermon S. Circulating testosterone as the hormonal basis of sex differences in athletic performance. Endocr Rev. 2018;39(5):803–829.
[10] Bhasin S, Storer TW, Berman N, Callegari C, Clevenger B, Phillips J, Bunnell TJ, Tricker R, Shirazi A, Casaburi R. The effects of supraphysiologic doses of testosterone on muscle size and strength in normal men. N Engl J Med. 1996 Jul 4;335(1):1–7.
[11] Lanciotti L, Cofini M, Leonardi A, Penta L, Esposito S. Up-To-Date Review About Minipuberty and Overview on Hypothalamic-Pituitary-Gonadal Axis Activation in Fetal and Neonatal Life. Front Endocrinol (Lausanne). 2018 Jul 23;9:410.

5.6. A comprehensive review [12] of fitness data from over 85 thousand Australian children aged 9-17 years showed that compared to 9-year-old females, 9-year-old males were faster at short sprints (9.8%) and one mile (16.6%), could jump 9.5% further from a standing position (a test of explosive strength), could complete 33% more push-ups in 30 seconds and had a 13.8% stronger grip.

5.7. A similarly large advantage for males was found in a study of Greek children [13], in which 6-year-old males, compared to 6-year-old females, completed 16.6% more shuttle runs in a given time and could jump 9.7% further from a standing position. In terms of aerobic endurance capacity, 6–7-year-old males have been shown to have higher absolute and relative (to body mass) maximum oxygen uptake than 6–7-year-old females [14].

5.8. A study by Tønnessen et al. [15] analyzed the 100 all-time best Norwegian male and female 60-m, 800-m, long jump, and high jump athletes in each age category from 11 to 18 years. Sex differences in performance were already present at age 11 (1% for 60 m, 4.8% for 800 m, 3.6% for long jump, and 3.5% for high jump) and grew substantially to 10-18% by age 18 in all disciplines studied.

5.9. Sartorio et al. [16] examined sex differences in maximum handgrip strength and body composition in 278 children of normal weight and growth. The children were divided into three groups with mean ages of 8, 11, and 13 years, respectively. A marked difference between the sexes was evident as early as 8 years of age, and boys had > 10% greater fat-free mass and handgrip strength at all ages. Handgrip strength was strongly correlated with fat-free mass.

5.10. Telford et al. [17] studied physical activity and fitness at ages 8 and 12 in 276 boys and 279 girls from 29 schools. At age 8, girls had 18% lower cardio-respiratory fitness, 44% lower eye-hand coordination, and higher percent body fat (28% vs 23%) compared with boys. However, girls were

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[12] Catley MJ, Tomkinson GR. Normative health-related fitness values for children: analysis of 85347 test results on 9-17-year-old Australians since 1985. Br J Sports Med. 2013 Jan;47(2):98-108.

[13] Tambalis KD, Panagiotakos DB, Psarra G, Daskalakis S, Kavouras SA, Geladas N, Tokmakidis S, Sidossis LS. Physical fitness normative values for 6-18-year-old Greek boys and girls, using the empirical distribution and the lambda, mu, and sigma statistical method. Eur J Sport Sci. 2016 Sep;16(6):736-46.

[14] Eiberg S, Hasselstrom H, Grønfeldt V, Froberg K, Svensson J, Andersen LB. Maximum oxygen uptake and objectively measured physical activity in Danish children 6-7 years of age: the Copenhagen school child intervention study. Br J Sports Med. 2005 Oct;39(10):725-30.

[15] Tønnessen E, Svendsen IS, Olsen IC, Guttormsen A, Haugen T. Performance development in adolescent track and field athletes according to age, sex and sport discipline. PLoS One. 2015 Jun 4;10(6):e0129014.

[16] Sartorio A, Lafortuna CL, Pogliaghi S, Trecate L. The impact of gender, body dimension and body composition on hand-grip strength in healthy children. J Endocrinol Invest. 2002 May;25(5):431-5.

[17] Telford RM, Telford RD, Olive LS, Cochrane T, Davey R. Why Are Girls Less Physically Active than Boys? Findings from the LOOK Longitudinal Study. PLoS One. 2016 Mar 9;11(3):e0150041.

also 19% less physically active than boys, and physical activity was associated with cardio-respiratory fitness and percent body fat in girls.

5.11. Handelsman [18] wanted to determine the timing of the sex divergence in athletic performance and relate it to the increase in circulating testosterone resulting from male puberty. The sports analyzed were elite swimming, running and jumping in track and field, and hand grip strength in non-athletes. The results showed that sex differences in athletic performance, although small, were generally measurable before puberty and grew substantially by age 12 and reached a plateau in the late teens. The author concluded that the similar timing of the sex-specific divergence in each of these events, in relation to the increase in circulating testosterone to adult male levels, strongly suggests that they all reflect increases in muscle size and strength, although the effects of other androgen-dependent effects on bone, hemoglobin, and psychology may also contribute. The following figure illustrates these sex differences in athletic performance across age groups.

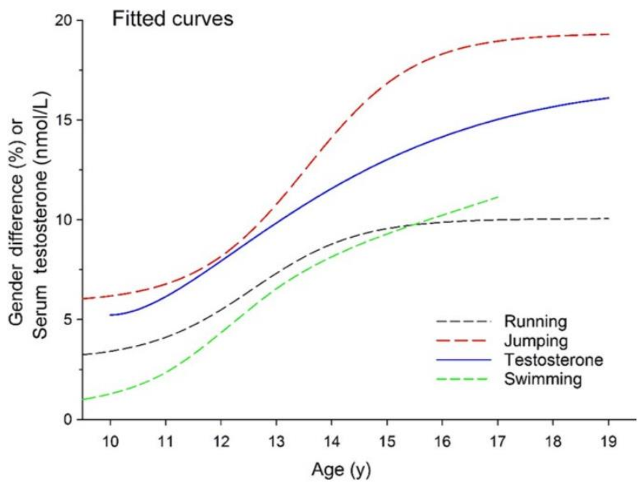

Figure 1. Adjusted sigmoidal curve plot of sex-specific performance differences (in percent) as a function of age (in years) in running, jumping, and swimming, and serum testosterone [18].

5.12. To conclude this section, it is evident that male athletic performance far exceeds that of females. These sex differences are observed in childhood, adolescence, and adulthood. Before puberty, however, these differences are smaller, varies between different performance metrics, and are not always consistent. During and after puberty, sex differences are so large that it would be highly unlikely that girls could win school competitions if they competed against boys in sports where strength, stamina and/or physique are important factors for performance.

[18] Handelsman DJ. Sex differences in athletic performance emerge coinciding with the onset of male puberty. Clin Endocrinol (Oxf). 2017 Jul;87(1):68-72.

6. Regulation of inclusion of transgender girls/women in female sporting categories

6.1. The inclusion of transgender girls/women in sport and the eligibility criteria for the female category have been the subject of much debate, particularly in recent years.

6.2. The Indiana High School Athletic Association (IHSAA) has previously developed a policy to govern the eligibility and participation of all students, including transgender students, in IHSAA-sponsored interscholastic athletics events. For transgender girls, this included a statement and/or credible documentation from an appropriate medical professional that the transgender student had completed counseling and other medical or psychological interventions related to transition and had either completed at least one year of hormone treatment related to transition or had undergone a medically confirmed sex-reassignment procedure. In addition, medical examinations and tests, as well as physiological testing, must demonstrate that the transgender student has no physical (bone structure, muscle mass, and/or testosterone levels, etc.) or physiological advantages over a genetic female of the same age group.

6.3. In my opinion, this policy was not scientifically sound and was not feasible. It was not scientifically sound because scientific data suggest that hormone therapy is not sufficient to mitigate the athletic advantage that males have over females. It was not feasible because case-by-case testing and trials are unlikely to be successful because of the incentive to underperform in performance tests. In addition, case-by-case testing of objective biological characteristics risks further stigmatizing the vulnerable transgender population, as only those deemed "female enough" by testing will be allowed to compete in the female category.

6.4. In early 2020, World Rugby announced that it was revising its transgender guidelines. One of the reasons [19] for this was my team's publication showing that 12 months of testosterone suppression in transgender women resulted in minimal changes in muscle mass and strength [20].

6.5. After a very transparent and science-based process, World Rugby announced in the fall of 2020 that transgender women would no longer be able to participate in international women's rugby. Based on scientific evidence, World Rugby concluded that player welfare and fairness of competition could not be ensured if transgender women were allowed to play in the women's category.

[19] https://www.world.rugby/the-game/player-welfare/guidelines/transgender/faqs

[20] Wiik A, Lundberg TR, Rullman E, Andersson DP, Holmberg M, Mandić M, Brismar TB, Dahlqvist Leinhard O, Chanpen S, Flanagan JN, Arver S, Gustafsson T. Muscle Strength, Size, and Composition Following 12 Months of Gender-affirming Treatment in Transgender Individuals. J Clin Endocrinol Metab. 2020 Mar 1;105(3):dgz247.

6.6. The most comprehensive assessment of transgender inclusion in sport was conducted by the UK Sports Councils (published online 30 September 2021) [21]. This study explored the views and experiences of hundreds of people in sport, including transgender individuals and advocacy groups. It also examined current policy and the latest scientific evidence on transgender inclusion in sport.

6.7. In short, the UK Sports Councils concluded that although all sports are committed to the inclusion of transgender people in sport, categorization by sex is lawful, and fairness in competition cannot be reconciled with self-identification in the female category. It was also noted that, based on current evidence, testosterone suppression is unlikely to ensure fairness between transgender women and natal females, and that categorization within the sex binary is and remains the most meaningful functional classification. In my professional opinion, this guide to transgender inclusion is accurate and science based.

7. Growth and maturation during puberty

7.1. Puberty is characterized by significant anatomical and physiological changes leading to the mature state typical of adulthood. The onset and progression of puberty are controlled by the hypothalamic-pituitary-gonadal axis. A progressive increase in pulsatile Gonadotropin hormone-releasing hormone secretion is responsible for the onset and progression of puberty [22]. In American females and males, puberty begins at ages 8.0 to 14.9 years in females and 9.7 to 14.1 years in males and is completed at ages 12.4 to 16.8 years in females and 13.7 to 17.9 years in males [23]. The average female experiences the onset of puberty 0.5-1 year earlier than the average male and completes puberty with a comparable age difference.

7.2. Sex hormones and growth hormones are important for both the onset and maintenance of sexual maturation and growth during puberty. Testosterone is the most important male sex hormone and promotes male characteristics such as a deeper voice, facial hair, and muscle development. Estrogen is the most important female sex hormone and plays an important role in the development of female secondary sex characteristics.

7.3. The first visible signs of puberty in females are usually the development of breasts. In males, the earliest signs of puberty are the growth of the

[21] https://equalityinsport.org/resources/index.html

[22] Rey RA. The Role of Androgen Signaling in Male Sexual Development at Puberty. Endocrinology. 2021 Feb 1;162(2):bqaa215.

[23] Lee PA. Normal ages of pubertal events among American males and females. J Adolesc Health Care. 1980 Sep;1(1):26-9.

testes. Females reach their peak height velocity at about 12.5 years of age, while males reach it just before the age of 14.

7.4. Circulating testosterone concentrations increase in males during puberty, eventually resulting in circulating testosterone 15-20 times higher than in children or females of any age. It is widely accepted and experimentally supported that circulating testosterone during male development is the primary cause of the sex differences in athletic performance that manifest at puberty and are then maintained in adulthood, independent of therapies that alter testosterone levels in adulthood.

8. Suppressing puberty

8.1. Some professional bodies recommend that puberty be suppressed in certain transgender minors, preferably with the help of gonadotropin-releasing hormone agonists [24]. The most common recommendation is that eligible minors have undergone psychiatric evaluation and have reached at least the Tanner stage II of puberty, meaning that clear signs of puberty have appeared. This approach attempts to alleviate the psychological discomfort by halting the development of secondary sexual characteristics, thus substantially expanding the window for gender clarification.

8.2. With puberty blockers, progression of sexual development eventually comes to a halt if it begins early enough in puberty. Discontinuation of the drug leads to reactivation of the hypothalamic-pituitary-gonadal axis, resulting in continuation of pubertal development in line with gonadal sex [13].

8.3. Suppression of puberty has been studied in the clinical treatment of children with central precocious puberty, but comparatively little data are available in transgender adolescents. Although the treatment with gonadotropin-releasing hormone agonists is generally effective in suppressing the progression of puberty [25], the effects of suppressing puberty in transgender boys or girls have not yet been studied in terms of outcomes in strength, muscle mass, or other athletic indicators.

8.4. Despite the lack of athletic performance data, a recent study reported that height in adulthood is relatively unaffected by prior treatment with GnRH analogs and estradiol during adolescence, implying that trans girls grow taller than reference females [26]. This height advantage could confer

[24] Mahfouda S, Moore JK, Siafarikas A, Zepf FD, Lin A. Puberty suppression in transgender children and adolescents. Lancet Diabetes Endocrinol. 2017 Oct;5(10):816-826.
[25] Hembree WC. Management of juvenile gender dysphoria. Curr Opin Endocrinol Diabetes Obes. 2013 Dec;20(6):559-64.
[26] Boogers LS, Wiepjes CM, Klink DT, Hellinga I, van Trotsenburg ASP, den Heijer M, Hannema SE. Trans girls grow tall: adult height is unaffected by GnRH analogue and estradiol treatment. J Clin Endocrinol Metab. 2022 Jun 6:dgac349. doi: 10.1210/clinem/dgac349.

athletic advantages in various sports, not least because height in general is also strongly correlated with total lean body mass.

8.5. If athletic category eligibility criteria depended on circulating testosterone levels or evidence of puberty-suppressing medications, the relevant athletic association would have to implement a rigorous compliance and testing protocol that would require significant effort and resources.

8.6. Puberty blockers also present an ethical dilemma that is handled differently in different countries. While some professional organizations consider them feasible for some transgender minors, others, such as the National Board of Health and Welfare in Sweden [27], have concluded that the risks of puberty blockers and gender-affirming hormone treatments for those under 18 currently outweigh the potential benefits for the group as a whole.

9. Effects of testosterone suppression in transgender girls/women who have undergone male puberty

9.1. In a recent review paper that I co-authored with Dr Emma Hilton from the University of Manchester, we examined studies that have assessed longitudinal changes in muscle mass, lean body mass, and muscle strength in transgender women undergoing testosterone suppression [28].

9.2. After the literature search and screening of papers, we found 12 longitudinal studies relevant for the assessment of whether the male advantage is reduced or eliminated with testosterone suppression in transgender women.

9.3. We found that transgender women generally maintain their bone mass over a period of at least 24 months of testosterone suppression.

9.4. We also reported that lean body mass decreases by approximately 3-5% after 12 months of testosterone suppression, and this was consistent across studies.

9.5. In a study from my research team [29], a comprehensive series of magnetic resonance imaging and computed tomography scans were performed before and after 12 months of testosterone suppression and estrogen supplementation in 11 transgender women. Thigh volume (both anterior and posterior thigh) and quadriceps cross-sectional area decreased by -4

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[27] https://www.socialstyrelsen.se/om-socialstyrelsen/pressrum/press/uppdaterade-rekommendationer-for-hormonbehandling-vid-konsdysfori-hos-unga/

[28] Hilton EN, Lundberg TR. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Med. 2021 Feb;51(2):199-214.

[29] Wiik A, Lundberg TR, Rullman E, Andersson DP, Holmberg M, Mandić M, Brismar TB, Dahlqvist Leinhard O, Chanpen S, Flanagan JN, Arver S, Gustafsson T. Muscle Strength, Size, and Composition Following 12 Months of Gender-affirming Treatment in Transgender Individuals. J Clin Endocrinol Metab. 2020 Mar 1;105(3):dgz247.

and -5%, respectively, after the 12-month period. This small loss should be placed in relation to the > 30% advantage in muscle mass that transgender women had over comparison women before hormone therapy. Overall, these data on muscle size confirm previous results of whole-body lean mass measurements related to the modest effects of testosterone suppression.

9.6. In a multicenter study, 249 transgender women were found to have a -4% decrease in grip strength after 12 months of cross-hormone treatment, with no differences between testosterone levels, age groups, or BMI tertiles [30]. After 1 year of hormone treatment, the transgender women still had a 21% advantage in grip strength over a comparison group of females.

9.7. While most longitudinal studies have reported muscle/lean mass and/or strength values after 12 months of testosterone suppression, it appears that the net loss of these values does not decrease significantly at year 2 or 3 of testosterone suppression [31]. This suggests that a plateau or new equilibrium state is reached within the first year, a phenomenon also observed in transgender men, in whom muscle mass gains appear to stabilize between the first and second years of testosterone treatment.

9.8. These longitudinal data reveal a clear pattern of very modest changes in muscle mass and strength in transgender women who suppress testosterone. These conclusions were confirmed by a subsequent systematic review published in the prestigious British Journal of Sports Medicine [32].

9.9. As I substantiated with extensive citations in my research report with Dr. Hilton, well-controlled studies of biological males undergoing strength training during testosterone suppression show that exercise protects and even improves muscle mass and strength characteristics.

9.10. All in all, the collective body of scientific evidence suggests that testosterone suppression is highly unlikely to reverse the athletic advantage of males over females.

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[30] Scharff M, Wiepjes CM, Klaver M, et al. Change in grip strength in trans people and its association with lean body mass and bone density. Endocr Connect. 2019;8:1020–8.
[31] Hilton EN, Lundberg TR. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Med. 2021 Feb;51(2):199-214.
[32] Harper J, O'Donnell E, Sorouri Khorashad B, McDermott H, Witcomb GL. How does hormone transition in transgender women change body composition, muscle strength and haemoglobin? Systematic review with a focus on the implications for sport participation. Br J Sports Med. 2021 Aug;55(15):865-872.

I verify under the penalties for perjury that the foregoing representations are true.

On the 15th of June 2022

Tommy Lundberg, PhD

Appendix 1

CURRICULUM VITAE

1 NAME

Tommy Richard Lundberg

2 BIRTH DATA

(yyyy-mm-dd)**:** 1981-04-15

3 EDUCATION AND DEGREES

Higher education courses (completion year)

2018 Pedagogy for doctoral supervisors (2 weeks)
2018 Leadership for research group leaders (2 weeks)
2017 Future Educational Leader (5 weeks)
2017 Open Networked Learning (ONL171), 2 weeks
2015 Teaching and Learning in Higher Education (GHPD), 5 weeks
2015 Introductory Doctoral Supervision Course (1 week)

Doctoral education

2010-2014 Doctoral studies, 240 credits, Dept. of Health Sciences, Mid Sweden University

Graduate degree

2009 Master of Science in Exercise Physiology, Loughborough University, UK

Master and undergraduate study programmes

2008-2009 MSc in Exercise Physiology (12 months), Loughborough University
2006-2008 Biology and Sports Science (120 credits), Mid Sweden University
2001-2003 Coaching and Sport Management (120 credits), Växjö University

Other relevant education

2006 Certified fitness coach in sports, Swedish Sports Confederation

4 DOCTORAL DEGREE

2014 Doctoral degree in Sports Science, Mid Sweden University. *Thesis title: The effects of aerobic exercise on human skeletal muscle adaptations to resistance exercise*. Main supervisor: Per Tesch. Co-supervisor: Ola Eiken.

5 POSTDOC APPOINTMENTS

2015-2018 50% Postdoc at the Karolinska Institutet, Dept. of Laboratory Medicine, Div. of Clinical Physiology, through funding from a fellowship awarded by the Swedish Council for Research in Sport Science

6 DOCENT STATUS

2021 Awarded the Title Docent in Physiology (September 2021)

7 CURRENT POSITION

2014- Lecturer, Karolinska Institutet, Dept. of Laboratory Medicine, Div. of Clinical Physiology. Time devoted to research: 50%

Current scientific activity

An overarching theme of my previous, current and planned future long-term research concerns the control and regulation of skeletal muscle mass and function. I am interested in how human skeletal muscle responds and adapts to increased or decreased loading. In contexts such as sporting performance, exercise, aging and disease, this work examines the functional, metabolic, morphological and molecular adaptations to, for example, acute and chronic resistance and/or aerobic exercise, and cross-hormone therapy.

Current teaching activity

The main focus of my teaching is within the field of human physiology, with a particular specialization in exercise physiology. I teach this subject in several courses for different medical degree programs at Karolinska Institutet, including the Physiotherapy degree programme, the Biomedical Laboratory Sciences degree programme and the Occupational Therapist degree programme. I am a course instructor and examiner for a contract education course called Advanced Exercise Physiology (4.5 credits).

8 SCIENTIFIC PUBLICATIONS

Bibliometric parameters (verified June, 2022)

Total number of peer-reviewed papers: 34

Total number of citations:

- 1270 Google Scholar

h-index:

- 16 Google Scholar

9 PRIOR POSITIONS

2010-2014 Doctoral student, Mid Sweden University, Dept. of Health Sciences
2003-2006 Director of Sports, Åland Island Football Association (full-time)

10 SELECTED ACADEMIC DISTINCTIONS

2021 Docent

2017 Swedish Central Association for Sport Promotion (SCIF) prize for most prominent young researcher in Sport Science

2009 MSc, pass with distinction

SCIENTIFIC PORTFOLIO

A. List of all peer-reviewed publications (in reverse order)

1: **Lundberg TR**, Feuerbacher JF, Sünkeler M, Schumann M. The Effects of Concurrent Aerobic and Strength Training on Muscle Fiber Hypertrophy: A Systematic Review and Meta-Analysis. Sports Med. 2022 Apr 27. doi:10.1007/s40279-022-01688-x. Epub ahead of print. PMID: 35476184.

2: Niklasson E, Borga M, Dahlqvist Leinhard O, Widholm P, Andersson DP, Wiik A, Holmberg M, Brismar TB, Gustafsson T**, Lundberg TR**. Assessment of anterior thigh muscle size and fat infiltration using single-slice CT imaging versus automated MRI analysis in adults. Br J Radiol. 2022 May 1;95(1133):20211094. doi:10.1259/bjr.20211094. Epub 2022 Feb 23. PMID: 35195445.

3: Mandić M, Hansson B, Lovrić A, Sundblad P, Vollaard NBJ, **Lundberg TR**, Gustafsson T, Rullman E. Improvements in Maximal Oxygen Uptake After Sprint-Interval Training Coincide with Increases in Central Hemodynamic Factors. Med Sci Sports Exerc. 2022 Jun 1;54(6):944-952. doi: 10.1249/MSS.0000000000002872. Epub 2022 Feb 8. PMID: 35136000.

4: Skoglund E, **Lundberg TR**, Rullman E, Fielding RA, Kirn DR, Englund DA, von Berens Å, Koochek A, Cederholm T, Berg HE, Gustafsson T. Functional improvements to 6 months of physical activity are not related to changes in size or density of multiple lower-extremity muscles in mobility-limited older individuals. Exp Gerontol. 2022 Jan;157:111631. doi: 10.1016/j.exger.2021.111631. Epub 2021 Nov 20. PMID: 34813901.

5: Schumann M, Feuerbacher JF, Sünkeler M, Freitag N, Rønnestad BR, Doma K, **Lundberg TR**. Compatibility of Concurrent Aerobic and Strength Training for Skeletal Muscle Size and Function: An Updated Systematic Review and Meta- Analysis. Sports Med. 2021 Nov 10. doi: 10.1007/s40279-021-01587-7. Epub ahead of print. PMID: 34757594.

6: Hilton EN, **Lundberg TR**. Correction to: Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Med. 2021 Oct;51(10):2235. doi: 10.1007/s40279-021-01480-3. PMID: 33914284; PMCID: PMC8587241.

7: Steele J, Androulakis-Korakakis P, Carlson L, Williams D, Phillips S, Smith D, Schoenfeld BJ, Loenneke JP, Winett R, Abe T, Dufour S, Franchi MV, Sarto F, **Lundberg TR**, Gentil P, Kvorning T, Giessing J, Sedliak M, Paoli A, Spotswood F, Lucas A, Fisher JP. The Impact of Coronavirus (COVID-19) Related Public-Health Measures on Training Behaviours of Individuals Previously Participating in Resistance Training: A Cross-Sectional Survey Study. Sports Med. 2021 Jul;51(7):1561-1580. doi: 10.1007/s40279-021-01438-5. Epub 2021 Apr 19. PMID: 33871831; PMCID: PMC8054258.

8: Hilton EN, **Lundberg TR**. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Med. 2021 Feb;51(2):199-214. doi: 10.1007/s40279-020-01389-3. Erratum in: Sports Med. 2021 Oct;51(10):2235. PMID: 33289906; PMCID: PMC7846503.

9: **Lundberg TR**, Martínez-Aranda LM, Sanz G, Hansson B, von Walden F, Tesch PA, Fernandez-Gonzalo R. Early accentuated muscle hypertrophy is strongly associated with myonuclear accretion. Am J Physiol Regul Integr Comp Physiol. 2020 Jul 1;319(1):R50-R58. doi: 10.1152/ajpregu.00061.2020. Epub 2020 May 20. PMID: 32432913.

10: Fernandez-Gonzalo R, Tesch PA, **Lundberg TR**, Alkner BA, Rullman E, Gustafsson T. Three months of bed rest induce a residual transcriptomic signature resilient to resistance exercise countermeasures. FASEB J. 2020 Jun;34(6):7958-7969. doi: 10.1096/fj.201902976R. Epub 2020 Apr 15. PMID: 32293758.

11: Sanz G, Martínez-Aranda LM, Tesch PA, Fernandez-Gonzalo R, **Lundberg TR**. Reply to Egginton et al.: The utility of the Muscle2View pipeline to quantify the capillary-to-muscle fiber interface. J Appl Physiol (1985). 2020 Feb 1;128(2):460-461. doi: 10.1152/japplphysiol.00005.2020. PMID: 32073334.

12: Mandić M, Rullman E, Widholm P, Lilja M, Dahlqvist Leinhard O, Gustafsson T, **Lundberg TR**. Automated assessment of regional muscle volume and hypertrophy using MRI. Sci Rep. 2020 Feb 10;10(1):2239. doi: 10.1038/s41598-020-59267-x. PMID: 32042024; PMCID: PMC7010694.

13: Berg HE, Truong D, Skoglund E, Gustafsson T, **Lundberg TR**. Threshold-automated CT measurements of muscle size and radiological attenuation in multiple lower-extremity muscles of older individuals. Clin Physiol Funct Imaging. 2020 May;40(3):165-172. doi: 10.1111/cpf.12618. Epub 2020 Feb 5. PMID: 31913561.

14: Wiik A, **Lundberg TR**, Rullman E, Andersson DP, Holmberg M, Mandić M, Brismar TB, Dahlqvist Leinhard O, Chanpen S, Flanagan JN, Arver S, Gustafsson T. Muscle Strength, Size, and Composition Following 12 Months of Gender-affirming Treatment in Transgender Individuals. J Clin Endocrinol Metab. 2020 Mar 1;105(3):dgz247. doi: 10.1210/clinem/dgz247. PMID: 31794605.

15: Sanz G, Martínez-Aranda LM, Tesch PA, Fernandez-Gonzalo R, **Lundberg TR**. Muscle2View, a CellProfiler pipeline for detection of the capillary-to-muscle fiber interface and high-content quantification of fiber type-specific histology. J Appl Physiol (1985). 2019 Dec 1;127(6):1698-1709. doi: 10.1152/japplphysiol.00257.2019. Epub 2019 Nov 7. PMID: 31697593.

16: Franco I, Fernandez-Gonzalo R, Vrtačnik P, **Lundberg TR**, Eriksson M, Gustafsson T. Healthy skeletal muscle aging: The role of satellite cells, somatic mutations and exercise. Int Rev Cell Mol Biol. 2019;346:157-200. doi: 10.1016/bs.ircmb.2019.03.003. Epub 2019 Apr 12. PMID: 31122394.

17: **Lundberg TR**, Gustafsson T. Fibre hypertrophy, satellite cell and myonuclear adaptations to resistance training: Have very old individuals reached the ceiling for muscle fibre plasticity? Acta Physiol (Oxf). 2019 Sep;227(1):e13287. doi: 10.1111/apha.13287. Epub 2019 May 13. PMID: 31009166.

18: Hansson B, Olsen LA, Nicoll JX, von Walden F, Melin M, Strömberg A, Rullman E, Gustafsson T, Fry AC, Fernandez-Gonzalo R, **Lundberg TR**. Skeletal muscle signaling responses to resistance exercise of the elbow extensors are not compromised by a preceding bout of aerobic exercise. Am J

Physiol Regul Integr Comp Physiol. 2019 Jul 1;317(1):R83-R92. doi: 10.1152/ajpregu.00022.2019. Epub 2019 Apr 10. PMID: 30969843.

19: Steinz MM, Persson M, Aresh B, Olsson K, Cheng AJ, Ahlstrand E, Lilja M, **Lundberg TR**, Rullman E, Möller KÄ, Sandor K, Ajeganova S, Yamada T, Beard N, Karlsson BC, Tavi P, Kenne E, Svensson CI, Rassier DE, Karlsson R, Friedman R, Gustafsson T, Lanner JT. Oxidative hotspots on actin promote skeletal muscle weakness in rheumatoid arthritis. JCI Insight. 2019 Mar 28;5(9):e126347. doi: 10.1172/jci.insight.126347. PMID: 30920392; PMCID: PMC6538353.

20: **Lundberg TR**, García-Gutiérrez MT, Mandić M, Lilja M, Fernandez-Gonzalo R. Regional and muscle-specific adaptations in knee extensor hypertrophy using flywheel versus conventional weight-stack resistance exercise. Appl Physiol Nutr Metab. 2019 Aug;44(8):827-833. doi: 10.1139/apnm-2018-0774. Epub 2019 Jan 8. PMID: 30620623.

21: **Lundberg TR**, Howatson G. Analgesic and anti-inflammatory drugs in sports: Implications for exercise performance and training adaptations. Scand J Med Sci Sports. 2018 Nov;28(11):2252-2262. doi: 10.1111/sms.13275. Epub 2018 Sep 2. PMID: 30102811.

22: Wiik A, Andersson DP, Brismar TB, Chanpen S, Dhejne C, Ekström TJ, Flanagan JN, Holmberg M, Kere J, Lilja M, Lindholm ME, **Lundberg TR**, Maret E, Melin M, Olsson SM, Rullman E, Wåhlén K, Arver S, Gustafsson T. Metabolic and functional changes in transgender individuals following cross-sex hormone treatment: Design and methods of the GEnder Dysphoria Treatment in Sweden (GETS) study. Contemp Clin Trials Commun. 2018 Apr 12;10:148-153. doi: 10.1016/j.conctc.2018.04.005. PMID: 30023449; PMCID: PMC6046513.

23: Cardinale DA, Lilja M, Mandić M, Gustafsson T, Larsen FJ, **Lundberg TR**. Resistance Training with Co-ingestion of Anti-inflammatory Drugs Attenuates Mitochondrial Function. Front Physiol. 2017 Dec 19;8:1074. doi: 10.3389/fphys.2017.01074. PMID: 29311990; PMCID: PMC5742251.

24: Lilja M, Mandić M, Apró W, Melin M, Olsson K, Rosenborg S, Gustafsson T, **Lundberg TR**. High doses of anti-inflammatory drugs compromise muscle strength and hypertrophic adaptations to resistance training in young adults. Acta Physiol (Oxf). 2018 Feb;222(2). doi: 10.1111/apha.12948. Epub 2017 Sep 16. PMID: 28834248.

25: **Lundberg TR**, Weckström K. Fixture congestion modulates post-match recovery kinetics in professional soccer players. Res Sports Med. 2017 Oct-Dec;25(4):408-420. doi: 10.1080/15438627.2017.1365296. Epub 2017 Aug 10. PMID: 28795586.

26: Tesch PA, Fernandez-Gonzalo R, **Lundberg TR**. Clinical Applications of Iso-Inertial, Eccentric-Overload (YoYo™) Resistance Exercise. Front Physiol. 2017 Apr 27;8:241. doi: 10.3389/fphys.2017.00241. PMID: 28496410; PMCID: PMC5406462.

27: **Lundberg TR**, Fernandez-Gonzalo R, Tesch PA, Rullman E, Gustafsson T. Aerobic exercise augments muscle transcriptome profile of resistance exercise. Am J Physiol Regul Integr Comp Physiol. 2016 Jun 1;310(11):R1279-87. doi: 10.1152/ajpregu.00035.2016. Epub 2016 Apr 13. PMID: 27101291; PMCID: PMC4935502.

28: Tesch PA, **Lundberg TR**, Fernandez-Gonzalo R. Unilateral lower limb suspension: From subject selection to "omic" responses. J Appl Physiol (1985). 2016 May 15;120(10):1207-14. doi: 10.1152/japplphysiol.01052.2015. Epub 2016 Feb 4. PMID: 26846557.

29: **Lundberg TR**, Fernandez-Gonzalo R, Norrbom J, Fischer H, Tesch PA, Gustafsson T. Truncated splice variant PGC-1α4 is not associated with exercise-induced human muscle hypertrophy. Acta Physiol (Oxf). 2014 Oct;212(2):142-51. doi: 10.1111/apha.12310. Epub 2014 May 21. PMID: 24800995.

30: Fernandez-Gonzalo R, **Lundberg TR**, Alvarez-Alvarez L, de Paz JA. Muscle damage responses and adaptations to eccentric-overload resistance exercise in men and women. Eur J Appl Physiol. 2014 May;114(5):1075-84. doi: 10.1007/s00421-014-2836-7. Epub 2014 Feb 12. PMID: 24519446.

31: **Lundberg TR**, Fernandez-Gonzalo R, Tesch PA. Exercise-induced AMPK activation does not interfere with muscle hypertrophy in response to resistance training in men. J Appl Physiol (1985). 2014 Mar 15;116(6):611-20. doi: 10.1152/japplphysiol.01082.2013. Epub 2014 Jan 9. PMID: 24408998.

32: Fernandez-Gonzalo R, **Lundberg TR**, Tesch PA. Acute molecular responses in untrained and trained muscle subjected to aerobic and resistance exercise training versus resistance training alone. Acta Physiol (Oxf). 2013 Dec;209(4):283-94. doi: 10.1111/apha.12174. PMID: 24112827.

33: **Lundberg TR**, Fernandez-Gonzalo R, Gustafsson T, Tesch PA. Aerobic exercise does not compromise muscle hypertrophy response to short-term resistance training. J Appl Physiol (1985). 2013 Jan 1;114(1):81-9. doi: 10.1152/japplphysiol.01013.2012. Epub 2012 Oct 25. PMID: 23104700.

34: **Lundberg TR**, Fernandez-Gonzalo R, Gustafsson T, Tesch PA. Aerobic exercise alters skeletal muscle molecular responses to resistance exercise. Med Sci Sports Exerc. 2012 Sep;44(9):1680-8. doi: 10.1249/MSS.0b013e318256fbe8. PMID: 22460475.

B. Scientific/popular scientific papers in national journals

- **Lundberg T**. Anti-inflammatory drugs - a double-edged sword. Swedish sports medicine 4/2019.
- **Lundberg T**, Rullman E, Gustafsson T. Exercise prolongs life - or? Swedish sports medicine 3/2019
- **Lundberg T**. Effects of NSAIDs on training results. Best Practice Rheumatology. Nov. 2018.
- **Lundberg T**, Berglind D, Gudiol J. Big gains from reviewing protein intake. Läkartidningen. 2018; 115: E79H
- Lilja M, Mandic M, **Lundberg T**. Anti-inflammatory drugs inhibit muscle growth. Swedish sports research 1 Nov 2017.
- Gustafsson T, **Lundberg T**, Vollard N. Intensive intervals a hit for fitness. Swedish Sports Research 4/2015
- **Lundberg T**. New findings on combined training of strength and endurance. Swedish Sports Medicine 3/2014.
- **Lundberg T**. Combined training of strength and endurance. Swedish Sports Medicine 3/2010.

C. Educational books

Books

Lundberg T. Styrketräningens fysiologi (English translation: The Physiology of Strength Training). Tommy Lundberg/Publit. Apr. 2019. ISBN: 9789178190775

Book chapters

Lundberg T. Long-term Effects of supplementary aerobic training on muscle hypertrophy. In: Schumann M, Rønnestad B (Eds.) Concurrent aerobic and strength training: Scientific basics and practical applications. Springer. 2019. ISBN 978-3-319-75547-2
McPhee JS, **Lundberg TR**. Muscle form and function. In: A Comprehensive Guide to Sports Physiology and Injury Management. Elsevier. 2020 (ISBN 9780702074899).
Lundberg TR, McPhee JS. Muscle adaptations and fatigue. In: A Comprehensive Guide to Sports Physiology and Injury Management. Elsevier. 2020 (ISBN 9780702074899).

D. Speaker and oral presentations (selected)

Invited speaker at international and national (selected) congresses

- **Lundberg T. "**The Compatibility of Endurance and Strength Training: Old Myths and New Science". *American College of Sports Medicine (ACSM) 68th Annual Meeting*, 1-5, 2021 in Washington DC (held virtually due to Covid-19*)*.
- **Lundberg T. "**Physiology around the inclusion of transgender people - What are the problems in sport?". *Sports & Diversity - Transgender Inclusion, February 2021*, 1-5, 2021 in Karlstad, Sweden (held virtually due to Covid-19*)*.
- **Lundberg T**. "Concurrent training and Hypertrophy". *Scandinavian Sports Medicine Congress*. 30 Jan-2 Feb 2019, Copenhagen
- **Lundberg T.** "Effect of NSAID on skeletal muscle adaptation to training". *Scandinavian Sports Medicine Congress.* February 1-3, 2018 in Copenhagen
- **Lundberg T.** "The Make-up and Regeneration of Hamstring Muscle and Connective Tissue: Implications for Performance and Return to Play". *The 5th International Global Hamstring Project*. Nov 17, 2018 in Barcelona

Oral presentations of own accepted and peer-reviewed abstracts

- **Lundberg TR**, Hansson B, Olsen LA, von Walden F, Fernandez-Gonzalo R. Concurrent Exercise of the Arm Extensors Modulates Anabolic Signaling and Gene expression for Ribosome Biogenesis. *Presented at the American College of Sports Medicine 66th Annual Meeting, Orlando, 2019.*
- **Lundberg TR**, Lilja M, Mandic M, Maddipati KR, Gustafsson T, Rullman E. Human Skeletal Muscle Lipid Mediator Responses to Resistance Exercise and Anti-inflammatory Drugs. *Presented at the American College of Sports Medicine 65ft Annual Meeting, Minneapolis, 2018.*
- **Lundberg TR**, Fernandez-Gonzalo R, Tesch PA, Rullman E, Gustafsson T. Aerobic Exercise Augments the Muscle Transcriptome Profile of Subsequent Resistance Exercise. *Presented at the American College of Sports Medicine 63rd Annual Meeting, Indianapolis, Boston, 2016.*

- **Lundberg TR**, Fernandez-Gonzalo R, Carlsson D, Tesch PA. Aerobic exercise prior to resistance exercise compromises functional adaptations, yet boosts increases in muscle size. *Presented at the 18th Annual Congress of the European College of Sport Science, Barcelona, Spain, 2013.*
- **Lundberg TR**, Fernandez-Gonzalo R, Rodriguez-Miguelez P, Tesch PA. Relationship between acute myostatin expression, p70S6K phosphorylation and muscle adaptations to aerobic and resistance training. *Presented at the American College of Sports Medicine 60th Annual Meeting, Indianapolis, Idianapolis, 2013.*
- **Lundberg TR**, Fernandez-Gonzalo R, Åkerström S, Tesch PA. Increase in Muscle Size Following 5-wk Resistance Training is Exaggerated by Concurrent Aerobic Exercise. *Presented at the American College of Sports Medicine 59th Annual Meeting, San Fransisco, California, 2012.*
- **Lundberg T**, Fernandez-Gonzalo R, Gustafsson T, Tesch PA. A Single Bout of Aerobic Exercise Compromises Down-regulation of MuRF Expression Subsequent to Resistance Exercise. *Presented at the American College of Sports Medicine 58th Annual Meeting, Denver, Colorado, 2011.*

E. Research funding obtained in the last 5 years

External research funding obtained in international or national competition as *principal applicant*

Grant provider	Project title	Amount	Own share	Time period
Swedish Council for Research in Sport Science	Macrophage- and satellite cell-mediated adaptations to resistance training with NSAIDs	SEK 373 550	100%	01.01-2021 – 31.12-2021
Swedish Council for Research in Sport Science	Myonuclear content and ribosome biogenesis following 8 weeks of resistance training and NSAID intake	SEK 257 000	100%	01.01-2020 – 31.12-2020
Ragnhild and Einar Lundströms memorial fund	Identification of new targets and effective methods for the treatment of sarcopenia	SEK 30 000	100%	01.01-2018 – 31.12-2018
Swedish Council for Research in Sport Science	The novel role of inflammatory lipid mediators in muscle adaptive responses to resistance exercise	SEK 150 000	100%	01.01-2018 – 31.12-2018
Swedish Council for Research in Sport Science	Effects of NSAIDs on skeletal muscle adaptation to strength training	SEK 450 000 (salary funding)	100%	01.01-2018 – 31.12-2018
Swedish Council for Research in Sport Science	NSAID compromises exercise-induced increases in muscle strength and	SEK 185 000	100%	01.01-2017 – 31.12-2017

	hypertrophy: possible mechanisms			
Swedish Council for Research in Sport Science	Effects of NSAIDs on skeletal muscle adaptation to strength training	SEK 450 000 (salary funding)	100%	01.01-2017 – 31.12-2017
Lars Hiertas memorial fund	Identification of new targets and effective methods for the treatment of sarcopenia	SEK 50 000	100%	01.01-2017 – 31.12-2017
Tornspiran foundation	Identification of new targets and effective methods for the treatment of sarcopenia	SEK 100 000	100%	01.01-2017 – 31.12-2017
Swedish Council for Research in Sport Science	Effects of NSAIDs on skeletal muscle adaptation to strength training	SEK 100 000	100%	01.01-2016 – 31.12-2016
Swedish Council for Research in Sport Science	Effects of NSAIDs on protein synthesis and adaptation to strength training in human skeletal muscle	SEK 450 000 (salary funding)	100%	01.01-2016 – 31.12-2016
Swedish Council for Research in Sport Science	Effects of NSAIDs on protein synthesis and adaptation to strength training in human skeletal muscle	SEK 135 000	100%	01.01-2015 – 31.12-2015
Swedish Council for Research in Sport Science	Effects of NSAIDs on protein synthesis and adaptation to strength training in human skeletal muscle	SEK 450 000 (salary funding)	100%	01.01-2015 – 31.12-2015
Lars Hiertas memorial fund	Effects of NSAIDs on protein synthesis and adaptation to strength training in human skeletal muscle	SEK 45 000	100%	01.01-2015 – 31.12-2015

External research funding obtained in international or national competition as *co-applicant*

Grant provider	Principal applicant	Project title	Amount	Own share	Time period
Swedish National Space Agency	Rodrigo Fernandez Gonzalo	Transcriptomic Regulation of Bedrest-Induced Muscle and Immune System Alterations: Investigating the Role of	SEK 4 503 000	Not specified (but 20% of my salary included) in the budget).	01.01-2021– 31.12-2022

		Long Non-Coding RNA			
Swedish Council for Research in Sport Science	Anna Wiik	Cross-sex hormone therapy: effects on muscle morphology, strength, aerobic capacity in transgenders	SEK 275 000	Not specified	01.01-2020 – 31.12-2020
Swedish Council for Research in Sport Science	Eric Rullman	Automatic and quantitative assessment of muscle mass and body composition in athletes using MRI	SEK 210 000	Not specified	01.01-2017 – 31.12-2017

Significant other research funding received (donation, grant in local competition – etc.) as *principal applicant*

Grant provider	Project title	Amount	Own share	Time period
KI funds	Internal research grant	SEK 24 900	100%	2018
Åland's Self-Government jubilee fund	Effects of match-congestion on the performance and recovery of elite football players	EUR 4 500	100%	2016

F. Research supervision

Ongoing supervision of a PhD candidate, with the applicant serving as *main supervisor*

Mats Lilja, Project: NSAIDs and muscle adaptations to resistance exercise. Registered June 1, 2017. Half-time completed June 11, 2020 at Karolinska Institutet.

Previous supervision of a PhD candidate, with the applicant serving as *co-supervisor*

Elisabeth Skoglund, Project: Muscular aging - mechanisms, consequences and potential treatment. Half-time completed December 5th, 2018 at Uppsala University. PhD defended: December 3, 2021.

G. Evaluation of others work

2020 External reviewer for the PhD thesis of Baubak Shamim, Australian Catholic University, Melbourne, AUS. Thesis title: Concurrent exercise: From training to transcriptome.

H. Referee for scientific journals

+35 reviewer assignments in the following journals from 2014 to 2022:

- International Journal of Sports Medicine
- Sports Medicine
- Acta Physiologica
- Scandinavian Journal of Science and Medicine in Sports
- American Journal of Physiology
- Journal of Applied Physiology
- Journal of Applied Physiology, Nutrition and Metabolism
- Research in Sports Medicine
- J Strength Cond Research
- Nutrients
- Ageing Research Reviews
- Physiol Genomics
- European Journal of Sport Science
- Medicine and Science in Sport and Exercise
- British Journal of Sports Medicine
- Frontiers in Physiology
- Sports Medicine (Open)

I. Collaboration with the surrounding community

I have given >20 lectures on topics related to my expertise to the larger community, including sports federations.

Media

I took part in the creation of this video on gene doping by SVT

KI official news article about my research:

New study on changes in muscle mass and strength after gender-affirming treatment may have an impact on sports regulations

Anti-inflammatory drugs can inhibit muscle growth

I have been interviewed in national and international media numerous times, especially about these two research fields above. This covers media articles both in national and international media, including, for example, the New York Times. I also featured live in Sky News in July 2021 (during the Olympics), speaking on the transgender debate.

PEDAGOGICAL ACTIVITY

TEACHING ACTIVITY

Subject area and competence

My teaching focuses on human physiology, anatomy, exercise physiology, physical activity and health, and applied fitness/strength and conditioning. I teach this subject in several courses for different medical degree programs at Karolinska Institutet, including the Physiotherapy degree program, the Biomedical Laboratory Sciences degree program, and the Occupational Therapist degree program. I am also the inventor, course leader and examiner for a contract education course called Advanced Exercise Physiology (4.5Hp). During my time as a PhD student, I have dedicated 20% of my time to teaching in the Sports Science degree programme at Mid Sweden University, which includes exercise testing and physiological assessment (see relevant courses below). For the past 3 years I have been the main teacher of the course "Applied Physiology and Nutrition" at School of Naprapathy in Stockholm.

Scope/time of teaching

I currently spend 50% of my working hours on teaching. That equates to 693 teaching hours per year, including planning, actual teaching, and classroom management. Actual classroom (or online lecture) teaching hours are estimated at 180 hours per year.

Degree project supervision (main supervisor only)

Level	Name	Time period	Study Programme	Academic credits	University
Degree project	Erik Niklasson	2021	Study Programme in Medicine	30	Karolinska Institutet
Master's degree	Björn Hansson	2020	Study Programme in Sport Science	30	Swedish School of Sport and Health Sciences
Master's degree	Gordan Divlak	2016	Study Programme in Sport Science	30	Swedish School of Sport and Health Sciences
Master's degree	Mirko Mandic	2016	Master programme in Sports Medicine and Physiology	30	Örebro University
Bachelor's degree	Rebecka Zaar	2020	Study Programme in Nutrition	15	Stockholm University and Karolinska Institutet
Bachelor's degree	Isabelle Christiansson	2018	Study Programme in Nutrition	15	Stockholm University and Karolinska Institutet
Bachelor's degree	Lisa Larsson	2016	Study Programme in Biomedical Laboratory Science	15	Karolinska Institutet

Course director/coordinator assignments

Role/assignment	Study programme	Course	Time period
Course coordinator	Study Programme in Nursing, 180 credits	Anatomy and Physiology in healthy humans, distance course (12 credits)	2014-2015
Course coordinator	Contract Education Course, advanced level	Advanced Exercise Physiology (4,5 credits)	2018-ongoing
Moment/module coordinator	Study Programme in Occupational Therapy, 180 credits	Moment/module 2 (7.5 credits) in Anatomy and Physiology (15 credits)	2015-ongoing

Examination and assessment

Role/assignment	Study programme	Course	Time period
Course examiner	Contract Education Course, advanced level	Advanced Exercise Physiology (4,5 credits)	2018-ongoing
Course examiner	Study Programme in Physiotherapy, 180 credits	Physiology III (4,5 credits)	2016-ongoing
Responsible for written examinations	Study Programme in Occupational Therapy, 180 credits	Moment/module 2 (7.5 credits) in Anatomy and Physiology (15 credits)	2015-ongoing
Responsible for written examinations	Study Programme in Physiotherapy, 180 credits	Physiology III (4,5 credits)	2016-ongoing
Responsible for written examinations	Contract Education Course, advanced level	Advanced Exercise Physiology (4,5 credits)	2018-ongoing
Responsible for written examinations	Study Programme in Nursing, 180 credits	Anatomy and Physiology in healthy humans, distance course (12 credits)	2014-VT2015
Responsible for practical examinations (heart rate and blood pressure)	Study Programme in Nursing, 180 credits	Anatomy and Physiology in healthy humans, distance course (12 credits)	2014-VT2015

PEDGOGICAL EDUCATION AND DEVELOPMENT OF TEACHING SKILLS

Formal studies in university-level teaching

2018	Pedagogy for doctoral supervisors, 2 weeks
2017-2018	Leadership for research group leaders, 2 weeks
2016-2017	Future Educational Leader, 5 weeks
2017	Open Networked Learning (ONL171), 2 weeks
2015	Teaching and Learning in Higher Education (GHPD), 5 weeks
2015	Introductory Doctoral Supervision Course, 1 week

LEADERSHIP AND DEVELOPMENT

TRAINING IN LEADERSHIP AND DEVELOPMENT

Formal education related to leadership and development

2018	Pedagogy for doctoral supervisors (2 weeks)
2017-2018	Leadership for research group leaders (2 weeks)
2016-2017	Future Educational Leader (5 weeks)
2017	Open Networked Learning (ONL171), 2 weeks
2015	Teaching and learning in Higher Education (GHPD), 5 weeks
2013	Doctoral course in Presentation Techniques, Cooperation and Relationships, 3 credits, Karolinska Institutet
2013	Innovative applications of research and science, 4.5 credits, Mid Sweden University/Linnaeus University/Örebro University/Karlstad University
2001-2003	Sports Coaching, 7.5 credits, Växjö University International Sports Coaching, 7.5 credits, Växjö University Leadership and Organizational Theory, 7.5 credits, Växjö University

MANAGERIAL POSITIONS

Chairmanship

2019-Ongoing	Chair for the Competence Network in Physiology, Swedish Ice-hockey Federation

Responsibility of management/area of responsibility

2015-Ongoing	Responsible for data storage and data management at the Division of Clinical Physiology, Karolinska Institutet
2019-Ongoing	Facility responsible for the exercise laboratory at the Division of Clinical Physiology, Karolinska Institutet

Supervisory responsibility

2003-2006	Director of Sports (full-time position), Åland Island Football Association. Supervisor of one full-time employee.

COMMITTEE WORK

2020	Expert delegate at the 2020 World Rugby expert meeting for Transgender participation in sport, London
2010-2014	Member of the Sports Science teaching committee, Mid Sweden University

CONSULTANCY WORK

2020-ongoing	Elite project within the Swedish Football Association: The role of biological maturation in talent development and player education
2019-Ongoing	Competence Network in Physiology, Swedish Ice hockey Federation

EXHIBIT 10

A.M., by her mother and next friend, E. M.

.v.

Indianapolis Public Schools; Superintendent, Indianapolis Public Schools

Case 1:22-cv-01075-JMS-DLP

Expert witness statement
Emma Hilton, PhD

1. Overview of qualifications

1.1. My name is Emma Hilton. I am currently employed as a postdoctoral researcher in developmental biology at the University of Manchester, UK, a world top 50 university.[1] I am also an unpaid director of Sex Matters, a UK-based policy group who lobby for clarity on the protected characteristic of sex in law and in institutions.[2]

1.2. I have been asked by the legal team for the State of Indiana to provide my expert scientific opinion on the need for a protected female sports category and the loss of fairness for female athletes arising from the inclusion of transgender girls and transgender women.

1.3. The opinions put forward in this statement are my own, grounded in my education and scientific expertise, and do not necessarily reflect those of my employer, the University of Manchester. I declare no conflicts of interest. I will make no personal, social, sporting or academic gains from the opinions expressed here. I have been compensated for my time preparing this report ($300 USD per hour).

1.4. In 1999, I received my Bachelor of Science degree from the University of Warwick, UK, where I studied Biochemistry. In 2004, I received my Doctor of Philosophy degree from the University of Warwick, UK, where I researched the development and growth of vertebrate embryos.

1.5. I have extensive research experience in the field of developmental biology—the study of how embryos grow and how individuals mature—and human clinical genetics. I have authored over 20 peer-reviewed publications in development and genetics journals and received over 1100 citations. My h-index is 16.[3] I have acted as an expert reviewer for multiple clinical genetics journals.

1.6. My developmental biology career has focussed on the molecular mechanisms underpinning inherited genetic disorders in humans, including those that differently affect males and females, and those that affect nerve and/or muscle development during embryogenesis.[4] In 2007, I was named as an Outstanding Young Investigator by the European Society of Human Genetics, for my work on a sex-linked genetic disorder that causes death in male fetuses.[5] I teach genetics, inheritance and genetic disorders. I have contributed a chapter entry to a key medical textbook on genetic disorders.[6]

1.7. I participate keenly in sports at an amateur level. Over the past five years, I have applied my academic developmental genetics knowledge to the study of sex differences in development and how they affect sporting performance. Publications most relevant to this expert statement are listed in the following sections.

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[1] https://www.manchester.ac.uk/study/experience/reputation/rankings/
[2] https://sex-matters.org/about/emma-hilton-phd/
[3] https://scholar.google.com/citations?user=A8zl2ggAAAAJ&hl=en
[4] https://www.research.manchester.ac.uk/portal/emma.hilton.html
[5] https://www.eshg.org/index.php?id=102
[6] Epstein's Inborn Errors of Development: The Molecular Basis of Clinical Disorders of Morphogenesis. Oxford University Press, Oxford, UK.

1.8. Hilton and Lundberg, 2021. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Medicine 51, 199–214.[7]

(From abstract) "*Here, we review how differences in biological characteristics between biological males and females affect sporting performance and assess whether evidence exists to support the assumption that testosterone suppression in transgender women removes the male performance advantage and thus delivers fair and safe competition. We report that the performance gap between males and females becomes significant at puberty and often amounts to 10–50% depending on sport... [T]he muscular advantage enjoyed by transgender women is only minimally reduced when testosterone is suppressed.*"

(Metrics) Journal five-year impact factor: 12.194; citations: 31; Altmetric score: 4115 (on June 7th 2022). Evidenced by its current Altmetric score, this review has received widespread global attention. It is the most popular peer-reviewed article ever published by Sports Medicine, an international leader in the field. It has been referenced in the mainstream news in 62 different outlets, extensively in online media, and in scientific media including Nature.[8]

1.9. Hilton et al., 2021. The Reality of Sex. Irish Journal of Medical Science, 190: 1647.[9]

(Extract) "*Human sex is an observable, immutable, and important biological classification; it is a fundamental characteristic of our species, foundational to many biology disciplines, and a major differentiator in medical/health outcomes.*"

(Metrics) This journal is the official organ of the Royal Academy of Medicine in Ireland. Journal five-year impact factor: 1.441; citations: 1; Altmetric score: 717 (on June 7th 2022).

1.10. Pike, Hilton and Howe, 2021. Fair Game: Biology, Fairness and Transgender Athletes in Women's Sport. Macdonald-Laurier Institute, Canada.[10]

(Summary) We review the importance of sex categories in sport, synthesising knowledge across developmental biology, the physiology of transgender women, and sports philosophy. We conclude that a female category that excludes all males, regardless of gender identity, is philosophically coherent in terms of category definition and necessary to ensure everyone can compete fairly and fully. We argue it is reasonable for female athletes to expect that their rights will be upheld by the institutions and procedures of their sports.

1.11. In 2020, I was invited by World Rugby to give evidence to the Transgender Working Group, which was tasked with reviewing their regulations for inclusion of

[7] https://link.springer.com/article/10.1007/s40279-020-01389-3
[8] https://link.altmetric.com/details/95647691
[9] https://link.springer.com/article/10.1007/s11845-020-02464-4
[10] https://macdonaldlaurier.ca/files/pdf/Dec2021_Fair_game_Pike_Hilton_Howe_PAPER_FWeb.pdf

transgender women in female categories in elite international competition.[11] After an extensive, “mock courtroom/adversarial” consultation process that heard evidence from all quarters, World Rugby determined that female categories can only be safe and fair if males, regardless of gender identity, are excluded from female categories.

1.12. I have been invited to consult with sports and athlete groups like the US-based Women’s Sports Policy Working Group[12] and the UK Sports Council Equality Group, who cited Hilton and Lundberg, 2021 in their influential policy document.[13] I regularly liaise with various UK and international sporting bodies seeking advice on policy formation.

1.13. In 2022, I was invited to speak at a private meeting at the UK House of Lords and wrote a house-wide briefing pack. I have recently contributed to a literature review on transgender athletes to be published by the Parliamentary Office of Science and Technology in June 2022.

1.14. I have published opinion pieces in the mainstream media. Most recently, I wrote with Professor David Handelsman, an international expert in the pharmacology of androgens and expert witness for World Athletics, in a piece called **What science tells us about transgender women athletes** (The Australian, May 9th 2022).[14]

1.15. My short form academic CV is provided in Appendix 1.

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[11] https://www.world.rugby/news/563437/landmark-world-rugby-transgender-workshop-important-step-towards-appropriate-rugby-specific-policy; World Rugby Transgender Guidelines, 2020.
[12] https://womenssportspolicy.org/
[13] https://www.uksport.gov.uk/news/2021/09/30/transgender-inclusion-in-domestic-sport; Sports Council Equality Group Guidance for Transgender Inclusion in Domestic Sport, 2021.
[14] https://amp.theaustralian.com.au/sport/what-science-tells-us-about-transgender-women-athletes/news-story/cb8b7a30f68745a3fa65442b7ff15694

2. Summary of expert witness statement

2.1. Performance gaps between males and females in almost all sports are detectable during childhood and cemented during puberty. Broadly, male athletic advantage is conferred by superior skeletal and muscle metrics and a more efficient cardiovascular system, although there are perhaps thousands of smaller magnitude physical differences that contribute to male athletic advantage. Male athletic advantage, the result of typical male development starting *in utero*, is acquired largely but not wholly under the influence of testes-derived testosterone.

2.2. Male athletic advantage is not necessarily evident by performance or output metrics. Rather, as for other physical parameters like age and impairment, it is rationalised from the extensive medical and biological knowledge on class-level physical differences, in this case between the male and female sexes.

2.3. Protected female sports categories that render ineligible people with the benefit of male athletic advantage acquired during typical male development are justified to protect fairness (and, discipline-dependent, safety) for female athletes who, by virtue of typical female development, do not benefit from male athletic advantage.

2.4. The suppression of testosterone post-puberty in transgender women who have gained male athletic advantage during development does not affect skeletal proportions and reduces muscle mass by only a modest amount. The magnitude of reduction in strength experienced by transgender women suppressing testosterone in adulthood is wholly insufficient to mitigate the large performance gap between males and females which forms the justification for sex categories in many sports. The sparse evidence regarding musculoskeletal metrics in transgender girls who have partially-blocked puberty reveals adult metrics like height far exceeding those of typical females.

2.5. Considering the above, it is my professional opinion that the Indiana General Assembly is justified in protecting fairness for female athletes in sports competition by restricting from female categories transgender girls and transgender women, because those individuals will have acquired male athletic advantage by virtue of biological development, and acquisition of male athletic advantage is not entirely removed by either puberty blockers and/or testosterone suppression post-puberty.

1. Sex and reproductive development

1.1. Across the natural world, the words *male* and *female* describe reproductive function; how an individual (or tissue) functions in the contribution of small gametes (like sperm) or large gametes (like ova), respectively, to the next generation. In healthy humans, there are two evolved anatomical body patterns, each corresponding to one of the two reproductive functions. That is, in humans, there are two sexes.

1.2. During embryonic development *in utero*, males and females develop sex-specific primary sex characteristics required for function during reproduction. Healthy male anatomy comprises external testes (also called testicles) that will make sperm, internal genital structures like the vas deferens (that carries sperm from the testicles to penis) and external genitalia in the form of a penis and scrotum. In contrast, healthy female anatomy comprises internal ovaries that will make eggs, internal genital structures like a uterus and vagina, and external genitalia in the form of a vulva, incorporating the clitoris.

1.3. The various parts of the reproductive anatomy of a healthy baby (gonad type, internal genitalia, external genitalia) develop in a coordinated sequence of events. As such, sex is routinely and reliably observed at birth by visual and palpable[15] assessment of external genitalia.

1.4. The above descriptions of primary sex are standard, appearing in dictionaries,[16] key biology textbooks,[17] academic publications[18] and medical consensus statements like that issued by the Endocrine Society in 2021.[19] By these standard descriptions of sex, transgender girls and transgender women are biologically male.

1.5. Disorders of sex development (DSDs), where the development of reproductive anatomy is atypical or disrupted,[20] are very rare[21] but frequently used to argue that sex in humans cannot be described as simply male and female. While it is true that, rarely even within DSDs, the sex of some individuals is difficult to classify, this is usually irrelevant when considering transgender people who do not typically have DSDs.

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[15] "Palpable" means, roughly, "detect by touching". This assessment is typically used to confirm the healthy descent of testes in male babies.

[16] Examples include: Oxford English Dictionary; Merriam-Webster Dictionary.

[17] Examples include: Baresi and Gilbert, 2020. Developmental Biology. Oxford University Press, UK; Wolpert, Tickle and Martinez Arias. Principles of Development. Oxford University Press, UK.

[18] Academic publications defining sex, actively researching sex or incidentally dependent on these understandings of sex are too numerous to consider. For example, a search on the scientific publication database PubMed for only "male [AND] sperm" (that is, not an exhaustive search) retrieves over 100,000 results, including multiple results from Nobel Laureates in Physiology or Medicine, and from a huge array of biology and medical disciplines.

[19] Barghava et al., 2021. Considering Sex as a Biological Variable in Basic and Clinical Studies: An Endocrine Society Scientific Statement. Endocrine Reviews, 42(3): 219-258.

[20] For example: Arboleda et al., 2014. DSDs: genetics, underlying pathologies and psychosexual differentiation. Nature Reviews Endocrinology 10(10): 603-615.

[21] Sax, 2002. How common is Intersex? A response to Anne Fausto-Sterling. Journal of Sex Research 39 (3): 174-178.

2. Sex and somatic growth

2.1. Beyond differences in reproductive anatomy, males and females differ in somatic (non-reproductive) physical characteristics. Somatic differences first emerge *in utero* and are evident at birth. Small differences in average body length (measured as head-bottom length) can be detected by ultrasound from the first trimester of pregnancy, with males already slightly longer than females.[22] Larger average skull diameter in male fetuses at twenty weeks has also been reported.[23] Gestational growth charts track not just higher male values for skull diameter but also abdominal circumference and estimated fetal weight.[24] In a large study of male and female fetuses and newborns, Broer-Brown et al (2016) concluded that, "*Sex affects both fetal as well as infant growth. Besides body size, also body proportions differ between males and females with different growth patterns*."[25] Although the magnitude of *in utero* and birth differences in size are small, they are consistently different between males and females; indeed, sex is considered necessary to clinically assess fetal growth with accuracy.[26]

2.2. Analysis of growth charts[27] for male and female infants reveals that, at birth, males are, on average, slightly longer and heavier than females. Males are consistently 1-2 cm taller than females between 0-10 years old. Boys at 10 years old also have a larger vertebral cross-sectional area (larger spinal columns) than girls.[28] Girls enter puberty earlier than boys, typically around 10 years old, and the growth spurt associated with earlier pubertal onset accounts for taller female height between 10-14 years old. Boys catch up and overtake girls in height at around 14 years old.

2.3. At puberty, both sexes undergo rapid somatic changes as they mature in preparation for reproduction, leading to measurably different adult body shapes ('sexual dimorphism').[29] Many male secondary sex characteristics are rooted in our evolutionary history of male fighting ability, displays of strength and competition for mates[30] and become increasingly evident as puberty progresses. When briefly considering sexually-dimorphic physical characteristics, adolescent and adult males are typically taller with wider shoulders, longer limbs and longer digits. They have

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[22] Pedersen, 1980. Ultrasound evidence of sexual difference in fetal size in first trimester. British Medical Journal 281(6250): 1253.
[23] Persson et al., 1978. Impact of fetal and maternal factors on the normal growth of the biparietal diameter. Scandinavian Association of Obstetricians and Gynaecologists 78: 21-27.
[24] Schwartzler et al., 2004. Sex-specific antenatal reference growth charts for uncomplicated singleton pregnancies at 15–40 weeks of gestation. Ultrasound in Obstetrics and Gynaecology 23(1): 23-29.
[25] Broere-Brown et al, 2016. Sex-specific differences in fetal and infant growth patterns: a prospective population-based cohort study. Biology of Sex Differences 7: 65.
[26] Galjaard et al., 2019. Sex differences in fetal growth and immediate birth outcomes in a low-risk Caucasian population. Biology of Sex Differences 10: 48.
[27] For example: World Health Organisation https://www.who.int/tools/child-growth-standards/standards; Centre for Disease Control https://www.cdc.gov/growthcharts/clinical_charts.htm; Royal College of Paediatrics and Child Health https://www.rcpch.ac.uk/resources/growth-charts
[28] Gilsanz et al., 1997. Differential Effect of Gender on the Sizes of the Bones in the Axial and Appendicular Skeletons. Journal of Clinical Endocrinology and Metabolism 82(5): 1603-1607.
[29] For example: Well, 2007. Sexual dimorphism of body composition. Best Practice and Research Clinical Endocrinology and Metabolism 21(3): 415-430.
[30] For example: Morris et al., 2020. Sexual dimorphism in human arm power and force: implications for sexual selection on fighting ability. Journal Of Experimental Biology 223(2): 212365; Puts, 2010. Beauty and the beast: mechanisms of sexual selection in humans. Evolution And Human Behaviour 31(3): 157-175.

larger and denser muscle mass, reduced fat mass, different distributions of muscle and fat and stiffer connective tissue. They have higher amounts of haemoglobin (the molecule that carries oxygen in blood), and larger hearts and lungs.[31]

2.4. It should be noted that this is a non-exhaustive list of sexually-dimorphic differences between males and females, which would number into the thousands and include, for example, the fine architecture of muscle tissue like proportions of cell type (fibre type, stem cell populations), cell morphology (numbers of nuclei, amounts of myoglobin) and some 3000 muscle-specific gene expression differences,[32] to the minutiae of different visual perception, hand-eye coordination and tracking capacity.[33]

[31] Reviewed in: Hilton and Lundberg, 2021. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Medicine 51, 199–214 (and references therein).
[32] Haizlip et al., 2014. Sex-Based Differences in Skeletal Muscle Kinetics and Fiber-Type Composition. Physiology (30)1: 30-39.
[33] For example: Mathew et al., 2020. Sex differences in visuomotor tracking. Scientific Reports 10: 11863.

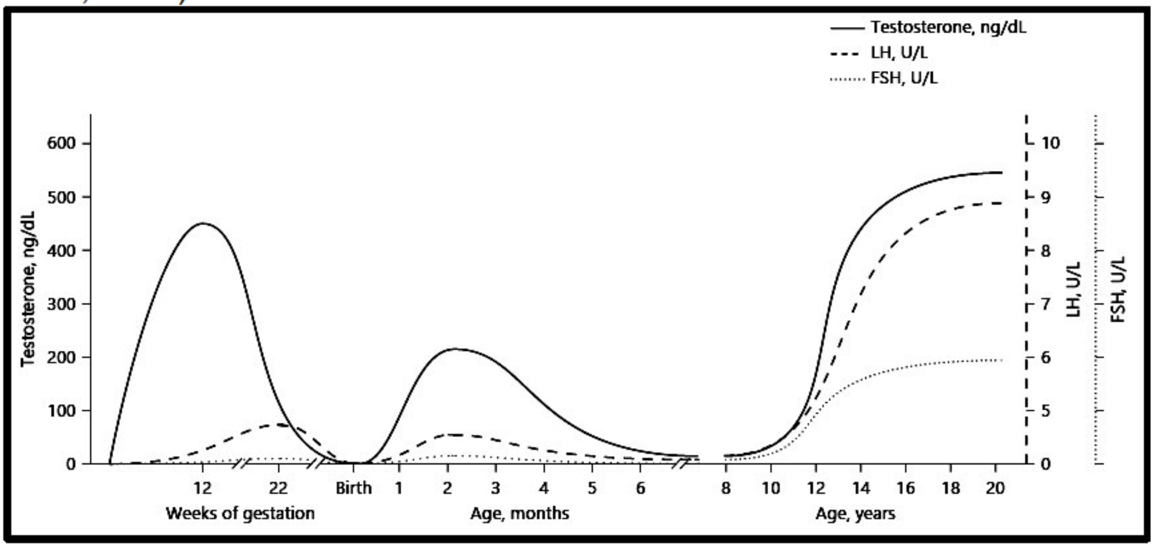
3. Genetics, hormones and development

3.1. Sex differentiation is initiated *in utero* by the presence or absence of a gene called SRY, typically carried on the Y chromosome, and triggering bipotential gonadal development into testes or ovaries in males or females, respectively.[34] The developing gonads, in conjunction with other tissues, establish sex-specific hormonal milieu that, in concert with hormones produced elsewhere, are involved in ongoing male or female physical development.[35]

3.2. It is often assumed that hormones are the driver of all physical sex differences downstream of gonad differentiation.[36] However, analysis of sex-specific genetic architecture in adults reveals some 6500 differences in gene expression, likely to influence development and function outside of hormone effects.[37] Indeed, that "every cell has a sex" dependent on genetics and independent of hormones is recognised and increasingly of scientific interest.[38]

3.3. A key hormone generating physical differences between males and females is testosterone. Males are exposed to testosterone at three stages of development: 1. in utero; 2. in the post-natal 'minipuberty' period; and 3. during classic puberty (Figure 1, solid line; Becker and Hesse, 2020[39]).

Figure 1. "***The three endocrine puberties in boys.***"
(*Reproduced from Becker and Hesse, 2020, with permission from S. Karger AG, Basel, CHE.*)



[34] Sekido and Lovell-Badge, 2013. Genetic control of testis development. Sexual Development 7:21-32.
[35] Nussey and Whitehead, 2001. Endocrinology: An Integrated Approach. BIOS Scientific Publishers, Oxford, UK.
[36] Lovell-Badge, 1993. Sex determining gene expression during embryogenesis. Philosophical Transactions of The Royal Society (Biological Sciences) 339: 159-164.
[37] Gershoni and Pietrokovski, 2017. The landscape of sex-differential transcriptome and its consequent selection in human adults. BMC Biology 15(1): 7.
[38] For example: Shah et al., 2014. Do you know the sex of your cells? American Journal of Physiology (Cell Physiology) 306(1): C3-C18; Ainsworth, 2017. Sex and the single cell. Nature 550: S6-S8.
[39] Becker and Hesse, 2020. Minipuberty: Why Does it Happen? Hormone Research in Paediatrics 93(2): 76-84.

3.4. *In utero*, from around 12 weeks of gestation, testosterone and derived dihydrotestosterone (DHT) are involved in the development of male reproductive anatomy. Testosterone is primarily produced by the male testes.[40] Testosterone promotes the formation of the vas deferens and other male internal genital structures, while DHT is necessary for the development of the penis and prostate gland.[41] The effect of testosterone on somatic development does not appear to be significant, and the sex differences in fetal size described in **Section 2.1** are not related to hormones but rather to the sex-specific genetics of maternal-placental interactions which affect, for example, nutrient exchange.[42]

3.5. In the post-natal minipuberty period between 1 week to 6 months of age, transient activation of the hypothalamic-pituitary-gonadal axis means males are exposed to a corresponding burst of testosterone.[43] This burst of testosterone supports male penis and testes growth,[44] and is associated with higher growth velocity in the first six months of life,[45] higher weight gain, lower acquisition of body fat and lower body mass index.[46] The transient exposure to testosterone in minipuberty thus seems to underpin the well-established structural differences between males and females in childhood described in **Section 2.2**.

3.6. At puberty, males experience levels of testosterone up to 20 times greater than in females, driving development during the ensuing teenage years of male secondary sex characteristics.[47] The effects of testosterone on male growth during puberty are well-characterised and hardly require exhaustive analysis here.[48]

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[40] Richmond and Rogol, 2007. Male pubertal development and the role of androgen therapy. Nature Clinical Practice Endocrinology and Metabolism 3(4): 338-344.
[41] Theakston, 2020. Development of the Reproductive System https://teachmeanatomy.info/the-basics/embryology/reproductive-system
[42] Buckberry et al., 2014. Integrative transcriptome meta-analysis reveals widespread sex-biased gene expression at the human fetal–maternal interface. Molecular Human Reproduction 20(8): 810-819.
[43] Lanciotti et al., 2018. Up-To-Date Review About Minipuberty and Overview on Hypothalamic-Pituitary-Gonadal Axis Activation in Fetal and Neonatal Life. Frontiers in Endocrinology 9: 410.
[44] Boas et al., 2006. Postnatal penile length and growth rate correlate to serum testosterone levels: a longitudinal study of 1962 normal boys. European Journal of Endocrinology 154(1): 125-129.
[45] Kiviranta et al., 2016. Transient Postnatal Gonadal Activation and Growth Velocity in Infancy. Pediatrics 138(1): e20153561.
[46] Becker et al., 2015. Hormonal 'minipuberty' influences the somatic development of boys but not of girls up to the age of 6 years. Clinical Endocrinology 83: 694-701.
[47] Handelsman et al., 2018. Circulating Testosterone as the Hormonal Basis of Sex Differences in Athletic Performance. Endocrine Reviews 39(5): 803-829.
[48] Reviewed in, for example: Hiort, 2002. Androgens and puberty. Best Practice and Research Clinical Endocrinology and Metabolism 16(1): 31-41; Richmond and Rogol, 2007. Male pubertal development and the role of androgen therapy. Nature Clinical Practice Endocrinology and Metabolism 3(4): 338-344.

4. Sex and sporting advantage

4.1. In most athletic sports—those where outcome is affected by speed, stamina, strength and physique—males have a class-level advantage over females. Male advantage is founded in physical differences described in **Section 2** that underpin functional differences in muscular strength, skeletal levers and proportions, force application, upper to lower body strength, and cardiovascular and respiratory function. In turn, these functional differences confer superior athleticism.[49] Examination of a variety of sporting records and performances identifies few athletic sporting disciplines where males do not possess performance advantage over females.[50]

4.2. The physical, functional and performance advantages in adult males are summarised in Figure 2, using reported record performances across multiple sports and sporting actions (current at the time of publication of Hilton and Lundberg, 2021). Male strength is disproportionately large in the upper body, and sports and sporting movements that require upper body input typically exhibit larger performance gaps than those where lower body strength is key. Performance differences, emerging from the physical and functional differences between adult males and females, are insurmountable,[51] and the significance of male puberty is evidenced by the fact that male performances match then exceed those of elite adult females by the age of 14-15 years old.[52]

4.3. Performance differences between males and females in childhood can be detected by, for example, comparison of schoolchildren international records in track and field.[53] An overview of male advantage in selected disciplines (comprising common, simple movements) at 5 years, 10 years and 15 years of age is shown Figure 3. There is no clear pattern of male advantage in running and jumping events at 5 years or 10 years old. However, male advantage in throwing events is clearly-evident at these pre-pubertal ages. Data for 10 year olds may underestimate male advantage, as girls are typically experiencing early puberty and growth which permits some amount of catch up with males. As expected, male advantage across all selected disciplines is evident by 15 years of age, with all the presented 15 year old male records bettering those of elite adult females.

[49] For example: Tonnessen et al., 2015. Performance development in adolescent track and field athletes according to age, sex and sport discipline. PLOS One 10(6): e0129014.
[50] For example: Olympic performances https://olympics.com/en/olympic-games/olympic-results; track and field performances https://www.worldathletics.org/stats-zone
[51] Thibault et al., 2010. Women and Men in Sport Performance: The Gender Gap has not Evolved since 1983. Journal of Sports Science and Medicine 9(2): 214-223.
[52] Hilton and Lundberg, 2021. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Medicine 51, 199-214.
[53] International age records http://age-records.125mb.com

Figure 2. Physical, functional and performance differences between males and females.
(*Adapted from Pike, Hilton and Howe, 2021, from data in Hilton and Lundberg, 2021.*)

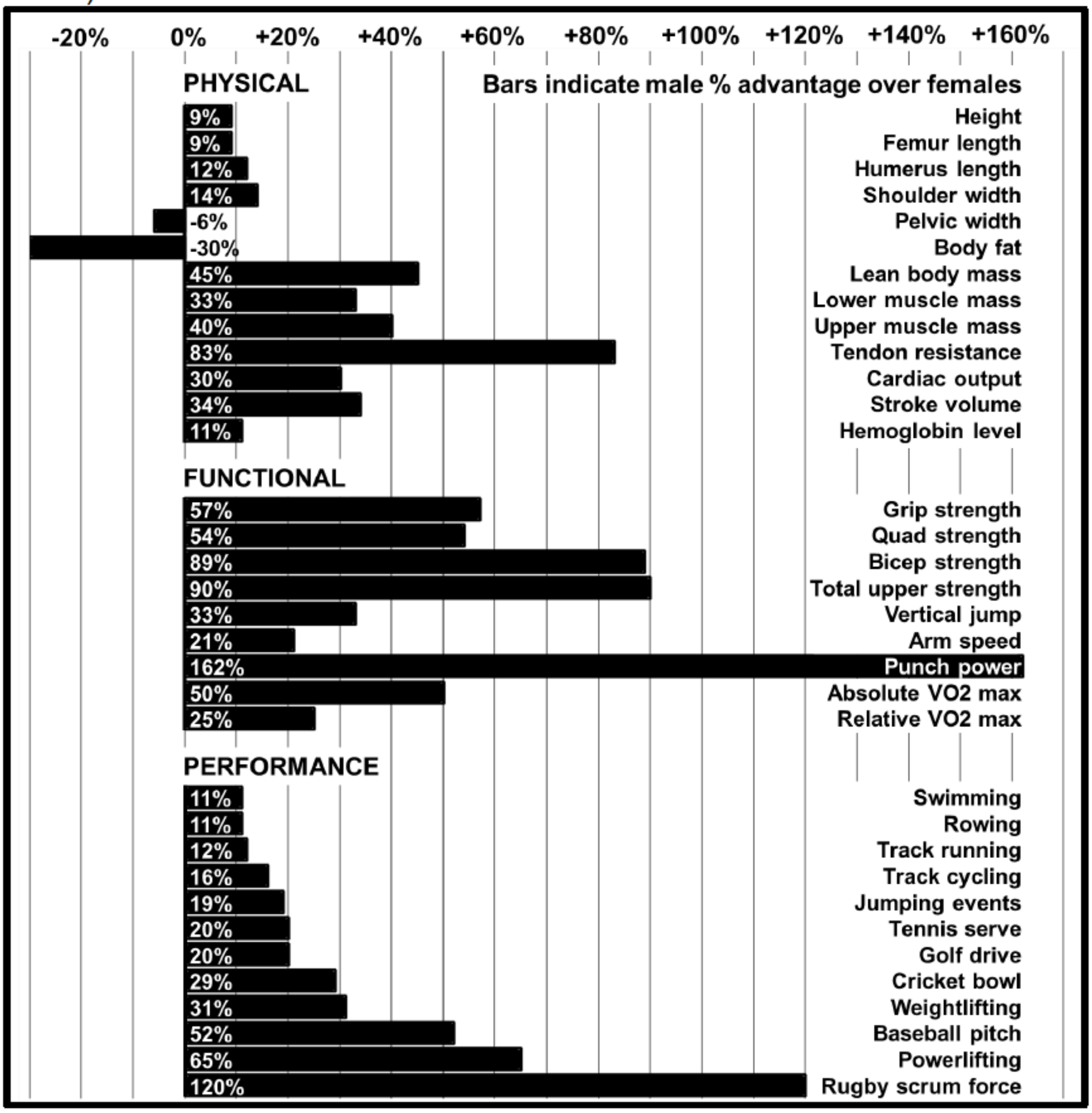
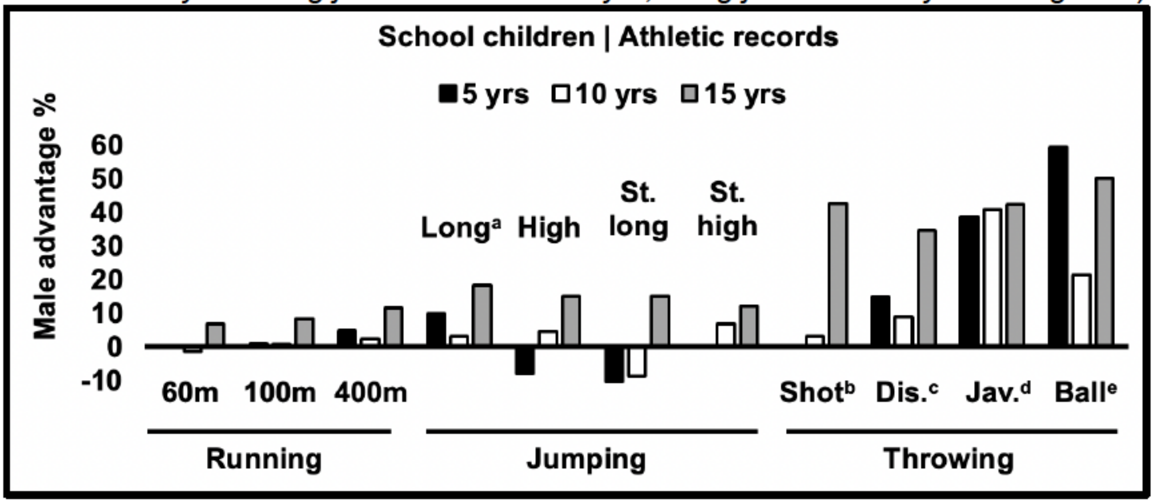


Figure 3. The male advantage over females in schoolchild track and field records.
(Abbreviations and notes: St. – standing; Dis. – discus; Jav. – javelin; yrs – years. [a]Youngest data pair at 6 yrs. [b]2kg shot at 5 and 10 yrs; 4kg shot (girls) and 5kg shot (boys) at 15 yrs. [c]Youngest data pair at 7 yrs; 500g discus at 7 and 10 yrs; 1kg discus at 15 yrs. [d]400g javelin at 5 and 10 yrs; 600g javelin at 15 yrs. [e]200g ball.)



4.4. Large cohort studies of fitness data in typical schoolchildren reveals differences evident from as young as 6 years old, and males can run faster, jump longer, complete more push ups and shuttle runs, and have higher grip strength.[54] Young males of 6-7 years old have higher absolute and relative VO_{2max} than female peers.[55] Thus, athletic differences among schoolchildren are detectable and measurable, and are likely influenced by biological differences in physical size and ensuing functional differences.

4.5. Finally, male advantage over females is not limited to those physical and functional differences conferred by male morphology, shape and size. Most obviously, female athletes must typically deal with the effects of the menstrual cycle and the cyclical effects of hormones on training capacity and performance. The menstrual cycle is known to affect cardiovascular, respiratory, brain function, response to ergogenic aids, orthopedics, and metabolic parameters,[56] and represents a barrier to athletic capacity not experienced by males.

4.6. Injury susceptibility differs between males and females, with subsequent impacts on training time. Emerging research shows that compared with males, female rugby players appear more susceptible to concussive injuries, with more severe

[54] For example: Catley and Tomkinson, 2013. Normative health-related fitness values for children: analysis of 85347 test results on 9–17-year-old Australians since 1985. British Journal of Sports Medicine 47(2): 98–108; Tambalis et al., 2016. Physical fitness normative values for 6–18-year-old Greek boys and girls, using the empirical distribution and the lambda, mu, and sigma statistical method. European Journal of Sport Science 16(6): 736-746.
[55] Eiberg et al., 2005. Maximum oxygen uptake and objectively measured physical activity in Danish children 6–7 years of age: the Copenhagen school child intervention study. British Journal of Sports Medicine 39(10): 725-730.
[56] Meignie et al., 2021. The Effects of Menstrual Cycle Phase on Elite Athlete Performance: A Critical and Systematic Review. Frontiers in Physiology 12: 654585.

outcomes. This has been attributed to lower impact resistance in their neck muscles and more delicate brain structures.[57]

[57] www.rugbypass.com/news/long-term-brain-damage-could-be-a-significantly-bigger-issue-in-womens-rugby-than-mens-says-lead-concussion-doctor/

5. Sports categories and concepts of advantage

5.1. Sports where performance or competitor safety is affected by sex ("sex-affected sports") routinely employ a protected female category that excludes males, to secure fairness for (and, discipline-dependent, safety of) female athletes. This separation on the basis of sex in pursuit of fair, safe sports and sporting opportunities for female athletes is permissible under much national equality legislation, including, for example, the UK Equality Act 2010.[58]

5.2. Misunderstandings regarding the nature of categories and advantage are common. Sports categories control for baseline physiological differences in sex, age, and impairment (and occasionally weight) that affect results or outcomes independently of the characteristics sporting competition seeks to reward – a package of talent, strategy, training, and dedication.

5.3. Categories are rationalised on biological principles and do not mean that all persons of a non-protected category will beat all persons of the protected category. Rather, they recognise that like-for-like—given equal amounts of talent, strategy, training and dedication—males have a physical bonus (for example, of superior height and muscle mass) over females, 25 year olds have a fitness bonus over those in Masters sport and physical maturity over those in school sport, and able-bodied people have the bonus of bodies unimpeded by impairment or disability. Categories exist to ensure those physiological bonuses do not obscure outcomes that should depend on talent, strategy, training, and dedication.

5.4. Conceptually, all athletes have access to the package of talent, strategy, training and dedication that sporting competition seeks to reward. For example, both males and females, old and young, and able-bodied or impaired, can possess the 'speed gene'[59] that alters muscle fibre type distribution, thought to favour the explosive power important in sports like sprinting. This same pool of athletes can be coached in equally good strategies and equally effective psychology during gameplay, can train equally hard, can eat equally well, can wear the same shoes, and so on. The gross physiological differences in different types of body—the advantages of being male, being able-bodied and being at peak age and physical maturity—transcend the differences in athletes that result from talent, strategy, training and dedication.

5.5. It is via categories that fairness is achieved, and all people included in sports, regardless of baseline physiological differences. We ensure that winning opportunities for the more talented athlete—a fundamental characteristic of sport—are preserved, in the case of sex by instituting a female category.

5.6. Advantage should be considered as a "kind" rather than an "amount"; that is, it exists regardless of magnitude. Indeed, as well as regulating for very large unfair advantages, sports bodies have a history of regulating for even very small unfair advantages. For example, inside lane track runners closer to the traditional start gun hear the gun more quickly and more loudly than those in outside lanes, offering them a small kind of advantage unavailable to the whole field. To combat this

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[58] UK Equality Act 2010, Part 14, Section 195.
[59] Pickering and Kiely, 2017. ACTN3: More than Just a Gene for Speed. Frontiers in Physiology 8: 1080.

advantage, worth around 150 milliseconds in a staggered start of a 400m track, runners typically now start races via a loudspeaker at each block.[60]

5.7. A common argument is to frames ‘advantage’ as simply a property of results or outcomes (for example, any person who is faster than any other has ‘advantage’, while people who are equally fast are said to be fairly-matched), one undermines the very existence of categories. The logical outcome is sports organised not to reward talent but to reward a combination of talent and talent-independent physical properties that together deliver a winning outcome. In such a framework, almost all sports at every competitive level will be dominated by able-bodied males aged around 20-35 years old.

5.8. What has traditionally been described as a “girl’s/women’s category” is, in fact, upon deeper examination, more precisely understood as a category for females that excludes males who have acquired *any* magnitude of male athletic advantage by virtue of biology, regardless of performance relative to the female field. The ineligibility of those with *any* male advantage is necessary to maintain the integrity of the female sports category.

[60] Holmes, 2008. Olympic start gun gives inside runners an edge. New Scientist, 23rd June 2008.

6. Treatment of transgender girls and transgender women

6.1. Transgender girls and transgender women may feel deep distress and discomfort with their male body ("gender dysphoria"), have a sense of identification with the female sex ("gender identity") and may take social, pharmaceutical and/or surgical steps to be perceived and treated as if they were female.

6.2. In adulthood, transgender women may opt for surgical removal of the testes, which has the effect of lowering testosterone levels to those of females[61] and reducing the functional or visual impact of their male physical characteristics; in addition, estrogen supplementation typically promotes feminisation of, for example, breast tissue.[62] For pre-surgical transgender women, hormonal regimes in adulthood typically include the suppression of either testosterone production or activity (for example, via gonadotropin-releasing hormone [GnRH] agonists, spironolactone or cyproterone acetate), and the addition of estrogen.

6.3. Early pharmaceutical interventions in transgender girls may involve blocking male puberty via GnRH analogue ("puberty blockers"), administered after the onset of puberty (at least Tanner stage 2; in male children, the appearance of pubic hair, and increase in testicular volume and reddening of scrotum skin).[63] This is typically followed by a regime of cross-sex hormones from 16 years old. Puberty blockers do not, therefore, completely block the entirety of male puberty.

6.4. Most children reporting gender dysphoria or incongruent gender identity desist; that is, gender identity issues resolve with puberty.[64] For this reason, puberty blockers are not administered until after the onset of puberty and there is demonstrable persistence of gender identity issues. Furthermore, the reported effects and side-effects of puberty blockers are serious, including long-term effects on bone growth, brain development, fertility and sexual function, and short-term effects like headaches, hot flashes, mood swings, and depression and anxiety,[65] necessitating caution with their prescription until biologically-appropriate.

6.5. Children seeking early treatment from the major UK gender identity service have high levels of mental health comorbidities and self-harming behaviours, and are a cohort increasingly dominated by female children and those reporting same-sex

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[61] Nishiyama, 2014. Serum testosterone levels after medical or surgical androgen deprivation: a comprehensive review of the literature. Urologic Oncology 32(1): 38.e17-28.
[62] Unger, 2016. Hormone therapy for transgender patients. Translational Andrology and Urology. 5(6): 877-884.
[63] Puberty progression is assessed using "Tanner staging", which describes the typical physical changes in boys and girls using landmarks of external genitalia in males (testicular volume, penis length and skin appearance), quantity and coarseness of pubic hair in both sexes, and breast development in girls. In males, Tanner stage 2 indicates the first signs of puberty, around the age of 11 years old, comprising the appearance of downy pubic hair, an increase in testicular volume and reddening of the scrotum skin. At Tanner stage 3, around the age of 13 years old, the penis begins to grow in length. Testicular volume increase and penis growth continues during later stages, and pubic hair becomes course and curly. For more information, see: https://childgrowthfoundation.org/wp-content/uploads/2020/03/Puberty-and-Tanner-Stages_v2.0.pdf
[64] Wallien and Cohen-Kattenis, 2008. Psychosexual outcome of gender-dysphoric children. Journal of the American Academy of Child and Adolescent Psychiatry 47(12): 1413-1423.
[65] Reported by various healthcare providers, for example: Mayo Clinic, NHS, St. Louis Children's Hospital.

attraction.[66] Almost all children who initiate puberty blockers continue to cross-sex hormones[67] and long-term follow-up studies show the persistence of mental health comorbidities into adulthood.[68]

6.6. In light of the potential for medical harm while outcomes remain uncertain, many jurisdictions have cautioned against or restricted the use of puberty blockers in children, including the Swedish National Board of Health and Welfare,[69] the Finnish Health Authority,[70] and the French National Academy of Medicine.[71] The UK Cass Review Interim Report notes the large evidence gaps to support puberty blockers as the first line treatment for dysphoric children.[72] Pioneers of the original protocol for treatment of childhood dysphoria have advocated re-evaluation in light of the rapidly-changing cohort demographics.[73]

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[66] Griffin et al., 2021. Sex, gender and gender identity: A re-evaluation of the evidence. British Journal of Psychiatry Bulletin 45(5): 291-299.
[67] De Vries et al., 2011. Puberty suppression in adolescents with gender identity disorder: a prospective follow-up study. Journal of Sexual Medicine 8(8): 2276-2283.
[68] Dhejne et al., 2011. Long-Term Follow-Up of Transsexual Persons Undergoing Sex Reassignment Surgery: Cohort Study in Sweden. PLOS ONE 6(2): e16885.
[69] https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/kunskapsstod/2022-3-7799.pdf
[70] https://palveluvalikoima.fi/documents/1237350/22895838/Summary+transgender.pdf/2cc3f053-2e34-39ce-4e21-becd685b3044/Summary+transgender.pdf?t=1592318543000
[71] https://segm.org/sites/default/files/22.2.25-Communique-PCRA-19-Medecine-et-transidentite-genre.pdf
[72] https://cass.independent-review.uk/wp-content/uploads/2022/03/Cass-Review-Interim-Report-Final-Web-Accessible.pdf
[73] de Vries, 2020. Challenges in Timing Puberty Suppression for Gender-Nonconforming Adolescents. Pediatrics 146(4): e2020010611.

7. Transgender girls and transgender women in sport

7.1. Given the role of testosterone in the development of male characteristics relevant for sporting performance and the typical treatments sought by transgender women, the International Olympic Committee (IOC) and other sporting federations have historically sought to include transgender women in female sport by regulating levels of testosterone for 12 months prior to competition.[74]

7.2. Many sports federations adopted the historic IOC guidelines without further scrutiny. However, World Athletics, for example, put in place more stringent requirements around testosterone suppression,[75] albeit with no evidence that suppression to their chosen 5 nmol/litre elicits some meaningful difference in male performance advantage not achieved with the 10 nmol/litre limit set by the IOC. In contrast, World Rugby, after an exhaustive, transparent, evidence-based consulting process, barred transgender women from competing in the female category in events they regulate, identifying clear and unacceptable safety risks for female players.[76]

7.3. It is inferred from the historical guidance that the IOC believed testosterone suppression sufficient to remove the male performance advantage provided by male-typical secondary sex characteristics. In 2020, with the IOC equivocating over a review of their testosterone guidelines, Dr Tommy Lundberg (Karolinska Institutet, SWE) and I tested the guidelines' promise to protect fair competition by reviewing peer-reviewed published longitudinal changes in muscular and skeletal metrics in transgender women suppressing testosterone in adulthood for a minimum of 12 months.[77]

7.4. Having reviewed measures of bone density, lean body mass, muscle mass and strength tests, we identified a unified consensus in 11 original studies covering approximately 800 transgender women that skeletal metrics like height and bone length were unaffected, bone mass was preserved, and muscle mass and strength was decreased by 4% over 12 months of testosterone suppression. Where we could compare final measurements in transgender women with reference female subjects from the same cohort study, we found that muscle mass and strength measurements remained far higher than reference female subjects. A summary of this data is shown in Figure 4.

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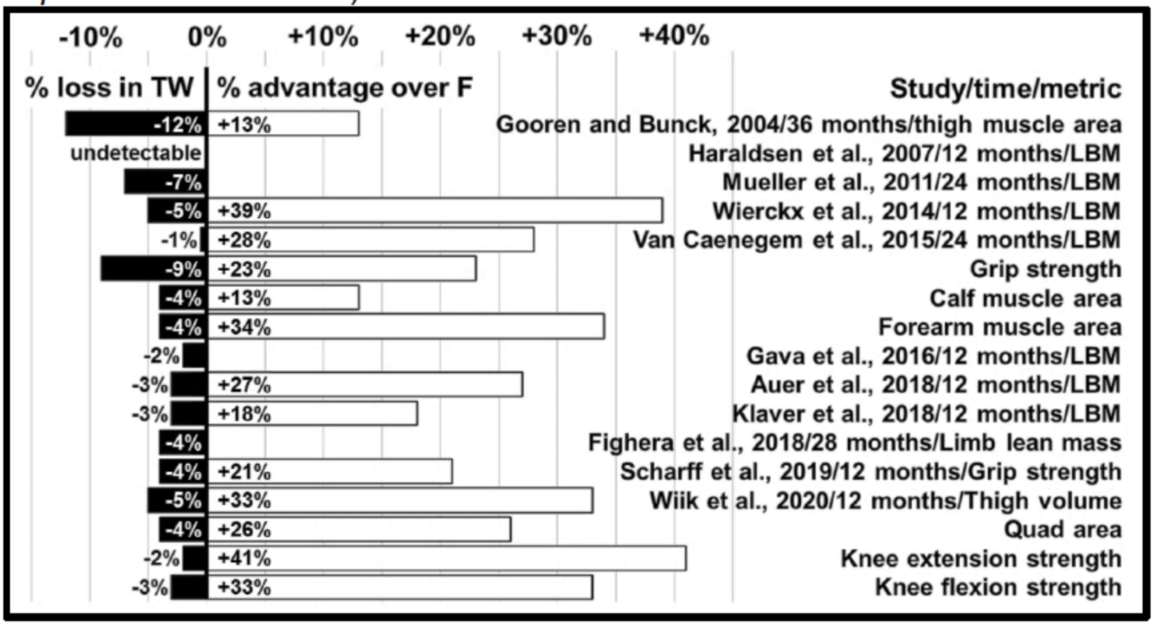
[74] https://stillmed.olympic.org/Documents/Commissions_PDFfiles/Medical_commission/2015-11_ioc_consensus_meeting_on_sex_reassignment_and_hyperandrogenism-en.pdf
[75] https://www.worldathletics.org/download/download?filename=ace036ec-a21f-4a4a-9646-fb3c40fe80be.pdf&urlslug=C3.5%20-%20Eligibility%20Regulations%20Transgender%20Athletes
[76] https://www.world.rugby/the-game/player-welfare/guidelines/transgender?lang=en
[77] Hilton and Lundberg, 2021. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Medicine 51, 199–214. Note: the date disparity of the published paper represents the gap between article submission and publication.

Figure 4. A summary of muscle mass and strength loss in transgender women, and comparisons of retained muscle mass and strength advantage over reference female subjects.
(*Adapted from Pike, Hilton and Howe, 2021; originally collected in Hilton and Lundberg, 2021. The % advantage over reference female subjects was calculated where females were included in the same study cohort; absence of data bars here reflects absence of such females in the relevant study. Abbreviations and notes: TW – transgender women; F – females; LBM – lean body mass. Although female data was available in Fighera et al., 2018, the values reported were surprisingly large for the metric of female limb mass, and the authors have not responded to requests for clarification.*)

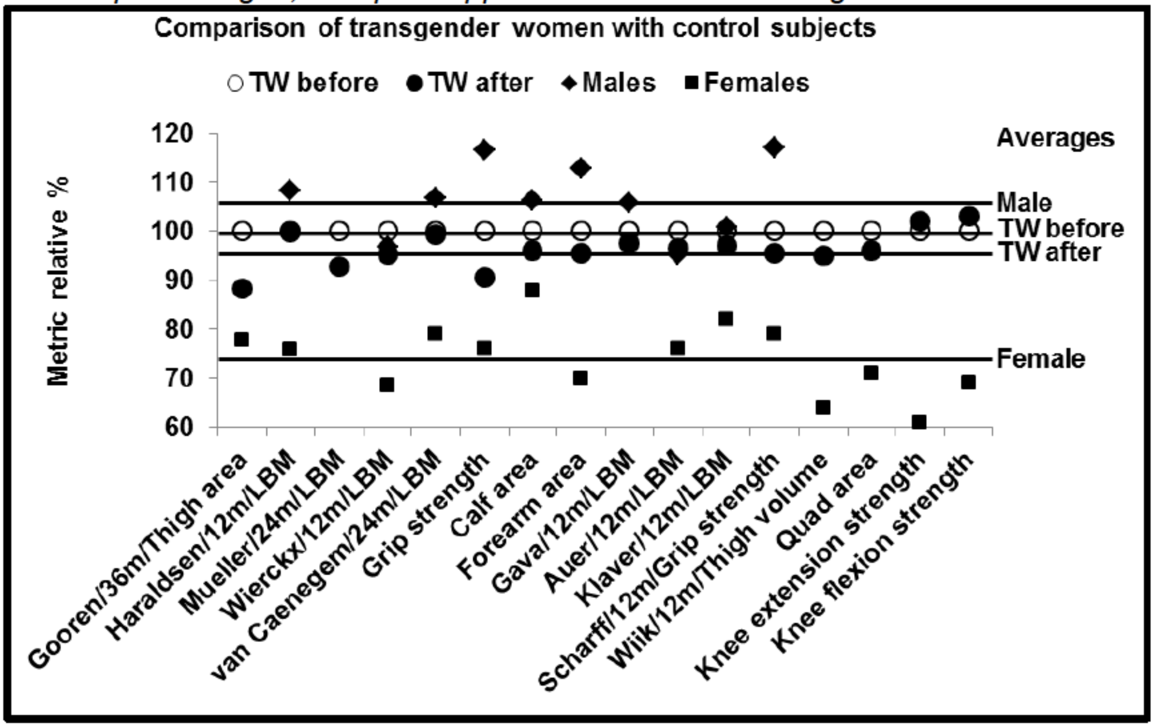


7.5. To gain an overall picture of the effects on muscle mass and strength in transgender women pre- and post- at least 12 months of testosterone suppression, I compared pre- and post- metrics for transgender women across the above dataset with data from control males and females (Figure 5). The 4% reduction in muscle mass and strength in transgender women pre- and post- at least 12 months of testosterone suppression was not statistically significant. The difference between transgender women and control males was statistically significant, with transgender women pre- and post- at least 12 months of testosterone suppression deviating from control males by -7% and -11%, respectively. The difference between transgender women and females is also statistically significant; however, transgender women pre- and post- at least 12 months of testosterone suppression deviate from control females by +35% and +30%, respectively. Thus, our dataset show that transgender women remain within "male range" in terms of muscle mass and strength.

7.6. We concluded that our "*data significantly undermine the delivery of fairness and safety presumed by the [testosterone suppression] criteria set out in transgender inclusion policies*" like that of the historic IOC guidelines, adopted by many sports federations. This conclusion was later supported in a second review of the same dataset, which concluded that, "*hormone therapy decreases strength, LBM and* *muscle area, yet values remain above that observed in cisgender women, even after 36 months.*"[78]

[78] Harper et al., 2021. How does hormone transition in transgender women change body composition, muscle strength and haemoglobin? Systematic review with a focus on the implications for sport participation. British Journal of Sports Medicine 55(15): 865-872.

Figure 5. Relative metrics in transgender women pre- and post- testosterone suppression, compared with control males and females.
(*Abbreviations and notes: TW – transgender women. Metrics were converted to relative percentages, with pre-suppression metrics in transgender women at 100%.*)



7.7. More recently, the IOC have advocated inclusion strategies that caution against the presumption of advantage in transgender women and remove from sporting federations any obligation to regulate inclusion via testosterone levels.[79] I believe these guidelines have abandoned any recourse to scientific data about testosterone, male development and the enduring effects of male puberty on sports performance, as well as failing to understand the rationale of categories.

7.8. Most sporting federations exempt from testosterone regulations those who have blocked puberty before cross-sex hormone treatment. To my knowledge, there is no published data on skeletal metrics, muscle mass and strength metrics in a cohort of transgender girls who have blocked puberty from Tanner stage 2.

7.9. In his testimony, Dr Fortenberry mentions a new study of adult height acquisition in puberty-blocked transgender girls, claiming that final adult height in transgender women is close to what would be expected in the absence of testosterone influence. I believe this to reference a recent study by Boogers et al., 2022, called, "**Trans girls grow tall: adult height is unaffected by GnRH analogue and estradiol treatment.**"[80] In this study, transgender girls who had received puberty blockers from around 13 years of age, then cross-sex hormones at 16 years of age, acquired an average adult height of 180.4cm (GnRH analogue plus ethinylestradiol) or 185.3cm (GnRH analogue plus estradiol). Using predicted adult height based on

[79] https://stillmed.olympics.com/media/Documents/News/2021/11/IOC-Framework-Fairness-Inclusion-Non-discrimination-2021.pdf?_ga=2.12453172.1440744041.1655066386-1543202720.1655066386
[80] Boogers et al., 2022. Trans girls grow tall: adult height is unaffected by GnRH analogue and estradiol treatment. Journal of Clinical Endocrinology and Metabolism. Epub ahead of print, PMID: 35666195.

parental heights, the authors conclude that GnRH analogue plus ethinylestradiol—but not GnRH analogue plus estradiol—reduces adult height. GnRH analogue plus ethinylestradiol delivers an average adult height far larger than the population female average (170.7cm) and closer to the population male average (183.8cm). This particular hormone regime *does* deliver adult height close to "target height", which is the height decided between clinicians and the patient as both desirable for the transgender woman to feel less discomfort but within the bounds of what is achievable under current hormone regimes. I believe Dr Fortenberry has interpreted "target height" as "female height" and misinterpreted the results of this study.

7.10. As above, studies of transgender women who have at least partially-blocked puberty show that adult height acquisition remains closer to male than female averages. Furthermore, lean body mass in young adulthood remains higher than in reference females[81] and grip strength remains higher than in a matched cohort of transgender boys.[82]

[81] Klaver et al., 2018. Early Hormonal Treatment Affects Body Composition and Body Shape in Young Transgender Adolescents. Journal of Sexual Medicine 15(2): 251-260.

[82] Tack et al., 2018. Proandrogenic and Antiandrogenic Progestins in Transgender Youth: Differential Effects on Body Composition and Bone Metabolism. Journal of Clinical Endocrinology and Metabolism 103(6): 2147-2156.

8. Summary

8.1. Considering the above witness statement, it is my professional opinion that the Indiana General Assembly is justified in protecting fairness for female athletes in sports competition by restricting from those female categories transgender girls and transgender women, because those individuals will have acquired male athletic advantage by virtue of biological development, and acquisition of male athletic advantage is not entirely removed by either puberty blockers and/or testosterone suppression post-puberty.

8.2. Further, it is my professional opinion that the typical course of early male development, driven by both genetics and hormones, delivering structural differences (compared to females) from as early as first trimester gestation, and translating to performance differences during childhood athletics and school programme activities means it is justifiable to separate A.M. (and other transgender girls) from sports activities designated as female-only.

I verify under the penalties for perjury that the foregoing representations are true.

Emma Hilton, PhD
16th June 2022

Appendix 1. Short form academic CV

EMMA NIAMH HILTON
CURRICULUM VITAE

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ROLES

04/2019 - present	Postdoctoral research associate, Division of Infection, Immunity & Respiratory Medicine, University of Manchester (funding from BBSRC; NC3Rs; Cystic Fibrosis Foundation).
01/2014 - 04/2019	Research Fellow, University of Manchester (funding from MRC, Newlife).
01/2010 - 01/2014	Stepping Stone Research Fellow, Genetic Medicine, University of Manchester (funded internally).
06/2003 - 12/2009	Postdoctoral research associate, Genetic Medicine, University of Manchester (MRC).

ACADEMIC QUALIFICATIONS

2004	Ph.D. Developmental Biology, University of Warwick, UK.
1999	B.Sc. (Honours) Biochemistry, University of Warwick, UK.

KEY ACHIEVEMENTS

In my research career, I have successfully synthesised my expertise as a developmental biologist with clinical genetics research, have been a key driver in establishing Xenopus as an animal model for human genetics research in Manchester and have collaborated on many projects with diverse developmental outcomes. I have published over 20 manuscripts and one book chapter. I have co-supervised one PhD student (awarded 2015). In June 2007, I received the Young Investigator Award for Outstanding Science from the European Society for Human Genetics, using Xenopus to model syndromic microphthalmia 2 and identifying novel clinically-relevant phenotypes in patients based on my frog studies.

SELECTED PUBLICATIONS (Google Scholar: Citations 1181, h-index 16)

Randles, M., Hamidi, H., Lausecker, F., Humphries, J.D., Byron, A., **Hilton, E.N.**, Clark, S.J., Miner, J.H., Zent, R., Humphries, M.J. and Lennon, R. Integrin-specific signalling pathways determine podocyte morphologies on basement membrane ligands. *Submitted, Nat. Commun.*

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long-term diabetes mellitus alters the transcriptome and biomechanical properties of the rat urinary bladder. Sci Rep. 11(1):1-16.
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AUTHORED BOOK CHAPTERS
Hilton, E., Black, G.C.M., Bardwell, V. *BCOR* and oculofaciocardiodental syndrome. (2008/2013). Epstein's Inborn Errors of Development: The Molecular Basis of Clinical Disorders of Morphogenesis, 2nd/3rd edition, Oxford University Press, Oxford, UK.

GRANT INCOME
- 2016-2018 Newlife (£115,735). Towards novel therapies for an inherited congenital neuropathy affecting the urinary bladder. Woolf, Newman, Kimber, **Hilton** (Co-app).
- 2014-2016 MRC (£507,695). Molecular bases of congenital bladder diseases. Woolf, Newman, Gardiner, **Hilton** (Research Co-I).
- 2010-2013 KRUK (£180,000). Urofacial syndrome (UFS): a novel genetic model to understand human renal tract function and malformation. Newman, Woolf, McKenzie, **Hilton** (Co-app).
- 2010-2014 University of Manchester (£salary + £40,000 project costs). Xenopus as a model organism for human development and disease. **Hilton** (Stepping Stone Fellowship Award).
- 2008-2010 Newlife (£100,000). The role of BCL-6 corepressor-modulated TGFβ signalling in MCOPS2 and other microphthalmia syndromes. Black, Manson, **Hilton** (Co-app).

EXHIBIT 11

***A.M. v. Indianapolis Public Schools, et al.*, Case No. 1:22-cv-1075-JMS-DLP**

EXPERT REPORT OF WILLIAM BOCK, III.[1]

1. Introduction and overview of qualifications

1.1. My name is William Bock, III. I am a partner at the Indianapolis, Indiana law firm of Kroger, Gardis & Regas, III. I was the General Counsel for the United States Anti-Doping Agency (USADA) during 2007-2020. Both before and after service as USADA's General Counsel I served as outside counsel to USADA for a period totaling over twenty-one (21) years. Congress has determined that USADA shall "serve as the independent anti-doping organization for the amateur athletic competitions recognized by the United States Olympic Committee and be recognized worldwide as the independent national anti-doping organization for the United States." USADA "serve[s] as the United States representative responsible for coordination with other anti-doping organizations coordinating amateur athletic competitions recognized by the United States Olympic Committee to ensure the integrity of athletic competition, the health of the athletes, and the prevention of use by United States amateur athletes of performance-enhancing drugs or prohibited performance-enhancing methods adopted by the Agency."[2] During 2009-2021 I served as one of six international arbitrators for the international swimming federation (Federation Internationale de Natation-FINA), Anti-Doping Panel, adjudicating eligibility cases involving international swimmers and other aquatic sports athletes. I am currently a member of the National Collegiate Athletic Association (NCAA) Division I Committee on Infractions, handling major infractions cases involving rule violations in collegiate sports. I served on the NCAA Doping, Drug Education and Drug Testing Task Force. Since 1992 I have served as legal counsel to athletes, coaches, sports officials, sports organizations, and anti-doping laboratories in hundreds of sport eligibility matters.[3]

1.2. I received my J.D. degree, *cum laude*, from the University of Michigan Law School in 1989.

1.3. I was named a lawyer of the year in 2012 by *Colorado Law Week*, and in 2013 designated a Distinguished Barrister by the *Indiana Lawyer*. I was selected as a 2014 honoree for the NASBA Center for Public Trust's *Being a*

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[1] ©2022 by William Bock, III, all rights reserved.
[2] 21 U.S.C. § 2001(b)(4).
[3] A partial list of contested sport eligibility cases in which I have served as legal counsel and which progressed to a hearing or final written decision is attached to this Declaration as Appendix **A**.

Difference Award and have been named a *Super Lawyer* in the State of Indiana each year during 2015-2022. I have been included in Who's Who Legal's list of the top three hundred international sports lawyers during 2019-2021. I received a twenty-year service award from USADA on May 26, 2021.

1.4. Published materials I have principally authored are listed in Appendix **B**. A partial listed of invited presentation is Appendix **C**. My curriculum vitae is Appendix **D**.

1.5. I previously served as an expert witness for the PGA Tour in *V.J. Singh v. PGA Tour*, Supreme Court of New York, No. 651659/2013.

1.6. I have been asked by counsel for the State of Indiana to provide expert testimony on: transgender eligibility rules in sport, the manner in which anti-doping procedures and practices are used in connection with transgender eligibility rules to monitor the suppression of testosterone by transgender females, sport eligibility principles relevant to determining competitive advantage in sport, sport eligibility principles relevant to protecting athlete safety, and the adequacy of the Indiana High School Athletic Association (IHSAA) transgender athlete eligibility rules.

1.7. In connection with providing testimony in this case I have reviewed the Complaint, Plaintiff's brief in support of her motion for preliminary injunction, declarations of E.M. and of James D. Fortenberry, M.D., M.S, and declarations of Dr. James Carlson, Dr. Emma Hilton, Dr. Tommy Lundberg and Nancy Hogshead-Makar. My opinions contained in this report are based upon experience, background and knowledge gained through my job responsibilities in sport, familiarity with the underlying eligibility rules in sport, my review of the foregoing documents and the documents referenced in this report, including the List of Sources Relied Upon in Appendix **E**.

1.8. I am being compensated for my services as an expert witness at the rates of $650 per hour for study and analysis of the issues on which I have been asked to provide expert testimony and for preparation of an expert report(s), preparation for testifying and testifying at deposition(s) and/or trial.

1.9. In this declaration, when I use the term "transgender" I am referring to persons who are males or females, but who identify as a member of the opposite sex (*e.g.*, a "transgender female" refers to a biological male).

1.10. The opinions in this declaration are my own and do not necessarily reflect the opinions of Kroger, Gardis & Regas, LLP or of any client or of any organization with which I am or have been affiliated.

2. Summary of opinions in declaration

2.1. Applying principles developed in anti-doping eligibility rules to protect a level playing field and fair competition, transgender females possess a competitive advantage over biological females.

2.2. Applying principles developed in anti-doping eligibility rules to protect the safety of athletes, transgender females create an unacceptable risk of injury for biological females competing in contact and combat sports.

2.3. The IHSAA's transgender eligibility rules do not protect a level playing field and athlete safety using objective and repeatable standards.

2.4. The IHSAA's transgender eligibility rules do not adequately monitor testosterone suppression in compliance with recognized international standards.

2.5. H.E.A. 1041 protects a level playing field and athlete safety using objective and repeatable standards that are consistent with sport eligibility principles regularly applied in domestic and international sport.

3. Universality of Sport Eligibility Rules to Advance Competitive Fairness and Protect Athlete Health and Safety

3.1. It is universally accepted that sport must have eligibility rules to advance competitive fairness,[4] promote meaningful competition, and protect athlete health and safety.

3.1.1. For instance, anti-doping eligibility rules in international sport are said to be "founded on the intrinsic value of sport"[5] referred to as "the spirit of sport"[6] which is asserted to be "the ethical pursuit of human excellence through the dedicated perfection of each Athlete's natural talents."[7]

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[4] The question of "competitive advantage" is also central to the positions taken by Plaintiff who claims a transgender girl "has no competitive advantages in athletic participation compared to other girls." Complaint, ¶ 36.
[5] World Anti-Doping Code (2021) (the "Code"), Fundamental Rationale for the World Anti-Doping Code, *available at*: https://www.wada-ama.org/sites/default/files/resources/files/2021_wada_code.pdf
[6] *Id.*
[7] *Id.*

3.1.2. The Olympic Charter even characterizes the practice of sport as a "human right"[8] and sets forth rules and appeal processes to protect that right.

3.2. There is a long history in the U.S. and around the world of developing sport eligibility rules and accepted standards and norms have developed in relation to sport eligibility rules.[9]

3.2.1. For example, it is accepted that sport eligibility rules must be objective set forth in writing and fairly and consistently enforced.[10]

3.2.2. Objective rules are necessary to exclude subjective or biased decision-making in relation to sport eligibility.

3.2.3. Examples where objective eligibility rules are required in sport include:

3.2.3.1. Anti-doping rules, including rules relating to the use of testosterone,

3.2.3.2. Olympic or national team selection rules, and

3.2.3.3. Transgender eligibility rules.

3.2.4. In addition to objective rules, sport systems typically (including in relation to each of the examples listed above) provide a mechanism for impartial review of the application of objective criteria.

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[8] Olympic Charter, Fundamental Principles of Olympism, *available at*: https://stillmed.olympics.com/media/Document%20Library/OlympicOrg/General/EN-Olympic-Charter.pdf

[9] As stated by Drs. Handelsman, Hirschberg and Bermon, "[i]f sports are defined as the organized playing of competitive games according to rules, fixed rules are fundamental in representing the boundaries of fair sporting competition." Handelsman, D.J., Hirschberg, A.L., Bermon, S., "Circulating Testosterone as the Hormonal Basis of Sex Differences in Athletic Performance," *Endocr. Rev.* 2018 Oct; 39(5): 803-829, p. 806.

[10] *See*, *e.g.*, Title IX of the 1972 Education Amendments, Pub. L. 92-318, Title IX, 20 U.S.C. § 1681 *et seq.*; Ted Stevens Olympic and Amateur Sports Act, 36 U.S.C. §220501 *et seq.*, Authorization of the U.S. Anti-Doping Agency, 21 U.S.C. § 2001 *et seq.*; World Anti-Doping Code; Olympic Charter.

3.2.5. Objective rules designed to preserve meaningful and fair competition include:

3.2.5.1. Anti-doping rules which define which prohibited methods[11] and substances can and cannot be used in sport,

3.2.5.2. Amateurism rules which prohibit professional athletes from competing against amateurs,

3.2.5.3. Male and female categories which protect the female category of sport against male biological advantage by making males ineligible to compete in female sport,[12]

3.2.5.4. Paralympic disability classifications which seek to have individuals within like categories in terms of kind and scope of disability compete against each other, and

3.2.5.5. Weight classifications in combat sports such as boxing, mixed martial arts or wrestling which only permit athletes within specified weight bands to compete against each other.

3.2.6. Objective rules designed to protect athlete safety include:

3.2.6.1. Anti-doping rules banning products which increase the risk of harm to athletes by harming the health of the athlete ingesting the substance or the health or safety of that athlete's competitors,

3.2.6.2. Male and female classifications which prevent males (who tend to be taller, heavier, and faster) from creating a heightened risk of injury for female athletes in contact and combat sports, and

3.2.6.3. Weight classifications in combat sports such as boxing, mixed martial arts, or wrestling which limit the risk of injury from physically unequally matched opponents.

3.3. The protective purposes for which sport has long divided its participants into male and female categories is captured in the introduction to World Athletics'[13] October 1, 2019, *Eligibility Regulations for Transgender Athletes*.

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[11] A prohibited method is something other than a prohibited substance that is believed to make competition less fair or safe and is therefore prohibited under sport rules.

[12] *See*, *e.g.*, Handelsman, *et al.*, p. 803 ("Elite athletic competitions have separate male and female events due to men's physical advantages in strength, speed, and endurance so that a protected female category with objective entry criteria is required.").

[13] World Athletics is the international federation for the sport of track and field.

This introduction states that, "because of the significant advantages in size, strength and power enjoyed (on average) by men over women from puberty onwards, due in large part to much higher levels of androgenic hormones, and the impact that such advantages can have on sporting performance, it is necessary to have separate competition categories for males and females in order to preserve the safety, fairness and integrity of the sport, for the benefit of all of its participants and stakeholders." The introduction goes on to state that World Athletics "wants its athletes to be incentivized to make the huge commitments required to excel in the sport, and so to inspire new generations to join the sport and aspire to the same excellence." And they recognize that a failure to "deliver on the promise of fair and meaningful competition offered by the division of the sport into male and female categories of competition" would discourage participation and disincentivize commitment by those unable to keep up. Thus, World Athletics is resolved "not . . . to risk discouraging [the] aspirations [of sports participants] by permitting competition that is not fair and meaningful."

3.4. As the foregoing examples make clear, eligibility for sport competitions is typically not simply a matter of individual choice or self-selection. Rather, sport eligibility is strictly defined, highly segmented, almost never open to all comers, and subject to a variety of barriers to entry that are designed to advance the twin goals of meaningful competitive opportunities and safety. Individuals who wish to compete in sport must invariably submit to detailed and comprehensive eligibility categories and rules which exclude those unable to comply with the rules. In no competitive sport anywhere is there an absence of eligibility rules, as it is a truism that without eligibility rules sport cannot be meaningfully competitive.

4. Regulation of Competitive Advantage and Safety in Sport

4.1. Sources of competitive advantage are closely examined, typically well understood, and strictly regulated in sport.

4.1.1. For instance, swimsuits that reduce drag and increase performance have been banned by the international swimming federation[14] which has detailed rules and a pre-approval process for swimwear to be worn in competitions.[15]

[14] "'Fast suits' and Olympic swimming: a tale of reduced drag and broken records," *The Conversation* (Aug. 3, 2012), available at: https://theconversation.com/fast-suits-and-olympic-swimming-a-tale-of-reduced-drag-and-broken-records-7960.
[15] *See* https://www.fina.org/swimming/approved-swimwear.

4.1.2. In 2008, research was published indicating that runners nearer the starting gun had an advantage measured in milliseconds.[16] As a consequence, starter's guns at the Olympics have been outlawed in favor of a timing system that permits a starting beep to be heard from a speaker located at each starting block so that no athlete has an advantage.[17]

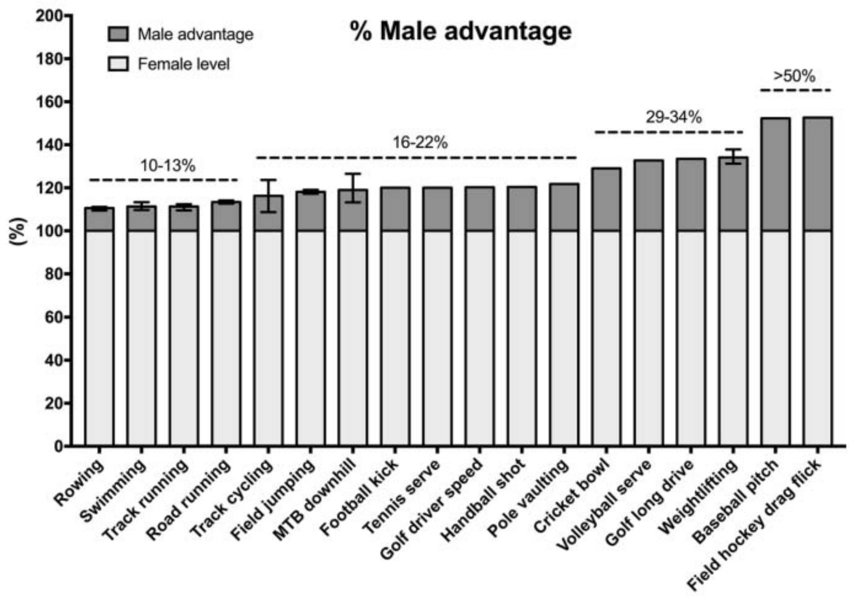
4.1.3. "Sex is a major factor influencing best performances and world records"[18] in Olympic sport. In one study, researchers evaluated 82 quantifiable events since the beginning of the Olympic era (*i.e.*, from 1896 to 2007). They looked at both the best performances by men and women in these events and the top 10 performers in each gender in swimming and track and field. The researchers found a stabilization of the gender gap after 1983 and that men outperformed women in all sports with a mean difference of 10.0% ± 2.94% between them depending upon the event.[19] They found: "The gender gap ranges from 5.5% (800-m freestyle, swimming) to 18.8% (long jump). The mean gap is 10.7% for running performances, 17.5% for jumps, 8.9% for swimming races, 7.0% for speed skating and 8.7% in cycling." Moreover, they noted that many of these timed performances for women "coincided with later-published evidence of state-institutionalized or individual doping," suggesting that the gender gap is actually even larger than the differences reported by the researchers.[20] The researchers concluded that the gender gap is unlikely to change significantly in the future.

4.1.4. Dr. Emma N. Hilton and Dr. Tommy R. Lundberg report that "the performance gap between males and females becomes significant at

[16] "Olympic start gun gives inside runners an edge," by Bob Holmes, June 23, 2008, *available at*: https://www.newscientist.com/article/dn14183-olympic-start-gun-gives-inside-runners-an-edge/#ixzz7VwldE6Sr; "Olympic Sprinters Nearest Starting Gun Get Advantage," Live Science (Aug. 7, 2008), *available at*: https://www.livescience.com/2749-olympic-sprinters-nearest-starting-gun-advantage.html.
[17] "Why They Stopped Using Real Pistols to Start Olympic Races," by Jason Plautz, Mental Floss (Aug. 15, 2016), *available at*: https://www.mentalfloss.com/article/31429/why-they-stopped-using-real-pistols-start-olympic-races.
[18] Thibault, V., Guillaume, M., Berthelot, G., El Helou, N., Schaal, K., Quinquis, L., Nassif, H., Tafflet, M., Escolano, S., Herine, O., Toussaint, J.F., "Women and men in sport performance: The gender gap has not evolved since 1983," *Journal of Sports Science and Medicine* (2010) 9, 214-223, p. 214, *available at*: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3761733/
[19] *Id.*
[20] *Id.*

puberty and often amounts to 10-50% depending on sport."[21] They note that the performance gap between men and women is not limited to certain sports but applies generally to most skills necessary for success in sport. Here is a chart that illustrates the male advantage across a wide group of discrete sport skills.

Fig. 1 The male performance advantage over females across various selected sporting disciplines. The female level is set to 100%. In sport events with multiple disciplines, the male value has been averaged across disciplines, and the error bars represent the range of the advantage. The metrics were compiled from publicly available sports federation databases and/or tournament/competition records. *MTB* mountain bike



Reproduced from: Hilton, E.N., Lundberg, T., "Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage," Sports Medicine, (2021) 51:199-214, p. 202, Fig. 1.

4.1.5. The performance gap between men and women is well understood in sport. As explained above, the substantial competitive advantages that men possess over women is one of the two primary reasons for the female category of sport; the other being, protecting the safety of female competitors in certain sports.

4.1.6. The lesson from the above examples is that in competitive sport, minute performance differences arising from factors outside of natural biology and training are considered material and when found, are generally eliminated if possible. In other words, the general rule in competitive sport is to maximize meaningful competition by removing

[21] Hilton, E.N., Lundberg, T.R., "Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage," *Sports Medicine* (2021) 51:199-214, p. 199.

even small competitive advantages where possible. Additionally, because of the significant performance gap between men and women male and female categories were created to permit meaningful and fair competition within the two sex-based categories.

4.2. There are at least three key areas in which sport has developed or begun to develop comprehensive eligibility rules to address competitive advantage and athlete safety.

4.2.1. Anti-doping programs and eligibility rules are a universal example of sport regulation of competitive advantage and safety.

4.2.2. Likewise, the division of sport into the male and female categories is made on the basis of competitive advantage and safety.

4.2.3. Finally, transgender athlete eligibility rules are an emerging example of sport regulation of competitive advantage and safety.

4.3. As this case demonstrates, the desire of some biological males (*i.e.*, transgender females with male biological performance advantages) to compete as transgender females in the female category without distinction as to sport, competitive advantages, or safety concerns, has created tension with the paradigm of male and female categories, the means by which sport has for decades protected the rights of biological females to compete equally in sport.

5. Regulation of Competitive Advantage and Safety Through Anti-Doping Rules

5.1. Accepted Rationale for Sport Anti-Doping Rules

5.1.1. It is well understood in the field of anti-doping that competitive advantage can be achieved through pharmacological (including hormonal) intervention. Therefore, international and domestic sport organizations and anti-doping authorities have imposed, and elite athletes submit to, a comprehensive anti-doping system that involves education, submission of 24/7 whereabouts information, rigorous hormone monitoring (known as the Athlete Biological Passport) and regular drug testing.

5.1.2. Anti-doping rules have developed over a nearly 60-year period over which the enormous advantages that can be gained through use of male hormones and other pharmacological agents have become apparent.[22]

5.1.3. As reflected in the rules set forth below, the accepted rationale for anti-doping rules and the robust international anti-doping system designed to prevent the use of hormones and other prohibited substances in sport is preventing unfair competitive advantage and protecting athlete safety.

5.2. Basic Rule:

To be included on the Prohibited List a substance must satisfy at least two of the following three criteria:

(1) The "*potential* to enhance . . . sport performance."[23]

(2) A "*potential* health risk to the Athlete."[24]

(3) Use violates "the spirit of sport."[25]

5.2.1.1. Thus, for a substance to be banned it must only have a "potential" to enhance sport performance and increase risk. There is no threshold level of performance enhancement or increased risk that must be met before a substance can be banned.

5.2.1.2. Athletes may also apply to use in sport a medication that is on the Prohibited List through a Therapeutic Use Exemption (TUE) process. TUEs are also dependent on the medication not creating any potential for additional performance enhancement as explained further below.

5.2.1.3. Therapeutic Use Exemption Rule:

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[22] For example, on October 20, 1968, East Germany's Margitta Gummel threw the shot, a then world record, 19.61 meters to beat teammate Marita Lange by 0.83m and to win the women's gold medal at the Mexico City Olympics. East German secret police (Stasi) files would later show Gummel was using oral turinabol over the 11-week period when she obtained her performance gain. With her world record throw, Gummel had achieved a 1.6 meter or 9% improvement on her personal best within a single season. Yet, this gain from steroids is less than the competitive advantage that will be available to many transgender females.

[23] World Anti-Doping Code Art. 4.3.1.1.

[24] Code Art. 4.3.1.2.

[25] Code Art. 4.3.1.3.

An athlete can only obtain a TUE to use a prohibited substance if they meet *each* of four conditions:

(1) The Prohibited Substance or Prohibited Method in question is *needed* to treat a diagnosed medical condition supported by relevant clinical evidence.[26]

(2) The Therapeutic Use of the Prohibited Substance or Prohibited Method *will not*, on the balance of probabilities, *produce any additional enhancement of performance* beyond what might be anticipated by a return to the Athlete's normal state of health following the treatment of the medical condition.[27]

(3) The Prohibited Substance or Prohibited Method is an indicated treatment for the medical condition, and there is *no reasonable permitted* Therapeutic *alternative*.[28]

(4) The necessity for the Use of the Prohibited Substance or Prohibited Method is *not a consequence*, wholly or in part, *of* the *prior Use* (without a TUE) *of a substance or method which was prohibited* at the time of such Use.[29]

6. Essential Components of the Anti-Doping System in Sport

6.1.1. Prohibited List

6.1.1.1. Foundational to the anti-doping system is a defined list of prohibited methods and substances which are banned in sport. As explained above, methods and substances are placed on the Prohibited List if they may yield a competitive advantage or undermine safety.

6.1.1.2. One of the key prohibited substances in sport is the male sex hormone testosterone. Testosterone and other anabolic-androgenic agents are among the most effective and commonly abused doping agents in sport and have a dramatic impact on sport performance.[30] Testosterone is known to regulate numerous

[26] World Anti-Doping Agency (WADA) International Standard for Therapeutic Use Exemptions (ISTUE), Art. 4.2(a) (emphasis added).
[27] ISTUE, Art. 4.2(b) (emphasis added).
[28] ISTUE, Art. 4.2(c) (emphasis added).
[29] ISTUE, Art. 4.2(d) (emphasis added).
[30] Saudan, C., Baume, N., Robinson, N., Avois, L., Mangin, P., and Saugy, M., "Testosterone and doping control," *Br J Sports Med*. 2006 Jul; 40(Suppl 1): i21–i24, *available at*:

developmental and physiological processes including muscle protein metabolism, sexual and cognitive functions, erythropoiesis,[31] plasma lipid levels, and bone metabolism.[32]

6.1.1.3. Athletes use steroids to increase lean muscle mass, improve strength and speed, and to be able to train harder and increase endurance[33] Floyd Landis, Tyler Hamilton and multiple other professional athletes I have interviewed have told me that they used testosterone after hard workouts to increase their ability to recover. They would also take small amounts of testosterone after difficult race stages for similar reasons.

6.1.1.4. Steroids are extremely powerful performance enhancers in women. For instance, Kelli White, a female sprinter ensnared in the BALCO scandal, told me that after just a few months of using the anabolic agent tetrahydrogestrinone she was able to lower her 100-meter time by several tenths of a second. Other female athletes who admitted steroid use to me confessed to similar dynamic effects on performance.

6.1.2. Athlete Whereabouts System

6.1.2.1. In all robust sport testing programs, athletes are subject to testing 365 days a year and do not have "off-seasons" or blackout periods when testing does not occur. Whereabouts information (dates, times, locations, training schedules, regular activities, etc.) is information submitted by an athlete to their anti-doping organization. This information allows the athlete to be located for out-of-competition testing.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2657495/#:~:text=The%20World%20Anti%E2%80%90Doping%20Agency%20provided%20a%20guide%20in,testosterone%20metabolite%2C%20dihydrotestosterone%2C%20or%20a%20masking%20agent%2C%20epitestosterone.

[31] Erythropoiesis is the process by which red blood cells are generated in the bone-marrow. *See* Shamidi, N.T., "Androgens and Erythropoiesis," *N. Engl. J. Med.*, 1973 Jul 12;289(2):72-80. doi: 10.1056/NEJM197307122890205 *available at*: https://www.nejm.org/doi/10.1056/NEJM197307122890205?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed ("numerous reports have now firmly established that androgens stimulate erythropoiesis").

[32] "Testosterone and doping control," *supra.*

[33] Rogol, A.D., Yesalis, C.E., "Anabolic-androgenic steroids and athletes: what are the issues?" *The Journal of Clinical Endocrinology & Metabolism*, Volume 74, Issue 3, 1 March 1992, Pages 465–469, https://doi.org/10.1210/jcem.74.3.1740476,

6.1.3. Regular No Notice Out-of-Competition Testing

6.1.3.1. No notice, out-of-competition testing protects a level playing field and deters doping by eliminating times athletes know they will not be tested and might otherwise use performance-enhancing drugs or prohibited methods (PEDs) without detection.[34]

6.1.3.2. The primary goal of testing is "to deter the athlete from making the decision to use a performance-enhancing drug or method."[35]

6.1.3.3. "Deterrence is based on three perceptions: the certainty that the individual could be caught; the severity of the formal and informal sanctions; and the celerity of the imposition of those sanctions."[36] Research demonstrates that, "[t]he perception that the individual can be caught is the most important of the three factors."[37]

6.1.3.4. Therefore, [t]o be effective, punishments imposed by anti-doping agencies must be credible (certain), severe enough to outweigh the intended benefits of the misdeed, and swift enough to counter the immediate anticipated benefits of the wrongful acts in the mind of the offender."[38]

6.1.3.5. Anti-doping researchers have concluded "there is a threshold level of certainty or a 'tipping point' that is required for *any* deterrent effect to be created."[39] "Estimates from criminological research consistently have shown that in order for punishment to provide a credible threat the certainty of punishment must reach a threshold probability of .30." Therefore, "[i]f the perception of the certainty of punishment for doping among athletes is not .30 or higher, then, there is little if any deterrent effect."[40] In other words, for deterrence to occur athletes must perceive that there is at least a thirty percent chance of being caught. To achieve a

[34] The clearance times for some prohibited substances can be very short and is sometimes measured by only hours after which a performance benefit may remain but the drug is no longer detectable in bodily fluids.

[35] Bowers, L.D., "The Quest for Clean Competition in Sports: Deterrence and the Role of Detection," *Clinical Chemistry* 60:10 (2014), *available at*: http://hwmaint.clinchem.org/cgi/doi/10.1373/clinchem.2014.226175.

[36] *Id.*

[37] *Id.*

[38] Bowers, L.D., Paternoster, R., "Inhibiting doping in sports: deterrence is necessary, but not sufficient," *Sport, Ethics and Philosophy*, 2016 DOI: 10.1080/17511321.2016.1261930, *available at*: http://dx.doi.org/10.1080/17511321.2016.1261930.

[39] *Id.*

[40] *Id.*

maximum deterrent effect the perceived risk of detection must be significantly higher, likely as much as 75%.[41]

6.1.4. Regular Measurement of Athlete Hormone Levels: The Athlete Biological Passport

6.1.4.1. In 2009, the World Anti-Doping Agency (WADA) approved the Hematological Model of the Athlete Biological Passport (ABP) which relies on measuring indirect markers in blood over time to detect possible doping. The principle behind the ABP is that monitoring of selected biological parameters over time will indirectly reveal the effects of doping on the body. This approach allows anti-doping organizations to evaluate individual, longitudinal profiles for each athlete and to monitor fluctuations potentially indicative of use of performance-enhancing hormones, drugs, or methods. Statistical tools utilize data from an athlete's previous samples to predict the likely individual limits or reference range for future samples. If data from a sample falls outside of the athlete's reference range, this abnormal value may be an indication of doping and follow up analysis and testing is conducted. In some cases, a single out of limit value can result in an anti-doping case being brought.

6.1.4.2. In 2008 the international federation in the sport of cycling implemented an ABP program in advance of WADA approval. The chart provided as Appendix **F** reflects a substantial drop in abnormal values for a blood parameter known as reticulocytes in professional cyclists after the cycling ABP program was implemented. The second page of Appendix **F** is a chart demonstrating that times in the 10,000-meter race in international competition have generally gotten slower in tandem with introduction of new anti-doping tests. Both pages provide a visual depiction of change in athlete behavior brought about through hormone monitoring and/or drug testing.

6.1.5. Investigations

6.1.5.1. In addition to a robust testing program, protecting a level playing field requires a vigorous investigative program to follow up on so-called "nonanalytical evidence" of doping, meaning evidence other

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[41] *Id.*

than a positive drug test.[42] Over the years, USADA has generally found that 30 – 50% of the cases of proven doping established by USADA have resulted from investigations and nonanalytical evidence.

6.2. Anti-Doping Lessons Applied to Emerging Transgender Eligibility Questions

6.2.1. Competitive Advantage Under Anti-Doping Rules

6.2.1.1. It is well known in sport that margins between competitors can be exceedingly small. For example, at the 2008 Olympic Games Michael Phelps won his seventh gold medal in the 100-meter butterfly over Milorad Cavic by .01 of a second, a mere 4.7 millimeters, and at the 1984 Los Angeles Olympic Games Nancy Hogshead and Carrie Steinseifer tied in the 100-meter freestyle.

6.2.1.2. Recognizing how slight margins in sport can be, the anti-doping rules do not tolerate any competitive advantage. "It is the Athletes' personal duty to ensure that *no* Prohibited Substance enters their bodies,"[43] and they "are responsible for *any* Prohibited Substance or its Metabolites or Markers found to be present in their Samples."[44] Thus, any detectable amount of a prohibited substance in an athlete's sample will constitute an anti-doping rule violation.[45] The anti-doping rules reflect that *any* competitive advantage gained due to hormonal advantage is too much. By this standard *any* competitive advantage obtained in the female category through male biology or male hormones is unfair performance enhancement.

6.2.2. Unfair Competitive Advantage or Safety Concerns Due to Hormonal Disparities Can Disincentivize Sport Participation

[42] *See* WADA International Standard for Testing and Investigations, Part Three: Standards for Intelligence Gathering and Investigations, *available at*: https://www.wada-ama.org/sites/default/files/resources/files/international_standard_isti_-_2021.pdf.
[43] Code, Art. 2.1.1 (emphasis added).
[44] *Id.*
[45] Code, Art. 2.1.3 ("Excepting those substances for which a Decision Limit is specifically identified in the Prohibited List or a Technical Document, the presence of any reported quantity of a Prohibited Substance or its Metabolites or Markers in an Athlete's Sample shall constitute an anti-doping rule violation.").

6.2.2.1. Doping within a sport can disincentivize participation in that sport by those unwilling to dope. For example, during the "EPO[46] era" the sport of cycling lost cyclists who left the professional ranks once they recognized they did not have a reasonable chance of success competing with dopers.[47] Others did not attempt a professional career in cycling specifically because they did not think they could be successful without doping.

6.2.2.2. Likewise, for safety reasons athletes are frequently reluctant to compete against athletes they believe are doped. Before USADA began a drug testing program for Ultimate Fighting Championship (UFC), fighter Georges St. Pierre stepped away from his sport saying, "I will never fight again in MMA without my opponent and myself being thoroughly tested for the most advanced PEDs by a credible independent anti-doping organization."[48]

6.2.2.3. These experiences suggest that participation in sport by biological females could be disincentivized should they come to believe either their safety has been compromised or their competitive opportunities diminished by transgender athletes.

6.2.2.4. Concern that transgender eligibility in girls sport could lead to a decline in sport participation by biological girls is further supported by research showing that the attrition rate in sport is two to three times greater for girls than for boys.[49]

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[46] Erythropoietin (EPO) is a potent natural generator of red blood cells that can also be taken to cheat. Testosterone increases EPO and red blood cell production. The EPO era is generally considered to be the time period before the ABP came into use in cycling.

[47] *See*, *e.g.*, Cycling Independent Reform Commission, Report to the President of the Union Cycliste Internationale (2015), p. 40 *available at*: https://www.velonews.com/wp-content/uploads/2015/03/CIRC-Report-2015.pdf ("Those few who rejected doping and left the sport appear to share a common factor in that they had an alternative . . . in another walk of life."); Bowers, L.D., "The Quest for Clean Competition in Sports: Deterrence and the Role of Detection," *Clinical Chemistry* 60:10 (2014), *available at*: http://hwmaint.clinchem.org/cgi/doi/10.1373/clinchem.2014.226175. ("Cyclist Scott Mercier was forced to make the choice to quit the sport he loved because he was unwilling to become a fraud and risk his health.")

[48] "Georges St. Pierre says he will never return to the UFC without independent drug testing," by Brent Bookhouse, (Aug. 22, 2014), *available at*: https://www.bloodyelbow.com/2014/8/22/6054745/georges-st-pierre-ufc-interview-drug-testing-fighter-union.

[49] Zarrett, N., Cooky, C., Veliz, P., "Coaching through a Gender Lens: Maximizing Girls' Play and Potential," *Women's Sports Foundation*, (April, 2019), p. 6.

6.2.3. Escalating the Arms Race

6.2.3.1. Another acknowledged effect of athlete perception that other athletes are gaining a hormonal advantage is that it escalates the performance enhancing arms race, causing athletes who might not otherwise dope to use PEDs to attempt to remain competitive.

6.2.3.2. In Major League Baseball the result of anti-doping rules without robust enforcement is acknowledged to have been the so-called "steroids era," where banned drug use was rampant and players felt obligated to use steroids to compete.[50]

6.2.3.3. Analyzing what happened when doping became prevalent in pro cycling, the Cycling Independent Reform Commission said:

> A typical narrative from that period was of a gifted non-doping amateur, who had previously competed closely with riders from the rest of the world, turning professional. He would find that his former amateur competitors were now significantly faster than him, and he soon realized that doping was the difference, and not a hugely increased training schedule, advanced nutritional supplements or professional team technology. The rider was confronted with a stark choice, either to fall away from professional riding or dope. . . Doping became the norm in the peloton, not only to increase performance but also just to keep up with the rest of the peloton. Doping became organised, sophisticated, widespread and systematic. [51]

These examples demonstrate how destructive and disheartening it is when athletes believe their competitors have achieved an unfair competitive advantage. The result has been athletes' loss of faith in sport governance and in many cases a desperate effort by athletes, and sometimes their coaches, to cheat to reset the competitive balance.

[50] Report to the Commissioner of Baseball of an Independent Investigation into the Illegal Use of Steroids and Other Performance Enhancing Substances by Players in Major League Baseball, by George J. Mitchell, December 13, 2007, pp. SR-14 – SR-17, SR-36, 60-257, *available at*: http://files.mlb.com/mitchrpt.pdf.

[51] Cycling Independent Reform Commission, Report to the President of the Union Cycliste Internationale (2015), p. 40 *available at*: https://www.velonews.com/wp-content/uploads/2015/03/CIRC-Report-2015.pdf.

6.2.3.4. A similar fate may befall women's sport if female athletes believe they are disadvantaged by the hormonal and structural advantages of transgender athletes competing in their sport and that the only way they can compete is through illicit means.

6.2.4. The Financial Cost of Commitment to a Level Playing Field

6.2.4.1. In 2019 USADA's total program costs solely for its Olympic program (not including its UFC program) were $21,632,450.[52] USADA conducted 7,336 tests, including 6,073 urine tests and 1,263 blood tests.[53] An estimated average cost for urine sample analysis is about $500 - $750 per sample, including sample collection and shipping costs. Special analysis, such as carbon isotope analysis or EPO testing puts the cost per sample at well over $1,000 per sample. Blood samples are considerably more expensive than urine samples as they require refrigeration, prompter sample shipping and collection by a trained phlebotomist.

6.2.4.2. Therefore, to the extent a sport chooses to adopt hormone suppression (as discussed below) as a basis for transgender eligibility in the female category very significant resources would need to be invested in a robust hormone monitoring program for transgender females.

6.2.4.3. Most states have not adopted successful and robust high school anti-doping programs and none are believed to have yet attempted any program of regular hormone suppression monitoring.

7. Regulation of Competitive Advantage and Safety Through Transgender Eligibility Rules

7.1. Key Questions Addressed in Transgender Eligibility Rules

7.1.1. Competitive Advantage

7.1.1.1. Testosterone

7.1.1.1.1. Sport organizations by and large treat the topic of "competitive advantage" arising from testosterone

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[52] https://www.usada.org/wp-content/uploads/2019-USADA-Annual-Report.pdf
[53] *Id.*

consistently in relation to anti-doping and transgender eligibility, typically assessing what constitutes "performance enhancement" (or unfair performance enhancement) from testosterone.

7.1.1.2. Other aspects of Male Sport Advantage

7.1.1.2.1. As explained in the reports of Drs. Hilton and Lundberg, there are additional aspects of male competitive advantage beyond testosterone (and likely not curable through hormone suppression) that must also be considered if the goal for transgender eligibility is, consistent with the goal in anti-doping, a level playing field.

7.1.2. Athlete Safety

7.1.2.1. As in anti-doping rules, a key aspect of emerging transgender eligibility rules in contact and combat sports is athlete safety.

7.2. Anti-Doping Monitoring Principles and Practices Cross-Applied to Transgender Eligibility Rules

7.2.1. Hormone Monitoring

7.2.1.1. All of the recently developed transgender sport eligibility rules in Olympic and Paralympic sport draw directly from the field of anti-doping, applying similar testing procedures, analytical methods and compliance standards and rules.

7.2.2. Therapeutic Use Exemptions

7.2.2.1. An athlete's application to use testosterone as part of a transgender transitioning process is made to the relevant anti-doping agency and proceeds under anti-doping TUE rules.[54]

7.3. Determining What Constitutes Unfair "Competitive Advantage"

7.3.1. As explained above, anti-doping rules start from the understanding that *any* competitive advantage obtained through hormonal advantage is too much. Applying this standard, *any* competitive advantage gained

[54] *See*, *e.g.*, https://www.wada-ama.org/sites/default/files/2022-01/TUE%20Physician%20Guidelines_Transgender%20Athletes_Final%20%28January%202022%29.pdf.

through male biology or hormones is unfair performance enhancement for an athlete competing in the female category in sport.

7.3.2. From a performance standpoint the benefit obtained from a transgender female athlete's male development (whether in utero, during the mini-puberty phase occurring in a male infant's first six months, or as a result of puberty) is analogous to advantage gained by male or female athletes using exogenous testosterone or other anabolic agents. Thus, disadvantages faced by female athletes competing against PED-using women are analogous to disadvantages faced by biological females when competing against transgender female competitors.

7.3.3. Based on the data supplied by Drs. Hilton and Lundberg, advantages from male biology available to transgender female athletes appear to be greater than even the performance gains attributable to the most notorious, level playing field altering, doping practices. For instance, the performance gain from "blood doping," the scourge of the Tour de France and professional cycling from the early 1980s through at least 2010, is generally acknowledged to be about 5 – 9 %, much lower than the advantage many transgender females have over biological females.[55]

7.4. Key Components of International Sport Transgender Eligibility Regulations

7.4.1. Safety concerns

7.4.1.1. International Rugby Eligibility Rules

7.4.1.1.1. World Rugby was the first international sport federation to adopt comprehensive transgender eligibility rules. Regarding transgender females, Rugby's rules state:

7.4.1.1.1.1. Transgender women who transitioned pre-puberty and have not experienced the biological effects of testosterone during puberty and adolescence can play

[55] *See*, *e.g.*, Gledhill, N., "Blood doping and related issues," *Medicine and Science in Sports and Exercise*: Volume 14 - Issue 3 – pp. 183-189, available at: https://journals.lww.com/acsm-msse/Abstract/1982/03000/Blood_doping_and_related_issues__a_brief_review.5.aspx (showing a 5-9% increase in VO2max from blood doping).
a brief review

women's rugby (subject to confirmation of medical treatment and the timing thereof).[56]

7.4.1.1.1.2. Transgender women who transitioned post-puberty and have experienced the biological effects of testosterone during puberty and adolescence cannot currently play women's rugby. [57]

7.4.2. Competitive Advantage Concerns

7.4.2.1. World Athletics Eligibility Rules

7.4.2.1.1. World Athletics' rules require a transgender athlete wishing to switch to the women's category to engage in testosterone suppression to reduce her serum concentration of testosterone below 5 nmol/L continuously for a period of at least 12 months and to demonstrate to an expert panel the athlete has been continuously suppressed throughout that period.[58]

7.4.2.1.2. World Athletics' rules make clear that should a transgender female athlete's testosterone level exceed the 5 nmol/L threshold at any time, the athlete will be required to abstain from competition for a year and maintain uninterrupted and continuous suppression below the threshold before regaining the opportunity to compete.

7.4.2.1.3. World Athletics reserves the right to test transgender females at any time and the athlete must agree to provide whereabouts information and submit to blood testing for this purpose. At any time, the World Athletics' Medical Manager can require the athlete to submit additional information.

7.4.2.1.4. Under World Athletics' rules, if an athlete competes with serum testosterone levels over the threshold the results for the competition will be disqualified. The athlete may be disciplined under the World Athletics Code of Conduct and

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[56] *Available at*: https://www.world.rugby/the-game/player-welfare/guidelines/transgender/women.
[57] *Id.*
[58] World Athletics Eligibility Regulations for Transgender Athletes ("WA Regulations"), Art. 1.2, *available at*: file:///C:/Users/wb/Documents/Issues/Transgender%20Athletes/World%20Athletics/C3.5%20-%20Eligibility%20Regulations%20Transgender%20Athlete%20(1).pdf.

fined and/or face a period of ineligibility from sport or other discipline.

7.4.2.1.5. Additionally, World Athletics sets out stringent requirements for sample collection to occur in the morning when serum testosterone levels are highest, using standard anti-doping collection procedures, and requiring refrigeration and prompt transportation of samples, and use of high-resolution analytical techniques.

7.4.2.2. USA Swimming Eligibility Rules

7.4.2.2.1. On February 1, 2022, USA Swimming released a document entitled "USA Swimming Athlete Gender Inclusion, Competitive Equity, and Eligibility Policy" which was added to its rules as Article 19.0 Athlete Inclusion Procedures.[59]

7.4.2.2.2. The USA Swimming eligibility rules set forth a rebuttable presumption to be overcome by a swimmer seeking a male to female transition. This presumption states:

> In addition to other relevant factors considered by the Panel [in relation to the Panel's consideration of whether the athlete has a competitive advantage over biological female competitors] it shall be presumed that the athlete is not eligible unless the athlete demonstrates that the concentration of testosterone in the athlete's serum has been less than 5 nmol/L (as measured by liquid chromatography coupled with mass spectrometry) continuously for a period of at least thirty-six (36) months before the date of Application. This must include at a minimum three (3) separate blood tests within the past three hundred sixty-five days (365) preceding the Application, with the last test conducted within ninety (90) days prior to the athlete's Application. This presumption may be rebutted if the Panel finds, in the unique circumstances of the case, that the [requirement to demonstrate a lack of competitive advantage] has been satisfied notwithstanding the athlete's serum testosterone results (e.g., the athlete has a medical condition which limits the bioavailability of the athlete's free testosterone).

[59] *Available at*: https://www.usaswimming.org/docs/default-source/governance/governance-lsc-website/rules_policies/usa-swimming-policy-19.pdf.

7.4.2.2.3. If a transgender female athlete is granted eligibility, to retain eligibility that athlete "must keep [their] serum testosterone concentration below 5 nmol/L and comply with any other conditions of the Elite Athlete/Event Fairness Panel's approval for so long as the athlete wishes to compete in the Female category in Elite Events."

8. Strengths and Weaknesses in the IHSAA Transgender Eligibility Regulation

8.1. IHSAA Identifies Key Values of Fairness and Safety

8.1.1. The IHSAA Gender Policy (the "IHSAA Policy") currently on the website of the IHSAA (*i.e.*, IHSAA Gender Policy 03.31.2021.pdf) states that it was "developed . . . to address the eligibility and participation of all students, including transgender students, in IHSAA-sponsored interscholastic athletics." The IHSAA Policy explicitly recognizes the need to "limit[] participation on single gender athletic teams to students of one gender" for reasons of "health and safety . . . competitive equity . . . safeguarding a level playing field and . . . ensuring . . . fair opportunity for athletic participation."

8.1.2. The IHSAA Policy further states that it seeks to promote the health and safety of all students, "and especially the health and safety of female students who would otherwise have to participate in activities with biological males or androgen-supplemented females who are generally stronger and faster than their biological females [sic] counterparts and by promoting Title IX competitive equity." Thus, the IHSAA Policy states it intends to recognize and apply the principles of fairness (*i.e.*, "a level playing field") and athlete health and safety which are key values underlying many sport rules, including anti-doping rules.

8.2. Participation Component

8.2.1. The IHSAA Policy provides, "[i]t is a tenant of the IHSAA that, except as permitted by rules [applying to mixed teams], a student may only participate in interscholastic competition as a member of a single gender Athletic Team when the Gender of the Athletic Team matches the student's Birth Gender." The IHSAA terms this the "Participation Component" of its Policy.

8.3. Waiver of Participation Component of Policy

8.3.1. The IHSAA Policy allows for a transgender female athlete to apply for a waiver of the Participation Component. Such a waiver, if granted, will permit a transgender female to compete in the girls' category. For a transgender student wishing to compete in the IHSAA's girls' category of sport the student must establish:

(1) "through testimony and/or creditable documentation, from an appropriate health-care professional, that the Transgender student has completed counseling, and other medical or psychological interventions related to Gender transition, and has either (a) completed a minimum of one (1) year of hormone treatment related to gender transition or (b) undergone a medically confirmed gender reassignment procedure, and"

(2) "through medical examination and testing and through physiological testing that the Transgender Female student does not possess physical (bone structure, muscle mass, and/or testosterone hormonal levels, etc.) or physiological advantages over a genetic female of the same age group."

8.4. Weaknesses in the IHSAA Policy

8.4.1. The IHSAA Policy inaccurately presumes there exists an effective and efficient means of conducting physiological testing regarding whether the transgender female student "possess[es] physical or physiological advantages over a genetic female." The IHSAA Policy, however, does not identify what that testing may entail or identify any uniform, reliable, or recommended, way to conduct such testing.

8.4.2. While the IHSAA Policy requires medical intervention for gender transition to include a minimum *one year* of hormone treatment or a medical reassignment procedure, it sets no required hormonal level(s), such as the 5 nmol/L level set by USA Swimming and World Athletics, and requires no testing or follow up to ensure compliance.

8.4.2.1. The reports of Drs. Hilton and Lundberg indicate a one-year period of suppression is insufficient.

8.4.2.2. In addition, the IHSAA Policy fails to meet the objectivity criteria that is a necessity for athlete eligibility rules. It provides nothing in the way of an evidentiary standard or measurable evaluative process to ensure robust review of the waiver application or to guide the IHSAA Gender Committee's review of applications and decisions on whether to approve them.

8.4.2.3. Nor does the IHSAA set a measurable level of testosterone suppression as do the rules of other sport organizations which require testosterone suppression for transgender females to compete in the female category of sport. Without requiring a level of suppression, the IHSAA cannot ensure that the suppression IHSAA requires would have any effect on the performance advantages accruing to transgender girls as a result of their body's production of male levels of testosterone.

8.4.2.4. Finally, even if it could be assumed that a program of hormone suppression is a reasonable way to address the competitive advantage of transgender females, the IHSAA policy neglects to provide for any follow-up testing to confirm compliance, leaving open the prospect of additional performance gains either as a result of negligence or intentional manipulation. Thus, the IHSAA Policy hands a key to transgender females to gain additional performance advantages over biological girls due to lack of oversight.

8.4.2.5. Thus, while the IHSAA Policy expressly embraces the goals of competitive fairness and safety in protecting girls' sport competition, its policy does not employ clear, consistent, effective, easy to apply, or easily repeatable means of protecting those values. Rather, the IHSAA Policy opens the door to unchecked discretion in the evaluative process by both the transgender student's physician and the IHSAA Gender Committee.

8.4.2.6. Athlete Safety

8.4.2.6.1. Concussions

8.4.2.6.1.1. At all levels and for more than a decade, sport organizations have been focused on reducing concussion risk to athletes. The focus on concussion prevention is important and should be a high priority.

8.4.2.6.1.2. Concussions raise serious long term health implications and can have lifelong debilitating effects. "[Y]oung athletes may suffer significant long-term cognitive, memory, and fine motor impairment secondary to sports related, mild, traumatic brain injuries."[60] Evaluation of the brains of former athletes who have suffered concussions "demonstrates abnormal deposition of a certain type of protein (tau) associated with head trauma, defined as chronic traumatic encephalopathy (CTE)."[61] "[D]amage to the brain from collisions has been shown to cause greater instance of mental illness such as depression and psychosis. Through . . . even one substantial head injury, the connections between brain neurons can be profoundly disrupted."[62]

8.4.2.6.1.3. High school age and adolescent girls face a serious risk of concussion while participating in sport. Consistent with the data presented by Dr. Hilton, these risks will necessarily only increase to the extent that transgender athletes begin competing in girls' sports in Indiana.

8.4.2.6.1.4. A 2017 study looked at traumatic brain injuries in high school athletes between 2005 and 2016.[63] The high school sports surveyed were girls' softball, volleyball, soccer and basketball and boys' baseball, basketball, football, wrestling and soccer.[64] Over 11 years, there were some 2.7 million concussions reported in these sports, an average of 671 concussions per day.[65] As noted above, it takes only a single concussion to create lifelong ramifications for a young girl. Avoiding or limiting such risks is a public health priority of the highest order.

8.4.2.6.1.5. While football had the highest rate of concussions on a recent nationwide survey, girls' soccer was second,

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[60] Brown, K.A., Patel, D.R., "Participation in sports in relation to adolescent growth and development," *Transl Pediatr* 2017;6(3):150-159, p. 156, *available at*: https://tp.amegroups.com/article/view/14626/14780

[61] Cardenas, J., M.D., "Concussion in Sports – Past, Present and Future," *NFHS* (Oct. 26, 2017), *available at*: https://www.nfhs.org/articles/concussion-in-sports-past-present-and-future/.

[62] "What Parents Should Know," *supra*.

[63] Gill, N., "Study: State Concussion Laws Effective in Reducing Rates of Injury," *NFHS* (Nov. 2, 2017), *available at*: https://www.nfhs.org/articles/study-state-concussion-laws-effective-in-reducing-rates-of-injury/.

[64] *Id*.

[65] *Id*.

followed by boys wrestling.[66] When "comparing the rates in gender comparable/available sports (basketball, soccer, baseball/softball), *females had almost double the annual rate of concussions as males*."[67]

8.4.2.6.1.6. This safety information related to concussion risk is significant as the IHSAA on May 2, 2002, added girls wrestling as an emerging sport under the governance of the ISAA. Thus, going forward high schools girls will be participating in scholastic competition in the combat sport of wrestling under the auspices of the IHSAA, creating additional potential for serious injury when competing against transgender girls.[68] Already, 350 girls from 113 high schools competed in the most recent Indiana girls' high school wrestling state tournament.[69]

8.4.2.6.1.7. Thus, girls competing in sport in Indiana face significant concussion risks. The severity of those risks appears likely to increase if transgender females gain eligibility in the girls category of high school sport.

8.4.2.6.2. ACL injuries

8.4.2.6.2.1. Another type of regularly recurring and significant injury in sport impacted by the size, strength, and speed of athletes is anterior cruciate ligament (ACL) injury. According to the NFHS, "ACL injuries have reached epidemic levels in high school sports and the devastating short- and long-term effects are a serious concern for parents, athletics administrators, coaches, sports medicine professionals, and most importantly – high school athletes."[70] Knee injuries currently account for one out of every seven injuries suffered by high

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[66] *Id.*
[67] *Id (emphasis added).*
[68] *See* "Boys Volleyball, Girls Wrestling approved as IHSAA Emerging Sports," IHSAA News Release (May 2, 2022), *available at*: https://www.ihsaa.org/Portals/0/ihsaa/documents/news%20media/2021-22/050222.Board.pdf.
[69] *Id.*
[70] Janofsky, J., "ACL Injury Prevention: The Importance of Neuromuscular Training," *NFHS*, April 16, 2019, *available at*: https://www.nfhs.org/articles/acl-injury-prevention-the-importance-of-neuromuscular-training/.

school athletes.[71] "A recent survey of more than 2,000 parents throughout the United States found that joint injuries were second only to concussions as the most concerning sports-related injury."

8.4.2.6.2.2. ACL injuries often necessitate surgery and up to a year of rehabilitation.[72] However, the long-term impact of an ACL injury is even more concerning. "Athletes with ACL injuries are four times more likely to develop painful knee arthritis within 10 years of the injury than non-injured athletes. They are seven times more likely to eventually need knee replacement surgery – and at a much younger age – than those who haven't been injured."[73]

8.4.2.6.2.3. Girls are at a high risk of ACL injuries. Requiring girls to compete post puberty against male body types in contact sports will put biological girls at increased risk of ACL injuries.

9. Conclusions

9.1. If the same standard of performance enhancement applied under the anti-doping rules is applied to the competitive advantage that transgender girls have because of being born with a male body and innate male sport advantages, then transgender girls should be ineligible to compete in the girls' category of sport.[74]

9.2. For the State of Indiana to implement a testosterone suppression monitoring program of sufficient quality to ensure the suppression of testosterone in transgender girls who wish to compete in girls sport it would need to invest substantial resources in an athlete whereabouts program, sample collection and testing rules, a no advance notice testing program, sample analysis, and a system of sanctions for non-compliance, none of which is currently administered by the State or the IHSAA.

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[71] *Id.*
[72] *Id.*
[73] *Id.*
[74] *Compare Play On: Celebrating 100 Years of High School Sports in Indiana*, by Bill Beck (Foreword by Frank O'Bannon), Centennial Publishing, 2003 (Governor O'Bannon: "*It is only when the playing field is truly level that every athlete will succeed, regardless of the game's outcome*.").

9.3. Although the IHSAA expressly embraces the goals of competitive fairness and safety in protecting girls' sport competition against "biological males or androgen-supplemented females," the IHSAA's transgender athlete eligibility policy, does not employ clear, consistent, effective, easy to apply, or repeatable means of protecting those values.

9.4. In the event that transgender girls become eligible to compete in girls' scholastic sports in Indiana, I would be concerned that that participation in scholastic sport by biological girls may decline and that pressures on biological girls to use PEDs would increase, as this situation would match previous patterns in sport where disregard of unfair competitive advantages have incentivized conduct detrimental to sport.

9.5. If transgender girls possessing male size, strength, speed and/or other similar indicia of male biological advantage become eligible to compete in girls' scholastic sports in Indiana, it is my opinion that this would put biological girls at greater risk of debilitating injuries, including concussions and ACL injuries in middle school and high school sport in Indiana.

9.6. Based on the factors typically considered when determining eligibility rules in sport, H.E.A. 1041 constitutes a reasonable, effective, and administratively appropriate sport eligibility rule based on objective criteria pertaining to performance enhancement, competitive advantage, and safety, all of which are factors regularly considered by sport organizations and legislative bodies when setting sport eligibility standards.

This declaration is executed within the State of Indiana on the date set forth below. I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 17th day of June 2022.

William Bock, III

APPENDIX A

William Bock, III, Partial List of Contested Sports Eligibility Cases Which Progressed to a Hearing or Final Written Decision

Year	Case Name	Final Resolution Date	Case Description	Link
1994	**Rosselli *et al*. v. U.S. Bobsled & Skeleton Federation**	2.1994	Olympic eligibility arbitration for U.S. Bobsled team members	None
1999	**Anonymous v. USA Track & Field**	1999	Represented track and field athlete in successful dismissal of case following positive drug test	None
1999	**Anonymous v. USA Rowing**	1999	Represented track and field athlete in successful dismissal of case following positive drug test	None
2000	**Thomas v. USA Cycling**	7.2000	Successful representation in arbitration of U.S. Cyclist challenging exclusion from Olympic team. Obtained ride off to qualify for spot on Olympic team	None
2000	**Anonymous v. USA Swimming**	7.2000	Represented swimmer in successful dismissal of case following positive drug test	None
2001	**Frasure v. International Paralympic Committee**	2001	Represented U.S. Paralympian and world champion Brian Frasure in proceedings before the Court of Arbitration for Sport	None
2001	**Anonymous v. USA Track & Field**	2001	Represented track and field athlete in obtaining successful dismissal of case following AAA hearing after positive drug test	None

Year	Case Name	Final Resolution Date	Case Description	Link
2002	**USADA v. Pastorello** CAS No. 2002/A/363	6.27.2002	Boxing 19-norandrosterone and 19-noretiocholanolone	https://www.usada.org/wp-content/uploads/arbitration_ruling_6_28_2002_Pastorello.pdf https://www.usada.org/wp-content/uploads/boxpastorelloAAA0102.pdf
2002	**USADA v. Reed** AAA No. 33 190 00701 01	4.22.2002	Table Tennis 19-norandrosterone and 19-noretiocholanolone	https://www.usada.org/wp-content/uploads/arbitration_ruling_4_24_2002_Reed.pdf
2002	**USADA v. Jovanovic** AAA No. 30-190-000912 CAS No. 2002/A/360	2.7.2002	Bobsled and Skeleton 19-norandrosterone and 19-noretiocholanolone	https://www.usada.org/wp-content/uploads/arbitration_ruling_2_11_2002_Jovanovic.pdf https://www.usada.org/wp-content/uploads/bobjovanovic9mo012602AAA.pdf
2003	**USADA v. Cherry** AAA No. 30 190 00463 03	11.20.2003	Track and Field 19-norandrosterone and 19-noretiocholanolone Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/arbitration_ruling_11_24_2003_Cherry.pdf
2003	**USADA v. Vencill** AAA No. 30 190 00291 03 CAS No. 2003/A/484	11.18.2003	Swimming Norandrosterone Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/arbitration_ruling_11_20_2003_Vencill.pdf https://www.usada.org/wp-content/uploads/arbitration_ruling_7_24_2003_Vencill.pdf https://www.usada.org/wp-content/uploads/arbitration_ruling_3_17_2004_Vencill.pdf
2003	**USADA v. Caruso** AAA No. 33 190 00475 03	8.6.2003	Boxing Furosemide Diuretics and Other Masking Agents - S5	https://www.usada.org/wp-content/uploads/arbitration_ruling_8_7_2003_Caruso.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2004	**Young v. USOC**	2004	Co-Counsel for USOC in District Court lawsuit brought by track and field athlete Jerome Young challenging USOC's disclosure of documents to IAAF and IOC.	None
2004	**Young v. Hamm**	10.21.2004	CAS upholds Paul Hamm's gymnastics gold medal against challenge by Korean gymnast Yang Tae Young) (Oct. 21, 2004). Represented Colombian gymnastics judge Oscar Buitrago Reyes in the proceedings.	None
2004	**USADA v. Edwards** AAA No. 30 190 00675 04 CAS No. OG 04/003	8.17.2004	Track and Field Nikethamide, Salbutamol Stimulants - S6	https://www.usada.org/wp-content/uploads/TFedwardsfinalCAS081704.pdf https://www.usada.org/wp-content/uploads/TFedwardsfinalAAA081104.pdf https://www.usada.org/wp-content/uploads/TFedwardsinterimAAA081104.pdf
2004	**USADA v. Harrison** AAA No. 30 190 00091 04	8.2.2004	Track and Field Modafinil Stimulants - S6	https://www.usada.org/wp-content/uploads/TFharrisonAAA080204.pdf
2005	**Brittany Viola v. USA Diving**	8.2005	World Championship Diving Team Eligibility Arbitration	None
2005	**USADA v. Wade** AAA No. 30 190 01334 04	11.9.2005	Track and Field 19-Norandrosterone Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/aaa_cas-decision-wade1.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2006	**USADA v. Hartman** AAA No. 30 190 00900 05	6.10.2006	Judo Non-Analytical: Refusal, T/E > 4 Indeterminate, CIR Positive Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-George-Hartman-June-2006.pdf
2007	**United States v. Graham**	2007	Counsel for USADA, federal judge recognized that USADA may assert an investigative privilege, protecting confidentiality of information in USADA investigations	*United States v. Graham*, 555 F.Supp.2d 1046 (N.D.Cal. 2007)
2007	**USADA v. Jenkins** AAA No. 30 190 00199 07	1.25.2008	Track and Field Tetrahydrocannabinol Acid Cannabinoids - S8	https://www.usada.org/wp-content/uploads/JENKINS_AAA_CAS.pdf https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-LaTasha-Jenkins-January-20082.pdf
2007	**USADA v. Piasecki** AAA No. 30 190 00358 07	9.24.2007	Wrestling 6a-Hydroxyandrostenedi oneAnabolic Agents - S1	https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-Nathan-Piasecki-September-2007.pdf
2008	**USADA v. Leogrande** AAA No. 77 190 00111 08	12.1.2008	Cycling Non-Analytical	https://www.usada.org/wp-content/uploads/AAA-Leogrande-Award-Signed-111-2.pdf
2008	**USADA v. Gatlin** AAA No. 30 190 00170 07 CAS No. 2008/A/1461	6.6.2008	Track and Field Testosterone Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/CAS-Decision_Gatlin_Sept-2008.pdf https://www.usada.org/wp-content/uploads/Gatlin_CAS_Decision_6-6-08.pdf https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-Justin-Gatlin-January-2008.pdf https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-Dissent-Justin-Gatlin-January-2008.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2008	**USADA v. Hardy** AAA No. 77 190 00288 08 CAS No. 2009/A/1870	5.21.2010	Swimming	https://www.usada.org/wp-content/uploads/Hardy-Award-August-2008.pdf https://www.usada.org/wp-content/uploads/AAA_CAS-Decision-Hardy-May-2009.pdf https://www.usada.org/wp-content/uploads/hardy-cas.pdf
2008	**USADA v. Warren** CAS No. 2008/A/1473	7.24.2008	Wrestling Carboxy-THC	https://www.usada.org/wp-content/uploads/CAS-Warren-Decision-July-2008.pdf https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-Joe-Warren-January-20081.pdf
2008	**USADA v. E. Thompson** CAS No. 2008/A/1490	6.25.2008	Track and Field Benzoylecgonine Stimulants - S6	https://www.usada.org/wp-content/uploads/THOMPSON-CAS.pdf https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-Eric-Thompson-January-2008.pdf
2008	**USADA v. Reed** AAA No. 30 190 000548 07	12.15.2008	Table Tennis Carboxy-THC Cannabinoids - S8	https://www.usada.org/wp-content/uploads/Reed-USADA-AAA-No-30-190-000548-07-Decision.pdf
2008	**USADA v. Moreau** AAA No. 30 190 00825 07	5.7.2008	Weightlifting Carboxy-THC Cannabinoids - S8	https://www.usada.org/wp-content/uploads/Arbitration-Ruling-Moreau-May-2008.pdf
2009	**USADA v. Barnwell** AAA No. 77 190 00514 09	3.8.2010	Track and Field Testosterone Prohormones Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/Barnwell_Preliminary_Award.pdf https://www.usada.org/wp-content/uploads/Barnwell1.pdf
2009	**USADA v. Clinger** AAA No. 77 190 E 00389 09	3.12.2010	Cycling Adverse CIR, Modafinil Anabolic Agents - S1, Stimulants - S6	https://www.usada.org/wp-content/uploads/Clinger_Preliminary_Award.pdf https://www.usada.org/wp-content/uploads/clinger.pdf
2009	**USADA v. Page** AAA No. 77 190 00016 09	2.4.2009		https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-Jonathan-Page-February-2009f.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2009	**USADA v. Brunemann** AAA No. 77 190 E 00447 08	1.26.2009	Swimming Hydrochlorothiazide and Triamterene	https://www.usada.org/wp-content/uploads/Brunemann-Award-2009.pdf
2010	**USADA v. Oliveira** AAA No. 77 190 00429 09 CAS No. 2010/A/2107	12.6.2010	Cycling Oxilofrine Stimulants - S6	https://www.usada.org/wp-content/uploads/oliveiraCAS.pdf https://www.usada.org/wp-content/uploads/award-77-190-429-09.pdf
2010	**USADA v. Merritt** AAA No. 77 190 00293 10	10.15.2010	Track and Field Adverse CIR Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/merritt.pdf
2010	**USADA v. O'Bee** AAA No. 77 190 00515 09	10.01.2010	Cycling Erythropoietin (EPO) Peptide Hormones, Growth Factors and Related Substances - S2	https://www.usada.org/wp-content/uploads/obee.pdf
2010	**USADA v. Stewart** AAA No. 77 190 00110 10	6.25.2010	Track and Field Non-Analytical	https://www.usada.org/wp-content/uploads/6-25-10-Arbitrator-Award-110.pdf
2010	**USADA v. Cosby** AAA No. 77 190 00543 09	5.5.2010	Track and Field Hydrochlorothiazide & Chlorothiazide Diuretics and Other Masking Agents - S5	https://www.usada.org/wp-content/uploads/cosby.pdf
2011	**USADA v. Block** AAA No. 77 190 00154 10	3.17.2011	Track and Field Non-Analytical	https://www.usada.org/wp-content/uploads/ArbitrationAwardBlock.pdf
2011	**Graham v. U.S. Anti-Doping Agency**	2011	Represented USADA in track coach Trevor Graham's unsuccessful federal court challenge to rule violations	*Graham v. U.S. Anti-Doping Agency, 2011 WL 1261321 (E.D.N.C. 2011)*
2012	**Armstrong v. Tygart**	7.2012	Lead attorney defending USADA in a lawsuit brought by Armstrong in federal court	*Armstrong v. Tygart*, 886 F.Supp.2d 572 (W.D. Tex. 2012)
2012	**USADA v. Armstrong**	10.10.2012	Cycling Non-Analytical	https://www.usada.org/wp-content/uploads/ReasonedDecision.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2012	**USADA v. Jelks** AAA No. 77 190 00074 12	5.23.2012	Track and Field Non-Analytical: 3 Whereabouts	https://www.usada.org/wp-content/uploads/AAAJelks.pdf
2012	**USADA v. L. Thompson** AAA No. 77 190 00042 12	5.2.2012	Boxing Non-Analytical: 3 Whereabouts	https://www.usada.org/wp-content/uploads/LenroyThompson.pdf
2012	**USADA v. Arias** AAA No. 77 190 00043 12	3.27.2012	Boxing Non-Analytical: 3 Whereabouts	https://www.usada.org/wp-content/uploads/LuisArias.pdf
2012	**USADA v. Hellebuyck** AAA No. 77 190 00168 11	1.30.2012	Track and Field Erythropoietin Peptide Hormones, Growth Factors and Related Substances - S2	https://www.usada.org/wp-content/uploads/hellebuyckaaaruling.pdf
2013	**USADA v. Meeker** AAA No. 77 190 00335 13	11.18.2013	Cycling 19-norandrosterone and 19-noretiocholanolone Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/Richard_Meeker_AAA_decision.pdf
2014	**USADA v. Trafeh** AAA No. 01-14-0000-4694 CAS No. 2014/A/3866	8.13.2015	Track and Field Non-analytical: EPO, Non-Analytical: Evasion	https://www.usada.org/wp-content/uploads/AAA-decision-Trafeh-December-2014.pdf https://www.usada.org/wp-content/uploads/2015-08-14-Trafeh-AWARD.pdf
2014	**USADA v. Drummond** AAA No. 01-14-0000-6146	12.17.2014	Track and Field Non-Analytical	https://www.usada.org/wp-content/uploads/AAA-decision-Drummond-December-2014.pdf
2014	**USADA v. Bruyneel** AAA No. 77 190 00225 12 CAS No. 2014/A/3598	10.24.2018	Cycling Non-Analytical	https://www.usada.org/wp-content/uploads/aaa42214.pdf https://www.usada.org/wp-content/uploads/CAS-Award-Bruyneel-Celaya-Marti.pdf
2014	**USADA v. Celaya** AAA No. 77 190 00226 12 CAS No. 2014/A-3618	10.24.2018	Cycling Non-Analytical	https://www.usada.org/wp-content/uploads/aaa42214.pdf https://www.usada.org/wp-content/uploads/CAS-Award-Bruyneel-Celaya-Marti.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2014	**USADA v. Marti** AAA No. 77 190 00229 12 CAS No. 2014/A/3599	10.24.2018	Cycling Non-Analytical	https://www.usada.org/wp-content/uploads/aaa42214.pdf https://www.usada.org/wp-content/uploads/CAS-Award-Bruyneel-Celaya-Marti.pdf
2014	**USADA v. Davis** AAA No. 77 190 00587 13	4.15.2014	Track and Field Non-Analytical: 3 Whereabouts	https://www.usada.org/wp-content/uploads/walter-davis-april-2014.pdf
2014	**USADA v. Beyene** AAA No. 77 190 00389 13	2.18.2014	Track and Field Methylhexaneamine (Dimethylpentylamine) Stimulants - S6	https://www.usada.org/wp-content/uploads/aaabeyene.pdf
2015	**USADA v. Asfaw** AAA No. 01-14-0001-4332	3.9.2015	Track and Field Ephedrine Stimulants - S6	https://www.usada.org/wp-content/uploads/3-10-15-Reasoned-Decision-and-Award.pdf
2015	**USADA v. Leinders** AAA No. 77-20-1300-0604	1.16.2015	Cycling Non-Analytical	https://www.usada.org/wp-content/uploads/AAA_decision_Leinders_December_2014.pdf
2016	**USADA v. Rivera** AAA No. 01-16-0000-6096	8.31.2016	Weightlifting 16ß-hydroxystanozolol, Stanozolol Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/2016_08_31-AAA-Award-Rivera.pdf
2016	**USADA v. Raquira** AAA No. 01-16-0000-7103	8.17.2016	Cycling Adverse CIR Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/2016_08_17-AAA-Award-Raquira.pdf
2016	**USADA v. Pizza** AAA No. 01-15-0006-1251	7.18.2016	Track and Field Adverse CIR Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/AAA-Decision-Pizza-Award-07-18-2016-.pdf
2016	**USADA v. Tierney** AAA No. 01-16-0002-4207	7.8.2016	Swimming DOU: Breo Ellipta Beta-2 Agonists - S3	https://www.usada.org/wp-content/uploads/AAA-Decision-Tierney-Award-07-08-2016-.pdf https://www.usada.org/wp-content/uploads/2016-06-22-Operative-Award-USADA-v-Tierney-.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2016	**USADA v. Lea** AAA No. 01-15-0005-6647 CAS No. 2016/A/4371	5.4.2016	Cycling Noroxycodone Narcotics - S7	https://www.usada.org/wp-content/uploads/2016-05-04-CAS-Award-Robert-Lea.pdf https://www.usada.org/wp-content/uploads/AAA-Decision-Lea-Award-01-05-2016.pdf
2016	**USADA v. Jones**	11.7.2016	MMA Clomiphene; Letrozole	https://ufc.usada.org/jon-jones-receives-doping-sanction/
2017	**USADA v. Dosterschill** AAA No. 01-16-0004-4862	5.10.2017	Weightlifting 1α-methyl-5α-androstan-3α-ol-17-one (metabolite of Mesterolone), 2α-methyl-5α-androstan-3α-ol-17-one (metabolite of Drostanolone), 4-chloro-17-hydroxymethyl-17-methyl-18-nor-5β-androst-13-ene-3-ol (metabolite of Dehydrochloromethyltestosterone), Adverse CIR, Amphetamine Anabolic Agents - S1, Stimulants - S6	https://www.usada.org/wp-content/uploads/AAA-CAS-Decision-Robert-Dosterschill-May-2017.pdf
2017	**USADA v. Roberts** AAA No. 01-17-0003-4443	7.10.2017	Track and Field Probenecid Diuretics and Other Masking Agents - S5	https://www.usada.org/wp-content/uploads/07_12_17-Gil-Roberts-AAA-FinalAward.pdf
2017	**USADA v. Barnes** AAA No. 01-17-0001-6275	6.29.2017	Weightlifting GW1516 Sulfone, GW1516 Sulfoxide Hormone and Metabolic Modulators - S4	https://www.usada.org/wp-content/uploads/2017_6_30-AAA-Award-Benjamin-Barnes.pdf
2017	**USADA v. Johnson** AAA No. 01-16-0005-1367	6.30.2017	Bobsled and Skeleton, Cycling Modafinil Stimulants - S6	https://www.usada.org/wp-content/uploads/2017_06_30-AAA-Award-Johnson.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2017	**USADA v. Bailey** AAA No. 01-17-0002-7722 CAS No. 2017/A-5320	6.13.2018	Bobsled and Skeleton, Track and Field Dimethylbutylamine Stimulants - S6	https://www.usada.org/wp-content/uploads/Ryan-Bailey-Final-AAA-Award.pdf https://www.usada.org/wp-content/uploads/Ryan-Bailey-Final-Award.pdf
2017	**USADA v. Blazejack** AAA No. 01-16-0005-1873	7.14.2017	Cycling Clenbuterol Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/Tony-Blazejack-AAA-Final-Award.pdf
2017	**USADA v. Blandford** AAA No. 01-17-0002-9207	11.20.2017	Cycling, Triathlon Non-Analytical: Use and Possession of Testosterone, hGH and Oxandrolone	https://www.usada.org/wp-content/uploads/Jenna-Blandford-AAA-Award-Nov.-2017.pdf
2017	**USADA v. Lesnar**	1.4.2017	MMA Clomiphene	https://ufc.usada.org/brock-lesnar-receives-doping-sanction/
2018	**USADA v. Jones**	9.19.2018	MMA Chlorine-substituted Anabolic Steroid	https://ufc.usada.org/independent-arbitrator-imposes-15-month-sanction-for-jon-jones/
2018	**USADA v. Tukhugov**	2.15.2018	MMA Ostarine	https://ufc.usada.org/ruslan-magomedov-zubaira-tukhugov-accept-doping-sanctions/
2018	**USADA v. Magomedov**	2.15.2018	MMA Ostarine	https://ufc.usada.org/ruslan-magomedov-zubaira-tukhugov-accept-doping-sanctions/
2018	**USADA v. Rivera**	1.19.2018	MMA Clenbuterol	https://ufc.usada.org/francisco-rivera-recieves-doping-sanction/
2019	**USADA v. Jones** AAA No. 01-18-0004-6622 CAS No. 2019/A/6376	12.12.2019	Paralympic Track and Field, Track and Field 3-hydroxystanozolol (Stanozolol Metabolites) Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/AAA-Decision-Stirley-Jones.pdf https://www.usada.org/wp-content/uploads/Stirley-Jones-CAS-Decision.pdf
2019	**USADA v. Brown** AAA No. 01-17-0003-6197 CAS No. 2019/A/6530	10.7.2019	Complicity, Non-Analytical: Administration, Non-Analytical: Aggravating Circumstances, Non-Analytical: Tampering, Non-Analytical: Trafficking	https://www.usada.org/wp-content/uploads/Jeffrey-Brown-FINAL-AAA-Award.pdf https://www.usada.org/wp-content/uploads/CAS-Decision-Salazar-Brown.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2019	**USADA v. Salazar** AAA No. 01-17-0004-0880 CAS No. 2019/A/6531	9.30.2019	Complicity, Non-Analytical: Administration, Non-Analytical: Aggravating Circumstances, Non-Analytical: Possession, Non-Analytical: Tampering, Non-Analytical: Trafficking	https://www.usada.org/wp-content/uploads/Salazar-AAA-Decision.pdf https://www.usada.org/wp-content/uploads/CAS-Decision-Salazar-Brown.pdf
2019	**USADA v. Dwyer** AAA No. 01-19-0000-6431	10.11.2019	Swimming Adverse CIR Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/Conor-Dwyer-Final-AAA-Award.pdf
2019	**USADA v. Akuna** AAA No. 01-19-0001-4148	11.25.2019	Weightlifting 17β-hydroxymethyl-17α-methyl-18-norandrost-1,4,13-trien-3-one (metabolite of Methandienone), 4-chloro-18-nor-17β-hydroxymethyl, 17α-methyl-5α-androst-13-en-3α-ol (metabolite of Oral Turinabol) Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/Kiara-Akuna-Final-AAA-Award.pdf
2019	**USADA v. C. Costa**	4.26.2019	MMA Non-Analytical: Possession and Administration	https://ufc.usada.org/paulo-costa-and-carlos-costa-accept-doping-sanctions/
2019	**USADA v. P Costa**	4.26.2019	MMA Non-Analytical: Intravenous Infusion	https://ufc.usada.org/paulo-costa-and-carlos-costa-accept-doping-sanctions/
2019	**USADA v. Magomedov**	4.1.2019	MMA Methyltestosterone; Stanozolol	https://ufc.usada.org/ruslan-magomedov-receives-lifetime-sanction-after-additional-violations/
2020	**Athlete re. USADA TUE Denial** AAA No. 01-19-0002-7536	6.23.2020		https://www.usada.org/wp-content/uploads/Redacted-TUE-Denial-Award-July-2020.pdf

Year	Case Name	Final Resolution Date	Case Description	Link
2020	**USADA v. Hudson** CAS No. 2019/A/6180	10.23.2020	Weightlifting Dehydrochlormethyltestosterone ("DHCMT") metabolite M3 Anabolic Agents - S1	https://www.usada.org/wp-content/uploads/Ryan-Hudson-CAS-Jurisdiction-Decision.pdf https://www.usada.org/wp-content/uploads/Ryan-Hudson-Final-CAS-Decision.pdf
2020	**USADA v. Starykowicz** CAS No. 2020/A/6892	8.5.2020	Triathlon	https://www.usada.org/wp-content/uploads/Andrew-Starykowicz-CAS-Decision.pdf
2020	**USADA v. Penchel**	3.23.2020	MMA Non-Analytical: Complicity	https://ufc.usada.org/lucas-penchel-accepts-doping-sanction/

APPENDIX B
PUBLICATIONS

- *USADA v. Lance Armstrong*, Reasoned Decision on Disqualification and Ineligibility, Oct. 10, 2012 (editor and principal author),[1]
- "OPINION: The 'Deflategate' Penalty Isn't Too Harsh," *Law360* (June 1, 2015)
- "How MLB Will Decide Whether To Lift Pete Rose Ban," *Law360* (July 20, 2015)
- "Focusing On Athlete Legacy To Deter Cheating," *Law360* (August 25, 2015)
- "International Sports Is Broken," *Law360* (October 21, 2015)
- "The Courage To Confront The Behemoth Of Russian Doping," *Law360* (December 1, 2015)
- "Track & Field Corruption – Olympic Sport On The Precipice?" *Law360* (January 19, 2016)
- "Why the Handling of Kamila Valieva's Positive Sample Constitutes Anti-Doping Malpractice" KGR website (February 11, 2022)
- "Why Kamila Valieva Should Compete on Tuesday" KGR website (February 13, 2022)

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[1] *Available at*: https://www.usada.org/wp-content/uploads/ReasonedDecision.pdf

APPENDIX C
PARTIAL LIST OF INVITED PRESENTATIONS

- 2019, USOPC NGB Best Practices Legal Seminar, Indianapolis, IN, October 24, 2019

- 2019, "Setting the Pace in Debating Integrity," Sport Resolutions Annual Conference, London, England, May 1 -2, 2019

- 2019, "Legal Perspectives of New Collection and Testing Methods," Partnership for Clean Competition, London, England, April 16 -18, 2019

- 2017, USA Track & Field Annual Meeting, "Who Will Lead the Fight for Clean Sport?" Columbus, OH December 2, 2017

- 2017, "Sports and Arbitration - Ultimate Umpires," Annual Meeting of the College of Commercial Arbitrators, Minneapolis, MN, October 13, 2017

- 2017, USADA Science Symposium, Orlando, FL, October 2, 2017

- 2017, "Doping in Sport: How the Culture Might Change," University of Pepperdine Law School, Malibu, CA, April 13, 2017

- 2017, Tackling Doping in Sport, London, England, March 8-9, 2017[1]

- 2015, Address to Deutsche Bundestag Sports Committee, German Embassy, Washington, D.C., October 23, 2015

- 2015, USADA Symposium on Anti-Doping Science, Landsdowne, Virginia, The Importance of Anti-Doping Investigations as a Complement to Testing, September, 2015[2]

- 2015, The Australian Bar Association - "The Transforming Power of the Truth: USADA's Lance Armstrong Investigation," Washington, D.C., July 4, 2015

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[1] https://www.sportsintegrityinitiative.com/tackling-doping-sport-removal-conflicts-interest-central/

[2] https://www.usada.org/about/science/symposium/designing-an-effective-deterrence-program/deterrence-takes-center-stage/

- 2015, ABCD (Brazil Anti-Doping Agency) Anti-Doping Forum - "The Lance Armstrong Case and Intelligence in Anti-Doping," Brasila, Brazil, April 14, 2015

- 2015, American Chemical Society National Meeting, Science & Investigations, Denver, CO, March, 2015[3]

- 2014, International Narcotics Interdiction Association Meeting, "Sports Doping Investigations," Dallas, TX, June 16, 2014

- 2014, "Conducting an Investigation from a Practical Point of View," World Anti-Doping Agency, ADO Symposium, Lausanne, Switzerland, March 26, 2014

- 2013, "What the Armstrong Case Says About the Condition of Sport," Play the Game Conference, Keynote Address, Aarhus, Denmark, October 28, 2013[4]

- 2013, British Sports Law Association, "What the Armstrong Case Says About the Condition of Sport," London, England, October 17, 2013

- 2013, USADA Symposium on Anti-Doping Science, Indianapolis, Indiana, October 7, 2013

- 2013, National Collegiate Athletic Association Doping Task Force, "Fundamentals of Anti-Doping," July 15, 2013

- 2013, Sports Lawyers Association Annual Meeting, Panel on Sports Doping Issues, Atlanta, GA, May, 2013

- 2013, McGarr Symposium on Sport and Society, "The Real Price of Winning at All Costs: A Discussion about Elite Cycling," University of Texas, Austin, TX, April 21, 2013[5]

- 2013, Texas Review of Entertainment and Sports Law, University of Texas Law School, Austin, TX, April 21, 2013

- 2013, Crain's Detroit Business, Keynote Speaker, General Counsel Forum, Detroit, MI, April 16, 2013

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[3] https://www.usada.org/spirit-of-sport/science/science-spans-generations/
[4] https://www.playthegame.org/conferences/play-the-game-2013/on-demand-streaming.html
[5] https://vimeo.com/66747448 ; https://vimeo.com/65071416

- 2013, University of Michigan Law School, "Ethical Implications from the Lance Armstrong Case," Ann Arbor, MI, April 16, 2013

- 2013, French National Olympic Committee, Keynote Speaker, 13th National Symposium Against Doping, Paris, France, April 5, 2013

- 2013, International Sport Integrity and Security Conference, Doha, Qatar, March 18, 2013

- 2012, Dutch Sports Law Society, Amsterdam, Netherlands, November 15, 2012

- 2012, Anti-Doping Norway, "Cycling Investigations Strategies," November 13, 2012

- 2012, Southwestern Law School, "Ethics in Sport & Society," Los Angeles, CA, November 5, 2012

- 2012, "Perspectives on Drug Testing," University of Michigan Law School, February 17, 2012

- 2011, USOC Best Practices Seminar, Colorado Springs, CO, April 27, 2011

- 2010, Hofstra University, "The Anti-Doping Movement: Athletes' Health and Rights," Long Island, NY, October 29, 2010[6]

- 2008, USOC NGB Forum, Colorado Springs, CO, September 24, 2008

- 2008, Road Runner's Club of America, Cincinnati, OH, Drug Testing by the United States Anti-Doping Agency, May, 2008

- 2007, Chicago Bar Association, Chicago, IL, Sports Doping Panel, September, 2007

- 2007, William & Mary School of Law, 8th Annual Sports & Entertainment Law Symposium, March, 2007

[6] https://scholarlycommons.law.hofstra.edu/suaps/

- 2007, United States Olympic Committee, Sports Law Best Practices Seminar, Colorado Springs, CO, January, 2007

- 2006, Sports Law Leadership Summit (American Conference Institute), New York City, September 27-28, 2006

- 2005, "Drugs, Dingers and Denials: How Doping Has Changed Sport and What Is Being Done About It" Sports & Entertainment Section of the Indianapolis Bar Association, December, 2005

- 2005, "Winning At All Costs - Today's Addiction," Valparaiso University Sports Law Conference, Chicago, IL, February, 2005

- 2005, DePaul University Sports Law Conference, panel on sports doping issues, Chicago, IL, March, 2005

- 2005, American Bar Association Forum on the Sports and Entertainment Industries Annual Meeting, presentation on sports drug testing issues, New York, NY

- 2004, Sports Lawyers Association Annual Meeting, Baltimore, MD, Participated on panel addressing current legal issues involving Olympic Movement athletes, May, 2004

- 2002, Olympic Games Training for Pro Bono Legal Panel, Salt Lake City, UT - Invited by USOC to make presentation to panel of pro bono attorneys to represent athletes during 2002 Winter Olympic Games, January, 2002

Appendix D

William Bock, III

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EXPERIENCE

General Counsel, U.S. Anti-Doping Agency, Colorado Springs, CO **2007 to Nov. 2020**

- Hire and manage successful investigative and legal team
- Close working relationship with federal law enforcement agencies, FBI, DEA, DHS, etc.
- Handled hundreds of investigations and sports eligibility disputes
- Lead counsel before American Arbitration Association and Court of Arbitration for Sport in more than 50 contested hearings
- Successful prosecutions of numerous high-profile athletes and coaches including Lance Armstrong and personnel on U.S. Postal Service Cycling Team; Nike Oregon Project Coach Alberto Salazar, and sprinter Justin Gatlin
- Work described in New York Times best seller list books: *Wheelmen: Lance Armstrong, the Tour de France, and the Greatest Sports Conspiracy Ever*; *Cycle of Lies: The Fall of Lance Armstrong* and *Game of Shadows: Barry Bonds, BALCO, and the Steroids Scandal that Rocked Professional Sports*

Partner, Kroger, Gardis & Regas, LLP, Indianapolis, IN **1992 to present**

- National litigation and sports law practice
- Successfully briefed or argued cases in Indiana Supreme Court and Court of Appeals, U.S. Court of Appeals for Seventh Circuit and many federal district courts
- Expertise in class actions, commercial, constitutional, environmental, elections labor/employment, shareholder disputes and sports law
- Representative current or former clients: City of East Chicago, Porter County Commissioners, Marion County Clerk, Marion County Election Board, Johnson County Election Board, Indianapolis City-County Council, U.S. Anti-Doping Agency, U.S. Olympic & Paralympic Committee, International Association of Athletics Federations, Simmons Company, Ryder Dedicated Logistics, Inc.

Parliamentarian, Indiana House of Representatives **2004-2006**

- Advised Speaker of the House on parliamentary procedure, ethical and legal issues
- Member of Speaker's Leadership Team, assisted strategy development
- Managed outside legal counsel in lawsuits defending legislative prayer and photo ID law

Member, NCAA Division I Committee on Infractions **2016 to present**

- Public member of panel hearing cases involving potential violation of NCAA rules

Member, Federation Internationale De Natation Doping Panel **2009 to 2021**

- Served on 15+ international hearing panels for swimmers alleged to have violated rules

Law Clerk, Hon. John Daniel Tinder, U.S. Dist. Court, Southern Dist. of IN **1990-1992**

Associate, Litigation, Baker & Daniels, Indianapolis, IN **1989-1990**

EDUCATION

University of Michigan Law School, Ann Arbor, MI **1986-1989**

- Juris Doctorate, *cum laude*
- Law School Student Senate
- Campbell Moot Court Competition
- Michigan Journal of Law Reform

Oral Roberts University, Tulsa, OK **1981-1985**

- Bachelor of Arts, *summa cum laude*, in History
- Student Body President (1983-1984 & 1984-1985)
- National Merit Scholar
- Harry S. Truman Scholarship, National Runner-Up
- Outstanding Senior Paper, History Department

ADMITTED TO PRACTICE

Indiana, Colorado; U.S. Supreme Court; U.S. Courts of Appeal for Sixth and Seventh Circuits; various U.S. District Courts

HONORS AND AWARDS

- Who's Who Legal **2019-2021**
- *Super Lawyer* (Indiana) **2015-2022**
- "Being A Difference" Award, NASBA Center for the Public Trust **2014-2015**
- Distinguished Barrister by the *Indiana Lawyer* **2013**
- Lawyer of the Year by *Law Week Colorado* **2012**

COMMUNITY INVOLVEMENT

INDIANA OPPORTUNITY FUND **2011– 2021**

- President of not-for-profit public benefit corporation organized to promote free market opportunities in Indiana in the economic, educational, and governmental arenas and to support the efforts of Hoosier leaders who advance policies to promote free market reforms

NEIGHBORHOOD ADVOCACY CORPORATION **1996 – 2000**

- Founding Board Member of not-for-profit corporation designed to use pro bono civil litigation strategies to revitalize low income neighborhoods

INDIANA PRISON FELLOWSHIP **1992 – 1998**

- Former Board Member and Co-Chairman for state-wide prison ministry

Appendix E

Additional Sources Relied Upon

- The World Anti-Doping Code (the "Code"), 2003, 2009, 2015, 2021[1] versions.

- The Prohibited List International Standard (the "Prohibited List") and other International Standards and Guideline documents promulgated by the World Anti-Doping Agency ("WADA"), from 1999 to present, including:

  a. WADA International Standard for Testing and Investigations,[2]

  b. WADA International Standard for Results Management,[3]

  c. WADA International Standard for Laboratories,[4]

  d. WADA International Standard for the Protection of Privacy and Personal Information,[5]

  e. WADA International Standard for Therapeutic Use Exemptions,[6]

  f. WADA International Standard for Code Compliance by Signatories,[7]

  g. WADA Athlete Biological Passport Guidelines,[8]

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[1] Current version *available at*: https://www.wada-ama.org/sites/default/files/resources/files/2021_wada_code.pdf.
[2] Current version *available at*: https://www.wada-ama.org/sites/default/files/resources/files/international_standard_isti_-_2021.pdf
[3] Current version *available at*: https://www.wada-ama.org/sites/default/files/resources/files/international_standard_isrm_-_final_english_-_post_exco_20_may_2021.pdf.
[4] Current version *available at*: https://www.wada-ama.org/sites/default/files/resources/files/isl_2021.pdf.
[5] Current version *available at*: https://www.wada-ama.org/sites/default/files/2022-01/international_standard_ispppi_-_november_2021_0.pdf
[6] Current version available at: https://www.wada-ama.org/sites/default/files/resources/files/international_standard_istue_-_2021.pdf.
[7] Current version *available at*: https://www.wada-ama.org/sites/default/files/resources/files/international_standard_isccs_2021.pdf.
[8] Current version *available at*: https://www.wada-ama.org/sites/default/files/resources/files/guidelines_abp_v8_final.pdf

h. WADA Technical Document – TD2021BAR[9]

i. WADA Technical Document – TD2021EAAS[10]

j. WADA Technical Document – TD2021NA[11]

- UNESCO International Convention Against Doping in Sport[12]

- The U.S. Anti-Doping Agency ("USADA") Protocol for Olympic and Paralympic Movement Testing (the "USADA Protocol")[13] and other anti-doping rules, policies and procedures promulgated by USADA from 2000 to present, most of which I participated in drafting, including:

a. USADA Whereabouts Policy,[14]

b. USADA Therapeutic Use Exemption Policy,[15]

c. USADA Whistleblowing Policy,[16]

d. USADA-Initiated U.S. Athlete Interview Rights and Responsibilities,[17] and

e. USADA-Led Non-Analytical Investigations Principles.[18]

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[9] Current version *available at*: https://www.wada-ama.org/sites/default/files/resources/files/td2021bar_final_eng_v2.0.pdf.
[10] Current version *available at*: https://www.wada-ama.org/sites/default/files/2022-01/td2021eaas_final_eng_v_2.0.pdf.
[11] Current version *available at*: https://www.wada-ama.org/sites/default/files/resources/files/td2021na_final_eng_v2.0_m.pdf
[12] *Available at*: https://unesdoc.unesco.org/ark:/48223/pf0000142594.
[13] Current version *available at*: https://www.usada.org/wp-content/uploads/USADA_protocol.pdf
[14] Current version *available at*: https://www.usada.org/wp-content/uploads/USADA_Whereabouts-Policy.pdf
[15] Current version *available at*: https://www.usada.org/wp-content/uploads/USADA_TUE_Policy.pdf
[16] Current version *available at*: https://www.usada.org/wp-content/uploads/2021-Whistleblower-Policy.pdf
[17] Current version *available at*: https://www.usada.org/wp-content/uploads/2021-US-Athlete-Interview-Rights-and-Responsibilities.pdf
[18] Current version *available at*: https://www.usada.org/wp-content/uploads/2021-Non-Analytical-Investigations-Principles.pdf

- The USOPC Anti-Doping Policy,[19]

- USOPC Bylaws, Section 8.4.1(c)(iv),[20]

- USADA 2019 Annual Report,[21]

- "Teens and Steroids: A Dangerous Combo," U.S. Food & Drug Administration,[22]

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- "Steroids are Blamed in Suicide of Young Athlete," New York Times, by Duff Wilson, March 10, 2005,[24]

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- "How Marginal Gains Can Give Elite Athletes the Edge," by Anthony King, The Irish Times, April 4, 2016,[26]

- "Pursuing Alberto Salazar, anti-doping agency found itself fighting Nike, by Jeff Manning, The Oregonian, (Oct. 6, 2019),[27]

- "A New Book on Nike Pulls No Punches," by Martin Fritz-Huber, *Outside Magazine*, (Oct. 2, 2020),[28]

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[19] Current version *available at*: https://www.usada.org/wp-content/uploads/USOPC-NADP.pdf
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[21] *Available at*: https://www.usada.org/wp-content/uploads/2019-USADA-Annual-Report.pdf
[22] *Available at*: https://www.fda.gov/consumers/consumer-updates/teens-and-steroids-dangerous-combo
[23] *Available at*: https://pubmed.ncbi.nlm.nih.gov/10596737/
[24] *Available at*: https://www.nytimes.com/2005/03/10/sports/steroids-are-blamed-insuicide-of-young-athlete.html
[25] *Available at*: https://pubmed.ncbi.nlm.nih.gov/26417784/.
[26] *Available at*: https://www.irishtimes.com/news/science/how-marginal-gains-can-give-elite-athletes-the-edge-1.2736311.
[27] *Available at*: https://www.oregonlive.com/business/2019/10/in-pursuing-salazar-anti-doping-agency-found-itself-fighting-nike.html
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[30] *available at*: https://pubmed.ncbi.nlm.nih.gov/3948861/.
[31] *available at*: https://www.nfhs.org/articles/state-legislatures-continue-to-update-concussion-laws/.
[32] *available at*: https://www.nfhs.org/articles/study-state-concussion-laws-effective-in-reducing-rates-of-injury/.
[33] *available at*: https://bjsm.bmj.com/content/51/11/A62.3;
[34] *available at*: https://jvavolleyball.org/here-comes-boom-real-facts-concussions/
[35] *available at*: https://www.pewresearch.org/fact-tank/2022/06/07/about-5-of-young-adults-in-the-u-s-say-their-gender-is-different-from-their-sex-assigned-at-birth/.

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- "When Children Say They're Trans," by Jesse Singal, *Atlantic* (July/August 2018),[37]

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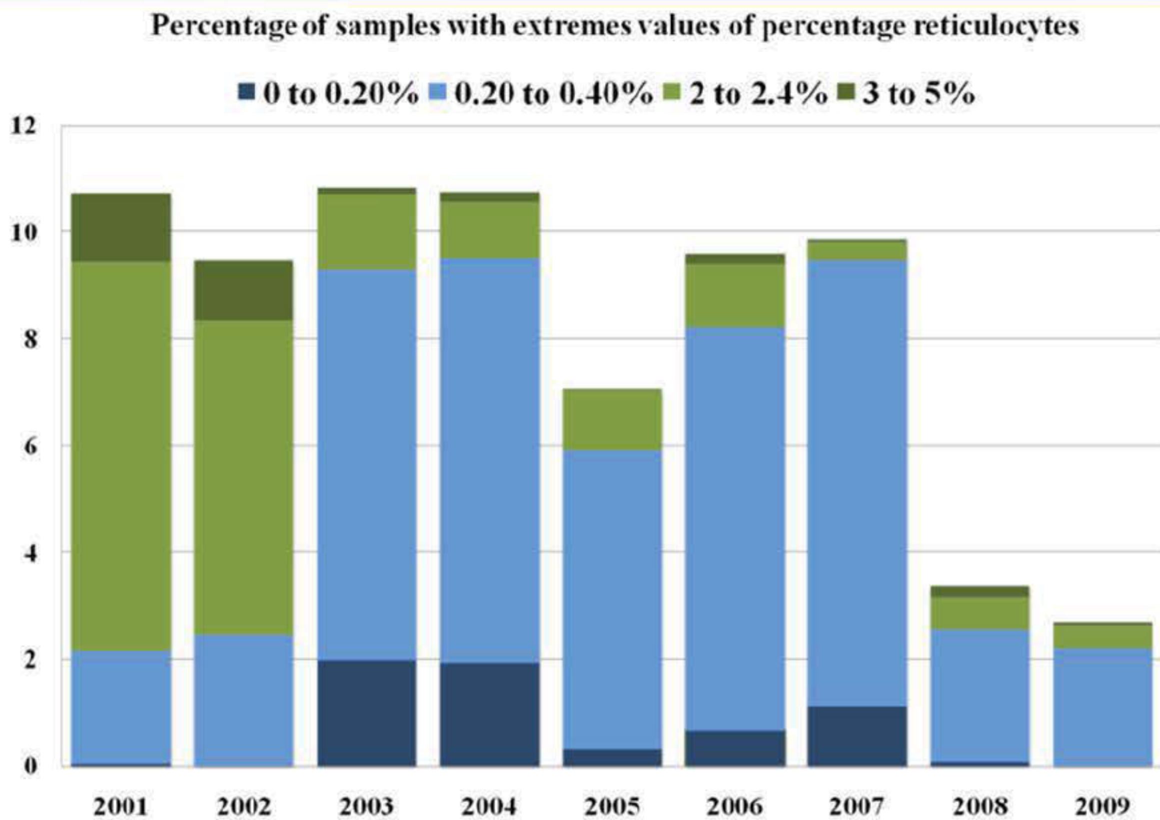
[37] *available at*: https://www.theatlantic.com/magazine/archive/2018/07/when-a-child-says-shes-trans/561749/

Appendix F

Evolution of Reticulocyte Count Results



Courtesy of Dr Zorzoli, UCI

Performance Profile: 10,000m

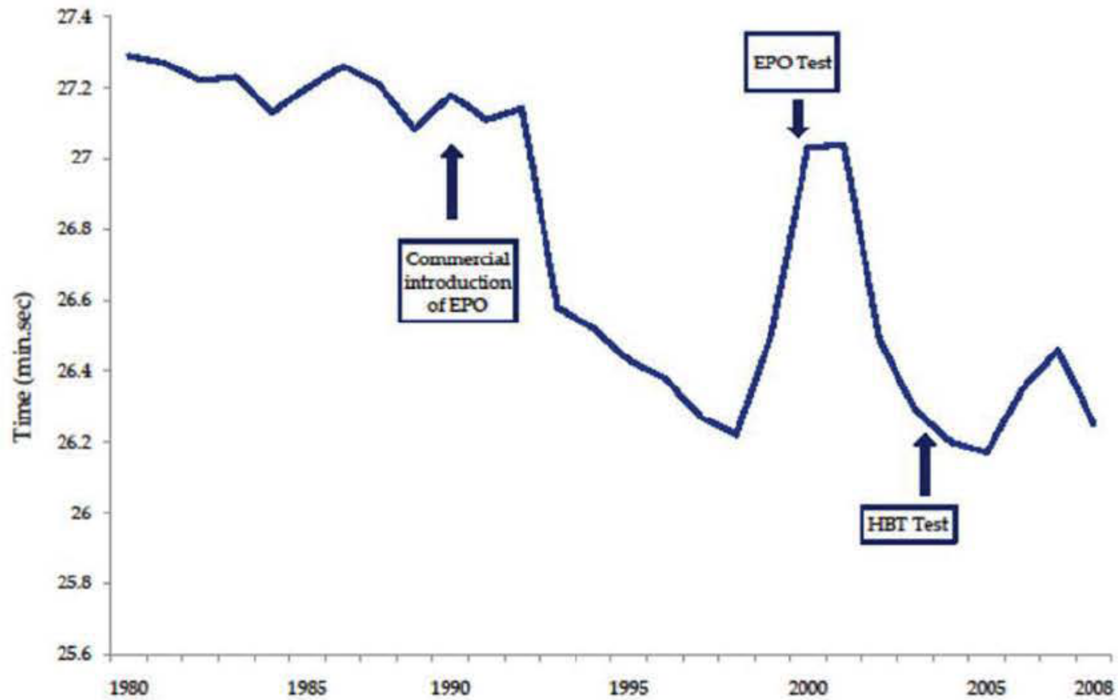


EXHIBIT 12

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON

Plaintiff,

v.

WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA

Defendants,

and

LAINEY ARMISTEAD

Defendant-Intervenor.

Case No. 2:21-cv-00316

Hon. Joseph R. Goodwin

DECLARATION OF LAINEY ARMISTEAD

I, Lainey Armistead, under penalty of perjury, declare as follows:

1. I am a twenty-two-year-old resident of Charleston, West Virginia, in Kanawha County, and have personal knowledge of the information below.

2. I am a junior and female athlete at West Virginia State University (WVSU) in Charleston, West Virginia, where I am a member of the women's soccer team. Soccer is my passion and life-defining pursuit.

Athletics Background

3. I come from a family of talented athletes. My dad was a multi-sport athlete in high school and an All-American soccer player in college. He later coached club soccer. My

mom was a high school and collegiate cheerleader. Two of my brothers went on to play soccer in college.

4. Soccer was like the air I breathed growing up. I first kicked a soccer ball at three years old—almost as soon as I could walk. I grew up playing pick-up soccer games with my brothers, being coached by my dad on technique, and cheering at soccer matches alongside my family.

5. I started playing on club soccer teams in my home state of Kentucky at age seven and continued competing on club teams through the end of my high school career.

6. I was excited to enjoy success on those club soccer teams. When I was just nine years old, my club soccer team won the indoor U.S. Youth Futsall National Championships—which is the largest and most prestigious indoor youth soccer competition in the country. It was an unforgettable experience.

7. I later went on to help my club soccer team win state championships during my freshman and sophomore years of high school. Those wins pushed me to try even harder.

8. Also during my sophomore year of high school, I had the honor of being selected from my club soccer team (Kentucky Fire) as one of only 20 girls in the nation to be invited to compete in a showcase soccer event in Las Vegas.

9. In addition to club soccer, I also competed on my school's middle school and high school soccer teams. One of my favorite memories from that time was helping my high school soccer team win the state championship during my freshman year of high school.

Competing in Women's Collegiate Athletics

10. It was my dream to play soccer in college. And I hoped my hard work would pay off with a college scholarship. I know, however, that athletic scholarships are limited and competitive.

11. After visiting approximately ten different colleges, I decided to visit West Virginia State University (WVSU), a public state university. I immediately knew this was where I wanted to attend college and I committed the same day.

12. WVSU offered me a soccer scholarship to compete on its women's soccer team. That scholarship helps pay for my education and brings me one step closer to my dream of being a lawyer someday.

13. Without a scholarship, I likely would have attended a college in my hometown and been saddled with school loans. My athletic scholarship opened the door for me to attend the school of my choice.

14. WVSU is an NCAA Division II soccer team and competes in the NCAA Mountain East Conference.

15. There are 11 players per team (22 players total) on the soccer field at any given time, though teams may have two or three times that many players total. Those 11 starting positions are highly coveted and competitive.

16. Team players are grouped into four general categories:

a. the front, or attacking positions, which are called strikers;

b. the midfielder positions;

c. the defender positions;

d. and the goalie.

17. I play starting left wingback on the soccer field, which is a defender position. But I "attack" a lot, which means I run up and down the field much of the game.

18. I also have the privilege of serving as team captain. This is a leadership position that is voted on by both players and coach, and has responsibilities that include organizing the team, determining what jerseys to wear, serving as liaison between the players and coaches, and also serving as liaison between the players and referee.

19. In 2020, I received the Stinger Award for "Female Teammate of the Year" in WVSU women's soccer.

20. Due to the COVID-19 pandemic, I currently have three years of NCAA eligibility left.

21. My teammates and I train hard to win. We do running drills, weightlifting, and watch replay videos of our prior games to evaluate how we can improve.

22. But it is not always easy. I have made many sacrifices over the course of my athletic career to play the sport that I love. I have missed school dances and spring breaks; family events; and friends' birthdays. I have given up my weekends and free time. I stay at school late for practice and get up early to train.

23. But I make these sacrifices because I want to be the best that I can be. I want to win—not just for myself, but also for my teammates. And it is that love of winning that helps me press through when the going gets tough.

24. I love my sport. It's exhilarating to see all the training and hard work that we put in at practice pay off on the field.

25. Soccer is called the "beautiful sport"—and for good reason. It is the most played sport in the world. Like music, soccer transcends culture. You can play a pick-up game of soccer with anyone regardless of language or background.

26. But soccer is also beautiful because it takes incredible teamwork to achieve a win. Soccer is a 90-minute game. It is much more difficult for women to run nonstop for a full 90-miuntes than it is for men. As a result, women's soccer games are different than men's. We have to be more cohesive. We pass the ball more, communicate more, and rely on our teammates more. But rather than a downside, I see teamwork as a thing of beauty. I love accomplishing things as a group. And when I step on the field with those ten other women, I know they have my back and I have theirs. We play hard for each other. As a result, my teammates have become some of my closest friends.

27. Soccer also taught me life skills like mental and physical toughness, perseverance, and good sportsmanship. It taught me that hard work and discipline pay off. It taught me the value of teamwork. It provided leadership opportunities that will benefit my future career. It opened new financial opportunities, such as benefitting from my image and likeness. It has given me lasting friendships with my teammates. And it has given me something to strive for. I would not be the person I am today without soccer.

Safety Concerns in Soccer

28. Soccer is a rough contact sport, and injuries are common among female athletes.

29. From my own observations, concussions, knee injuries, and ankle injuries are the most common injuries incurred by soccer players. In the first couple games of the WVSU fall 2021 soccer season alone, members of my team suffered all three of these injuries.

30. Playing a rough contact sport with other girls is one thing. But having played pick-up soccer games with my brothers and street soccer with men, I have realized that playing a rough contact sport with men is entirely different.

31. Males are generally stronger, fitter, faster, and have a bigger stature than women, which gives them advantages of strength, speed, and size in soccer. They compete at a faster pace. They kick the ball harder. They have physical frames that are generally larger.

32. Thankfully, I can enjoy a casual pick-up game of soccer with men because they take it easier on me. They do not go "all-in" because they know they could hurt me. But it would be a different story if a male was seriously competing and making full use of his strength, speed, and size in a soccer match against me. Based on my long experience playing competitive team soccer, I would be more worried that I could be injured by a male than a female competitor in a game in which players are trying their hardest to win.

Fairness in Women's Sports

33. A couple years ago, I heard about female track athletes in Connecticut who lost to biological males competing in their races. I learned that these two males won 15 women's state championship titles in girls' high school track and field. I was appalled and heartbroken for those girls. It felt so unfair. But I was thankful that those athletes had the courage to stand up.

34. I also heard that a male who competed on the University of Montana men's team track and cross-country team began competing in women's cross-country and track events and displaced collegiate female athletes.

35. So when I heard that West Virginia's legislature passed the Save Women's Sports Act to protect the integrity of women's sports, I enthusiastically supported it.

36. I never dreamed this would be an issue in West Virginia. And I never thought this issue could personally impact my competition till I learned a lawsuit had been filed against the new West Virginia law to protect women's sports.

37. Getting involved in this lawsuit was a weighty decision. I sought a lot of counsel and considered my options carefully before deciding to become involved in a case of this public importance and controversy. It's not always easy standing up for what you believe in.

38. And I know from experience in friendly competitions against men that facing a male in a soccer game changes the entire dynamics on the field and poses not just fairness but safety concerns, as well.

39. If forced to compete against a male athlete, I would have to face the hard decision of competing on an unfair playing field with heightened safety risks, or not competing at all.

40. A single male on my team could displace me or one of my teammates from a starting position—or a position on the team.

41. Even if the male athlete was on my team—arguably giving my team an advantage—I would treat that individual with respect and kindness, but it would still be unfair to displace a female athlete from her place on the field or from that position. And it also would not be fair to the female players on the opposing team.

42. Allowing males into women's athletics allows a person with a male body to take opportunities away from female athletes—whether that is a spot on the team, a starting position on the field, an athletic scholarship, the opportunity to benefit from her likeness, or recognition and awards—and is contrary to the entire purpose of women's sports.

43. Women's sports exist to give girls like me a chance to compete in sports on a level playing field.

44. Women have worked so hard to be taken seriously on the athletic level.

45. I fear that too many women feel pressured to remain silent about their beliefs.

46. I want other little girls in the future, or my own daughters, to not have to worry about competing against males. I also fear that girls in the future might consider not playing at all if they feel they cannot win against a physically superior male. Winning is the motivation for a lot of us who played sports for years.

47. I believe that protecting fairness in women's sports is a women's rights issue. This isn't just about fair play for me: it's about protecting fairness and safety for female athletes across West Virginia. It's about ensuring that future generations of female athletes are not discriminated against but have access to the same equal athletic opportunities that shaped my life.

48. Being an athlete in college has made me even more passionate about the sport that I play. I want fairness and equality in sports. And I want to ensure those standards are protected for other girls, too.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Lainey Armistead

Lainey Armistead
Dated: April 20, 2022

EXHIBIT 13

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J, by her next friend and mother, HEATHER JACKSON, *Plaintiff*, v. WEST VIRGINIA STATE BOARD OF EDUCATION, HARRISON COUNTY BOARD OF EDUCATION, WEST VIRGINIA SECONDARY SCHOOL ACTIVITIES COMMISSION, W. CLAYTON BURCH in his official capacity as State Superintendent, DORA STUTLER in her official capacity as Harrison County Superintendent, and THE STATE OF WEST VIRGINIA, *Defendants* and LAINEY ARMISTEAD, *Defendant-Intervenor*.	Case No. 2:21-cv-00316 Hon. Joseph R. Goodwin

DECLARATION OF MARY MARSHALL

I, Mary Marshall, declare as follows:

1. I am a twenty-one-year-old resident of Twin Falls, Idaho, and have personal knowledge of the information below.

2. I am a senior and female athlete at Idaho State University in Pocatello, Idaho, where I compete in cross-country and track and field.

Athletics Background

3. I first started playing basketball at 7 or 8 years old, and I continued through my sophomore year of high school. I enjoyed the competition, the adrenaline rush, and the sheer fun of the game.

4. In 8th grade, I started running track. My sophomore year of high school I started running cross country to get in shape for basketball. But to my surprise, I found out that I loved running *more* than playing basketball! So, I kept running races. And my sophomore year of high school, I dropped basketball altogether and started focusing on cross country and track.

5. I discovered that I am good at running. In two back-to-back years, my high school medley relay team won the State championship in our division. My junior year I won the state championship in the 300 intermediate hurdles. And in my senior year of high school, I won the State championship in the 800m for my division.

6. I love to run. It gives me confidence, improves my mood, and allows me to explore the great outdoors on foot. But being a competitive female athlete is about more than just running long distances. It is about community. My teammates have become my closest friends. We push each other to be our best, help one another through disappointments and losses, and cheer one another on as we celebrate victories. We travel together for sporting events and share overnight lodging: it's like a sisterhood. We enjoy one another so much that we even spend our free time together. Through running competitively, I have made some of my closest lifelong friends.

Competing in Women's Collegiate Athletics

7. I chose to attend college at Idaho State University (ISU) because it is close to home and I really liked my track coaches. And I am grateful to be one of the lucky ones to benefit from a women's track scholarship.

8. In college, I am primarily a mid-distance track athlete, focusing on shorter distances like the 800-meter and the mile. But I also compete in cross-country to stay in shape. In cross-country, I generally compete in the 5k.

9. Training is hard work. On Tuesdays and Thursdays, I usually have a two-hour workout with my team. On alternate days, my teammates and I get together for a five-to-six-mile run. Additionally, we have an hour-long weightlifting session on Mondays and Wednesdays.

10. But in the fall of my sophomore year of college, I learned that I would be racing against a male athlete who was competing on the University of Montana women's team because he identifies as female. I was appalled. I do not know how anyone could think this was fair to female athletes. Males are naturally fitter and faster than females.

11. I raced against this athlete, June Eastwood, not once, but twice. First, I competed against Eastwood in the Montana State Cross-Country Classic 3-mile event in the fall of 2019. And then I competed against Eastwood again in January 2020 at the Stacy Dragila Indoor mile event.

12. I lost both times. I was displaced and pushed down to a lower spot in the rankings than I would have earned had the playing field been level.

13. When I lose to another woman, I assume that she must train harder than I do and it drives me to work harder. If I lose to a man, it feels completely different. It's deflating. I wonder whether he works as hard as I do, whether he was even trying, or was that an easy race for him. It makes me think that no matter how hard I try, my hard work and effort will not matter.

14. Members of the men's track team sometimes do easy runs with me and my teammates on the women's track team. But we women are under no illusion that we would be competitive in a race against these men. Even our easy runs are at different paces. For example, an easy run for women is usually at an 8:30 pace, while an easy pace for men is around 7:30.

Fairness in Women's Sports

15. When I first heard about Idaho's H.B. 500 Fairness in Women's Sports Act, I was really excited. I hoped that this would be the solution we needed to keep men out of women's sports. And that's why—when the law was later challenged in court — I chose to stand up and intervene in the lawsuit to defend the law. I wanted to make sure that the voices of women were heard.

16. I have personally seen the negative impact on women when Eastwood was allowed to compete against women's teams, and I fear that as men realize they only need to "identify" as women in order to compete in the women's category, others might follow suit. In fact, I learned through my lawsuit that a male athlete, Lindsay Hecox, wants to compete on the Boise State women's track and cross-country team—a team that I compete against. I want to stop this before it becomes popular.

17. I want to preserve the camaraderie and sisterhood that comes from competing with an all-female team. There is no way that I would feel comfortable sharing a hotel room with a male athlete, regardless of how that person identified.

18. And I want other young women to benefit from sports as I did. I did well in high school sports. But if a boy had decided to compete against me in basketball, or track, or cross-country, I am not sure that I would have kept on competing. Success drives endeavor. And if I knew that I could not win, I might have dropped out of sports altogether.

19. That very idea concerns me. Sports has played such an important role in my life. It taught me how to work in groups and as a team. It taught me how to persist through disappointment. It taught me that if I put in the work, I will get the results. It has taught me how to interact with people I do not know, and how to respond to those in authority over me. It has

given me the confidence to study business, marketing, management, and economics at ISU because I hope to be an entrepreneur and own a business someday. These are the benefits that I want to preserve for the next generation of women.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Mary Marshall

Mary Kate Marshall

Dated: 4/19/22

EXHIBIT 14

**IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION**

B.P.J., by her next friend and mother, HEATHER JACKSON, *Plaintiff,* vs. WEST VIRGINIA STATE BOARD OF EDUCATION; HARRISON COUNTY BOARD OF EDUCATION; WEST VIRGINIA SECONDARY SCHOOLS ACTIVITIES COMMISSION; W. CLAYTON BURCH, in his official capacity as State Superintendent, DORA STUTLER, in her official capacity as the Harrison County Superintendent, and the STATE OF WEST VIRGINIA, *Defendants,* and LAINEY ARMISTEAD, *Defendant-Intervenor.*	Case No. 2:21-cv-00316 Hon. Joseph R. Goodwin

DECLARATION OF GREGORY A. BROWN, PH.D., FACSM

I, Dr. Gregory A. Brown, pursuant to 28 U.S. Code § 1746, declare under penalty of perjury under the laws of the United States of America that the facts contained in my Expert Declaration of Gregory A. Brown, Ph.D., FACSM in the Case of B.P.J. v. West Virginia State Board of Education, attached hereto, are true and correct to the best of my knowledge and belief, and that the opinions expressed therein represent my own expert opinions.

Executed on February 23, 2022.

Greg A. Brown

Gregory A. Brown

Expert Report of

Gregory A Brown, Ph.D. FACSM

In the case of B.P.J. vs. West Virginia State Board of Education.

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Personal Qualifications and Disclosure

I serve as Professor of Exercise Science in the Department of Kinesiology and Sport Sciences at the University of Nebraska Kearney, where I teach classes in Exercise Physiology among other topics. I am also the Director of the General Studies program. I have served as a tenured (and nontenured) professor at universities since 2002.

In August 2002, I received a Doctor of Philosophy degree from Iowa State University, where I majored in Health and Human Performance, with an emphasis in the Biological Bases of Physical Activity. In May 1999, I received a Master of Science degree from Iowa State University, where I majored in Exercise and Sport Science, with an emphasis in Exercise Physiology.

I have received many awards over the years, including the Mortar Board Faculty Excellence Honors Award, College of Education Outstanding Scholarship / Research Award, and the College of Education Award for Faculty Mentoring of Undergraduate Student Research. I have authored more than 40 refereed publications and more than 50 refereed presentations in the field of Exercise Science. I have authored chapters for multiple books in the field of Exercise Science. And I have served as a peer reviewer for over 25 professional journals, including *The American Journal of Physiology*, the *International Journal of Exercise Science*, the *Journal of Strength and Conditioning Research*, and *The Journal of Applied Physiology*.

My areas of research have included the endocrine response to testosterone prohormone supplements in men and women, the effects of testosterone prohormone supplements on health and the adaptations to strength training in men, the effects of energy drinks on the physiological response to exercise, and assessment of various athletic training modes in males and females. Articles that I have published that are closely related to topics that I discuss in this white paper include:

- Studies of the effect of ingestion of a testosterone precursor on circulating testosterone levels in young men. Douglas S. King, Rick L. Sharp, Matthew D. Vukovich, Gregory A. Brown, et al., *Effect of Oral Androstenedione on Serum Testosterone and Adaptations to Resistance Training in Young Men: A Randomized Controlled Trial*, JAMA 281: 2020-2028 (1999); G. A. Brown, M. A. Vukovich, et al., *Effects of Anabolic Precursors on Serum Testosterone Concentrations and Adaptations to Resistance Training in Young Men*, INT J SPORT NUTR EXERC METAB 10: 340-359 (2000).

- A study of the effect of ingestion of that same testosterone precursor on circulating testosterone levels in young women. G. A. Brown, J. C. Dewey, et al., *Changes in Serum Testosterone and Estradiol Concentrations Following Acute Androstenedione Ingestion in Young Women*, HORM METAB RES 36: 62-66 (2004.)

- A study finding (among other things) that body height, body mass, vertical jump height, maximal oxygen consumption, and leg press maximal strength were higher in a group of physically active men than comparably active women, while the women had higher percent body fat. G. A. Brown, Michael W. Ray, et al., *Oxygen Consumption, Heart Rate, and Blood Lactate Responses to an Acute Bout of Plyometric Depth Jumps in College-Aged Men And Women*, J. STRENGTH COND RES 24: 2475-2482 (2010).

- A study finding (among other things) that height, body mass, and maximal oxygen consumption were higher in a group of male NCAA Division 2 distance runners, while women NCAA Division 2 distance runners had higher percent body fat. Furthermore, these male athletes had a faster mean competitive running speed (~3.44 min/km) than women (~3.88 min/km), even though the men ran 10 km while the women ran 6 km. Katherine Semin, Alvah C. Stahlnecker, Kate A. Heelan, G. A. Brown, et al, *Discrepancy Between Training, Competition and Laboratory Measures of Maximum Heart Rate in NCAA Division 2 Distance Runners*, JOURNAL OF SPORTS SCIENCE AND MEDICINE 7: 455-460 (2008).

- A presentation at the 2021 American Physiological Society New Trends in Sex and Gender Medicine Conference entitled "Transwomen Competing in Women's Sports: What We Know and What We Don't". I have also authored an August 2021 entry for the American Physiological Society Physiology Educators Community of Practice Blog (PECOP Blog) titled "The Olympics, Sex, and Gender in the Physiology Classroom."

A list of my published scholarly work for the past 10 years appears as an Appendix.

Purpose of this Declaration

I have been asked by counsel for Defendant State of West Virginia and Intervenor Defendant Lainey Armistead in the matter of *B.P.J. by her next friend and mother Heather Jackson, v. State of West Virginia State Board of Education, et al.* to offer my opinions about the following: (a) whether males have inherent advantages in athletic performance over females, and if so the scale and physiological basis of those advantages, to the extent currently understood by science and (b) whether the sex-based performance advantage enjoyed by males is eliminated if feminizing hormones are administered to male athletes who identify as transgender (and in the case of prepubertal children, whether puberty blockers eliminate the advantage). In this declaration, when I use the terms "boy" or "male," I am referring to biological males based on the individual's reproductive biology and genetics as determined at birth. Similarly, when I use the terms "girl" or "female," I am referring to biological females based on the individual's reproductive biology and genetics as determined at birth. When I use the term transgender, I am referring to persons who are males or females, but who identify as a member of the opposite sex.

I have previously provided expert information in cases similar to this one in the form of a written declaration and a deposition in the case of *Soule vs. CIAC* in the state of Connecticut, and in the form of a written declaration in the case of *Hecox vs. Little* in the state of Idaho. I have not previously testified as an expert in any trials.

The opinions I express in this declaration are my own, and do not necessarily reflect the opinions of my employer, the University of Nebraska.

I have been compensated for my time serving as an expert in this case at the rate of $150 per hour. My compensation does not depend on the outcome in the case.

Overview

In this declaration, I explore three important questions relevant to current discussions and policy decisions concerning inclusion of transgender individuals in women's athletic competitions. Based on my professional familiarity with exercise physiology and my review of the currently available science, including that contained in the many academic sources I cite in this report, I set out and explain three basic conclusions:

- At the level of (a) elite, (b) collegiate, (c) scholastic, and (d) recreational competition, men, adolescent boys, or male children, have an advantage over equally aged, gifted, and trained women, adolescent girls, or female children in almost all athletic events;

- Biological male physiology is the basis for the performance advantage that men, adolescent boys, or male children have over women, adolescent girls, or female children in almost all athletic events; and

- The administration of androgen inhibitors and cross-sex hormones to men or adolescent boys after the onset of male puberty does not eliminate the performance advantage that men and adolescent boys have over women and adolescent girls in almost all athletic events. Likewise, there is no published scientific evidence that the administration of puberty blockers to males before puberty eliminates the pre-existing athletic advantage that prepubertal males have over prepubertal females in almost all athletic events.

In short summary, men, adolescent boys, and prepubertal male children perform better in almost all sports than women, adolescent girls, and prepubertal female children because of their inherent physiological advantages. In general, men, adolescent boys, and prepubertal male children, can run faster, output more muscular power, jump higher, and possess greater muscular endurance than women, adolescent girls, and prepubertal female children. These advantages become greater during and after male puberty, but they exist before puberty.

Further, while after the onset of puberty males are on average taller and heavier than females, a male performance advantage over females has been measured in weightlifting competitions even between males and females matched for body mass.

Male advantages in measurements of body composition, tests of physical fitness, and athletic performance have also been shown in children before puberty. These advantages are magnified during puberty, triggered in large part by the higher testosterone concentrations in men, and adolescent boys, after the onset of male puberty. Under the influence of these higher testosterone levels, adolescent boys and young men develop even more muscle mass, greater muscle strength, less body fat, higher bone mineral density, greater bone strength, higher hemoglobin concentrations, larger hearts and larger coronary blood vessels, and larger overall statures than women. In addition, maximal oxygen consumption (VO_2max), which correlates to ~30-40% of success in endurance sports, is higher in both elite and average men and boys than in comparable women and girls when measured in regard to absolute volume of oxygen consumed and when measured relative to body mass.

Although androgen deprivation (that is, testosterone suppression) may modestly decrease some physiological advantages that men and adolescent boys have over women and adolescent girls, it cannot fully or even largely eliminate those physiological advantages once an individual has passed through male puberty.

Evidence and Conclusions

I. The scientific reality of biological sex

1. The scientific starting point for the issues addressed in this report is the biological fact of dimorphic sex in the human species. It is now well recognized that dimorphic sex is so fundamental to human development that, as stated in a recent position paper issued by the Endocrine Society, it "must be considered in the design and analysis of human and animal research. . . . Sex is dichotomous, with sex determination in the fertilized zygote stemming from unequal expression of sex chromosomal genes." (Bhargava et al. 2021 at 220). As stated by Sax (2002 at 177), "More than 99.98% of humans are either male or female." All humans who do not suffer from some genetic or developmental disorder are unambiguously male or female.

2. Although sex and gender are used interchangeably in common conversation, government documents, and in the scientific literature, the American Psychological Association defines sex as "physical and biological traits" that "distinguish between males and females" whereas gender "implies the psychological, behavioral, social, and cultural aspects of being male or female (i.e., masculinity or femininity)" (https://dictionary.apa.org, accessed January 14, 2022). The concept that sex is an important biological factor determined at conception is a well-established scientific fact that is supported by statements from a number of respected organizations including, but not limited to, the Endocrine Society (Bhargava et al. 2021 at 220), the American Physiological Society (Shah 2014), the Institute of Medicine, and the National Institutes of Health (Miller 2014 at H781-82). Collectively, these and other organizations have stated that every cell has a sex

and every system in the body is influenced by sex. Indeed, "sex often influences gender, but gender cannot influence sex." (Bhargava 2021 at 228.)

3. To further explain: "The classical biological definition of the **2 sexes** is that females have ovaries and make larger female gametes (eggs), whereas males have testes and make smaller male gametes (sperm) … the definition can be extended to the ovaries and testes, and in this way the categories—female and male—can be applied also to individuals who have gonads but do not make gametes … sex is dichotomous because of the different roles of each sex in reproduction." (Bhargava 2021 at 221.) Furthermore, "sex determination begins with the inheritance of XX or XY chromosomes" (Bhargava 2021 at 221.) And, "Phenotypic sex differences develop in XX and XY embryos as soon as transcription begins. The categories of X and Y genes that are unequally represented or expressed in male and female mammalian zygotes … cause phenotypic sex differences" (Bhargava 2021 at 222.)

4. Although disorders of sexual development (DSDs) are sometimes confused with discussions of transgender individuals, the two are different phenomena. DSDs are disorders of physical development. Many DSDs are "associated with genetic mutations that are now well known to endocrinologists and geneticists." (Bhargava 2021 at 225) By contrast, a sense of transgender identity is usually not associated with any physical disorder, and "a clear biological causative underpinning of gender identity remains to be demonstrated." (Bhargava 2021 at 226.)

5. Further demonstrating the biological importance of sex, Gershoni and Pietrokovski (2017) detail the results of an evaluation of "18,670 out of 19,644 informative protein-coding genes in men versus women" and reported that "there are over 6500 protein-coding genes with significant S[ex]D[ifferential] E[xpression] in at least one tissue. Most of these genes have SDE in just one tissue, but about 650 have SDE in two or more tissues, 31 have SDE in more than five tissues, and 22 have SDE in nine or more tissues" (Gershoni 2017 at 2-3.) Some examples of tissues identified by these authors that have SDE genes include breast mammary tissue, skeletal muscle, skin, thyroid gland, pituitary gland, subcutaneous adipose, lung, and heart left ventricle. Based on these observations the authors state "As expected, Y-linked genes that are normally carried only by men show SDE in many tissues" (Gershoni 2017 at 3.) A stated by Heydari et al. (2022, at 1), "Y chromosome harbors male-specific genes, which either solely or in cooperation with their X-counterpart, and independent or in conjunction with sex hormones have a considerable impact on basic physiology and disease mechanisms in most or all tissues development."

6. In a review of 56 articles on the topic of sex-based differences in skeletal muscle, Haizlip et al., (2015) state that "More than 3,000 genes have been

identified as being differentially expressed between male and female skeletal muscle." (Haizlip 2015 at 30.) Furthermore, the authors state that "Overall, evidence to date suggests that skeletal muscle fiber-type composition is dependent on species, anatomical location/function, and sex" (Haizlip 2015 at 30.) The differences in genetic expression between males and females influence the skeletal muscle fiber composition (i.e. fast twitch and fast twitch sub-type and slow twitch), the skeletal muscle fiber size, the muscle contractile rate, and other aspects of muscle function that influence athletic performance. As the authors review the differences in skeletal muscle between males and females they conclude, "Additionally, all of the fibers measured in men have significantly larger cross-sectional areas (CSA) compared with women." (Haizlip 2015 at 31.) The authors also explore the effects of thyroid hormone, estrogen, and testosterone on gene expression and skeletal muscle function in males and females. One major conclusion by the authors is that "The complexity of skeletal muscle and the role of sex adding to that complexity cannot be overlooked." (Haizlip 2015 at 37.) The evaluation of SDE in protein coding genes helps illustrate that the differences between men and women are intrinsically part of the chromosomal and genetic makeup of humans which can influence many tissues that are inherent to the athletic competitive advantages of men compared to women.

II. Biological men, or adolescent boys, have large, well-documented performance advantages over women and adolescent girls in almost all athletic contests.

7. It should scarcely be necessary to invoke scientific experts to "prove" that men are on average larger, stronger, and faster than women. All of us, along with our siblings and our peers and perhaps our children, have passed through puberty, and we have watched that differentiation between the sexes occur. This is common human experience and knowledge.

8. Nevertheless, these differences have been extensively studied and measured. I cited many of these studies in the first paper on this topic that I prepared, which was submitted in litigation in January 2020. Since then, in light of current controversies, several authors have compiled valuable collections or reviews of data extensively documenting this objective fact about the human species, as manifest in almost all sports, each of which I have reviewed and found informative. These include Coleman (2020), Hilton & Lundberg (2021), World Rugby (2020), Harper (2021), Hamilton (2021), and a "Briefing Book" prepared by the Women's Sports Policy Working Group (2021). The important paper by Handelsman et al. (2018) also gathers scientific evidence of the systematic and large male athletic advantage.

9. These papers and many others document that men, adolescent boys, and prepubertal male children, substantially outperform comparably aged women,

adolescent girls and prepubertal female children, in competitions involving running speed, swimming speed, cycling speed, jumping height, jumping distance, and strength (to name a few, but not all, of the performance differences). As I discuss later, it is now clear that these performance advantages for men, adolescent boys, and prepubertal male children, are inherent to the biological differences between the sexes.

10. In fact, I am not aware of any scientific evidence today that disproves that after puberty men possess large advantages in athletic performance over women–so large that they are generally insurmountable for comparably gifted and trained athletes at every level (i.e. (a) elite, (b) collegiate, (c) scholastic, and (d) recreational competition). And I am not aware of any scientific evidence today that disproves that these measured performance advantages are at least largely the result of physiological differences between men and women which have been measured and are reasonably well understood.

11. My use of the term "advantage" in this paper must not be read to imply any normative judgment. The adult female physique is simply different from the adult male physique. Obviously, it is optimized in important respects for the difficult task of childbearing. On average, women require far fewer calories for healthy survival. Evolutionary biologists can and do theorize about the survival value or "advantages" provided by these and other distinctive characteristics of the female physique, but I will leave that to the evolutionary biologists. I use "advantage" to refer merely to performance advantages in athletic competitions.

12. I find in the literature a widespread consensus that the large performance and physiological advantages possessed by males–rather than social considerations or considerations of identity–are precisely the *reason* that most athletic competitions are separated by sex, with women treated as a "protected class." To cite only a few statements accepting this as the justification:

- Handelsman et al. (2018) wrote, "Virtually all elite sports are segregated into male and female competitions. The main justification is to allow women a chance to win, as women have major disadvantages against men who are, on average, taller, stronger, and faster and have greater endurance due to their larger, stronger, muscles and bones as well as a higher circulating hemoglobin level." (803)

- Millard-Stafford et al. (2018) wrote "Current evidence suggests that women will not swim or run as fast as men in Olympic events, which speaks against eliminating sex segregation in these individual sports" (530) "Given the historical context (2% narrowing in swimming over 44 y), a reasonable assumption might be that no more than 2% of the current performance gap could still potentially be attributed to sociocultural influences.", (533) and "Performance gaps between US men and women stabilized within less than a decade after federal legislation provided equal opportunities for female participation, but only modestly closed the overall gap in Olympic swimming by 2% (5% in running)." (533) Dr. Millard-Stafford, a full professor at Georgia Tech, holds a Ph.D. in Exercise Physiology and is a past President of the American College of Sports Medicine.

- In 2021, Hilton et al. wrote, "most sports have a female category the purpose of which is the protection of both fairness and, in some sports, safety/welfare of athletes who do not benefit from the physiological changes induced by male levels of testosterone from puberty onwards." (204)

- In 2020 the Swiss High Court ("Tribunal Fédéral") observed that "in most sports . . . women and men compete in two separate categories, because the latter possess natural advantages in terms of physiology."[1]

- The members of the Women's Sports Policy Working Group wrote that "If sports were not sex-segregated, female athletes would rarely be seen in finals or on victory podiums," and that "We have separate sex sport and eligibility criteria based on biological sex because this is the only way we can assure that female athletes have the same opportunities as male athletes not only to participate but to win in competitive sport. . . . If we did not separate athletes on the basis of biological sex–if we used any other physical criteria–we would never see females in finals or on podiums." (WSPWG Briefing Book 2021 at 5, 20.)

- In 2020, the World Rugby organization stated that "the women's category exists to ensure protection, safety and equality for those who do not benefit from the biological advantage created by these biological performance attributes." (World Rugby Transgender Women Guidelines 2020.)

- In 2021 Harper et al. stated "…the small decrease in strength in transwomen after 12–36 months of GAHT [Gender Affirming Hormone Therapy] suggests that transwomen likely retain a strength advantage

[1] "dans la plupart des sports . . . les femmes et les hommes concourent dans deux catégories séparées, ces derniers étant naturellement avantagés du point de vue physique." Tribunal Fédéral decision of August 25, 2020, Case 4A_248/2019, 4A_398/2019, at §9.8.3.3.

over cisgender women." (7) and "…observations in trained transgender individuals are consistent with the findings of the current review in untrained transgender individuals, whereby 30 months of GAHT may be sufficient to attenuate some, but not all, influencing factors associated with muscular endurance and performance." (8)

- Hamilton et al. (2021), in a consensus statement for the International Federation of Sports Medicine (FIMS) concluded that "Transwomen have the right to compete in sports. However, cisgender women have the right to compete in a protected category." (1409)

13. While the sources I mention above gather more extensive scientific evidence of this uncontroversial truth, I provide here a brief summary of representative facts concerning the male advantage in athletic performance.

A. Men are stronger.

14. Males exhibit greater strength throughout the body. Both Handelsman et al. (2018) and Hilton & Lundberg (2021) have gathered multiple literature references that document this fact in various muscle groups.

15. Men have in the neighborhood of 60%-100% greater **arm strength** than women. (Handelsman 2018 at 812.)[2] One study of elbow flexion strength (basically, bringing the fist up towards the shoulder) in a large sample of men and women found that men exhibited 109% greater isometric strength, and 89% higher strength in a single repetition. (Hilton 2021 at 204, summarizing Hubal (2005) at Table 2.)

16. **Grip strength** is often used as a useful proxy for strength more generally. In one study, men showed on average 57% greater grip strength than women. (Bohannon 2019.) A wider meta-analysis of multiple grip-strength studies not limited to athletic populations found that 18- and 19-year-old males exhibited in

[2] Handelsman expresses this as women having 50% to 60% of the "upper limb" strength of men. Handelsman cites Sale, *Neuromuscular function*, for this figure and the "lower limb" strength figure. Knox et al., *Transwomen in elite sport* (2018) are probably confusing the correct way to state percentages when they state that "differences lead to decreased trunk and lower body strength by 64% and 72% respectively, in women" (397): interpreted literally, this would imply that men have **almost 4x as much** lower body strength as do women.

the neighborhood of 2/3 greater grip strength than females. (Handelsman 2017 Figure 3, summarizing Silverman 2011 Table 1.)[3]

17. In an evaluation of maximal isometric handgrip strength in 1,654 healthy men, 533 healthy women aged 20-25 years and 60 "highly trained elite female athletes from sports known to require high hand-grip forces (judo, handball)," Leyk et al. (2007) observed that, "The results of female national elite athletes even indicate that the strength level attainable by extremely high training will rarely surpass the 50th percentile of untrained or not specifically trained men." (Leyk 2007 at 415.)

18. Men have in the neighborhood of 25%-60% greater **leg strength** than women. (Handelsman 2018 at 812.) In another measure, men exhibit 54% greater knee extension torque and this male leg strength advantage is consistent across the lifespan. (Neder 1999 at 120-121.)

19. When male and female Olympic weightlifters of the same body weight are compared, the top males lift weights between 30% and 40% greater than the females of the same body weight. But when top male and female performances are compared in powerlifting, without imposing any artificial limitations on bodyweight, the male record is 65% higher than the female record. (Hilton 2021 at 203.)

20. In another measure that combines many muscle groups as well as weight and speed, moderately trained males generated 162% greater punching power than females even though men do not possess this large an advantage in any single bio-mechanical variable. (Morris 2020.) This objective reality was subjectively summed up by women's mixed-martial arts fighter Tamikka Brents, who suffered significant facial injuries when she fought against a biological male who identified as female and fought under the name of Fallon Fox. Describing the experience, Brents said:

> "I've fought a lot of women and have never felt the strength that I felt in a fight as I did that night. I can't answer whether it's because she was born a man or not because I'm not a doctor. I can only say, I've never felt so overpowered ever in my life, and I am an abnormally strong female in my own right."[4]

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[3] Citing Silverman, *The secular trend for grip strength in Canada and the United States*, J. Ports Sci. 29:599-606 (2011).

[4] http://whoatv.com/exclusive-fallon-foxs-latest-opponent-opens-up-to-whoatv/ (last accessed October 5, 2021).

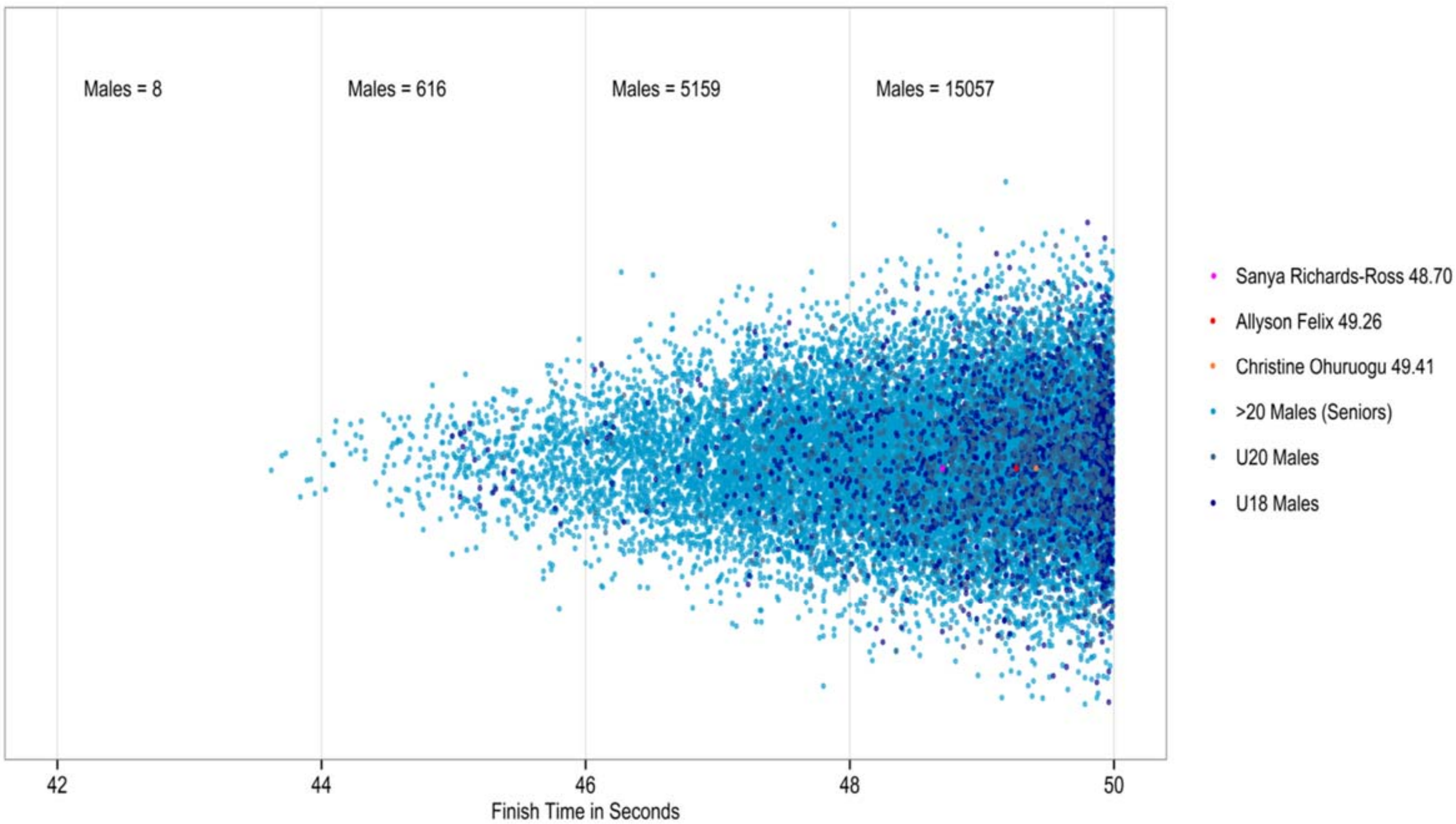
B. Men run faster.

21. Many scholars have detailed the wide performance advantages enjoyed by men in running speed. One can come at this reality from a variety of angles.

22. Multiple authors report a male speed advantage in the neighborhood of 10%-13% in a variety of events, with a variety of study populations. Handelsman et al. 2018 at 813 and Handelsman 2017 at 70 both report a male advantage of about 10% by age 17. Thibault et al. 2010 at 217 similarly reported a stable 10% performance advantage across multiple events at the Olympic level. Tønnessen et al. (2015 at 1-2) surveyed the data and found a consistent male advantage of 10%-12% in running events after the completion of puberty. They document this for both short sprints and longer distances. One group of authors found that the male advantage increased dramatically in ultra-long-distance competition (Lepers & Knechtle 2013.)

23. A great deal of current interest has been focused on track events. It is worth noting that a recent analysis of publicly available sports federation and tournament records found that men enjoy the *least* advantage in running events, as compared to a range of other events and metrics, including jumping, pole vaulting, tennis serve speed, golf drives, baseball pitching speed, and weightlifting. (Hilton 2021 at 201-202.) Nevertheless, as any serious runner will recognize, the approximately 10% male advantage in running is an overwhelming difference. Dr. Hilton calculates that "approximately 10,000 males have personal best times that are faster than the current Olympic 100m female champion." (Hilton 2021 at 204.) Professors Doriane Coleman, Jeff Wald, Wickliffe Shreve, and Richard Clark dramatically illustrated this by compiling the data and creating the figure below (last accessed on February 10, 2022, at https://bit.ly/35yOyS4), which shows that the *lifetime best performances* of three female Olympic champions in the 400m event—including Team USA's Sanya Richards-Ross and Allyson Felix—would not match the performances of "literally thousands of boys and men, including thousands who would be considered second tier in the men's category" *just in 2017 alone*: (data were drawn from the International Association of Athletics Federations (IAAF) website which provides complete, worldwide results for individuals and events, including on an annual and an all-time basis).

Comparing the Best Elite Females to Boys and Men:
Personal Bests for 3 Female Gold Medalists versus 2017 Performances by Boys and Men



24. Professor Coleman and her colleague Wicklyffe Shreve also created the table below (last accessed on February 10, 2022, at https://bit.ly/37E1s2X), which "compares the number of men—males over 18—competing in events reported to the International Association of Athletics Federation whose results in each event in 2017 would have ranked them above the very best elite woman that year."

TABLE 2 – World's Best Woman v. Number of Men Outperforming			
Event	Best Women's Result	Best Men's Result	# of Men Outperforming
100 Meters	10.71	9.69	2,474
200 Meters	21.77	19.77	2,920
400 Meters	49.46	43.62	4,341
800 Meters	1:55.16*	1:43.10	3,992+
1500 Meters	3:56.14	3:28.80	3,216+
3000 Meters	8:23.14	7:28.73	1307+
5000 Meters	14:18.37	12:55.23	1,243
High Jump	2.06 meters	2.40 meters	777
Pole Vault	4.91 meters	6.00 meters	684
Long Jump	7.13 meters	8.65 meters	1,652
Triple Jump	14.96 meters	18.11 meters	969

25. The male advantage becomes insuperable well before the developmental changes of puberty are complete. Dr. Hilton documents that even "schoolboys"–defined as age 15 and under–have beaten the female world records in running, jumping, and throwing events. (Hilton 2021 at 204.)

26. Similarly, Coleman and Shreve created the table below (last accessed on February 10, 2022, at https://bit.ly/37E1s2X), which "compares the number of boys—males under the age of 18—whose results in each event in 2017 would rank them above the single very best elite [adult] woman that year:" data were drawn from the International Association of Athletics Federations (IAAF) website

TABLE 1 – World's Best Woman v. Under 18 Boys			
Event	Best Women's Result	Best Boys' Result	# of Boys Outperforming
100 Meters	10.71	10.15	124+
200 Meters	21.77	20.51	182
400 Meters	49.46	45.38	285
800 Meters	1:55.16*	1:46.3	201+
1500 Meters	3:56.14	3:37.43	101+
3000 Meters	8:23.14	7:38.90	30
5000 Meters	14:18.37	12:55.58	15
High Jump	2.06 meters	2.25 meters	28
Pole Vault	4.91 meters	5.31 meters	10
Long Jump	7.13 meters	7.88 meters	74
Triple Jump	14.96 meters	17.30 meters	47

27. In an analysis I have performed of running events (consisting of the 100 m, 200 m, 400 m, 800 m, 1500 m, 5000 m, and 10000 m) in the Division 1, Division 2, and Division 3 NCAA Outdoor track championships for the years of 2010-2019, the average performance across all events of the 1st place man was 14.1% faster than the 1st place woman, with the smallest difference being a 10.2% advantage for men in the Division 1 100 m race. The average 8th place man across all events (the last place to earn the title of All American) was 11.2% faster than 1st place woman, with the smallest difference being a 6.5% advantage for men in the Division 1 100 m race. (Brown et al. Unpublished observations, to be presented at the 2022 Annual Meeting of the American College of Sports Medicine.)

28. Athletic.net® is an internet-based resource providing "results, team, and event management tools to help coaches and athletes thrive." Among the resources available on Athletic.net are event records that can be searched by nationally or by state age group, school grade, and state. Higerd (2021) in an evaluation of high school track running performance records from five states(CA, FL, MN, NY, WA), over three years (2017 – 2019) observed that males were 14.38% faster than females in the 100M (at 99), 16.17% faster in the 200M (at 100), 17.62% faster in the 400M (at 102), 17.96% faster in the 800M (at 103), 17.81% faster in the 1600M (at 105), and 16.83% faster in the 3200M (at 106).

C. Men jump higher and farther.

29. Jumping involves both leg strength and speed as positive factors, with body weight of course a factor working against jump height. Despite their substantially greater body weight, males enjoy an even greater advantage in jumping than in running. Handelsman 2018 at 813, looking at youth and young adults, and Thibault 2010 at 217, looking at Olympic performances, both found male advantages in the range of 15%-20%. See also Tønnessen 2015 (approximately 19%); Handelsman 2017 (19%); Hilton 2021 at 201 (18%). Looking at the vertical jump called for in volleyball, research on elite volleyball players found that males jumped on average 50% higher during an "attack" at the net than did females. (Sattler 2015; see also Hilton 2021 at 203 (33% higher vertical jump).)

30. Higerd (2021) in an evaluation of high school high jump performance available through the track and field database athletic.net®, which included five states (CA, FL, MN, NY, WA), over three years (2017 – 2019) (at 82) observed that in 23,390 females and 26,843 males, females jumped an average of 1.35 m and males jumped an average of 1.62 m, for an 18.18% performance advantage for males (at 96). In an evaluation of long jump performance in 45,705 high school females and 54,506 high school males the females jumped an average of 4.08 m and males jumped an average of 5.20 m, for a 24.14% performance advantage for males (at 97).

31. The combined male advantage of body height and jump height means, for example, that a total of seven women in the WNBA have ever dunked a basketball in the regulation 10 foot hoop,[5] while the ability to dunk appears to be almost universal among NBA players: "Since the 1996–97 season (the earliest data is available from Basketball-Reference.com), 1,801 different [NBA] players have combined for 210,842 regular-season dunks, and 1,259 out of 1,367 players (or 92%) who have played at least 1,000 minutes have dunked at least once."[6]

D. Men throw, hit, and kick faster and farther.

32. Strength, arm-length, and speed combine to give men a large advantage over women in throwing. This has been measured in a number of studies.

33. One study of elite male and female baseball pitchers showed that men throw baseballs 35% faster than women—81 miles/hour for men vs. 60 miles/hour for women. (Chu 2009.) By age 12, "boys' throwing velocity is already between 3.5 and 4 standard deviation units higher than the girls'." (Thomas 1985 at 276.) By age seventeen, the *average* male can throw a ball farther than 99% of seventeen-year-old females. (Lombardo 2018; Chu 2009; Thomas 1985 at 268.) Looking at publicly available data, Hilton & Lundberg found that in both baseball pitching and the field hockey "drag flick," the *record* ball speeds achieved by males are more than 50% higher than those achieved by females. (Hilton 2021 at 202-203.)

34. Men achieve serve speeds in tennis more that 15% faster than women; and likewise in golf achieve ball speeds off the tee more than 15% faster than women. (Hilton 2021 at 202.)

35. Males are able to throw a javelin more than 30% farther than females. (Lombardo 2018 Table 2; Hilton 2021 at 203.)

36. Men serve and spike volleyballs with higher velocity than women, with a performance advantage in the range of 29-34%. (Hilton 2021 at 204 Fig. 1.)

37. Men are also able to kick balls harder and faster. A study comparing collegiate soccer players found that males kick the ball with an average 20% greater velocity than females. (Sakamoto 2014.)

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[5] https://www.espn.com/wnba/story/_/id/32258450/2021-wnba-playoffs-brittney-griner-owns-wnba-dunking-record-coming-more.

[6] https://www.si.com/nba/2021/02/22/nba-non-dunkers-patty-mills-tj-mcconnell-steve-novak-daily-cover

E. Males exhibit faster reaction times.

38. Interestingly, men enjoy an additional advantage over women in reaction time–an attribute not obviously related to strength or metabolism (e.g. $V0_2$max). "Reaction time in sports is crucial in both simple situations such as the gun shot in sprinting and complex situations when a choice is required. In many team sports this is the foundation for tactical advantages which may eventually determine the outcome of a game." (Dogan 2009 at 92.) "Reaction times can be an important determinant of success in the 100m sprint, where medals are often decided by hundredths or even thousandths of a second." (Tønnessen 2013 at 885.)

39. The existence of a sex-linked difference in reaction times is consistent over a wide range of ages and athletic abilities. (Dykiert 2012.) Even by the age of 4 or 5, in a ruler-drop test, males have been shown to exhibit 4% to 6% faster reaction times than females. (Latorre-Roman 2018.) In high school athletes taking a common baseline "ImPACT" test, males showed 3% faster reaction times than females. (Mormile 2018.) Researchers have found a 6% male advantage in reaction times of both first-year medical students (Jain 2015) and world-class sprinters (Tønnessen 2013).

40. Most studies of reaction times use computerized tests which ask participants to hit a button on a keyboard or to say something in response to a stimulus. One study on NCAA athletes measured "reaction time" by a criterion perhaps more closely related to athletic performance–that is, how fast athletes covered 3.3 meters after a starting signal. Males covered the 3.3 meters 10% faster than females in response to a visual stimulus, and 16% faster than females in response to an auditory stimulus. (Spierer 2010.)

41. Researchers have speculated that sex-linked differences in brain structure, as well as estrogen receptors in the brain, may be the source of the observed male advantage in reaction times, but at present this remains a matter of speculation and hypothesis. (Mormile at 19; Spierer at 962.)

III. Men have large measured physiological differences compared to women which demonstrably or likely explain their performance advantages.

42. No single physiological characteristic alone accounts for all or any one of the measured advantages that men enjoy in athletic performance. However, scientists have identified and measured a number of physiological factors that contribute to superior male performance.

A. Men are taller and heavier than women

43. In some sports, such as basketball and volleyball, height itself provides competitive advantage. While some women are taller than some men, based on data from 20 countries in North America, Europe, East Asia, and Australia, the 50th percentile for body height for women is 164.7 cm (5 ft 5 inches) and the 50th percentile for body height for men is 178.4 cm (5 ft 10 inches). Helping to illustrate the inherent height difference between men and women, from the same data analysis, the 95th percentile for body height for women is 178.9 cm (5 feet 10.43 inches), which is only 0.5 cm taller than the 50th percentile for men (178.4 cm; 5 feet 10.24 inches), while the 95th percentile for body height for men is 193.6 cm (6 feet 4.22 inches). (Roser 2013.)

44. To look at a specific athletic population, an evaluation of NCAA Division 1 basketball players compared 68 male guards and 59 male forwards to 105 female guards and 91 female forwards, and found that on average the male guards were 187.4 ± 7.0 cm tall and weighed 85.2 ± 7.4 kg while the female guards were 171.6 ± 5.0 cm tall and weighed 68.0 ± 7.4 kg. The male forwards were 201.7 ± 4.0 cm tall and weighed 105.3 ± 5.9 kg while the female forwards were 183.5 ± 4.4 cm tall and weighed 82.2 ± 12.5 kg. (Fields 2018 at 3.)

B. Males have larger and longer bones, stronger bones, and different bone configuration.

45. Obviously, males on average have longer bones. "Sex differences in height have been the most thoroughly investigated measure of bone size, as adult height is a stable, easily quantified measure in large population samples. Extensive twin studies show that adult height is highly heritable with predominantly additive genetic effects that diverge in a sex-specific manner from the age of puberty onwards." (Handelsman 2018 at 818.) "Pubertal testosterone exposure leads to an ultimate average greater height in men of 12–15 centimeters, larger bones, greater muscle mass, increased strength and higher hemoglobin levels." (Gooren 2011 at 653.)

46. "Men have distinctively greater bone size, strength, and density than do women of the same age. As with muscle, sex differences in bone are absent prior to puberty but then accrue progressively from the onset of male puberty due to the sex difference in exposure to adult male circulating testosterone concentrations." (Handelsman 2018 at 818.)

47. "[O]n average men are 7% to 8% taller with longer, denser, and stronger bones, whereas women have shorter humerus and femur cross-sectional

areas being 65% to 75% and 85%, respectively, those of men." (Handelsman 2018 at 818.)

48. Greater height, leg, and arm length themselves provide obvious advantages in several sports. But male bone geometry also provides less obvious advantages. "The major effects of men's larger and stronger bones would be manifest via their taller stature as well as the larger fulcrum with greater leverage for muscular limb power exerted in jumping, throwing, or other explosive power activities." (Handelsman 2018 at 818.)

49. Male advantage in bone size is not limited to length, as larger bones provide the mechanical framework for larger muscle mass. "From puberty onwards, men have, on average, 10% more bone providing more surface area. The larger surface area of bone accommodates more skeletal muscle so, for example, men have broader shoulders allowing more muscle to build. This translates into 44% less upper body strength for women, providing men an advantage for sports like boxing, weightlifting and skiing. In similar fashion, muscle mass differences lead to decreased trunk and lower body strength by 64% and 72%, respectively in women. These differences in body strength can have a significant impact on athletic performance, and largely underwrite the significant differences in world record times and distances set by men and women." (Knox 2019 at 397.)

50. Meanwhile, distinctive aspects of the female pelvis geometry cut against athletic performance. "[T]he widening of the female pelvis during puberty, balancing the evolutionary demands of obstetrics and locomotion, retards the improvement in female physical performance." (Handelsman 2018 at 818.) "[T]he major female hormones, oestrogens, can have effects that disadvantage female athletic performance. For example, women have a wider pelvis changing the hip structure significantly between the sexes. Pelvis shape is established during puberty and is driven by oestrogen. The different angles resulting from the female pelvis leads to decreased joint rotation and muscle recruitment ultimately making them slower." (Knox 2019 at 397.)

51. There are even sex-based differences in foot size and shape. Wunderlich & Cavanaugh (2001) observed that a "foot length of 257 mm represents a value that is … approximately the 20th percentile men's foot lengths and the 80th percentile women's foot lengths." (607) and "For a man and a woman, both with statures of 170 cm (5 feet 7 inches), the man would have a foot that was approximately 5 mm longer and 2 mm wider than the woman." (608). Based on these, and other analyses, they conclude that "female feet and legs are not simply scaled-down versions of male feet but rather differ in a number of shape characteristics, particularly at the arch, the lateral side of the foot, the first toe, and the ball of the foot." (605) Further, Fessler et al. (2005) observed that "female foot length is consistently smaller than male foot length" (44) and concludes that

"proportionate foot length is smaller in women" (51) with an overall conclusion that "Our analyses of genetically disparate populations reveal a clear pattern of sexual dimorphism, with women consistently having smaller feet proportionate to stature than men." (53)

52. Beyond simple performance, the greater density and strength of male bones provide higher protection against stresses associated with extreme physical effort: "[S]tress fractures in athletes, mostly involving the legs, are more frequent in females, with the male protection attributable to their larger and thicker bones." (Handelsman 2018 at 818.)

C. Males have much larger muscle mass.

53. The fact that, on average, men have substantially larger muscles than women is as well known to common observation as men's greater height. But the male advantage in muscle size has also been extensively measured. The differential is large.

54. "On average, women have 50% to 60% of men's upper arm muscle cross-sectional area and 65% to 70% of men's thigh muscle cross-sectional area, and women have 50% to 60% of men's upper limb strength and 60% to 80% of men's leg strength. Young men have on average a skeletal muscle mass of >12 kg greater than age-matched women at any given body weight." (Handelsman 2018 at 812. See also Gooren 2011 at 653, Thibault 2010 at 214.)

55. "There is convincing evidence that the sex differences in muscle mass and strength are sufficient to account for the increased strength and aerobic performance of men compared with women and is in keeping with the differences in world records between the sexes." (Handelsman 2018 at 816.)

56. Once again, looking at specific and comparable populations of athletes, an evaluation of NCAA Division 1 basketball players consisting of 68 male guards and 59 male forwards, compared to 105 female guards and 91 female forwards, reported that on average the male guards had 77.7 ± 6.4 kg of fat free mass and 7.4 ± 3.1 kg fat mass while the female guards had 54.6 ± 4.4 kg fat free mass and 13.4 ± 5.4 kg fat mass. The male forwards had 89.5 ± 5.9 kg fat free mass and 15.9 ± 5.6 kg fat mass while the female forwards had 61.8 ± 5.9 kg fat free mass and 20.5 ± 7.7 kg fat mass. (Fields 2018 at 3.)

D. Females have a larger proportion of body fat.

57. While women have smaller muscles, they have proportionately more body fat, in general a negative for athletic performance. "Oestrogens also affect body

composition by influencing fat deposition. Women, on average, have higher percentage body fat, and this holds true even for highly trained healthy athletes (men 5%–10%, women 8%–15%). Fat is needed in women for normal reproduction and fertility, but it is not performance-enhancing. This means men with higher muscle mass and less body fat will normally be stronger kilogram for kilogram than women." (Knox 2019 at 397.)

58. "[E]lite females have more (<13 vs. <5 %) body fat than males. Indeed, much of the difference in [maximal oxygen uptake] between males and females disappears when it is expressed relative to lean body mass. . . . Males possess on average 7–9 % less percent body fat than females." (Lepers 2013 at 853.)

59. Knox et al. observe that both female pelvis shape and female body fat levels "disadvantage female athletes in sports in which speed, strength and recovery are important," (Knox 2019 at 397), while Tønnessen et al. describe the "ratio between muscular power and total body mass" as "critical" for athletic performance. (Tønnessen 2015 at 7.)

E. Males are able to metabolize and release energy to muscles at a higher rate due to larger heart and lung size, and higher hemoglobin concentrations.

60. While advantages in bone size, muscle size, and body fat are easily perceived and understood by laymen, scientists also measure and explain the male athletic advantage at a more abstract level through measurements of metabolism, or the ability to deliver energy to muscles throughout the body.

61. Energy release at the muscles depends centrally on the body's ability to deliver oxygen to the muscles, where it is essential to the complex chain of biochemical reactions that make energy available to power muscle fibers. Men have multiple distinctive physiological attributes that together give them a large advantage in oxygen delivery.

62. Oxygen is taken into the blood in the lungs. Men have greater capability to take in oxygen for multiple reasons. "**[L]ung capacity** [is] larger in men because of a lower diaphragm placement due to Y-chromosome genetic determinants." (Knox 2019 at 397.) Supporting larger lung capacity, men have "greater cross-sectional area of the trachea"; that is, they can simply move more air in and out of their lungs in a given time. (Hilton 2021 at 201.)

63. More, male lungs provide superior oxygen exchange even for a given volume: "The greater lung volume is complemented by testosterone-driven **enhanced alveolar multiplication** rate during the early years of life. Oxygen exchange takes place between the air we breathe and the bloodstream at the alveoli,

so more alveoli allows more oxygen to pass into the bloodstream. Therefore, the greater lung capacity allows more air to be inhaled with each breath. This is coupled with an improved uptake system allowing men to absorb more oxygen." (Knox 2019 at 397.)

64. "Once in the blood, oxygen is carried by haemoglobin. **Haemoglobin concentrations** are directly modulated by testosterone so men have higher levels and can carry more oxygen than women." (Knox 2019 at 397.) "It is well known that levels of circulating hemoglobin are androgen-dependent and consequently higher in men than in women by 12% on average…. Increasing the amount of hemoglobin in the blood has the biological effect of increasing oxygen transport from lungs to tissues, where the increased availability of oxygen enhances aerobic energy expenditure." (Handelsman 2018 at 816.) (See also Lepers 2013 at 853; Handelsman 2017 at 71.) "It may be estimated that as a result the average maximal oxygen transfer will be ~10% greater in men than in women, which has a direct impact on their respective athletic capacities." (Handelsman 2018 at 816.)

65. But the male metabolic advantage is further multiplied by the fact that men are also able to **circulate more blood per second** than are women. "Oxygenated blood is pumped to the active skeletal muscle by the heart. The left ventricle chamber of the heart is the reservoir from which blood is pumped to the body. The larger the left ventricle, the more blood it can hold, and therefore, the more blood can be pumped to the body with each heartbeat, a physiological parameter called 'stroke volume'.The female heart size is, on average, 85% that of a male resulting in the stroke volume of women being around 33% less." (Knox 2018 at 397.) Hilton cites different studies that make the same finding, reporting that men on average can pump 30% more blood through their circulatory system per minute ("cardiac output") than can women. (Hilton 2021 at 202.)

66. Finally, at the cell where the energy release is needed, men appear to have yet another advantage. "Additionally, there is experimental evidence that testosterone increases . . . **mitochondrial biogenesis**, myoglobin expression, and IGF-1 content, which may augment energetic and power generation of skeletal muscular activity." (Handelsman 2018 at 811.)

67. "Putting all of this together, men have a much more efficient cardiovascular and respiratory system." (Knox 2019 at 397.) A widely accepted measurement that reflects the combined effects of all these respiratory, cardiovascular, and metabolic advantages is referred to as "$V0_2max$," which refers to the maximum rate at which an individual can consume oxygen during aerobic

exercise.[7] Looking at 11 separate studies, including both trained and untrained individuals, Pate et al. concluded that men have a 50% higher $V0_2$max than women on average, and a 25% higher $V0_2$max in relation to body weight. (Pate 1984 at 92. See also Hilton 2021 at 202.)

IV. The role of testosterone in the development of male advantages in athletic performance.

68. The following tables of reference ranges for circulating testosterone in males and females are presented to help provide context for some of the subsequent information regarding athletic performance and physical fitness in children, youth, and adults, and regarding testosterone suppression in transwomen and athletic regulations. These data were obtained from the Mayo Clinic Laboratories (available at https://www.mayocliniclabs.com/test-catalog/overview/83686#Clinical-and-Interpretive, accessed January 14, 2022).

Reference ranges for serum testosterone concentrations in males and females.

Age	**Males**	**Females**
0 – 5 months	2.6 – 13.9 nmol/l	0.7 – 2.8 nmol/l
6 months – 9 years	0.2 – 0.7 nmol/l	0.2 – 0.7 nmol/l
10 – 11 years	0.2 – 4.5 nmol/l	0.2 – 1.5 nmol/l
12 -13 years	0.2 – 27.7 nmol/l	0.2 – 2.6 nmol/l
14 years	0.2 – 41.6 nmol/l	0.2 – 2.6 nmol/l
15 – 16 years	3.5 – 41.6 nmol/l	0.2 – 2.6 nmol/l
17 – 18 years	10.4 – 41.6 nmol/l	0.7 – 2.6 nmol/l
19 years and older	8.3 – 32.9 nmol/l	0.3 – 2.1 nmol/l

Please note that testosterone concentrations are sometimes expressed in units of ng/dl, and 1 nmol/l = 28.85 ng/dl.

69. Tanner Stages can be used to help evaluate the onset and progression of puberty and may be more helpful in evaluating normal testosterone concentrations than age in adolescents. "Puberty onset (transition from Tanner stage I to Tanner stage II) occurs for boys at a median age of 11.5 years and for girls

[7] $V0_2$max is "based on hemoglobin concentration, total blood volume, maximal stroke volume, cardiac size/mass/compliance, skeletal muscle blood flow, capillary density, and mitochondrial content." International Statement, *The Role of Testosterone in Athletic Performance* (January 2019), available at https://law.duke.edu/sites/default/files/centers/sportslaw/Experts_T_Statement_2019.pdf.

at a median age of 10.5 years. . . . Progression through Tanner stages is variable. Tanner stage V (young adult) should be reached by age 18." (https://www.mayocliniclabs.com/test-catalog/overview/83686#Clinical-and-Interpretive, accessed January 14, 2022).

Reference Ranges for serum testosterone concentrations by Tanner stage

Tanner Stage	**Males**	**Females**
I (prepubertal)	0.2 – 0.7 nmol/l	0.7 – 0.7 nmol/l
II	0.3 – 2.3 nmo/l	0.2 – 1.6 nmol/l
III	0.9 – 27.7 nmol/l	0.6 – 2.6 nmol/l
IV	2.9 – 41.6 nmol/l	0.7 – 2.6 nmol/l
V (young adult)	10.4 – 32.9 nmol/	0.4 – 2.1 nmol/l

70. Senefeld et al. (2020 at 99) state that "Data on testosterone levels in children and adolescents segregated by sex are scarce and based on convenience samples or assays with limited sensitivity and accuracy." They therefore "analyzed the timing of the onset and magnitude of the divergence in testosterone in youths aged 6 to 20 years by sex using a highly accurate assay" (isotope dilution liquid chromatography tandem mass spectrometry). Senefeld observed a significant difference beginning at age 11, which is to say about fifth grade.

Serum testosterone concentrations (nmol/L) in youths aged 6 to 20 years measured using isotope dilution liquid chromatography tandem mass spectrometry (Senefeld et al. ,2020, at 99)

	Boys			**Girls**		
Age (y)	**5th**	**50th**	**95th**	**5th**	**50th**	**95th**
6	0.0	0.1	0.2	0.0	0.1	0.2
7	0.0	0.1	0.2	0.0	0.1	0.3
8	0.0	0.1	0.3	0.0	0.1	0.3
9	0.0	0.1	0.3	0.1	0.2	0.6
10	0.1	0.2	2.6	0.1	0.3	0.9
11	0.1	0.5	11.3	0.2	0.5	1.3
12	0.3	3.6	17.2	0.2	0.7	1.4
13	0.6	9.2	21.5	0.3	0.8	1.5
14	2.2	11.9	24.2	0.3	0.8	1.6
15	4.9	13.2	25.8	0.4	0.8	1.8
16	5.2	14.9	24.1	0.4	0.9	2.0
17	7.6	15.4	27.0	0.5	1.0	2.0
18	9.2	16.3	25.5	0.4	0.9	2.1
19	8.1	17.2	27.9	0.4	0.9	2.3
20	6.5	17.9	29.9	0.4	1.0	3.4

A. Boys exhibit advantages in athletic performance even before puberty.

71. It is often said or assumed that boys enjoy no significant athletic advantage over girls before puberty. However, this is not true. Writing in their seminal work on the physiology of elite young female athletes, McManus and Armstrong (2011) reviewed the differences between boys and girls regarding bone density, body composition, cardiovascular function, metabolic function, and other physiologic factors that can influence athletic performance. They stated, "At birth, boys tend to have a greater lean mass than girls. This difference remains small but detectable throughout childhood with about a 10% greater lean mass in boys than girls prior to puberty." (28) "Sexual dimorphism underlies much of the physiologic response to exercise," and most importantly these authors concluded that, "Young girl athletes are not simply smaller, less muscular boys." (23)

72. Certainly, boys' physiological and performance advantages increase rapidly from the beginning of puberty until around age 17-19. But much data and multiple studies show that significant physiological differences, and significant male athletic performance advantages in certain areas, exist before significant developmental changes associated with male puberty have occurred.

73. Starting at birth, girls have more body fat and less fat-free mass than boys. Davis et al. (2019) in an evaluation of 602 infants reported that at birth and age 5 months, infant boys have larger total body mass, body length, and fat-free mass while having lower percent body fat than infant girls. In an evaluation of 20 boys and 20 girls ages 3-8 years old, matched for age, height, and body weight Taylor et al. (Taylor 1997) reported that the "boys had significantly less fat, a lower % body fat and a higher bone-free lean tissue mass than the girls" when "expressed as a percentage of the average fat mass of the boys", the girls' fat mass was 52% higher than the boys "…while the bone-free lean tissue mass was 9% lower" (at 1083.) In an evaluation of 376 prepubertal [Tanner Stage 1] boys and girls, Taylor et al. (2010) observed that the boys had 21.6% more lean mass, and 13% less body fat (when expressed as percent of total body mass) than did the girls. In a review of 22 peer reviewed publications on the topic, Staiano and Katzmarzyk (2012) conclude that "… girls have more T[otal]B[ody]F[at] than boys throughout childhood and adolescence. (at 4.)

74. In the seminal textbook, *Growth, Maturation, and Physical Activity*, Malina et al. (2004) present a summary of data from Gauthier et al. (1983) which present data from "a national sample of Canadian children and youth" demonstrating that from ages 7 to17, boys have a higher aerobic power output than do girls of the same ages when exercise intensity is measured using heart rate

(Malina at 242.) That is to say, that at a heart rate of 130 beats per minute, or 150, or 170, a 7 to 17 year old boy should be able to run, bike, or swim faster than a similarly aged girl.

75. Considerable data from school-based fitness testing exists showing that prepubertal boys outperform comparably aged girls in tests of muscular strength, muscular endurance, and running speed. These sex-based differences in physical fitness are relevant to the current issue of sex-based sports categories because, as stated by Lesinski et al. (2020), in an evaluation "of 703 male and female elite young athletes aged 8–18" (1) "fitness development precedes sports specialization" (2) and further observed that "males outperformed females in C[ounter]M[ovement]J[ump], D[rop]J[ump], C[hange]o[f]D[irection speed] performances and hand grip strength." (5).

76. Tambalis et al. (2016) states that "based on a large data set comprising 424,328 test performances" (736) using standing long jump to measure lower body explosive power, sit and reach to measure flexibility, timed 30 second sit ups to measure abdominal and hip flexor muscle endurance, 10 x 5 meter shuttle run to evaluate speed and agility, and multi-stage 20 meter shuttle run test to estimate aerobic performance (738). "For each of the fitness tests, performance was better in boys compared with girls ($p < 0.001$), except for the S[it and] R[each] test ($p < 0.001$)." (739) In order to illustrate that the findings of Tambalis (2016) are not unique to children in Greece, the authors state "Our findings are in accordance with recent studies from Latvia [ ] Portugal [ ] and Australia [Catley & Tomkinson (2013)]."(744).

77. The 20-m multistage fitness test is a commonly used maximal running aerobic fitness test used in the Eurofit Physical Fitness Test Battery and the FitnessGram Physical Fitness test. It is also known as the 20-meter shuttle run test, PACER test, or beep test (among other names; this is not the same test as the shuttle run in the Presidential Fitness Test). This test involves continuous running between two lines 20 meters apart in time to recorded beeps. The participants stand behind one of the lines facing the second line and begin running when instructed by the recording. The speed at the start is quite slow. The subject continues running between the two lines, turning when signaled by the recorded beeps. After about one minute, a sound indicates an increase in speed, and the beeps will be closer together. This continues each minute (level). If the line is reached before the beep sounds, the subject must wait until the beep sounds before continuing. If the line is not reached before the beep sounds, the subject is given a warning and must continue to run to the line, then turn and try to catch up with the pace within two more 'beeps'. The subject is given a warning the first time they fail to reach the line (within 2 meters) and eliminated after the second warning.

78. To illustrate the sex-based performance differences observed by Tambalis, I have prepared the following table showing the number of laps completed in the 20 m shuttle run for children ages 6-18 years for the low, middle, and top decile (Tambalis 2016 at 740 & 742), and have calculated the percent difference between the boys and girls using the same equation as Millard-Stafford (2018).

Performance difference between boys and girls ÷ Girls performance

Number of laps completed in the 20m shuttle run for children ages 6-18 years

	Male			Female			Male-Female % Difference		
Age	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**
6	4	14	31	4.0	12.0	26.0	0.0%	16.7%	19.2%
7	8	18	38	8.0	15.0	29.0	0.0%	20.0%	31.0%
8	9	23	47	9.0	18.0	34.0	0.0%	27.8%	38.2%
9	11	28	53	10.0	20.0	40.0	10.0%	40.0%	32.5%
10	12	31	58	11.0	23.0	43.0	9.1%	34.8%	34.9%
11	15	36	64	12.0	26.0	48.0	25.0%	38.5%	33.3%
12	15	39	69	12.0	26.0	49.0	25.0%	50.0%	40.8%
13	16	44	76	12.0	26.0	50.0	33.3%	69.2%	52.0%
14	19	50	85	12.0	26.0	50.0	58.3%	92.3%	70.0%
15	20	53	90	12.0	25.0	47.0	66.7%	112.0%	91.5%
16	20	54	90	11.0	24.0	45.0	81.8%	125.0%	100.0%
17	18	50	86	10.0	23.0	50.0	80.0%	117.4%	72.0%
18	13	48	87	8.0	23.0	39.5	62.5%	108.7%	120.3%

79. The Presidential Fitness Test was widely used in schools in the United States from the late 1950s until 2013 (when it was phased out in favor of the Presidential Youth Fitness Program and FitnessGram, both of which focus on health-related physical fitness and do not present data in percentiles). Students participating in the Presidential Fitness Test could receive "The National Physical Fitness Award" for performance equal to the 50th percentile in five areas of the fitness test, "while performance equal to the 85th percentile could receive the Presidential Physical Fitness Award." Tables presenting the 50th and 85th percentiles for the Presidential Fitness Test for males and females ages 6 – 17, and differences in performance between males and females, for curl-ups, shuttle run, 1 mile run, push-ups, and pull-ups appear in the Appendix.

80. For both the 50th percentile (The National Physical Fitness Award) and the 85th percentile (Presidential Physical Fitness Award), with the exception of curl-ups in 6-year-old children, boys outperform girls. The difference in pull-ups for the 85th percentile for ages 7 through 17 are particularly informative with boys

outperforming girls by 100% – 1200%, highlighting the advantages in upper body strength in males.

81. A very recent literature review commissioned by the five United Kingdom governmental Sport Councils concluded that while "[i]t is often assumed that children have similar physical capacity regardless of their sex, . . . large-scale data reports on children from the age of six show that young males have significant advantage in cardiovascular endurance, muscular strength, muscular endurance, speed/agility and power tests," although they "score lower on flexibility tests." (UK Sports Councils' Literature Review 2021 at 3.)

82. Hilton et al., also writing in 2021, reached the same conclusion: "An extensive review of fitness data from over 85,000 Australian children aged 9–17 years old showed that, compared with 9-year-old females, 9-year-old males were faster over short sprints (9.8%) and 1 mile (16.6%), could jump 9.5% further from a standing start (a test of explosive power), could complete 33% more push-ups in 30 [seconds] and had 13.8% stronger grip." (Hilton 2021 at 201, summarizing the findings of Catley & Tomkinson 2013.)

83. The following data are taken from Catley & Tomkinson (2013 at 101) showing the low, middle, and top decile for 1.6 km run (1.0 mile) run time for 11,423 girls and boys ages 9-17.

1.6 km run (1.0 mile) run time for 11,423 girls and boys ages 9-17

	Male			Female			Male-Female % Difference		
Age	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**
9	684	522	423	769.0	609.0	499.0	11.1%	14.3%	15.2%
10	666	511	420	759.0	600.0	494.0	12.3%	14.8%	15.0%
11	646	500	416	741.0	586.0	483.0	12.8%	14.7%	13.9%
12	621	485	408	726.0	575.0	474.0	14.5%	15.7%	13.9%
13	587	465	395	716.0	569.0	469.0	18.0%	18.3%	15.8%
14	556	446	382	711.0	567.0	468.0	21.8%	21.3%	18.4%
15	531	432	373	710.0	570.0	469.0	25.2%	24.2%	20.5%
16	514	423	366	710.0	573.0	471.0	27.6%	26.2%	22.3%
17	500	417	362	708.0	575.0	471.0	29.4%	27.5%	23.1%

84. Tomkinson et al. (2018) performed a similarly extensive analysis of literally millions of measurements of a variety of strength and agility metrics from the "Eurofit" test battery on children from 30 European countries. They provide detailed results for each metric, broken out by decile. Sampling the low, middle, and top decile, 9-year-old boys performed better than 9-year-old girls by between 6.5%

and 9.7% in the standing broad jump; from 11.4% to 16.1% better in handgrip; and from 45.5% to 49.7% better in the "bent-arm hang." (Tomkinson 2018.)

85. The Bent Arm Hang test is a measure of upper body muscular strength and endurance used in the Eurofit Physical Fitness Test Battery. To perform the Bent Arm Hang, the child is assisted into position with the body lifted to a height so that the chin is level with the horizontal bar (like a pull up bar). The bar is grasped with the palms facing away from body and the hands shoulder width apart. The timing starts when the child is released. The child then attempts to hold this position for as long as possible. Timing stops when the child's chin falls below the level of the bar, or the head is tilted backward to enable the chin to stay level with the bar.

86. Using data from Tomkinson (2018; table 7 at 1452), the following table sampling the low, middle, and top decile for bent arm hang for 9- to 17-year-old children can be constructed:

Bent Arm Hang time (in seconds) for children ages 9 - 17 years

	Male			Female			Male-Female % Difference		
Age	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**
9	2.13	7.48	25.36	1.43	5.14	16.94	48.95%	45.53%	49.70%
10	2.25	7.92	26.62	1.42	5.15	17.06	58.45%	53.79%	56.04%
11	2.35	8.32	27.73	1.42	5.16	17.18	65.49%	61.24%	61.41%
12	2.48	8.79	28.99	1.41	5.17	17.22	75.89%	70.02%	68.35%
13	2.77	9.81	31.57	1.41	5.18	17.33	96.45%	89.38%	82.17%
14	3.67	12.70	38.39	1.40	5.23	17.83	162.14%	142.83%	115.31%
15	5.40	17.43	47.44	1.38	5.35	18.80	291.30%	225.79%	152.34%
16	7.39	21.75	53.13	1.38	5.63	20.57	435.51%	286.32%	158.29%
17	9.03	24.46	54.66	1.43	6.16	23.61	531.47%	297.08%	131.51%

87. Evaluating these data, a 9-year-old boy in the 50th percentile (that is to say a 9-year-old boy of average upper body muscular strength and endurance) will perform better in the bent arm hang test than 9 through 17-year-old girls in the 50th percentile. Similarly, a 9-year-old boy in the 90th percentile will perform better in the bent arm hang test than 9 through 17-year-old girls in the 90th percentile.

88. Using data from Tomkinson et al. (2017; table 1 at 1549), the following table sampling the low, middle, and top decile for running speed in the last stage of the 20 m shuttle run for 9- to 17-year-old children can be constructed.

20 m shuttle Running speed (km/h at the last completed stage)

	Male			Female			Male-Female % Difference		
Age	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile
9	8.94	10.03	11.13	8.82	9.72	10.61	1.36%	3.19%	4.90%
10	8.95	10.13	11.31	8.76	9.75	10.74	2.17%	3.90%	5.31%
11	8.97	10.25	11.53	8.72	9.78	10.85	2.87%	4.81%	6.27%
12	9.05	10.47	11.89	8.69	9.83	10.95	4.14%	6.51%	8.58%
13	9.18	10.73	12.29	8.69	9.86	11.03	5.64%	8.82%	11.42%
14	9.32	10.96	12.61	8.70	9.89	11.07	7.13%	10.82%	13.91%
15	9.42	11.13	12.84	8.70	9.91	11.11	8.28%	12.31%	15.57%
16	9.51	11.27	13.03	8.71	9.93	11.14	9.18%	13.49%	16.97%
17	9.60	11.41	13.23	8.72	9.96	11.09	10.09%	14.56%	19.30%

89. Evaluating these data, a 9-year-old boy in the 50th percentile (that is to say a 9-year-old boy of average running speed) will run faster in the final stage of the 20 m shuttle run than 9 through 17-year-old girls in the 50th percentile. Similarly, a 9-year-old boy in the 90th percentile will run faster in the final stage of the 20-m shuttle run than 9 through 15, and 17-year-old girls in the 90th percentile and will be 0.01 km/h (0.01%) slower than 16-year-old girls in the 90th percentile.

90. Just using these two examples for bent arm hang and 20-m shuttle running speed (Tomkinson 2107, Tomkinson 2018) based on large sample sizes (thus having tremendous statistical power) it becomes apparent that a 9-year-old boy will be very likely to outperform similarly trained girls of his own age and older in athletic events involving upper body muscle strength and/or running speed.

91. Another report published in 2014 analyzed physical fitness measurements of 10,302 children aged 6 -10.9 years of age, from the European countries of Sweden, Germany, Hungary, Italy, Cyprus, Spain, Belgium, and Estonia. (De Miguel-Etayo et al. 2014.) The authors observed "… that boys performed better than girls in speed, lower- and upper-limb strength and cardiorespiratory fitness." (57) The data showed that for children of comparable fitness (i.e. 99th percentile boys vs. 99th percentile girls, 50th percentile boys vs. 50th percentile girls, etc.) the boys outperform the girls at every age in measurements of handgrip strength, standing long jump, 20-m shuttle run, and predicted VO_2max (pages 63 and 64, respectively). For clarification, VO_2max is the maximal oxygen consumption, which correlates to 30-40% of success in endurance sports.

92. The standing long jump, also called the Broad Jump, is a common and easy to administer test of explosive leg power used in the Eurofit Physical Fitness Test Battery and in the NFL Combine. In the standing long jump, the participant stands behind a line marked on the ground with feet slightly apart. A two-foot take-

off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The participant attempts to jump as far as possible, landing on both feet without falling backwards. The measurement is taken from takeoff line to the nearest point of contact on the landing (back of the heels) with the best of three attempts being scored.

93. Using data from De Miguel-Etayo et al. (2014, table 3 at 61), which analyzed physical fitness measurements of 10,302 children aged 6 -10.9 years of age, from the European countries of Sweden, Germany, Hungary, Italy, Cyprus, Spain, Belgium, and Estonia, the following table sampling the low, middle, and top decile for standing long jump for 6- to 9-year-old children can be constructed:

Standing Broad Jump (cm) for children ages 6-9 years

	Male			Female			Male-Female % Difference		
Age	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile	10th %ile	50th %ile	90th %ile
6-<6.5	77.3	103.0	125.3	69.1	93.8	116.7	11.9%	9.8%	7.4%
6.5-<7	82.1	108.0	130.7	73.6	98.7	121.9	11.5%	9.4%	7.2%
7-<7.5	86.8	113.1	136.2	78.2	103.5	127.0	11.0%	9.3%	7.2%
7.5-<8	91.7	118.2	141.6	82.8	108.3	132.1	10.7%	9.1%	7.2%
8-<8.5	96.5	123.3	146.9	87.5	113.1	137.1	10.3%	9.0%	7.1%
8.5-<9	101.5	128.3	152.2	92.3	118.0	142.1	10.0%	8.7%	7.1%

94. Another study of Eurofit results for over 400,000 Greek children reported similar results. "[C]ompared with 6-year-old females, 6-year-old males completed 16.6% more shuttle runs in a given time and could jump 9.7% further from a standing position." (Hilton 2021 at 201, summarizing findings of Tambalis et al. 2016.)

95. Silverman (2011) gathered hand grip data, broken out by age and sex, from a number of studies. Looking only at the nine direct comparisons within individual studies tabulated by Silverman for children aged 7 or younger, in eight of these the boys had strength advantages of between 13 and 28 percent, with the remaining outlier recording only a 4% advantage for 7-year-old boys. (Silverman 2011 Table 1.)

96. To help illustrate the importance of one specific measure of physical fitness in athletic performance, Pocek (2021) stated that to be successful, volleyball "players should distinguish themselves, besides in skill level, in terms of above-average body height, upper and lower muscular power, speed, and agility. Vertical jump is a fundamental part of the spike, block, and serve." (8377) Pocek further stated that "relative vertical jumping ability is of great importance in volleyball regardless of the players' position, while absolute vertical jump values can differentiate players not only in terms of player position and performance level but in their career trajectories." (8382)

97. Using data from Ramírez-Vélez (2017; table 2 at 994) which analyzed vertical jump measurements of 7,614 healthy Colombian schoolchildren aged 9 -17.9 years of age the following table sampling the low, middle, and top decile for vertical jump can be constructed:

Vertical Jump Height (cm) for children ages 9 - 17 years

	Male			Female			Male-Female % Difference		
Age	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**
9	18.0	24.0	29.5	16.0	22.3	29.0	12.5%	7.6%	1.7%
10	19.5	25.0	32.0	18.0	24.0	29.5	8.3%	4.2%	8.5%
11	21.0	27.0	32.5	19.5	25.0	31.0	7.7%	8.0%	4.8%
12	22.0	27.5	34.5	20.0	25.5	31.5	10.0%	7.8%	9.5%
13	23.0	30.5	39.0	19.0	25.5	32.0	21.1%	19.6%	21.9%
14	23.5	32.0	41.5	20.0	25.5	32.5	17.5%	25.5%	27.7%
15	26.0	35.5	43.0	20.2	26.0	32.5	28.7%	36.5%	32.3%
16	28.0	36.5	45.1	20.5	26.5	33.0	36.6%	37.7%	36.7%
17	28.0	38.0	47.0	21.5	27.0	35.0	30.2%	40.7%	34.3%

98. Similarly, using data from Taylor (2010; table 2, at 869) which analyzed vertical jump measurements of 1,845 children aged 10 -15 years in primary and secondary schools in the East of England, the following table sampling the low, middle, and top decile for vertical jump can be constructed:

Vertical Jump Height (cm) for children 10 -15 years

	Male			Female			Male-Female % Difference		
Age	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**	**10th %ile**	**50th %ile**	**90th %ile**
10	16.00	21.00	29.00	15.00	22.00	27.00	6.7%	-4.5%	7.4%
11	20.00	27.00	34.00	19.00	25.00	32.00	5.3%	8.0%	6.3%
12	23.00	30.00	37.00	21.00	27.00	33.00	9.5%	11.1%	12.1%
13	23.00	32.00	40.00	21.00	26.00	34.00	9.5%	23.1%	17.6%
14	26.00	36.00	44.00	21.00	28.00	34.00	23.8%	28.6%	29.4%
15	29.00	37.00	44.00	21.00	28.00	39.00	38.1%	32.1%	12.8%

99. As can be seen from the data from Ramírez-Vélez (2017) and Taylor (2010), males consistently outperform females of the same age and percentile in vertical jump height. Both sets of data show that an 11-year-old boy in the 90th percentile for vertical jump height will outperform girls in the 90th percentile at ages 11 and 12, and will be equal to girls at ages 13, 14, and possibly 15. These data indicate that an 11-year-old would be likely to have an advantage over girls of the same age and older in sports such as volleyball where "absolute vertical jump

values can differentiate players not only in terms of player position and performance level but in their career trajectories." (Pocek 2021 at 8382.)

100. Boys also enjoy an advantage in throwing well before puberty. "Boys exceed girls in throwing velocity by 1.5 standard deviation units as early as 4 to 7 years of age. . . The boys exceed the girls [in throwing distance] by 1.5 standard deviation units as early as 2 to 4 years of age." (Thomas 1985 at 266.) This means that the average 4- to 7-year-old boy can out-throw approximately 87% of all girls of his age.

101. Record data from USA Track & Field indicate that boys outperform girls in track events even in the youngest age group for whom records are kept (age 8 and under).[8]

American Youth Outdoor Track & Field Record times in age groups 8 and under (time in seconds)

Event	**Boys**	**Girls**	**Difference**
100M	13.65	13.78	0.95%
200M	27.32	28.21	3.26%
400M	62.48	66.10	5.79%
800M	148.59	158.11	6.41%
1500M	308.52	314.72	2.01%
Mean			3.68%

102. Looking at the best times within a single year shows a similar pattern of consistent advantage for even young boys. I consider the 2018 USATF Region 8 Junior Olympic Championships for the youngest age group (8 and under).[9]

2018 USATF Region 8 Junior Olympic Championships for the 8 and under age group

Event	**Boys**	**Girls**	**Difference**
100M	15.11	15.64	3.51%
200M	30.79	33.58	9.06%
400M	71.12	77.32	8.72%
800M	174.28	180.48	3.56%
1500M	351.43	382.47	8.83%
Mean			6.74%

[8] http://legacy.usatf.org/statistics/records/view.asp?division=american&location=outdoor%20track%20%26%20field&age=youth&sport=TF

[9] https://www.athletic.net/TrackAndField/meet/384619/results/m/1/100m

[9] https://www.athletic.net/CrossCountry/Division/List.aspx?DivID=62211

103. Using Athletic.net[9], for 2021 Cross Country and Track & Field data for boys and girls in the 7-8, 9-10, and 11-12 year old age group club reports, and for 5th, 6th, and 7th grade for the whole United States I have compiled the tables for 3000 m events, and for the 100-m, 200-m, 400-m, 800-m, 1600-m, 3000-m, long jump, and high jump Track and Field data to illustrate the differences in individual athletic performance between boys and girls, all of which appear in the Appendix. The pattern of males outperforming females was consistent across events, with rare anomalies, only varying in the magnitude of difference between males and females.

104. Similarly, using Athletic.net, for 2021 Track & Field data for boys and girls in the 6th grade for the state of West Virginia, I have compiled tables, which appear in the appendix, comparing the performance of boys and girls for the 100-m, 200-m, 400-m, 800-m, 1600-m, and 3200-m running events in which the 1st place boy was consistently faster than the 1st place girl, and the average performance of the top 10 boys was consistently faster than the average performance for the top 10 girls. Based on the finishing times for the 1st place boy and girl in the 6th grade in West Virginia 1600-m race, and extrapolating the running time to a running pace, the 1st place boy would be expected to finish 273 m in front of the 1st place girl, which is 2/3 of a lap on a standard 400-m track, or almost the length of 3 football fields. In comparison, the 1st place boy would finish 66 m in front of the 2nd place boy, and the 1st place girl would finish 20 m in front of the 2nd place girl.

Top 10 West Virginia boys and girls 6th grade outdoor track for 2021 (time in seconds)

	100 m			**200 m**			**400 m**		
	Boys	**Girls**		**Boys**	**Girls**		**Boys**	**Girls**	
1	13.18	14.00	Difference	26.97	29.28	Difference	60.04	65.50	Difference
2	13.94	14.19	between #1	29.38	30.05	between #1	60.48	67.51	between #1
3	14.07	14.47	boy and # 1	30.09	30.34	boy and # 1	66.26	68.60	boy and # 1
4	14.44	14.86	girl	30.10	30.73	girl	67.12	70.43	girl
5	14.46	14.92	5.9%	30.24	31.00	7.9%	68.28	71.09	8.3%
6	14.53	15.04		30.38	31.04		68.36	71.38	
7	14.75	15.04	Average	30.54	31.10	Average	69.65	73.61	Average
8	14.78	15.20	difference boys vs	30.69	31.10	difference boys vs	69.70	73.87	difference boys vs
9	14.84	15.25	girls	30.74	31.35	girls	69.76	74.07	girls
10	14.94	15.28	2.9%	30.99	31.64	2.4%	70.63	74.21	5.6%

	800 m			**1600 m**			**3200 m**		
	Boys	**Girls**		**Boys**	**Girls**		**Boys**	**Girls**	
1	147.2	164.5	Difference	305.5	357.8	Difference	678.4	776.6	Difference
2	147.9	166.1	between #1	318.1	361.6	between #1	750.0	809.8	between #1
3	152.1	167.2	boy and # 1	322.0	379.8	boy and # 1	763.3	811.0	boy and # 1
4	153.2	170.2	girl	336.0	385.2	girl	766.3	843.0	girl
5	155.3	171.0	10.6%	342.2	390.2	14.6%	771.7	850.6	12.7%
6	159.5	171.5		348.0	392.0		782.8	852.1	
7	159.9	174.8	Average	356.6	393.3	Average	794.1	858.0	Average
8	167.8	174.9	difference boys vs	357.5	395.7	difference boys vs	803.0	862.8	difference boys vs
9	169.2	175.9	girls	362.4	398.1	girls	812.1	869.9	girls
10	172.6	177.6	7.5%	366.0	403.2	11.5%	814.3	883.3	8.1%

105. As serious runners will recognize, differences of 3%, 5%, or 8% are not easily overcome. During track competition the difference between first and second place, or second and third place, or third and fourth place (and so on) is often 0.5 - 0.7%, with some contests being determined by as little as 0.01%.

106. I performed an analysis of running events (consisting of the 100-m, 200-m, 400-m, 800-m, 1500-m, 5000-m, and 10,000-m) in the Division 1, Division 2, and Division 3 NCAA Outdoor championships for the years of 2010-2019: the mean difference between 1st and 2nd place was 0.48% for men and 0.86% for women. The mean difference between 2nd and 3rd place was 0.46% for men and 0.57% for women. The mean difference between 3rd place and 4th place was 0.31% for men and 0.44% for women. The mean difference between 1st place and 8th place (the last place to earn the title of All American) was 2.65% for men and 3.77% for women. (Brown et al. Unpublished observations, to be presented at the 2022 Annual Meeting of the American College of Sports Medicine.)

107. A common response to empirical data showing pre-pubertal performance advantages in boys is the argument that the performance of boys may

represent a social–cultural bias for boys to be more physically active, rather than representing inherent sex-based differences in pre-pubertal physical fitness. However, the younger the age at which such differences are observed, and the more egalitarian the culture within which they are observed, the less plausible this hypothesis becomes. Eiberg et al. (2005) measured body composition, VO_2max, and physical activity in 366 Danish boys and 332 Danish girls between the ages of 6 and 7 years old. Their observations indicated that VO_2max was 11% higher in boys than girls. When expressed relative to body mass the boys' VO_2max was still 8% higher than the girls. The authors stated that "…no differences in haemoglobin or sex hormones[10] have been reported in this age group," yet "… when children with the same VO_2max were compared, boys were still more active, and in boys and girls with the same P[hysical] A[ctivity] level, boys were fitter." (728). These data indicate that in pre-pubertal children, in a very egalitarian culture regarding gender roles and gender norms, boys still have a measurable advantage in regards to aerobic fitness when known physiological and physical activity differences are accounted for.

108. And, as I have mentioned above, even by the age of 4 or 5, in a ruler-drop test, boys exhibit 4% to 6% faster reaction times than girls. (Latorre-Roman 2018.)

109. When looking at the data on testosterone concentrations previously presented, along with the data on physical fitness and athletic performance presented, boys have advantages in athletic performance and physical fitness before there are marked differences in testosterone concentrations between boys and girls.

110. For the most part, the data I review above relate to pre-pubertal children. Today, we also face the question of inclusion in female athletics of males who have undergone "puberty suppression." The UK Sport Councils Literature Review notes that, "In the UK, so-called 'puberty blockers' are generally not used until Tanner maturation stage 2-3 (i.e. after puberty has progressed into early sexual maturation)." (9.) While it is outside my expertise, my understanding is that current practice with regard to administration of puberty blockers is similar in the Unites States. Tanner stages 2 and 3 generally encompass an age range from 10 to 14 years old, with significant differences between individuals. Like the authors of the UK Sports Council Literature Review, I am "not aware of research" directly addressing the implications for athletic capability of the use of puberty blockers. (UK Sport Councils Literature Review at 9.) As Handelsman documents, the male advantage begins to increase rapidly–along with testosterone levels–at about age 11, or "very closely aligned to the timing of the onset of male puberty." (Handelsman 2017.) It seems likely that males who have undergone puberty suppression will

[10] This term would include testosterone and estrogens.

have physiological and performance advantages over females somewhere between those possessed by pre-pubertal boys, and those who have gone through full male puberty, with the degree of advantage in individual cases depending on that individual's development and the timing of the start of puberty blockade.

111. Tack et al. (2018) observed that in 21 transgender-identifying biological males, administration of antiandrogens for 5-31 months (commencing at 16.3 ± 1.21 years of age), resulted in nearly, but not completely, halting of normal age-related *increases* in muscle strength. Importantly, muscle strength did not decrease after administration of antiandrogens. Rather, despite antiandrogens, these individuals retained higher muscle mass, lower percent body fat, higher body mass, higher body height, and higher grip strength than comparable girls of the same age. (Supplemental tables).

112. Klaver et al. (2018 at 256) demonstrated that the use of puberty blockers did not eliminate the differences in lean body mass between biological male and female teenagers. Subsequent use of puberty blockers combined with cross-sex hormone use (in the same subjects) still did not eliminate the differences in lean body mass between biological male and female teenagers. Furthermore, by 22 years of age, the use of puberty blockers, and then puberty blockers combined with cross sex hormones, and then cross hormone therapy alone for over 8 total years of treatment still had not eliminated the difference in lean body mass between biological males and females.

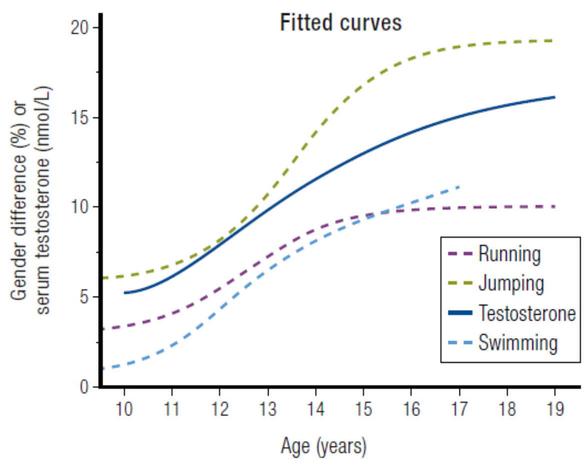
113. The effects of puberty blockers on growth and development, including muscle mass, fat mass, or other factors that influence athletic performance, have been minimally researched. Indeed, Klaver et al. (2018) is the only published research that I am aware of that has evaluated the use of puberty blockers on body composition. As stated by Roberts and Carswell (2021), "No published studies have fully characterized the impact of [puberty blockers on] final adult height or current height in an actively growing TGD youth." (1680). Likewise, "[n]o published literature provides guidance on how to best predict the final adult height for TGD youth receiving GnRHa and gender- affirming hormonal treatment." (1681). Thus, the effect of prescribing puberty blockers to a male child before the onset of puberty on the physical components of athletic performance is largely unknown. There is not any scientific evidence that such treatment eliminates the pre-existing performance advantages that prepubertal males have over prepubertal females.

B. The rapid increase in testosterone across male puberty drives characteristic male physiological changes and the increasing performance advantages.

114. While boys exhibit some performance advantage even before puberty, it is both true and well known to common experience that the male advantage

increases rapidly, and becomes much larger, as boys undergo puberty and become men. Empirically, this can be seen by contrasting the modest advantages reviewed immediately above against the large performance advantages enjoyed by men that I have detailed in Section II.

115. Multiple studies (along with common observation) document that the male performance advantage begins to increase during the early years of puberty, and then increases rapidly across the middle years of puberty (about ages 12-16). (Tønnessen 2015; Handelsman 2018 at 812-813.) Since it is well known that testosterone levels increase by more than an order of magnitude in boys across puberty, it is unsurprising that Handelsman finds that these increases in male performance advantage correlate to increasing testosterone levels, as presented in his chart reproduced below. (Handelsman 2018 at 812-13.)



116. Handelsman further finds that certain characteristic male changes including boys' increase in muscle mass do not begin at all until "circulating testosterone concentrations rise into the range of males at mid-puberty, which are higher than in women at any age." (Handelsman 2018 at 810.)

117. Knox et al. (2019) agree that "[i]t is well recognised that testosterone contributes to physiological factors including body composition, skeletal structure, and the cardiovascular and respiratory systems across the life span, with significant influence during the pubertal period. These physiological factors underpin strength, speed, and recovery with all three elements required to be competitive in almost all sports." (Knox 2019 at 397.) "High testosterone levels and prior male physiology provide an all-purpose benefit, and a substantial advantage. As the IAAF says, 'To the best of our knowledge, there is no other genetic or biological trait encountered in female athletics that confers such a huge performance advantage.'" (Knox 2019 at 399.)

118. However, the undisputed fact that high (that is, normal male) levels of testosterone drive the characteristically male physiological changes that occur across male puberty does not at all imply that artificially *depressing* testosterone levels after those changes occur will reverse all or most of those changes so as to eliminate the male athletic advantage. This is an empirical question. As it turns out, the answer is that while some normal male characteristics can be changed by means of testosterone suppression, others cannot be, and all the reliable evidence indicates that males retain large athletic advantages even after long-term testosterone suppression.

V. The available evidence shows that suppression of testosterone in a male after puberty has occurred does not substantially eliminate the male athletic advantage.

119. The 2011 "NCAA Policy on Transgender Student-Athlete Participation" requires only that males who identify as transgender be on unspecified and unquantified "testosterone suppression treatment" for "one calendar year" prior to competing in women's events. In supposed justification of this policy, the NCAA's Office of Inclusion asserts that, "It is also important to know that any strength and endurance advantages a transgender woman arguably may have as a result of her prior testosterone levels dissipate after about one year of estrogen or testosterone-suppression therapy." (NCAA 2011 at 8.)

120. Similarly, writing in 2018, Handelsman et al. could speculate that even though some male advantages established during puberty are "fixed and irreversible (bone size)," "[t]he limited available prospective evidence . . . suggests that the advantageous increases in muscle and hemoglobin due to male circulating testosterone concentrations are induced or reversed during the first 12 months." (Handelsman 2018 at 824.)

121. But these assertions or hypotheses of the NCAA and Handelsman are now strongly contradicted by the available science. In this section, I examine what is known about whether suppression of testosterone in males can eliminate the male physiological and performance advantages over females.

A. Empirical studies find that males retain a strong performance advantage even after lengthy testosterone suppression.

122. As my review in Section II indicates, a very large body of literature documents the large performance advantage enjoyed by males across a wide range of athletics. To date, only a limited number of studies have directly measured the effect of testosterone suppression and the administration of female hormones on the athletic performance of males. These studies report that testosterone suppression for a full year (and in some cases much longer) does not come close to eliminating

male advantage in strength (hand grip, leg strength, and arm strength) or running speed.

Hand Grip Strength

123. As I have noted, hand grip strength is a well-accepted proxy for general strength. Multiple separate studies, from separate groups, report that males retain a large advantage in hand strength even after testosterone suppression to female levels.

124. In a longitudinal study, Van Caenegem et al. reported that males who underwent standard testosterone suppression protocols lost only 7% hand strength after 12 months of treatment, and only a cumulative 9% after two years. (Van Caenegem 2015 at 42.) As I note above, on average men exhibit in the neighborhood of 60% greater hand grip strength than women, so these small decreases do not remotely eliminate that advantage. Van Caenegem et al. document that their sample of males who elected testosterone suppression began with less strength than a control male population. Nevertheless, after one year of suppression, their study population still had hand grip only 21% less than the control male population, and thus still far higher than a female population. (Van Caenegem 2015 at 42.)

125. Scharff et al. (2019) measured grip strength in a large cohort of male-to-female subjects from before the start of hormone therapy through one year of hormone therapy. The hormone therapy included suppression of testosterone to less than 2 nml/L "in the majority of the transwomen," (1024), as well as administration of estradiol (1021). These researchers observed a small decrease in grip strength in these subjects over that time (Fig. 2), but mean grip strength of this group remained far higher than mean grip strength of females—specifically, "After 12 months, the median grip strength of transwomen [male-to-female subjects] still falls in the 95th percentile for age-matched females." (1026).

126. Still a third longitudinal study, looking at teen males undergoing testosterone suppression, "noted no change in grip strength after hormonal treatment (average duration 11 months) of 21 transgender girls." (Hilton 2021 at 207, summarizing Tack 2018.)

127. In a fourth study, Lapauw et al. (2008) looked at the extreme case of testosterone suppression by studying a population of 23 biologically male individuals who had undergone at least two years of testosterone suppression, followed by sex reassignment surgery that included "orchidectomy" (that is, surgical castration), and then at least an additional three years before the study date. Comparing this group against a control of age- and height-matched healthy males, the researchers found that the individuals who had gone through testosterone suppression and then surgical castration had an average hand grip (41 kg) that was

24% weaker than the control group of healthy males. But this remains at least 25% *higher* than the average hand-grip strength of biological females as measured by Bohannon et al. (2019).

128. Summarizing these and a few other studies measuring strength loss (in most cases based on hand grip) following testosterone suppression, Harper et al. (2021) conclude that "strength loss with 12 months of [testosterone suppression] . . . ranged from non-significant to 7%. . . . [T]he small decrease in strength in transwomen after 12-36 months of [testosterone suppression] suggests that transwomen likely retain a strength advantage over cisgender women." (Hilton 2021 at 870.)

Arm Strength

129. Lapauw et al. (2008) found that 3 years after surgical castration, preceded by at least two years of testosterone suppression, biologically male subjects had 33% less bicep strength than healthy male controls. (Lapauw (2008) at 1018.) Given that healthy men exhibit between 89% and 109% greater arm strength than healthy women, this leaves a very large residual arm strength advantage over biological women.

130. Roberts et al. have recently published an interesting longitudinal study, one arm of which considered biological males who began testosterone suppression and cross-sex hormones while serving in the United States Air Force. (Roberts 2020.) One measured performance criterion was pushups per minute, which, while not exclusively, primarily tests arm strength under repetition. *Before* treatment, the biological male study subjects who underwent testosterone suppression could do 45% more pushups per minute than the average for all Air Force women under the age of 30 (47.3 vs. 32.5). *After* between one and two years of testosterone suppression, this group could still do 33% more pushups per minute. (Table 4.) Further, the body weight of the study group did not decline at all after one to two years of testosterone suppression (in fact rose slightly) (Table 3), and was approximately 24 pounds (11.0 kg) higher than the average for Air Force women under the age of 30. (Roberts 2020 at 3.) This means that the individuals who had undergone at least one year of testosterone suppression were not only doing 1/3 more pushups per minute, but were lifting significantly more weight with each pushup.

131. After two years of testosterone suppression, the study sample in Roberts et al. was only able to do 6% more pushups per minute than the Air Force female average. But their weight remained unchanged from their pre-treatment starting point, and thus about 24 pounds higher than the Air Force female average. As Roberts et al. explain, "as a group, transwomen weigh more than CW [cis-women]. Thus, transwomen will have a higher power output than CW when

performing an equivalent number of push-ups. Therefore, our study may underestimate the advantage in strength that transwomen have over CW." (Roberts 2020 at 4.)

Leg Strength

132. Wiik et al. (2020), in a longitudinal study that tracked 11 males from the start of testosterone suppression through 12 months after treatment initiation, found that isometric strength levels measured at the knee "were maintained over the [study period]."[11] (808) "At T12 [the conclusion of the one-year study], the absolute levels of strength and muscle volume were greater in [male-to-female subjects] than in . . . CW [women who had not undergone any hormonal therapy]." (Wiik 2020 at 808.) In fact, Wiik et al. reported that "muscle strength after 12 months of testosterone suppression was comparable to baseline strength. As a result, transgender women remained about 50% stronger than . . . a reference group of females." (Hilton 2021 at 207, summarizing Wiik 2020.)

133. Lapauw et al. (2008) found that 3 years after surgical castration, preceded by at least two years of testosterone suppression, subjects had peak knee torque only 25% lower than healthy male controls. (Lapauw 2008 at 1018.) Again, given that healthy males exhibit 54% greater maximum knee torque than healthy females, this leaves these individuals with a large average strength advantage over females even years after sex reassignment surgery.

Running speed

134. The most striking finding of the recent Roberts et al. study concerned running speed over a 1.5 mile distance–a distance that tests midrange endurance. Before suppression, the MtF study group ran 21% faster than the Air Force female average. After at least 2 year of testosterone suppression, these subjects still ran 12% faster than the Air Force female average. (Roberts 2020 Table 4.)

135. The specific experience of the well-known case of NCAA athlete Cece Telfer is consistent with the more statistically meaningful results of Roberts et al., further illustrating that male-to-female transgender treatment does not negate the inherent athletic performance advantages of a post-pubertal male. In 2016 and 2017 Cece Telfer competed as Craig Telfer on the Franklin Pierce University men's track team, being ranked 200th and 390th (respectively) against other NCAA Division 2 men. "Craig" Telfer did not qualify for the National Championships in any events. Telfer did not compete in the 2018 season while undergoing testosterone

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[11] Isometric strength measures muscular force production for a given amount of time at a specific joint angle but with no joint movement.

suppression (per NCAA policy). In 2019 Cece Telfer competed on the Franklin Pierce University *women's* team, qualified for the NCAA Division 2 Track and Field National Championships, and placed 1st in the women's 400 meter hurdles and placed third in the women's 100 meter hurdles. (For examples of the media coverage of this please see https://www.washingtontimes.com/news/2019/jun/3/cece-telfer-franklin-pierce-transgenderhurdler-wi/ last accessed May 29, 2020. https://www.newshub.co.nz/home/sport/2019/06/athletics-transgender-woman-cece-telfer-whopreviously-competed-as-a-man-wins-ncaa-track-championship.html (last accessed May 29, 2020.)

136. The table below shows the best collegiate performance times from the combined 2015 and 2016 seasons for Cece Telfer when competing as a man in men's events, and the best collegiate performance times from the 2019 season when competing as a woman in women's events. Comparing the times for the running events (in which male and female athletes run the same distance) there is no statistical difference between Telfer's "before and after" times. Calculating the difference in time between the male and female times, Telfer performed an average of 0.22% *faster* as a female. (Comparing the performance for the hurdle events (marked with H) is of questionable validity due to differences between men's and women's events in hurdle heights and spacing, and distance for the 110m vs. 100 m.) While this is simply one example, and does not represent a controlled experimental analysis, this information provides some evidence that male-to-female transgender treatment does not negate the inherent athletic performance advantages of a postpubertal male. (These times were obtained from https://www.tfrrs.org/athletes/6994616/Franklin_Pierce/CeCe_Telfer.html and https://www.tfrrs.org/athletes/5108308.html, last accessed May 29, 2020).

As Craig Telfer (male athlete)		**As Cece Telfer (female athlete)**	
Event	Time (seconds)	Event	Time (seconds)
55	7.01	55	7.02
60	7.67	60	7.63
100	12.17	100	12.24
200	24.03	200	24.30
400	55.77	400	54.41
55 H †	7.98	55 H†	7.91
60 H †	8.52	60 H†	8.33
110 H†	15.17	100 H†	13.41*
400 H‡	57.34	400 H‡	57.53**

* women's 3rd place, NCAA Division 2 National Championships
** women's 1st place, NCAA Division 2 National Championships
† men's hurdle height is 42 inches with differences in hurdle spacing between men and women
‡ men's hurdle height is 36 inches, women's height is 30 inches with the same spacing between hurdles

137. Similarly, University of Pennsylvania swimmer Lia Thomas began competing in the women's division in the fall of 2021, after previously competing for U. Penn. in the men's division. Thomas has promptly set school, pool, and/or league women's records in 200 yard freestyle, 500 yard freestyle, and 1650 yard freestyle competitions, beating the nearest female in the 1650 yard by an unheard-of 38 seconds.

138. In a pre-peer review article, Senefeld, Coleman, Hunter, and Joyner (doi: https://doi.org/10.1101/2021.12.28.21268483, accessed January 12, 2022) "compared the gender-related differences in performance of a transgender swimmer who competed in both the male and female NCAA (collegiate) categories to the sex-related differences in performance of world and national class swimmers" and observed that this athlete [presumably Lia Thomas based on performance times and the timing of this article] was unranked in 2018-2019 in the 100-yard, ranked 551st in the 200-yard, 65th in the 500-yard 32nd in the 1650-yards men's freestyle. After following the NCAA protocol for testosterone suppression and competing as a woman in 2021-2022, this swimmer was ranked 94th in the 100-yard, 1st in the 200-yard, 1st in the 500-yard, and 6th in the 1650-yard women's freestyle. The performance times swimming as a female, when compared to swimming as a male, were 4.6% slower in the 100-yard, 2.6% slower in the 200-yard, 5.6% slower in the 500-yard, and 6.8% slower in the 1650-yard events than when swimming as a male. *It is important to note that these are mid-season race times and do not represent season best performance times or in a championship event where athletes often set their personal record times*. The authors concluded "…that for middle distance events (100, 200 and 400m or their imperial equivalents) lasting between about one and five minutes, the decrements in performance of the transgender woman swimmer are less than expected on the basis of a comparison of a large cohort of world and national class performances by female and male swimmers" and "it is possible that the relative improvements in this swimmer's rankings in the women's category relative to the men's category are due to legacy effects of testosterone on a number of physiological factors that can influence athletic performance."

139. Harper (2015) has often been cited as "proving" that testosterone suppression eliminates male advantage. And indeed, hedged with many disclaimers, the author in that article does more or less make that claim with respect to "distance races," while emphasizing that "the author makes no claims as to the equality of performances, pre and post gender transition, in any other sport." (Harper 2015 at 8.) However, Harper (2015) is in effect a collection of unverified anecdotes, not science. It is built around self-reported race times from just eight self-selected transgender runners, recruited "mostly" online. How and on what websites the subjects were recruited is not disclosed, nor is anything said about how those not recruited online were recruited. Thus, there is no information to tell us whether these eight runners could in any way be representative, and the

recruitment pools and methodology, which could bear on ideological bias in their self-reports, is not disclosed.

140. Further, the self-reported race times relied on by Harper (2015) *span 29 years*. It is well known that self-reported data, particularly concerning emotionally or ideologically fraught topics, is unreliable, and likewise that memory of distant events is unreliable. Whether the subjects were responding from memory or from written records, and if so what records, is not disclosed, and does not appear to be known to the author. For six of the subjects, the author claims to have been able to verify "approximately half" of the self-reported times. Which scores these are is not disclosed. The other two subjects responded only anonymously, so nothing about their claims could be or was verified. In short, neither the author nor the reader knows whether the supposed "facts" on which the paper's analysis is based are true.

141. Even if we could accept them at face value, the data are largely meaningless. Only two of the eight study subjects reported (undefined) "stable training patterns," and even with consistent training, athletic performance generally declines with age. As a result, when the few data points span 29 years, it is not possible to attribute declines in performance to asserted testosterone suppression. Further, distance running is usually not on a track, and race times vary significantly depending on the course and the weather. Only one reporting subject who claimed a "stable training pattern" reported "before and after" times on the same course within three years' time," which the author acknowledges would "represent the best comparison points."

142. Harper (2015) to some extent acknowledges its profound methodological flaws, but seeks to excuse them by the difficulty of breaking new ground. The author states that, "The first problem is how to formulate a study to create a meaningful measurement of athletic performance, both before and after testosterone suppression. No methodology has been previously devised to make meaningful measurements." (2) This statement was not accurate at the time of publication, as there are innumerable publications with validated methodology for comparing physical fitness and/or athletic performance between people of different ages, sexes, and before and after medical treatment, any of which could easily have been used with minimal or no adaptation for the purposes of this study. Indeed, well before the publication of Harper (2015), several authors that I have cited in this review had performed and published disciplined and methodologically reliable studies of physical performance and physiological attributes "before and after" testosterone suppression.

143. More recently, and to her credit, Harper has acknowledged the finding of Roberts (2020) regarding the durable male advantage in running speed in the 1.5 mile distance, even after two years of testosterone suppression. She joins with co-

authors in acknowledging that this study of individuals who (due to Air Force physical fitness requirements) "could at least be considered exercise trained," agrees that Roberts' data shows that "transwomen ran significantly faster during the 1.5 mile fitness test than ciswomen," and declares that this result is "consistent with the findings of the current review in untrained transgender individuals" that even 30 months of testosterone suppression does not eliminate all male advantages "associated with muscle endurance and performance." (Harper 2021 at 8.) The Harper (2021) authors conclude overall "that strength may be well preserved in transwomen during the first 3 years of hormone therapy," and that [w]hether transgender and cisgender women can engage in meaningful sport [in competition with each other], even after [testosterone suppression], is a highly debated question." (Harper 2021 at 1, 8.)

144. Higerd (2021) "[a]ssess[ed] the probability of a girls' champion being biologically male" by evaluating 920,11 American high school track and field performances available through the track and field database Athletic.net in five states (CA, FL, MN, NY, WA), over three years (2017 – 2019),in eight events; high jump, long jump, 100M, 200M, 400M, 800M, 1600M, and 3200M and estimated that "there is a simulated 81%-98% probability of transgender dominance occurring in the female track and field event" and further concluded that "in the majority of cases, the entire podium (top of the state) would be MTF [transgender athletes]" (at xii).

B. Testosterone suppression does not reverse important male physiological advantages.

145. We see that, once a male has gone through male puberty, later testosterone suppression (or even castration) leaves large strength and performance advantages over females in place. It is not surprising that this is so. What is now a fairly extensive body of literature has documented that many of the specific male physiological advantages that I reviewed in Section II are not reversed by testosterone suppression after puberty, or are reduced only modestly, leaving a large advantage over female norms still in place.

146. Handelsman has well documented that the large increases in physiological and performance advantages characteristic of men develop in tandem with, and are likely driven by, the rapid and large increases in circulating testosterone levels that males experience across puberty, or generally between the ages of about 12 through 18. (Handelsman 2018.) Some have misinterpreted Handelsman as suggesting that all of those advantages are and remain entirely dependent–on an ongoing basis–on *current* circulating testosterone levels. This is a misreading of Handelsman, who makes no such claim. As the studies reviewed above demonstrate, it is also empirically false with respect to multiple measures of

performance. Indeed, Handelsman himself, referring to the Roberts et al. (2020) study which I describe below, has recently written that "transwomen treated with estrogens after completing male puberty experienced only minimal declines in physical performance over 12 months, substantially surpassing average female performance for up to 8 years." (Handelsman 2020.)

147. As to individual physiological advantages, the more accurate and more complicated reality is reflected in a statement titled "The Role of Testosterone in Athletic Performance," published in 2019 by several dozen sports medicine experts and physicians from many top medical schools and hospitals in the U.S. and around the world. (Levine et al. 2019.) This expert group concurs with Handelsman regarding the importance of testosterone to the male advantage, but recognizes that those advantages depend not only on *current* circulating testosterone levels in the individual, but on the "exposure in biological males to much higher levels of testosterone <u>during growth, development</u>, and throughout the athletic career." (*Emphasis added.*) In other words, both past and current circulating testosterone levels affect physiology and athletic capability.

148. Available research enables us to sort out, in some detail, which specific physiological advantages are immutable once they occur, which can be reversed only in part, and which appear to be highly responsive to later hormonal manipulation. The bottom line is that very few of the male physiological advantages I have reviewed in Section II above are largely reversible by testosterone suppression once an individual has passed through male puberty.

Skeletal Configuration

149. It is obvious that some of the physiological changes that occur during "growth and development" across puberty cannot be reversed. Some of these irreversible physiological changes are quite evident in photographs that have recently appeared in the news of transgender competitors in female events. These include skeletal configuration advantages including:

- Longer and larger bones that give height, weight, and leverage advantages to men;
- More advantageous hip shape and configuration as compared to women.

Cardiovascular Advantages

150. Developmental changes for which there is no apparent means of reversal, and no literature suggesting reversibility, also include multiple

contributors to the male cardiovascular advantage, including diaphragm placement, lung and trachea size, and heart size and therefore pumping capacity.[12]

151. On the other hand, the evidence is mixed as to hemoglobin concentration, which as discussed above is a contributing factor to $V0_2$ max. Harper (2021) surveyed the literature and found that "Nine studies reported the levels of Hgb [hemoglobin] or HCT [red blood cell count] in transwomen before and after [testosterone suppression], from a minimum of three to a maximum of 36 months post hormone therapy. Eight of these studies. . . found that hormone therapy led to a significant (4.6%–14.0%) decrease in Hgb/HCT ($p<0.01$), while one study found no significant difference after 6 months," but only one of those eight studies returned results at the generally accepted 95% confidence level. (Harper 2021 at 5-6 and Table 5.)

152. I have not found any study of the effect of testosterone suppression on the male advantage in mitochondrial biogenesis.

Muscle mass

153. Multiple studies have found that muscle mass decreases modestly or not at all in response to testosterone suppression. Knox et al. report that "healthy young men did not lose significant muscle mass (or power) when their circulating testosterone levels were reduced to 8.8 nmol/L (lower than the 2015 IOC guideline of 10 nmol/L) for 20 weeks." (Knox 2019 at 398.) Gooren found that "[i]n spite of muscle surface area reduction induced by androgen deprivation, after 1 year the mean muscle surface area in male-to- female transsexuals remained significantly greater than in untreated female-to-male transsexuals." (Gooren 2011 at 653.) An earlier study by Gooren found that after one year of testosterone suppression, muscle mass at the thigh was reduced by only about 10%, exhibited "no further reduction after 3 years of hormones," and "remained significantly greater" than in his sample of untreated women. (Gooren 2004 at 426-427.) Van Caenegem et al. found that muscle cross section in the calf and forearm decreased only trivially (4% and 1% respectively) after two years of testosterone suppression. (Van Caenegem 2015 Table 4.)

154. Taking measurements one month after start of testosterone suppression in male-to-female (non-athlete) subjects, and again 3 and 11 months after start of feminizing hormone replacement therapy in these subjects, Wiik et al.

[12] "[H]ormone therapy will not alter … lung volume or heart size of the transwoman athlete, especially if [that athlete] transitions postpuberty, so natural advantages including joint articulation, stroke volume and maximal oxygen uptake will be maintained." (Knox 2019 at 398.)

found that total lean tissue (i.e. primarily muscle) did not decrease significantly across the entire period. Indeed, "some of the [subjects] did not lose any muscle mass at all." (Wiik 2020 at 812.) And even though they observed a small decrease in thigh muscle mass, they found that isometric strength levels measured at the knee "were maintained over the [study period]." (808) "At T12 [the conclusion of the one-year study], the absolute levels of strength and muscle volume were greater in [male-to-female subjects] than in [female-to-male subjects] and CW [women who had not undergone any hormonal therapy]." (808)

155. Hilton & Lundberg summarize an extensive survey of the literature as follows:

> "12 longitudinal studies have examined the effects of testosterone suppression on lean body mass or muscle size in transgender women. The collective evidence from these studies suggests that 12 months, which is the most commonly examined intervention period, of testosterone suppression to female typical reference levels results in a modest (approximately− 5%) loss of lean body mass or muscle size. . . .
>
> "Thus, given the large baseline differences in muscle mass between males and females (Table 1; approximately 40%), the reduction achieved by 12 months of testosterone suppression can reasonably be assessed as small relative to the initial superior mass. We, therefore, conclude that the muscle mass advantage males possess over females, and the performance implications thereof, are not removed by the currently studied durations (4 months, 1, 2 and 3 years) of testosterone suppression in transgender women. (Hilton 2021 at 205-207.)

156. When we recall that "women have 50% to 60% of men's upper arm muscle cross-sectional area and 65% to 70% of men's thigh muscle cross-sectional area" (Handelsman 2018 at 812), it is clear that Hilton's conclusion is correct. In other words, biologically male subjects possess substantially larger muscles than biologically female subjects after undergoing a year or even three years of testosterone suppression.

157. I note that outside the context of transgender athletes, the testosterone-driven increase in muscle mass and strength enjoyed by these male-to-female subjects would constitute a disqualifying doping violation under all league anti-doping rules with which I am familiar.

C. Responsible voices internationally are increasingly recognizing that suppression of testosterone in a male after puberty has occurred does not substantially reverse the male athletic advantage.

158. The previous very permissive NCAA policy governing transgender participation in women's collegiate athletics was adopted in 2011, and the previous IOC guidelines were adopted in 2015. At those dates, much of the scientific analysis of the actual impact of testosterone suppression had not yet been performed, much less any wider synthesis of that science. In fact, a series of important peer-reviewed studies and literature reviews have been published only very recently, since I prepared my first paper on this topic, in early 2020.

159. These new scientific publications reflect a remarkably consistent consensus: once an individual has gone through male puberty, testosterone suppression does not substantially eliminate the physiological and performance advantages that that individual enjoys over female competitors.

160. Importantly, I have found no peer-reviewed scientific paper, nor any respected scientific voice, that is now asserting the contrary–that is, that testosterone suppression can eliminate or even largely eliminate the male biological advantage once puberty has occurred.

161. I excerpt the key conclusions from important recent peer-reviewed papers below.

162. Roberts 2020: "In this study, we confirmed that . . . the pretreatment differences between transgender and cis gender women persist beyond the 12-month time requirement currently being proposed for athletic competition by the World Athletics and the IOC." (6)

163. Wiik 2020: The muscular and strength changes in males undergoing testosterone suppression "were modest. The question of when it is fair to permit a transgender woman to compete in sport in line with her experienced gender identity is challenging." (812)

164. Harper 2021: "[V]alues for strength, LBM [lean body mass], and muscle area in transwomen remain above those of cisgender women, even after 36 months of hormone therapy." (1)

165. Hilton & Lundberg 2021: "evidence for loss of the male performance advantage, established by testosterone at puberty and translating in elite athletes to a 10–50% performance advantage, is lacking. . . . These data significantly

undermine the delivery of fairness and safety presumed by the criteria set out in transgender inclusion policies . . .” (211)

166. Hamilton et al. 2020, “Response to the United Nations Human Rights Council’s Report on Race and Gender Discrimination in Sport: An Expression of Concern and a Call to Prioritize Research”: “There is growing support for the idea that development influenced by high testosterone levels may result in retained anatomical and physiological advantages . . . . If a biologically male athlete self-identifies as a female, legitimately with a diagnosis of gender dysphoria or illegitimately to win medals, the athlete already possesses a physiological advantage that undermines fairness and safety. This is not equitable, nor consistent with the fundamental principles of the Olympic Charter.”

167. Hamilton et al. 2021, “Consensus Statement of the Fédération Internationale de Médecine du Sport” (International Federation of Sports Medicine, or FIMS), signed by more than 60 sports medicine experts from prestigious institutions around the world: The available studies “make it difficult to suggest that the athletic capabilities of transwomen individuals undergoing HRT or GAS are comparable to those of cisgender women.” The findings of Roberts et al. “question the required testosterone suppression time of 12 months for transwomen to be eligible to compete in women’s sport, as most advantages over ciswomen were not negated after 12 months of HRT.”

168. Outside the forum of peer-reviewed journals, respected voices in sport are reaching the same conclusion.

169. The **Women’s Sports Policy Working Group** identifies among its members and “supporters” many women Olympic medalists, former women’s tennis champion and LGBTQ activist Martina Navratilova, Professor Doriane Coleman, a former All-American women’s track competitor, transgender athletes Joanna Harper and Dr. Renee Richards, and many other leaders in women’s sports and civil rights. I have referenced other published work of Joanna Harper and Professor Coleman. In early 2021 the Women’s Sports Policy Working Group published a “Briefing Book” on the issue of transgender participation in women’s sports,[13] in which they reviewed largely the same body of literature I have reviewed above, and analyzed the implications of that science for fairness and safety in women’s sports.

170. Among other things, the Women’s Sports Policy Working Group concluded:

[13] https://womenssportspolicy.org/wp-content/uploads/2021/02/Congressional-Briefing-WSPWG-Transgender-Women-Sports-2.27.21.pdf

- "[T]he evidence is increasingly clear that hormones do not eliminate the legacy advantages associated with male physical development" (8) due to "the considerable size and strength advantages that remain even after hormone treatments or surgical procedures." (17)
- "[T]here is convincing evidence that, depending on the task, skill, sport, or event, trans women maintain male sex-linked (legacy) advantages even after a year on standard gender-affirming hormone treatment." (26, citing Roberts 2020.)
- "[S]everal peer-reviewed studies, including one based on data from the U.S. military, have confirmed that trans women retain their male sex-linked advantages even after a year on gender affirming hormones. . . . Because of these retained advantages, USA Powerlifting and World Rugby have recently concluded that it isn't possible fairly and safely to include trans women in women's competition." (32)

171. As has been widely reported, in 2020, after an extensive scientific consultation process, the **World Rugby** organization issued its Transgender Guidelines, finding that it would not be consistent with fairness or safety to permit biological males to compete in World Rugby women's matches, no matter what hormonal or surgical procedures they might have undergone. Based on their review of the science, World Rugby concluded:

- "Current policies regulating the inclusion of transgender women in sport are based on the premise that reducing testosterone to levels found in biological females is sufficient to remove many of the biologically-based performance advantages described above. However, peer-reviewed evidence suggests that this is not the case."
- "Longitudinal research studies on the effect of reducing testosterone to female levels for periods of 12 months or more do not support the contention that variables such as mass, lean mass and strength are altered meaningfully in comparison to the original male-female differences in these variables. The lowering of testosterone removes only a small proportion of the documented biological differences, with large, retained advantages in these physiological attributes, with the safety and performance implications described previously."
- ". . . given the size of the biological differences prior to testosterone suppression, this comparatively small effect of testosterone reduction allows substantial and meaningful differences to remain. This has significant implications for the risk of injury . . . ."

- " . . . bone mass is typically maintained in transgender women over the course of at least 24 months of testosterone suppression, ... Height and other skeletal measurements such as bone length and hip width have also not been shown to change with testosterone suppression, and nor is there any plausible biological mechanism by which this might occur, and so sporting advantages due to skeletal differences between males and females appear unlikely to change with testosterone reduction.

172. In September 2021 the government-commissioned Sports Councils of the United Kingdom and its subsidiary parts (the five Sports Councils responsible for supporting and investing in sport across England, Wales, Scotland and Northern Ireland) issued a formal "Guidance for Transgender Inclusion in Domestic Sport" (UK Sport Councils 2021), following an extensive consultation process, and a commissioned "International Research Literature Review" prepared by the Carbmill Consulting group (UK Sport Literature Review 2021). The UK Sport Literature Review identified largely the same relevant literature that I review in this paper, characterizes that literature consistently with my own reading and description, and based on that science reaches conclusions similar to mine.

173. The UK Sport Literature Review 2021 concluded:

- "Sexual dimorphism in relation to sport is significant and the most important determinant of sporting capacity. The challenge to sporting bodies is most evident in the inclusion of transgender people in female sport." "[The] evidence suggests that parity in physical performance in relation to gender-affected sport cannot be achieved for transgender people in female sport through testosterone suppression. Theoretical estimation in contact and collision sport indicate injury risk is likely to be increased for female competitors." (10)

- "From the synthesis of current research, the understanding is that testosterone suppression for the mandated one year before competition will result in little or no change to the anatomical differences between the sexes, and a more complete reversal of some acute phase metabolic pathways such as haemoglobin levels although the impact on running performance appears limited, and a modest change in muscle mass and strength: The average of around 5% loss of muscle mass and strength will not reverse the average 40-50% difference in strength that typically exists between the two sexes." (7)

- "These findings are at odds with the accepted intention of current policy in sport, in which twelve months of testosterone suppression is expected to create equivalence between transgender women and females." (7)

174. Taking into account the science detailed in the UK Sport Literature Review 2021, the UK Sports Councils have concluded:

- "[T]he latest research, evidence and studies made clear that there are retained differences in strength, stamina and physique between the average woman compared with the average transgender woman or non-binary person registered male at birth, with or without testosterone suppression." (3)
- "Competitive fairness cannot be reconciled with self-identification into the female category in gender-affected sport." (7)
- "As a result of what the review found, the Guidance concludes that the inclusion of transgender people into female sport cannot be balanced regarding transgender inclusion, fairness and safety in gender-affected sport where there is meaningful competition. This is due to retained differences in strength, stamina and physique between the average woman compared with the average transgender woman or non-binary person assigned male at birth, with or without testosterone suppression." (6)
- "Based upon current evidence, testosterone suppression is unlikely to guarantee fairness between transgender women and natal females in gender-affected sports. . . . Transgender women are on average likely to retain physical advantage in terms of physique, stamina, and strength. Such physical differences will also impact safety parameters in sports which are combat, collision or contact in nature." (7)

175. On January 15, 2022 the American Swimming Coaches Association (ASCA) issued a statement stating, "The American Swimming Coaches Association urges the NCAA and all governing bodies to work quickly to update their policies and rules to maintain fair competition in the women's category of swimming. ASCA supports following all available science and evidenced-based research in setting the new policies, and we strongly advocate for more research to be conducted" and further stated "The current NCAA policy regarding when transgender females can compete in the women's category can be unfair to cisgender females and needs to be reviewed and changed in a transparent manner." (https://swimswam.com/asca-issues-statement-calling-for-ncaa-to-review-transgender-rules/; Accessed January 16, 2022.)

176. On January 19, 2022, the NCAA Board of Governors approved a change to the policy on transgender inclusion in sport and stated that "…the updated NCAA policy calls for transgender participation for each sport to be determined by the policy for the national governing body of that sport, subject to ongoing review and recommendation by the NCAA Committee on Competitive Safeguards and Medical Aspects of Sports to the Board of Governors. If there is no N[ational]G[overning]B[ody] policy for a sport, that sport's international federation policy would be followed. If there is no international federation policy, previously established IOC policy criteria would be followed" (https://www.ncaa.org/news/2022/1/19/media-center-board-of-governors-updates-transgender-participation-policy.aspx; Accessed January 20, 2022.)

177. On February 1, 2022, because "…a competitive difference in the male and female categories and the disadvantages this presents in elite head-to-head competition … supported by statistical data that shows that the top-ranked female in 2021, on average, would be ranked 536th across all short course yards (25 yards) male events in the country and 326th across all long course meters (50 meters) male events in the country, among USA Swimming members," USA Swimming released its Athlete Inclusion, Competitive Equity and Eligibility Policy. The policy is intended to "provide a level-playing field for elite cisgender women, and to mitigate the advantages associated with male puberty and physiology." (USA Swimming Releases Athlete Inclusion, Competitive Equity and Eligibility Policy, available at https://www.usaswimming.org/news/2022/02/01/usa-swimming-releases-athlete-inclusion-competitive-equity-and-eligibility-policy.) The policy states:

- For biologically male athletes seeking to compete in the female category in certain "elite" level events, the athlete has the burden of demonstrating to a panel of independent medical experts that:
    - "From a medical perspective, the prior physical development of the athlete as Male, as mitigated by any medical intervention, does not give the athlete a competitive advantage over the athlete's cisgender Female competitors" and
    - There is a presumption that the athlete is not eligible unless the athlete "demonstrates that the concentration of testosterone in the athlete's serum has been less than 5 nmol/L . . . continuously for a period of at least thirty-six (36) months before the date of the Application." This presumption may be rebutted "if the Panel finds, in the unique circumstances of the case, that [the athlete's prior physical development does not give the athlete a competitive advantage] notwithstanding the athlete's serum testosterone results (e.g., the athlete has a medical condition

> which limits bioavailability of the athlete's free testosterone)." (USA Swimming Athlete Inclusion Procedures at 43.)

Conclusions

The research and actual observed data show the following:

- At the level of (a) elite, (b) collegiate, (c) scholastic, and (d) recreational competition, men, adolescent boys, or male children, have an advantage over equally gifted, aged and trained women, adolescent girls, or female children in almost all athletic events;
- Biological male physiology is the basis for the performance advantage that men, adolescent boys, or male children have over women, adolescent girls, or female children in almost all athletic events; and
- The administration of androgen inhibitors and cross-sex hormones to men or adolescent boys after the onset of male puberty does not eliminate the performance advantage that men and adolescent boys have over women and adolescent girls in almost all athletic events. Likewise, there is no published scientific evidence that the administration of puberty blockers to males before puberty eliminates the pre-existing athletic advantage that prepubertal males have over prepubertal females in almost all athletic events.

For over a decade sports governing bodies (such as the IOC and NCAA) have wrestled with the question of transgender inclusion in female sports. The previous polices implemented by these sporting bodies had an underlying "premise that reducing testosterone to levels found in biological females is sufficient to remove many of the biologically-based performance advantages." (World Rugby 2020 at 13.) Disagreements centered around what the appropriate threshold for testosterone levels must be–whether the 10nmol/liter value adopted by the IOC in 2015, or the 5nmol/liter value adopted by the IAAF.

But the science that has become available within just the last few years contradicts that premise. Instead, as the UK Sports Councils, World Rugby, the FIMS Consensus Statement, and the Women's Sports Policy Working Group have all recognized the science is now sharply "at odds with the accepted intention of current policy in sport, in which twelve months of testosterone suppression is expected to create equivalence between transgender women and females" (UK Sports Literature Review 2021 at 7), and it is now "difficult to suggest that the athletic capabilities of transwomen individuals undergoing HRT or GAS are comparable to those of cisgender women." (Hamilton, FIMS Consensus Statement 2021.) It is important to note that while the 2021 "IOC Framework on Fairness, Inclusion, and Non-Discrimination on the Basis of Gender Identity and Sex Variations" calls for an "evidence-based approach," that Framework does not actually reference *any* of the now extensive scientific evidence relating to the physiological differences between the sexes, and the inefficacy of hormonal intervention to eliminate male advantages relevant to most sports. Instead, the IOC calls on other sporting bodies to define criteria for transgender inclusion, while demanding that such criteria simultaneously ensure fairness, safety, and inclusion for all. The recently updated NCAA policy on transgender participation also relies on other sporting bodies to establish criteria for transgender inclusion while calling for fair competition and safety.

But what we currently know tells us that these policy goals—fairness, safety, and full transgender inclusion—are irreconcilable for many or most sports. Long human experience is now joined by large numbers of research papers that document that males outperform females in muscle strength, muscular endurance, aerobic and anaerobic power output, VO_2max, running speed, swimming speed, vertical jump height, reaction time, and most other measures of physical fitness and physical performance that are essential for athletic success. The male advantages have been observed in fitness testing in children as young as 3 years old, with the male advantages increasing immensely during puberty. To ignore what we know to be true about males' athletic advantages over females, based on mere hope or speculation that cross sex hormone therapy (puberty blockers, androgen inhibitors, or cross-sex hormones) might neutralize that advantage, when the currently available evidence says it does not, is not science and is not "evidence-based" policy-making.

Because of the recent research and analysis in the general field of transgender athletics, many sports organizations have revised their policies or are in the process of doing so. As a result, there is not any universally recognized policy among sports organizations, and transgender inclusion policies are in a state of flux, likely because of the increasing awareness that the goals of fairness, safety, and full transgender inclusion are irreconcilable.

Sports have been separated by sex for the purposes of safety and fairness for a considerable number of years. The values of safety and fairness are endorsed by numerous sports bodies, including the NCAA and IOC. The existing evidence of durable physiological and performance differences based on biological sex provides a strong evidence-based rationale for keeping rules and policies for such sex-based separation in place (or implementing them as the case may be).

As set forth in detail in this report, there are physiological differences between males and females that result in males having a significant performance advantage over similarly gifted, aged, and trained females in nearly all athletic events before, during, and after puberty. There is not scientific evidence that any amount or duration of cross sex hormone therapy (puberty blockers, androgen inhibitors, or cross-sex hormones) eliminates all physiological advantages that result in males performing better than females in nearly all athletic events. Males who have received such therapy retain sufficient male physiological traits that enhance athletic performance vis-à-vis similarly aged females and are thus, from a physiological perspective, more accurately categorized as male and not female.

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Appendix 1 – Data Tables

Presidential Physical Fitness Results[14]

Curl-Ups (# in 1 minute)

	Male		Female			Male-Female % Difference	
Age	**50th %ile**	**85th %ile**	**50th %ile**	**85th %ile**	**Age**	**50th %ile**	**85th %ile**
6	22	33	23	32	**6**	-4.3%	3.1%
7	28	36	25	34	**7**	12.0%	5.9%
8	31	40	29	38	**8**	6.9%	5.3%
9	32	41	30	39	**9**	6.7%	5.1%
10	35	45	30	40	**10**	16.7%	12.5%
11	37	47	32	42	**11**	15.6%	11.9%
12	40	50	35	45	**12**	14.3%	11.1%
13	42	53	37	46	**13**	13.5%	15.2%
14	45	56	37	47	**14**	21.6%	19.1%
15	45	57	36	48	**15**	25.0%	18.8%
16	45	56	35	45	**16**	28.6%	24.4%
17	44	55	34	44	**17**	29.4%	25.0%

[14] This data is available from a variety of sources. including: https://gilmore.gvsd.us/documents/Info/Forms/Teacher%20Forms/Presidentialchallengetest.pdf

Shuttle Run (seconds)

	Male		Female			Male-Female % Difference	
Age	50th %ile	85th %ile	50th %ile	85th %ile	Age	50th %ile	85th %ile
6	13.3	12.1	13.8	12.4	6	3.6%	2.4%
7	12.8	11.5	13.2	12.1	7	3.0%	5.0%
8	12.2	11.1	12.9	11.8	8	5.4%	5.9%
9	11.9	10.9	12.5	11.1	9	4.8%	1.8%
10	11.5	10.3	12.1	10.8	10	5.0%	4.6%
11	11.1	10	11.5	10.5	11	3.5%	4.8%
12	10.6	9.8	11.3	10.4	12	6.2%	5.8%
13	10.2	9.5	11.1	10.2	13	8.1%	6.9%
14	9.9	9.1	11.2	10.1	14	11.6%	9.9%
15	9.7	9.0	11.0	10.0	15	11.8%	10.0%
16	9.4	8.7	10.9	10.1	16	13.8%	13.9%
17	9.4	8.7	11.0	10.0	17	14.5%	13.0%

1 mile run (seconds)

	Male		Female			Male-Female % Difference	
Age	50th %ile	85th %ile	50th %ile	85th %ile	Age	50th %ile	85th %ile
6	756	615	792	680	6	4.5%	9.6%
7	700	562	776	636	7	9.8%	11.6%
8	665	528	750	602	8	11.3%	12.3%
9	630	511	712	570	9	11.5%	10.4%
10	588	477	682	559	10	13.8%	14.7%
11	560	452	677	542	11	17.3%	16.6%
12	520	431	665	503	12	21.8%	14.3%
13	486	410	623	493	13	22.0%	16.8%
14	464	386	606	479	14	23.4%	19.4%
15	450	380	598	488	15	24.7%	22.1%
16	430	368	631	503	16	31.9%	26.8%
17	424	366	622	495	17	31.8%	26.1%

Pull Ups (# completed)

	Male		Female			Male-Female % Difference	
Age	**50th %ile**	**85th %ile**	**50th %ile**	**85th %ile**	**Age**	**50th %ile**	**85th %ile**
6	1	2	1	2	**6**	0.0%	0.0%
7	1	4	1	2	**7**	0.0%	100.0%
8	1	5	1	2	**8**	0.0%	150.0%
9	2	5	1	2	**9**	100.0%	150.0%
10	2	6	1	3	**10**	100.0%	100.0%
11	2	6	1	3	**11**	100.0%	100.0%
12	2	7	1	2	**12**	100.0%	250.0%
13	3	7	1	2	**13**	200.0%	250.0%
14	5	10	1	2	**14**	400.0%	400.0%
15	6	11	1	2	**15**	500.0%	450.0%
16	7	11	1	1	**16**	600.0%	1000.0%
17	8	13	1	1	**17**	700.0%	1200.0%

Data Compiled from Athletic.Net

2021 National 3000 m cross country race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	691.8	728.4	Difference	607.7	659.8	Difference	608.1	632.6	Difference
2	722.5	739.0	#1 boy vs #	619.6	674.0	#1 boy vs #	608.7	639.8	#1 boy vs #
3	740.5	783.0	1 girl	620.1	674.7	1 girl	611.3	664.1	1 girl
4	759.3	783.5	5.0%	643.2	683.7	7.9%	618.6	664.4	3.9%
5	759.6	792.8		646.8	685.0		619.7	671.6	
6	760.0	824.1		648.0	686.4		631.2	672.1	
7	772.0	825.7	Average	648.8	687.0	Average	631.7	672.3	Average
8	773.0	832.3	difference	658.0	691.0	difference	634.9	678.4	difference
9	780.7	834.3	boys vs girls	659.5	692.2	boys vs girls	635.0	679.3	boys vs girls
10	735.1	844.4	6.2%	663.9	663.3	5.6%	635.1	679.4	6.3%

2021 National 3000 m cross country race time in seconds

	5th grade			6th grade			7th grade		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	625.5	667.0	Difference	545.3	582.0	Difference	534.0	560.7	Difference
2	648.8	685.0	#1 boy vs #	553.2	584.3	#1 boy vs #	541.0	567.0	#1 boy vs #
3	653.5	712.9	1 girl	562.3	585.1	1 girl	542.6	581.8	1 girl
4	658.4	719.2	6.2%	562.9	599.8	6.3%	544.6	583.0	4.8%
5	675.3	725.2		571.5	612.9		546.0	595.0	
6	677.4	727.7		588.0	622.0		556.0	599.0	
7	677.6	734.0	Average	591.3	624.9	Average	556.0	604.3	Average
8	679.1	739.4	difference	593.0	626.0	difference	556.0	606.0	difference
9	686.4	739.4	boys vs girls	593.8	628.0	boys vs girls	558.6	606.8	boys vs girls
10	686.4	746.4	7.3%	594.1	645.6	5.8%	563.2	617.0	7.1%

2021 National 100 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	13.06	14.24	Difference #1	10.87	12.10	Difference #1	11.37	12.08	Difference #1
2	13.54	14.41	boy vs # 1	10.91	12.24	boy vs # 1	11.61	12.43	boy vs # 1
3	13.73	14.44	girl	11.09	12.63	girl	11.73	12.51	girl
4	14.10	14.48	8.3%	11.25	12.70	10.2%	11.84	12.55	5.9%
5	14.19	14.49		11.27	12.75		11.89	12.57	
6	14.31	14.58		11.33	12.80		11.91	12.62	
7	14.34	14.69	Average	11.42	12.83	Average	11.94	12.65	Average
8	14.35	14.72	difference	11.43	12.84	difference	11.97	12.71	difference
9	14.41	14.77	boys vs girls	11.44	12.88	boys vs girls	12.08	12.71	boys vs girls
10	14.43	14.86	3.6%	11.51	12.91	11.1%	12.12	12.75	5.7%

2021 National 200 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	24.02	28.72	Difference #1	21.77	25.36	Difference #1	20.66	25.03	Difference #1
2	24.03	28.87	boy vs # 1	22.25	25.50	boy vs # 1	22.91	25.18	boy vs # 1
3	28.07	29.92	girl	22.48	25.55	girl	23.14	25.22	girl
4	28.44	29.95	16.4%	22.57	25.70	14.2%	23.69	25.49	17.5%
5	28.97	30.04		22.65	26.08		23.84	25.78	
6	29.26	30.09		22.77	26.22		24.23	25.89	
7	29.34	30.27	Average	23.11	26.79	Average	24.35	26.03	Average
8	29.38	30.34	difference	23.16	26.84	difference	24.58	26.07	difference
9	29.65	30.41	boys vs girls	23.28	26.91	boys vs girls	24.59	26.10	boys vs girls
10	29.78	30.54	6.1%	23.47	26.85	13.1%	24.61	26.13	7.9%

2021 National 400 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	66.30	67.12	Difference #1	49.29	56.80	Difference #1	51.96	55.70	Difference #1
2	66.88	67.67	boy vs # 1	50.47	58.57	boy vs # 1	55.52	57.08	boy vs # 1
3	67.59	67.74	girl	52.28	60.65	girl	55.58	57.60	girl
4	68.16	68.26	1.2%	52.44	61.45	13.2%	55.59	57.79	6.7%
5	68.51	68.37		53.31	61.81		55.72	58.02	
6	69.13	71.02		53.65	62.03		55.84	58.25	
7	69.75	72.73	Average	53.78	62.32	Average	55.92	59.25	Average
8	69.80	73.25	difference	54.51	62.33	difference	57.12	59.27	difference
9	69.81	73.31	boys vs girls	55.84	62.34	boys vs girls	57.18	59.40	boys vs girls
10	70.32	73.48	2.4%	55.90	62.40	13.0%	57.22	59.49	4.2%

2021 National 800 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	152.2	157.9	Difference #1	120.8	141.4	Difference #1	127.8	138.5	Difference #1
2	155.2	164.6	boy vs # 1	124.0	142.2	boy vs # 1	129.7	143.1	boy vs # 1
3	161.0	164.9	girl	125.1	148.8	girl	130.5	144.2	girl
4	161.1	165.9	3.6%	125.6	151.3	14.5%	133.2	144.2	7.7%
5	161.2	168.5		126.5	151.6		136.2	144.9	
6	161.6	169.9		136.5	152.5		136.5	145.0	
7	161.8	171.5	Average	137.1	153.1	Average	136.7	145.2	Average
8	162.2	173.1	difference	138.5	153.7	difference	136.7	145.6	difference
9	165.3	173.4	boys vs girls	139.5	153.8	boys vs girls	137.0	145.6	boys vs girls
10	166.9	174.7	4.5%	140.2	154.2	12.6%	137.9	145.8	6.9%

2021 National 1600 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	372.4	397.6	Difference #1	307.4	319.3	Difference #1	297.3	313.8	Difference #1
2	378.3	400.9	boy vs # 1	313.7	322.2	boy vs # 1	298.4	317.1	boy vs # 1
3	378.4	405.6	girl	315.0	322.6	girl	307.0	319.9	girl
4	402.0	435.2	6.3%	318.2	337.5	3.7%	313.9	323.3	5.2%
5	406.4	445.0		318.4	345.2		319.2	325.3	
6	413.4	457.0		320.5	345.7		320.4	326.2	
7	457.4	466.0	Average	327.0	345.9	Average	321.1	327.0	Average
8	473.3	466.8	difference	330.3	347.1	difference	321.9	330.0	difference
9	498.3	492.3	boys vs girls	333.4	347.5	boys vs girls	325.5	331.1	boys vs girls
10	505.0	495.0	4.0%	347.0	355.6	4.7%	327.1	332.5	2.9%

2021 National 3000 m Track race time in seconds

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	794.2	859.9	Difference #1	602.3	679.2	Difference #1	556.6	623.7	Difference #1
2	856.3		boy vs # 1	644.9	709.7	boy vs # 1	591.6	649.5	boy vs # 1
3			girl	646.6	714.2	girl	600.8	651.6	girl
4			7.6%	648.2	741.9	11.3%	607.1	654.9	10.8%
5		No		648.4	742.7		609.1	662.9	
6	No	Further		652.8	756.6		611.5	664.1	
7	further	Data	Average	658.9	760.2	Average	615.7	666.3	Average
8	data		difference	660.1	762.5	difference	617.3	666.8	difference
9			boys vs girls	662.7	780.2	boys vs girls	618.4	673.2	boys vs girls
10			NA%	671.6	792.3	12.7%	620.6	674.4	8.2%

2021 National Long Jump Distance (in inches)

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	156.0	176.0	Difference #1	256.8	213.8	Difference #1	224.0	201.3	Difference #1
2	156.0	163.8	boy vs # 1	247.0	212.0	boy vs # 1	222.5	197.3	boy vs # 1
3	155.0	153.0	girl	241.0	210.8	girl	220.5	195.8	girl
4	154.3	152.0	-11.4%	236.3	208.8	20.1%	210.3	193.5	11.3%
5	154.0	149.5		231.5	207.0		210.0	193.3	
6	152.8	146.0		225.0	204.8		206.8	192.5	
7	151.5	144.5	Average	224.0	194.5	Average	206.0	192.3	Average
8	150.8	137.5	difference	224.0	192.5	difference	205.5	192.0	difference
9	150.5	137.0	boys vs girls	221.8	192.3	boys vs girls	205.0	191.3	boys vs girls
10		No	1.4%			13.2%			9.1%
		Further							
	150.5	Data		219.0	187.5		204.5	189.0	

2021 National High Jump Distance (in inches)

	7-8 years old			9-10 years old			11-12 year old		
Rank	Boys	Girls		Boys	Girls		Boys	Girls	
1	38.0	37.5	Difference #1	72.0	58.0	Difference #1	63.0	56.0	Difference #1
2	38.0	34.0	boy vs # 1	70.0	58.0	boy vs # 1	61.0	56.0	boy vs # 1
3	36.0	32.0	girl	65.8	57.0	girl	60.0	57.0	girl
4	36.0	32.0	1.3	62.0	56.0	24.1%	59.0	56.0	12.5%
5	35.8	32.0		62.0	56.0		59.0	56.0	
6	35.5			62.0	55.0		59.0	55.0	
7	34.0		Average	61.0	54.0	Average	59.0	54.0	Average
8	32.0	No	difference	60.0	54.0	difference	58.0	54.0	difference
9	59.0	further	boys vs girls	59.0	No	boys vs girls	57.8	56.0	boys vs girls
10		Data	21.6%		Further	12.5%			6.9%
	56.0			56.0	Data		57.8	56.0	

Appendix 2 – Scholarly Publications in Past 10 Years

Refereed Publications

1. Brown GA, Shaw BS, Shaw I. How much water is in a mouthful, and how many mouthfuls should I drink? A laboratory exercise to help students understand developing a hydration plan. Adv Physiol Educ 45: 589–593, 2021.
2. Schneider KM and Brown GA (as Faculty Mentor). What's at Stake: Is it a Vampire or a Virus? International Journal of Undergraduate Research and Creative Activities. 11, Article 4. 2019.
3. Christner C and Brown GA (as Faculty Mentor). Explaining the Vampire Legend through Disease. UNK Undergraduate Research Journal. 23(1), 2019. (*This is an on-campus publication.)
4. Schneekloth B and Brown GA. Comparison of Physical Activity during Zumba with a Human or Video Game Instructor. 11(4):1019-1030. International Journal of Exercise Science, 2018.
5. Bice MR, Hollman A, Bickford S, Bickford N, Ball JW, Wiedenman EM, Brown GA, Dinkel D, and Adkins M. Kinesiology in 360 Degrees. International Journal of Kinesiology in Higher Education, 1: 9-17, 2017
6. Shaw I, Shaw BS, Brown GA, and Shariat A. Review of the Role of Resistance Training and Musculoskeletal Injury Prevention and Rehabilitation. Gavin Journal of Orthopedic Research and Therapy. 1: 5-9, 2016
7. Kahle A, Brown GA, Shaw I, & Shaw BS. Mechanical and Physiological Analysis of Minimalist versus Traditionally Shod Running. J Sports Med Phys Fitness. 56(9):974-9, 2016
8. Bice MR, Carey J, Brown GA, Adkins M, and Ball JW. The Use of Mobile Applications to Enhance Learning of the Skeletal System in Introductory Anatomy & Physiology Students. Int J Kines Higher Educ 27(1) 16-22, 2016
9. Shaw BS, Shaw I, & Brown GA. Resistance Exercise is Medicine. Int J Ther Rehab. 22: 233-237, 2015.
10. Brown GA, Bice MR, Shaw BS, & Shaw I. Online Quizzes Promote Inconsistent Improvements on In-Class Test Performance in Introductory Anatomy & Physiology. Adv. Physiol. Educ. 39: 63-6, 2015
11. Brown GA, Heiserman K, Shaw BS, & Shaw I. Rectus abdominis and rectus femoris muscle activity while performing conventional unweighted and weighted seated abdominal trunk curls. Medicina dello Sport. 68: 9-18. 2015
12. Botha DM, Shaw BS, Shaw I & Brown GA. Role of hyperbaric oxygen therapy in the promotion of cardiopulmonary health and rehabilitation. African Journal for

Physical, Health Education, Recreation and Dance (AJPHERD). Supplement 2 (September), 20: 62-73, 2014

13. Abbey BA, Heelan KA, Brown, GA, & Bartee RT. Validity of HydraTrend™ Reagent Strips for the Assessment of Hydration Status. J Strength Cond Res. 28: 2634-9. 2014
14. Scheer KC, Siebrandt SM, Brown GA, Shaw BS, & Shaw I. Wii, Kinect, & Move. Heart Rate, Oxygen Consumption, Energy Expenditure, and Ventilation due to Different Physically Active Video Game Systems in College Students. International Journal of Exercise Science: 7: 22-32, 2014
15. Shaw BS, Shaw I, & Brown GA. Effect of concurrent aerobic and resistive breathing training on respiratory muscle length and spirometry in asthmatics. African Journal for Physical, Health Education, Recreation and Dance (AJPHERD). Supplement 1 (November), 170-183, 2013
16. Adkins M, Brown GA, Heelan K, Ansorge C, Shaw BS & Shaw I. Can dance exergaming contribute to improving physical activity levels in elementary school children? African Journal for Physical, Health Education, Recreation and Dance (AJPHERD). 19: 576-585, 2013
17. Jarvi MB, Brown GA, Shaw BS & Shaw I. Measurements of Heart Rate and Accelerometry to Determine the Physical Activity Level in Boys Playing Paintball. International Journal of Exercise Science: 6: 199-207, 2013
18. Brown GA, Krueger RD, Cook CM, Heelan KA, Shaw BS & Shaw I. A prediction equation for the estimation of cardiorespiratory fitness using an elliptical motion trainer. West Indian Medical Journal. 61: 114-117, 2013.
19. Shaw BS, Shaw I, & Brown GA. Body composition variation following diaphragmatic breathing. African Journal for Physical, Health Education, Recreation and Dance (AJPHERD). 18: 787-794, 2012.

Refereed Presentations

1. Brown GA. Transwomen competing in women's sports: What we know, and what we don't. American Physiological Society New Trends in Sex and Gender Medicine conference. Held virtually due to Covid-19 pandemic. October 19 - 22, 2021, 2021.
2. Shaw BS, Boshoff VE, Coetzee S, Brown GA, Shaw I. A Home-based Resistance Training Intervention Strategy To Decrease Cardiovascular Disease Risk In Overweight Children Med Sci Sport Exerc. 53(5), 742. 68th Annual Meeting of the American College of Sports Medicine. Held virtually due to Covid-19 pandemic. June 1-5, 2021.
3. Shaw I, Cronje M, Brown GA, Shaw BS. Exercise Effects On Cognitive Function And Quality Of Life In Alzheimer's Patients In Long-term Care. Med

Sci Sport Exerc. 53(5), 743. 68th Annual Meeting of the American College of Sports Medicine. Held virtually due to Covid-19 pandemic. June 1-5, 2021.

4. Brown GA, Escalera M, Oleena A, Turek T, Shaw I, Shaw BS. Relationships between Body Composition, Abdominal Muscle Strength, and Well Defined Abdominal Muscles. Med Sci Sport Exerc. 53(5), 197. 68th Annual Meeting of the American College of Sports Medicine. Held virtually due to Covid-19 pandemic. June 1-5, 2021.

5. Brown GA, Jackson B, Szekely B, Schramm T, Shaw BS, Shaw I. A Pre-Workout Supplement Does Not Improve 400 M Sprint Running or Bicycle Wingate Test Performance in Recreationally Trained Individuals. Med Sci Sport Exerc. 50(5), 2932. 65th Annual Meeting of the American College of Sports Medicine. Minneapolis, MN. June 2018.

6. Paulsen SM, Brown GA. Neither Coffee Nor A Stimulant Containing "Pre-workout" Drink Alter Cardiovascular Drift During Walking In Young Men. Med Sci Sport Exerc. 50(5), 2409. 65th Annual Meeting of the American College of Sports Medicine. Minneapolis, MN. June 2018.

7. Adkins M, Bice M, Bickford N, Brown GA. Farm to Fresh! A Multidisciplinary Approach to Teaching Health and Physical Activity. 2018 spring SHAPE America central district conference. Sioux Falls, SD. January 2018.

8. Shaw I, Kinsey JE, Richards R, Shaw BS, and Brown GA. Effect Of Resistance Training During Nebulization In Adults With Cystic Fibrosis. International Journal of Arts & Sciences' (IJAS). International Conference for Physical, Life and Health Sciences which will be held at FHWien University of Applied Sciences of WKW, at Währinger Gürtel 97, Vienna, Austria, from 25-29 June 2017.

9. Bongers M, Abbey BM, Heelan K, Steele JE, Brown GA. Nutrition Education Improves Nutrition Knowledge, Not Dietary Habits In Female Collegiate Distance Runners. Med Sci Sport Exerc. 49(5), 389. 64th Annual Meeting of the American College of Sports Medicine. Denver, CO. May 2017.

10. Brown GA, Steele JE, Shaw I, Shaw BS. Using Elisa to Enhance the Biochemistry Laboratory Experience for Exercise Science Students. Med Sci Sport Exerc. 49(5), 1108. 64th Annual Meeting of the American College of Sports Medicine. Denver, CO. May 2017.

11. Brown GA, Shaw BS, and Shaw I. Effects of a 6 Week Conditioning Program on Jumping, Sprinting, and Agility Performance In Youth. Med Sci Sport Exerc. 48(5), 3730. 63rd Annual Meeting of the American College of Sports Medicine. Boston, MA. June 2016.

12. Shaw I, Shaw BS, Boshoff VE, Coetzee S, and Brown GA. Kinanthropometric Responses To Callisthenic Strength Training In Children. Med Sci Sport Exerc.

48(5), 3221. 63rd Annual Meeting of the American College of Sports Medicine. Boston, MA. June 2016.

13. Shaw BS, Shaw I, Gouveia M, McIntyre S, and Brown GA. Kinanthropometric Responses To Moderate-intensity Resistance Training In Postmenopausal Women. Med Sci Sport Exerc. 48(5), 2127. 63rd Annual Meeting of the American College of Sports Medicine. Boston, MA. June 2016.

14. Bice MR, Cary JD, Brown GA, Adkins M, and Ball JW. The use of mobile applications to enhance introductory anatomy & physiology student performance on topic specific in-class tests. National Association for Kinesiology in Higher Education National Conference. January 8, 2016.

15. Shaw I, Shaw BS, Lawrence KE, Brown GA, and Shariat A. Concurrent Resistance and Aerobic Exercise Training Improves Hemodynamics in Normotensive Overweight and Obese Individuals. Med Sci Sport Exerc. 47(5), 559. 62nd Annual Meeting of the American College of Sports Medicine. San Diego, CA. May 2015.

16. Shaw BS, Shaw I, McCrorie C, Turner S., Schnetler A, and Brown GA. Concurrent Resistance and Aerobic Training in the Prevention of Overweight and Obesity in Young Adults. Med Sci Sport Exerc. 47(5), 223. 62nd Annual Meeting of the American College of Sports Medicine. San Diego, CA. May 2015.

17. Schneekloth B, Shaw I, Shaw BS, and Brown GA. Physical Activity Levels Using Kinect™ Zumba Fitness versus Zumba Fitness with a Human Instructor. Med Sci Sport Exerc. 46(5), 326. 61st Annual Meeting of the American College of Sports Medicine. Orlando, FL. June 2014.

18. Shaw I, Lawrence KE, Shaw BS, and Brown GA. Callisthenic Exercise-related Changes in Body Composition in Overweight and Obese Adults. Med Sci Sport Exerc. 46(5), 394. 61st Annual Meeting of the American College of Sports Medicine. Orlando, FL June 2014.

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A complete CV is available at https://www.unk.edu/academics/hperls/bio_pages/current-vita-gab.pdf

EXHIBIT 15

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
CHARLESTON DIVISION

B.P.J., by her next friend and mother, HEATHER JACKSON, *Plaintiff,* vs. WEST VIRGINIA STATE BOARD OF EDUCATION; HARRISON COUNTY BOARD OF EDUCATION; WEST VIRGINIA SECONDARY SCHOOLS ACTIVITIES COMMISSION; W. CLAYTON BURCH, in his official capacity as State Superintendent, DORA STUTLER, in her official capacity as the Harrison County Superintendent, and the STATE OF WEST VIRGINIA, *Defendants,* and LAINEY ARMISTEAD, *Defendant-Intervenor.*	Case No. 2:21-cv-00316 Hon. Joseph R. Goodwin

DECLARATION OF DR. CHAD T. CARLSON, M.D., FACSM

I, Dr. Chad T. Carlson, pursuant to 28 U.S. Code § 1746, declare under penalty of perjury under the laws of the United States of America that the facts contained in my Expert Report of Dr. Chad T. Carlson, M.D., FACM prepared for *B.P.J. v. West Virginia*, attached hereto, are true and correct to the best of my knowledge and belief, and that the opinions expressed therein represent my own expert opinions.

Executed on February 23, 2022.

Chad T. Carlson, MD

Expert Report of Dr. Chad Thomas Carlson, M.D., FACM
prepared for *B.P.J. v. West Virginia*
February 23, 2022

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INTRODUCTION

Up to the present, the great majority of news, debate, and even scholarship about transgender participation in female athletics has focused on track and field events and athletes, and the debate has largely concerned questions of fairness and inclusion. However, the transgender eligibility policies of many high school athletic associations in the United States apply with equal force to all sports, including sports in which players frequently collide with each other, or can be forcefully struck by balls or equipment such as hockey or lacrosse sticks. And in fact, biologically male transgender athletes have competed in a wide range of high school, collegiate, and professional girls' or women's sports, including, at least, basketball,[1] soccer,[2] volleyball,[3] softball,[4] lacrosse,[5] and even women's tackle football.[6]

[1]https://www.espn.com/espnw/athletes-life/story/_/id/10170842/espnw-gabrielle-ludwig-52-year-old-transgender-women-college-basketball-player-enjoying-best-year-life (accessed 2/17/22)

[2]https://www.unionleader.com/news/education/nh-bill-limits-women-s-sports-to-girls-born-female/article_d1998ea1-a1b9-5ba4-a48d-51a2aa01b910.html; https://www.outsports.com/2020/1/17/21069390/womens-soccer-mara-gomez-transgender-player-argentina-primera-division-villa-san-marcos (accessed 6/20/21)

[3]https://news.ucsc.edu/2016/09/challenging-assumptions.html (accessed 6/20/21); https://www.outsports.com/2017/3/20/14987924/trans-athlete-volleyball-tia-thompson (accessed 6/20/21)

[4]https://www.foxnews.com/us/californias-transgender-law-allows-male-high-schooler-to-make-girls-softball-team (accessed 6/20/21)

[5]https://savewomenssports.com/f/emilys-story?blogcategory=Our+Stories (accessed 6/20/21)

[6]https://www.outsports.com/2017/12/13/16748322/britney-stinson-trans-football-baseball (accessed 6/20/21); https://www.mprnews.org/story/2018/12/22/transgender-football-player-prevails-in-lawsuit (accessed 6/20/21)

The science of sex-specific differences in physiology, intersecting with the physics of sports injury, leaves little doubt that participation by biological males in these types of girls' or women's sports, based on gender identity, creates significant additional risk of injury for the biologically female participants competing alongside these transgender athletes.

In 2020, after an extensive review of the scientific literature, consultation with experts, and modeling of expected injuries, World Rugby published revised rules governing transgender participation, along with a detailed explanation of how the new policy was supported by current evidence. World Rugby concluded that "there is currently no basis with which safety and fairness can be assured to biologically female rugby players should they encounter contact situations with players whose biological male advantages persist to a large degree," and that after puberty, "the lowering of testosterone removes only a small proportion of the documented biological differences." Hence, World Rugby concluded that biological men should not compete in women's rugby. (World Rugby Transgender Women Guidelines 2020.) World Rugby has been criticized by some for its new guidelines, but those criticisms have often avoided discussions of medical science entirely, or have asserted that modeling scenarios can overstate true risk. What cannot be denied, however, is that World Rugby's approach is evidence-based, and rooted in concern for athlete safety. As a medical doctor who has spent my career in sports medicine, it is my opinion that World Rugby's assessment of the evidence is scientifically sound, and that injury modeling meaningfully predicts that biologically male transgender athletes do constitute a safety risk for the biologically female athlete in women's sports.

In a similar vein, in 2021, the UK Sports Councils' Equality Group released new guidance for transgender inclusion in organized sports. This guidance was formulated after extensive conversations with stakeholders, a review of scientific findings related to transgender athletes in sport through early 2021, and an assessment of the use by some sport national governing bodies of case-by-case assessment to determine eligibility. Noteworthy within these stakeholder consultations was a lack of consensus on any workable solution, as well as concerns related to athlete safety and "adherence to rules which give sport validity." The Literature Review accompanying the guidance document further noted that "[t]here are significant differences between the sexes which render direct competition between males and females . . . unsafe in sports which allow physical contact and collisions." (UK Sports Councils' Equality Group Literature Review 2021 at 1.) Their review of the science "made clear that there are retained differences in strength, stamina and physique between the average woman compared with the average transgender woman….with or without testosterone suppression." (UK Sports Councils' Equality Group Guidance at 3.) This was also reflected in their ten guiding principles, stating that physical differences between the sexes will "impact safety parameters in sports which are combat, collision or contact in nature." (UK Sports Councils' Equality Group Guidance 2021 at 7.) Ultimately, UK Sport concluded that the full inclusion of transgender athletes in women's sports "cannot be reconciled within the current structure of sport," stating that "the inclusion of transgender people into female sport cannot be balanced regarding transgender inclusion, fairness and safety in gender-affected sport where there is meaningful competition . . . . due to retained differences in strength, stamina and physique between the average woman compared with the average transgender woman…, with or without testosterone suppression." (UK Sports Councils' Equality Group Guidance 2021 at 6.) Finally, UK Sport affirmed the use of sex categorization in sport, along with age and disability, as important for the maintenance of safety and fairness. (UK Sports Councils' Equality Group Guidance 2021 at 7-8.)

Unfortunately, apart from World Rugby's careful review and the recent release of UK Sports Councils' guidance, the public discourse is lacking any careful consideration of the question of safety. As a physician who has spent my career caring for athletes, I find this silence about safety both surprising and concerning. It is my hope through this white paper to equip and motivate sports leagues and policy makers to give adequate attention to the issue of safety for female athletes when transgender policies are being considered. I first explain the nature and causes of common sports injuries. I then review physiological differences between male and female bodies that affect the risk and severity of injuries to females when biological males compete in the female category, and explain why testosterone suppression does not eliminate these heightened risks to females. Finally, I explain certain conclusions about those risks.

CREDENTIALS

1. I am a medical doctor practicing Sports Medicine, maintaining an active clinical practice at Stadia Sports Medicine in West Des Moines, Iowa. I received my M.D. from the University of Nebraska College of Medicine in 1994 and completed a residency in family medicine at the University of Michigan in 1997.

2. Following my time in Ann Arbor, I matched to a fellowship in Sports Medicine at Ball Memorial Hospital in Muncie, Indiana, training from 1997 to 1999, with clinical time split between Central Indiana Orthopedics, the Ball State Human Performance Laboratory, and the Ball State University training room. I received my board certification in Sports Medicine in 1999, which I continue to hold. Since residency training, my practice has focused on Sports Medicine–the treatment and prevention of injuries related to sport and physical activity.

3. Since 1997, I have served in several clinical practices and settings as a treating physician, including time as team physician for both the University of Illinois and Ball State University, where I provided care to athletes in several sports, including football, ice hockey, basketball, field hockey, softball, gymnastics, soccer, and volleyball. In the course of my career, I have provided coverage for NCAA Power Five Conference championships and NCAA National

Championship events in basketball, field hockey and gymnastics, among other sports, as well as provided coverage for national championship events for U.S.A. gymnastics, and U.S. Swimming and Diving. I have also covered professional soccer in Des Moines.

4. Since 2006, I have been the physician owner of Stadia Sports Medicine in West Des Moines, Iowa. My practice focuses on treatment of sports and activity-related injury, including concussive injury, as well as problems related to the physiology of sport.

5. I have served in and provided leadership for several professional organizations over the course of my career. In 2004, I was designated a Fellow of the American College of Sports Medicine (ACSM). I have served on ACSM's Health and Science Policy Committee since 2010, and for a time chaired their Clinical Medicine Subcommittee. From 2009 to 2013, I served two elected terms on the Board of Directors of the American Medical Society for Sports Medicine (AMSSM), and during that time served as Chair of that body's Practice and Policy Committee. I was subsequently elected to a four-year term on AMSSM's executive committee in 2017, and from 2019-20, I served as AMSSM's President. AMSSM is the largest organization of sports medicine physicians in the world. I gained fellowship status through AMSSM in 2020–my first year of eligibility. My work for ACSM and AMSSM has brought with it extensive experience in public policy as relates to Sports Medicine.

6. In 2020, I was named as AMSSM's first board delegate to the newly-constituted Physical Activity Alliance. I am a named member of an NCAA advisory group on COVID-19, through which I provided input regarding the cancellation of the basketball tournament in 2020. I also serve as a member of the Iowa Medical Society's Sports Medicine Subcommittee and have been asked to serve on the Iowa High School Athletic Association's newly-forming Sports Medicine Advisory Committee.

7. I have served as a manuscript reviewer for organizational policy pronouncements, and for several professional publications, most recently a sports medicine board review book just published in 2021. I have published several articles on topics related to musculoskeletal injuries in sports and rehabilitation, which have been published in peer-reviewed journals such as Clinical Journal of Sports Medicine, British Journal of Sports Medicine, Current Reviews in Musculoskeletal Medicine, Athletic Therapy Today, and the Journal of Athletic Training. In conjunction with my work in policy advocacy, I have helped write several pieces of legislation, including the initial draft of what became the Sports Medicine Licensure Clarity Act, signed into law by President Trump in 2018, which eases the restrictions on certain practitioners to provide health services to athletes and athletic teams outside of the practitioner's home state. A list of my publications over the past ten (10) years is included as an appendix to this report.

8. In the past four years, I have not testified as an expert witness in a deposition or at trial.

9. I am being compensated for my services as an expert witness in this case at the rates of $650 per hour for consultation, $800 per hour for deposition testimony, and $3,500 per half-day of trial testimony.

I. OVERVIEW

10. In this statement, I offer information and my own professional opinion on the potential for increased injury risk to females in sports when they compete against biologically male transgender athletes.[7] At many points in this statement, I provide citations to published, peer-reviewed articles that provide relevant and supporting information to the points I make.

11. The principal conclusions that I set out in this white paper are as follows:

a. Government and sporting organizations have historically considered the preservation of athlete safety as one component of competitive equity.

b. Injury in sport is somewhat predictable based on modeling assumptions that take into account relevant internal and external risk factors.

[7] In the body of this paper, I use the terms "male" and "female" according to their ordinary medical meaning–that is to say, to refer to the two biological sexes. I also use the word "man" to refer to a biologically male human, and "woman" to refer to a biologically female human. In the context of this opinion, I include in these categories non-syndromic, biologically-normal males and females who identify as a member of the opposite sex, including those who use endogenous hormone suppression to alter their body habitus. In contexts that are not focused on questions of biology and physiology, terms of gender are sometimes used to refer to subjective identities rather than to biological categories – something I avoid for purposes of a paper focused on sports science

c. Males exhibit large average advantages in size, weight, and physical capacity over females—often falling far outside female ranges. Even before puberty, males have a performance advantage over females in most athletic events. Failure to preserve protected female-only categories in contact sports (broadly defined) will ultimately increase both the frequency and severity of injury suffered by female athletes who share playing space with these males.

d. Current research supports the conclusion that suppression of testosterone levels by males who have already begun puberty will not fully reverse the effects of testosterone on skeletal size, strength, or muscle hypertrophy, leading to persistence of sex-based differences in power, speed, and force-generating capacity.

12. In this white paper, I use the term "contact sports" to refer broadly to all sports in which collisions between players, or collisions between equipment such as a stick or ball and the body of a player, occur with some frequency (whether or not permitted by the rules of the game), and are well recognized in the field of sports medicine as causes of sport-related injuries.[8] The 1975 Title IX implementing regulations (34 CFR § 106.41) say that "for purposes of this [regulation] contact sports include boxing, wrestling, rugby, ice hockey, football, basketball, *and other sports* the purpose or major activity of which involves bodily contact." Certainly, all of the sports specifically named in the regulation fall within my definition of "contact sport." Mixed martial arts, field hockey (Barboza 2018), soccer (Kuczinski 2018), rugby (Viviers 2018), lacrosse

[8] It is common to see, within the medical literature, reference to distinctions between "contact" and "collision" sports. For purposes of clarity, I have combined these terms, since in the context of injury risk modeling, there is no practical distinction between them.

(Pierpoint 2019), volleyball,[9] baseball, and softball also involve collisions that can and do result in injuries, and so also fall within my definition.

II. A BRIEF HISTORY OF THE RATIONALE FOR SEPARATION OF SPORT BY SEX

13. World Rugby is correct when it notes that "the women's category exists to ensure protection, safety, and equality" for women. (World Rugby Transgender Women Guidelines 2020.) To some extent, those in charge of sport governing bodies in the modern era have always recognized the importance of grouping athletes together based on physical attributes, in order to ensure both safety and competitive balance. Weight classifications have existed in wrestling since it reappeared as an Olympic event in 1904. Women and men have participated in separate categories since the advent of intercollegiate sporting clubs early in the 20th century. When Title IX went into effect in 1975, there were just under 300,000 female high school athletes, and fewer than 10,000 female collegiate athletes. With the changes that resulted from Title IX, it was assumed that newly-available funds for women in sport would ensure the maintenance of existing, or creation of new, sex-segregated athletic teams that would foster greater participation by women. This has been borne out subsequently; by the first half of the 1980's these numbers had risen to 1.9 million and nearly 100,000 respectively. (Hult 1989.)

[9] See https://www.latimes.com/sports/story/2020-12-08/stanford-volleyball-hayley-hodson-concussions-cte-lawsuit, and https://volleyballmag.com/corinneatchison/ (both accessed 6/20/21).

14. The rationale for ongoing "separate but equal" status when it came to sex-segregated sports was made clear within the language of the original implementing regulations of Title IX , which, acknowledging real, biologically-driven differences between the sexes, created carve-out exceptions authorizing sex-separation of sport for reasons rooted in the maintenance of competitive equity. Importantly, the effect of these innate sex-based differences on the health and safety of the athlete were acknowledged by the express authorization of sex-separated teams for sports with higher perceived injury risk—i.e., "contact sports." (Coleman 2020.)

15. In the almost half century since those regulations were adopted, the persistent reality of sex-determined differences in athletic performance and safety has been recognized by the ongoing and nearly universal segregation of men's and women's teams–even those that are not classically defined as being part of a contact or collision sport.

16. Now, however, many schools and sports leagues in this country are permitting males to compete in female athletics—including in contact sports—based on gender identity. In my view, these policies have been adopted without careful analysis of safety implications. Other researchers and clinicians have addressed questions of the negative impact of such policies on fairness, or equality of athletic experiences for girls and women, in published articles, and in court submissions. One recent review of track and field performances, including sprints, distance races and field events, noted that men surpass the

top female performance in each category between 1000 and 10,000 times *each year*, with hundreds or thousands of men beating the top women in each event. (Coleman & Shreve.) Although this was not their primary focus, World Rugby well-summarized the point when it observed that in a ranking list of the top thousand performances in most sports, every year, *every one* will have been achieved by a biological male. (World Rugby Transgender Women Guidelines 2020.) Although most easily documented in athletes who have gone through puberty, these differences are not exclusively limited to post-pubescent athletes either.

17. I have reviewed the expert declaration of Gregory A. Brown, Ph.D., FACM of February 23, 2022, provided in this case, which includes evidence from a wide variety of sources, including population-based mass testing data, as well as age-stratified competition results, all of which support the idea that prepubertal males run faster, jump higher and farther, exhibit higher aerobic power output, and have greater upper body strength (evidenced by stronger hand grip and better performance with chin-ups or bent arm hang) than comparably aged females. This performance gap is well-documented in population-based physiologic testing data that exists in databases such as the Presidential Fitness Test, the Eurofit Fitness test, and additional mass testing data from the UK and Australia. Collectively, this data reveals that pre-pubertal males outperform comparably aged females in a wide array of athletic tests including but not limited to the countermovement jump test, drop jump test, change of direction

test, long jump, timed sit-up test, the 10 X 5 meter shuttle run test, the 20 meter shuttle run test, curl-ups, pull-ups, push-ups, one mile run, standing broad jump, and bent arm hang test. Dr. Brown further references studies showing a significant difference in the body composition of males and females before puberty. In sum, a large and unbridgeable performance gap between the sexes is well-studied and equally well-documented, beginning in many cases before puberty. In this white paper, I focus on some of these differences as they touch on the question of athlete safety.

III. UNDERSTANDING THE CAUSES OF SPORTS INJURIES

18. The causes for injury in sport are multifactorial. In recent decades, medical researchers have provided us an evolving understanding of how sports injuries occur, as well as the factors that make them more or less probable, and more or less severe. Broadly speaking, there are two ways of modeling injury: the epidemiological model, and the biomechanical model. These models are not mutually exclusive, but provide complementary conceptual frameworks to help us stratify risk in sport.

A. The epidemiological model of injury

19. From a practical standpoint, sports medicine researchers and clinicians often use the "epidemiological model" to explain, prevent and manage sports injuries. Broadly speaking, this model views an injury in sport as the product of internal and external risk factors, triggered by an inciting event. In other words, a given injury is "caused" by a number of different factors that are

unique to a given situation. (Meeuwise 1994.) When the interplay of these factors exceeds the injury threshold, injury occurs. One example of how this interplay might work would be a female distance runner in track who develops a tibial stress fracture, with identified risks of low estrogen state from amenorrhea (suppression of menses), an aggressive winter training program on an indoor tile surface, and shoes that have been used for too many miles, and are no longer providing proper shock absorption. Most risk factors ebb and flow, with the overall injury risk at any given time fluctuating as well. Proper attention to risk factor reduction *before* the start of the sports season (including appropriate rule-making) is the best way to reduce actual injury rates *during* the season.

20. As alluded to, the risk factors associated with injury can be broadly categorized as internal or external. Internal risk factors are internal to the athlete. These include relatively fixed variables, such as the athlete's age, biological sex, bone mineral density (which affects bone strength) and joint laxity, as well as more mutable variables such as body weight, fitness level, hydration state, current illness, prior injury, or psychosocial factors such as aggression.

21. External risk factors are, as the name suggests, external to the athlete. These include non-human risks such as the condition of the playing surface or equipment, athletic shoe wear, or environmental conditions. Other external risk factors come from opposing competitors, and include such

variables as player size, speed, aggressiveness, and overall adherence to the rules of the game. As already mentioned, these risks can be minimized through the proper creation and enforcement of rules, as well as the appropriate grouping of athletes together for purposes of competition. To the latter point, children don't play contact sports with adults and, in the great majority of cases, men and women compete in categories specific to their own biological sex. Certainly these categorical separations are motivated in part by average performance differences and considerations of fairness and opportunity. But they are also motivated by safety concerns. When properly applied, these divisions enhance safety because, when it comes to physical traits such as body size, weight, speed, muscle girth, and bone strength, although a certain amount of variability exists within each group, the averages and medians differ widely *between* the separated groups.[10]

22. Thus, each of these commonly utilized groupings of athletes represents a pool of individuals with predictable commonalities. Epidemiological risk assessment is somewhat predictable and translatable as long as these pools remain intact. But the introduction of outside individuals

[10] In some cases, safety requires even further division or exclusion. A welterweight boxer would not compete against a heavyweight, nor a heavyweight wrestle against a smaller athlete. In the case of youth sports, when children are at an age where growth rates can vary widely, leagues will accommodate for naturally-occurring large discrepancies in body size by limiting larger athletes from playing positions where their size and strength is likely to result in injury to smaller players. Thus, in youth football, players exceeding a certain weight threshold may be temporarily restricted to playing on the line and disallowed from carrying the ball, or playing in the defensive secondary, where they could impose high-velocity hits on smaller players.

into a given pool (e.g. an adult onto a youth football team, or males into most women's sports) would change the balance of risk inside that pool. Simply put, when you introduce larger, faster, and stronger athletes from one pool into a second pool of athletes who are *categorically* smaller (whether as a result of age or sex), you have altered the characteristics of the second pool, and, based on known injury modeling, have statistically increased the injury risk for the original athletes in that pool. This, in a nutshell, is the basis for World Rugby's recommendations.

23. Most clinical studies of the epidemiology of sports injuries use a multivariate approach, identifying multiple independent risk factors and examining how these factors might interact, in order to determine their relative contribution to injury risk, and make educated inferences about causation. (Meeuwise 1994.)

24. In applying the multivariate approach, the goal is to keep as many variables as possible the same so as to isolate the potential effect of a single variable (such as age or biological sex) on injury risk, as well as to determine how the isolated variable interacts with the other analyzed variables to affect injury risk. Failure to consider relevant independent variables can lead to error. Researchers focusing on differences between male and female athletes, for example, would not compare concussion rates of a high school girls' soccer team to concussion rates of a professional men's soccer team, because differences in the concussion rate might be due to a number of factors besides sex, such as age,

body mass, relative differences in skill, speed, or power, as well as differences in training volume and intensity.

25. As indicated earlier, an injury event is usually the end product of a number of different risk factors coming together. (Bahr 2005.) A collision between two soccer players who both attempt to head the ball, for example, might be the inciting event that causes a concussion. Although the linear and angular forces that occur through sudden deceleration would be the proximate cause of this injury, the epidemiological model of injury would also factor in "upstream" risks, predicting the possibility of an injury outcome for each athlete differently depending on the sum of these risks. If the collision injury described above occurs between two disparately-sized players, the smaller athlete will tend to decelerate more abruptly than the larger athlete, increasing the smaller athlete's risk for injury. Additional discrepancies in factors such as neck strength, running speeds, and muscle force generation capacity all result in differing risks and thus, the potential for differing injury outcomes from the same collision. As I discuss later in this white paper, there are significant statistical differences between the sexes when it comes to each of these variables, meaning that in a collision sport where skeletally mature males and females are playing against one another, there is a higher statistical likelihood that injury will result when collisions occur, and in particular there is a higher likelihood that a female will suffer injury. This again is the basis for the recent decision by World Rugby to disallow the crossover of men into women's rugby,

regardless of gender identity. (World Rugby Transgender Women Guidelines 2020.) The decision-making represented by this policy change is rational and rooted in objective facts and objective risks of harm, because it takes real, acknowledged, and documented physical differences between the sexes (in many cases before adolescence), and models expected injury risk on the basis of the known differences that persist even after hormone manipulation.

B. The biomechanical model of injury

26. Sports medicine researchers and clinicians also consider a biomechanical approach when it comes to understanding sports injuries. In the biomechanical model of injury, injury is considered to be analogous to the failure of a machine or other structure. Every bone, muscle, or connective tissue structure in an athlete's body has a certain load tolerance. Conceptually, when an external "load" exceeds the load tolerance of a given structure in the human body, an injury occurs. (Fung 1993 at 1.) Thus, researchers focus on the mechanical load—the force exerted on a bone, ligament, joint or other body part—and the load tolerance of that impacted or stressed body part, to understand what the typical threshold for injury is, and how predictable this might be. (McIntosh 2005 at 2-3.) Biomechanical models of injury usually consider forces in isolation. The more consistent the movement pattern of an individual, and the fewer the contributions of unexpected outside forces to the athlete, the more accurate biomechanical predictions of injury will be.

27. Biomechanical modeling can be highly predictive in relatively simple settings. For example, in blunt trauma injury from falls, mortality predictably rises the greater the fall. About 50% of people who fall four stories will survive, while only 10% will survive a fall of seven stories. (Buckman 1991.) As complexity increases, predictability in turn decreases. In sport, the pitching motion is highly reproducible, and strain injury to the ulnar collateral ligament (UCL) of the elbow can be modeled. The load tolerance of the UCL of a pitcher's elbow is about 32 Newton-meters, but the failure threshold of a ligament like this in isolation is not the only determinant of whether injury will occur. During the pitching motion, the valgus force imparted to the elbow (gapping stress across the inner elbow that stretches the UCL) routinely reaches 64 Newtons, which is obviously greater than the failure threshold of the ligament. Since not all pitchers tear their UCLs, other variables innate to an athlete must mitigate force transmission to the ligament and reduce risk. The load tolerance of any particular part of an athlete's body is thus determined by other internal factors such as joint stiffness, total ligament support, muscle strength across the joint, or bone mineral density. Injury load can be self-generated, as in the case of a pitcher's elbow, or externally-generated, as in the case of a linebacker hitting a wide receiver. While load tolerance will vary by individual, as described above, and is often reliant on characteristics innate to a given athlete, external load is determined by outside factors such as the nature of the playing surface or

equipment used, in combination with the weight and speed of other players or objects (such as a batted ball) with which the player collides. (Bahr 2005.)

28. As this suggests, the two "models" of sports injuries described above are not in any sense inconsistent or in tension with each other. Instead, they are complementary ways of thinking about injuries that can provide different insights. But the important point to make regarding these models is that in either model, injury risk (or the threshold for injury) rises and falls depending on the size of an externally-applied force, and the ability of a given athlete to absorb or mitigate that force.

IV. THE PHYSICS OF SPORTS INJURY

29. Sports injuries often result from collisions between players, or between a player and a rapidly moving object (e.g. a ball or hockey puck, a lacrosse or hockey stick). In soccer, for example, most head injuries result from collisions with another player's head or body, collision with the goal or ground, or from an unanticipated blow from a kicked ball. (Boden 1998; Mooney 2020.) In basketball, players often collide with each other during screens, while diving for a loose ball, or while driving to the basket. In lacrosse or field hockey, player-to-player, or player-to-stick contact is common.

30. But what are the results of those collisions on the human body? Basic principles of physics can cast light on this question from more than one angle. A general understanding of these principles can help us identify factors

that will predictably increase the relative risk, frequency, and severity of sports injuries, given certain assumptions.

31. First, we can consider **energy**. Every collision involves an object or objects that possess energy. The energy embodied in a moving object (whether a human body, a ball, or anything else) is called kinetic energy.

32. Importantly, the kinetic energy of a moving object is expressed as: $\boldsymbol{E_k = \frac{1}{2}mv^2}$. That is, kinetic energy is a function of the mass of the object multiplied by the *square* of its velocity. (Dashnaw 2012.) To illustrate with a simple but extreme example: if athletes A and B are moving at the same speed, but athlete A is twice as heavy, athlete A carries twice as much kinetic energy as athlete B. If the two athletes weigh the same amount, but athlete A is going twice as fast, athlete A carries four times as much kinetic energy as athlete B. But as I have noted, the kinetic energy of a moving object is a function of the mass of the object multiplied by the square of its velocity. Thus, if athlete A is twice as heavy, and moving twice as fast, athlete A will carry eight times the kinetic energy of athlete B into a collision.[11]

33. The implication of this equation means that what appear to be relatively minor discrepancies in size and speed can result in major differences in energy imparted in a collision, to the point that more frequent and more severe injuries can occur. To use figures that correspond more closely to average

[11] $2 \times 2^2 = 8$

differences between men and women, if Player M weighs only 20% more than Player F, and runs only 15% faster, Player M will bring *58% more kinetic energy* into a collision than Player F.[12]

34. The law of conservation of energy tells us that energy is never destroyed or "used up." If kinetic energy is "lost" by one body in a collision, it is inevitably transferred to another body, or into a different form. In the case of collision between players, or between (e.g.) a ball and a player's head, some of the energy "lost" by one player, or by the ball, may be transformed into (harmless) sound; some may result in an increase in the kinetic energy of the player who is struck (through acceleration, which I discuss below); but some of it may result in *deformation* of the player's body—which, depending on its severity, may result in injury. Thus, the greater the kinetic energy brought into a collision, the greater the potential for injury, all other things being equal.

35. Alternately, we can consider force and *acceleration*, which is particularly relevant to concussion injuries.

36. Newton's third law of motion tells us that when two players collide, their bodies experience equal and opposite forces at the point of impact.

37. Acceleration refers to the rate of change in speed (or velocity). When two athletes collide, their bodies necessarily accelerate (or decelerate) rapidly: stopping abruptly, bouncing back, or being deflected in a different

[12] $1.2 \times (1.15)^2 = 1.587$

direction. Newton's second law of motion tells us that: $\boldsymbol{F} = \boldsymbol{ma}$ (that is, force equals mass multiplied by acceleration). From this equation we see that when a larger and a smaller body collide, and (necessarily) experience equal and opposite forces, the smaller body (or smaller player, in sport) will experience more rapid acceleration. We observe this physical principle in action when we watch a bowling ball strike bowling pins: the heavy bowling ball only slightly changes its course and speed; the lighter pins go flying.

38. This same equation also tells us that if a given player's body or head is hit with a *larger* force (e.g., from a ball that has been thrown or hit faster), it will experience *greater* acceleration, everything else being equal.

39. Of course, sport is by definition somewhat chaotic, and forces are often not purely linear. Many collisions also involve angular velocities, with the production of rotational force, or torque. Torque can be thought of as force that causes rotation around a central point. A different but similar equation of Newtonian physics governs the principles involved.[13] Torque is relevant to injury in several ways. When torque is applied through joints in directions those joints are not able to accommodate, injury can occur. In addition, rotational force can cause different parts of the body to accelerate at different rates—in some cases, very rapid rates, also leading to injury. For example, a collision where the

[13] In this equation, $\boldsymbol{\tau} = \boldsymbol{I\alpha}$, torque equals moment of inertia multiplied by angular acceleration, where "moment of inertia" is defined as $\boldsymbol{I} = \boldsymbol{mr^2}$, that is, mass multiplied by the square of the distance to the rotational axis.

body is impacted at the waist can result in high torque and acceleration on the neck and head.

40. Sport-related concussion—a common sports injury and one with potentially significant effects—is attributable to linear, angular, or rotational acceleration and deceleration forces that result from impact to the head, or from an impact to the body that results in a whiplash "snap" of the head. (Rowson 2016.) In the case of a concussive head injury, it is the brain that accelerates or decelerates on impact, colliding with the inner surface of the skull. (Barth 2001 at 255.)

41. None of this is mysterious: each of us, if we had to choose between being hit either by a large, heavy athlete running at full speed, or by a small, lighter athlete, would intuitively choose collision with the small, light athlete as the lesser of the two evils. And we would be right. One author referred to the "increase in kinetic energy, and therefore imparted forces" resulting from collision with larger, faster players as "profound." (Dashnaw 2012.)

V. GENDER DIFFERENCES RELEVANT TO INJURY

42. It is important to state up front that it is self-evident to most people familiar with sport and sport injuries that if men and women were to consistently participate together in competitive contact sports, there would be higher rates of injury in women. This is one reason that rule modifications often

exist in leagues where co-ed participation occurs.[14] Understanding the physics of sports injuries helps provide a theoretical framework for why this is true, but so does common sense and experience. All of us are familiar with basic objective physiological differences between the sexes, some of which exist in childhood, and some of which become apparent after the onset of puberty, and persist throughout adulthood. And as a result of personal experience, all of us also have some intuitive sense of what types of collisions are likely to cause pain or injury. Not surprisingly, our "common sense" on these basic facts about the human condition is also consistent with the observations of medical science. Below, I provide quantifications of some of these well-known differences between the sexes that are relevant to injury risk, as well as some categorical differences that may be less well known.

A. Height and weight

43. It is an inescapable fact of the human species that males as a group are statistically larger and heavier than females. On average, men are 7% to 8% taller than women. (Handelsman 2018 at 818.) According to the most recently available Centers for Disease Control and Prevention (CDC) statistics, the weight of the average U.S. adult male is 16% greater than that of the average U.S. adult female. (CDC 2018.) This disparity persists into the athletic cohort.

[14] For example, see https://www.athleticbusiness.com/college/intramural-coed-basketball-playing-rules-vary-greatly.html (detailing variety of rule modifications applied in co-ed basketball). Similarly, coed soccer leagues often prohibit so-called "slide tackles," which are not prohibited in either men's or women's soccer. See, e.g.., http://www.premiercoedsports.com/pages/rulesandpolicies/soccer.

Researchers find that while athletes tend on average to be lighter than non-athletes, the weight difference between the average adult male and female athlete remains within the same range—between 14% and 23%, depending on the sport analyzed. (Santos 2014; Fields 2018.) Indeed, World Rugby estimates that the typical male rugby player weighs 20% to 40% more than the typical female rugby player. (World Rugby Transgender Women Guidelines 2020.) This size advantage by itself allows men to bring more force to bear in a collision.

B. Bone and connective tissue strength

44. Men have bones in their arms, legs, feet, and hands that are both larger and stronger per unit volume than those of women, due to greater cross-sectional area, greater bone mineral content, and greater bone density. The advantage in bone size (cross-sectional area) holds true in both upper and lower extremities, even when adjusted for lean body mass. (Handelsman 2018 at 818; Nieves 2005 at 530.) Greater bone size in men is also correlated with stronger tendons that are more adaptable to training (Magnusson 2007), and an increased ability to withstand the forces produced by larger muscles (Morris 2020 at 5). Male bones are not merely larger, they are stronger per unit of volume. Studies of differences in arm and leg bone mineral density – one component of bone strength – find that male bones are denser, with measured advantages of between 5% and 14%. (Gilsanz 2011; Nieves 2005.)

45. Men also have larger ligaments than women (Lin 2019 at 5), and stiffer connective tissue (Hilton 2021 at Table 1), providing greater protection against joint injury.

C. Speed

46. When it comes to acceleration from a static position to a sprint, men are consistently faster than women. World record sprint performance gaps between the sexes remain significant at between 7% and 10.5%, with world record times in women now exhibiting a plateau (no longer rapidly improving with time) similar to the historical trends seen in men. (Cheuvront 2005.) This performance gap has to do with, among other factors, increased skeletal stiffness, greater cross-sectional muscle area, denser muscle fiber composition and greater limb length. (Handelsman 2018.) Collectively, males, on average, run about 10% faster than females. (Lombardo 2018 at 93.) This becomes important as it pertains to injury risk, because males involved in sport will often be travelling at faster speeds than their female counterparts in comparable settings, with resultant faster speed at impact, and thus greater impact force, in a given collision.

D. Strength/Power

47. In 2014, a male mixed-martial art fighter identifying as female and fighting under the name Fallon Fox fought a woman named Tamikka Brents, and caused significant facial injuries in the course of their bout. Speaking about their fight later, Brents said:

> "I've fought a lot of women and have never felt the strength that I felt in a fight as I did that night. I can't answer whether it's because she was born a man or not because I'm not a doctor. I can only say, I've never felt so overpowered ever in my life, and I am an abnormally strong female in my own right."[15]

48. So far as I am aware, mixed martial arts is not a collegiate or high school interscholastic sport. Nevertheless, what Brent experienced in an extreme setting is true and relevant to safety in all sports that involve contact. In absolute terms, males as a group are substantially stronger than women.

49. Compared to women, men have "larger and denser muscle mass, and stiffer connective tissue, with associated capacity to exert greater muscular force more rapidly and efficiently." (Hilton 2021 at 201.) Research shows that on average, during the prime athletic years (ages 18-29) men have, on average, 54% greater total muscle mass than women (33.7 kg vs. 21.8 kg) including 64% greater muscle mass in the upper body, and 47% greater in the lower body. (Janssen 2000 at Table 1.) The cross-sectional area of muscle in women is only 50% to 60% that of men in the upper arm, and 65% to 70% of that of men in the thigh. This translates to women having only 50% to 60% of men's upper limb strength and 60% to 80% of men's lower limb strength. (Handelsman 2018 at 812.) Male weightlifters have been shown to be approximately 30% stronger than female weightlifters of equivalent stature and mass. (Hilton 2021 at 203.) But in competitive athletics, since the stature and mass of the average male

[15] https://bjj-world.com/transgender-mma-fighter-fallon-fox-breaks-skull-of-her-female-opponent/

exceeds that of the average female, actual differences in strength between average body types will, on average, exceed this. The longer limb lengths of males augment strength as well. Statistically, in comparison with women, men also have lower total body fat, differently distributed, and greater lean muscle mass, which increases their power-to-weight ratios and upper-to-lower limb strength ratios as a group. Looking at another common metric of strength, males average 57% greater grip strength (Bohannon 2019) and 54% greater knee extension torque (Neder 1999). Research shows that sex-based discrepancies in lean muscle mass begin to be established from infancy, and persist through childhood to adolescence. (Davis 2019; Kirchengast 2001; Taylor 1997; Taylor 2010; McManus 2011.)

50. Using their legs and torso for power generation, men can apply substantially larger forces with their arms and upper body, enabling them to generate more ball velocity through overhead motions, as well as to generate more pushing or punching power. In other words, isolated sex-specific differences in muscle strength in one region (even differences that in isolation seem small) can, and do combine to generate even greater sex-specific differences in more complex sport-specific functions. One study looking at moderately-trained individuals found that males can generate 162% more punching power than females. (Morris 2020.) Thus, multiple small advantages aggregate into larger ones.

E. Throwing and kicking speed

51. One result of the combined effects of these sex-determined differences in skeletal structure is that men are, on average, able to throw objects faster than women. (Lombardo 2018; Chu 2009; Thomas 1985.) By age seventeen, the *average* male can throw a ball farther than 99% of seventeen-year-old females—which necessarily means at a faster initial speed assuming a similar angle of release— despite the fact that factors such as arm length, muscle mass, and joint stiffness individually don't come close to exhibiting this degree of sex-defined advantage. One study of elite male and female baseball pitchers showed that men throw baseballs 35% faster than women—81 miles/hour for men vs. 60 miles/hour for women. The authors of this study attribute this to a sex-specific difference in the ability to generate muscle torque and power. (Chu 2009.) A study showing greater throwing velocity in male versus female handball players attributed it to differences in body size, including height, muscle mass, and arm length. (Van Den Tillaar 2012.) Interestingly, significant sex-related difference in throwing ability has been shown to manifest even before puberty, but the difference increases rapidly during and after puberty. (Thomas 1985 at 266.) These sex-determined differences in throwing speed are not limited to sports where a ball is thrown. Males have repeatedly been shown to throw a javelin more than 30% farther than females. (Lombardo 2018 Table 2; Hilton 2021 at 203.) Even in preadolescent children, differences exist. International youth records for 5- to

12-year-olds in the javelin show 34-55% greater distance in males vs. females using a 400g javelin.[16]

52. Men also serve and spike volleyballs with higher velocity than women, with a performance advantage in the range of 29-34%. (Hilton 2021.) Analysis of first and second tier Belgian national elite male volleyball players shows ball spike speeds of 63 mph and 56 mph respectively. (Forthomme 2005.) NCAA Division I female volleyball players—roughly comparable to the second-tier male elite group referenced above—average a ball spike velocity of approximately 40 mph (18.1 m/s). (Ferris 1995 at Table 2.) Notably, based on the measurements of these studies, male spiking speed in *lower* elite divisions is almost 40% greater than that of NCAA Division I female collegiate players. Separate analyses of serving speed between elite men and women Spanish volleyball players showed that the average power serving speed in men was 54.6 mph (range 45.3–64.6 mph), with maximal speed of 76.4 mph. In women, average power serving speed was 49 mph (range 41–55.3 mph) with maximal speed of 59 mph. This translates to an almost 30% advantage in maximal serve velocity in men. (Palao 2014.)

53. Recall that kinetic energy is dependent on mass and the square of velocity. A volleyball (with fixed mass) struck by a male, and traveling an

[16] http://age-records.125mb.com/.

average 35% faster than one struck by a female, will deliver 82% more energy to a head upon impact.

54. The greater leg strength and jumping ability of men confer a further large advantage in volleyball that is relevant to injury risk. In volleyball, an "attack jump" is a jump to position a player to spike the ball downward over the net against the opposing team. Research on elite national volleyball players found that on average, males exhibited a 50% greater vertical jump height during an "attack" than did females. (Sattler 2015.) Similar data looking at countermovement jumps (to block a shot) in national basketball players reveals a 35% male advantage in jump height. (Kellis 1999.) In volleyball, this dramatic difference in jump height means that male players who are competing in female divisions will more often be able to successfully perform a spike, and this will be all the more true considering that the women's net height is seven inches lower than that used in men's volleyball. Confirming this inference, research also shows that the successful attack percentage (that is, the frequency with which the ball is successfully hit over the net into the opponent's court in an attempt to score) is so much higher with men than women that someone analyzing game statistics can consistently identify games played by men as opposed to women on the basis of this statistic alone. These enhanced and more consistently successful attacks by men directly correlate to their greater jumping ability and attack velocity at the net. (Kountouris 2015.)

55. The combination of the innate male-female differences cited above, along with the lower net height in women's volleyball, means that if a reasonably athletic male is permitted to compete against women, the participating female players will likely be exposed to higher ball velocities that are outside the range of what is typically seen in women's volleyball. When we recall that ball-to-head impact is a common cause of concussion among women volleyball players, this fact makes it clear that participation in girls' or women's volleyball by biologically male individuals will increase concussion injury risk for participating girls or women.

56. Male sex-based advantages in leg strength also lead to greater kick velocity. In comparison with women, men kick balls harder and faster. A study comparing kicking velocity between university-level male and female soccer players found that males kick the ball with an average 20% greater velocity than females. (Sakamoto 2014.) Applying the same principles of physics we have just used above, we see that a soccer ball kicked by a male, travelling an average 20% faster than a ball kicked by a female, will deliver 44% more energy on head impact. Greater force-generating capacity will thus increase the risk of an impact injury such as concussion.

VI. ENHANCED FEMALE VULNERABILITY TO CERTAIN INJURIES

57. Above, I have reviewed physiological differences that result in the male body bringing greater weight, speed, and force to the athletic field or court,

and how these differences can result in a greater risk of injury to females when males compete against them. It is also true that the female body is more vulnerable than the male body to certain types of injury even when subject to comparable forces. This risk appears to extend to the younger age cohorts as well. An analysis of Finnish student athletes from 1987-1991, analyzing over 600,000 person-years of activity exposures, found, in students under fifteen years of age, higher rates of injury in girls than boys in soccer, volleyball, judo and karate. (Kujala 1995.) Another epidemiological study looking specifically at injury rates in over 14,000 middle schoolers over a 20 year period showed that "in sex-matched sports, middle school girls were more likely to sustain *any* injury (RR = 1.15, 95% CI = 1.1, 1.2) or a time-loss injury (RR = 1.09, 95% CI = 1.0, 1.2) than middle school boys." In analyzed both-sex sports (i.e., sex-separated sports that both girls and boys play, like soccer), girls sustained higher injury rates, and greater rates of time-loss injury. (Beachy 2014.) Another study of over 2000 middle school students at nine schools showed that the injury rate was higher for girls' basketball than for football (39.4 v 30.7/1000 AEs), and injury rates for girls' soccer were nearly double that of boys' soccer (26.3 v. 14.7/1000 AEs). (Caswell 2017.) In this regard, I will focus on two areas of heightened female vulnerability to collision-related injury which have been extensively studied: concussions, and anterior cruciate ligament injuries.

A. Concussions

58. Females are more likely than males to suffer concussions in comparable sports, and on average suffer more severe and longer lasting disability once a concussion does occur. (Harmon 2013 at 4; Berz 2015; Blumenfeld 2016; Covassin 2003; Rowson 2016.) Females also seem to be at higher risk for post-concussion syndrome than males. (Berz 2015; Blumenfeld 2016; Broshek 2005; Colvin 2009; Covassin 2012; Dick 2009; Marar 2012; Preiss-Farzanegan 2009.)

59. The most widely-accepted definition of sport-related concussion comes from the Consensus Statement on Concussion in Sport (see below).[17] (McCrory 2018.) To summarize, concussion is "a traumatically induced transient

[17] "Sport related concussion is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilised in clinically defining the nature of a concussive head injury include:

SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.

SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.

SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.

SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.

The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc) or other comorbidities (e.g., psychological factors or coexisting medical conditions)."

disturbance of brain function and involves a complex pathophysiological process" that can manifest in a variety of ways. (Harmon 2013 at 1.)

60. Sport-related concussions have undergone a significant increase in societal awareness and concurrent injury reporting since the initial passage of the Zachery Lystedt Concussion Law in Washington State in 2009 (Bompadre 2014), and the subsequent passage of similar legislation governing return-to-play criteria for concussed athletes in most other states in the United States. (Nat'l Cnf. of State Leg's 2018). Concussion is now widely recognized as a common sport-related injury, occurring in both male and female athletes. (CDC 2007.) Sport-related concussions can result from player-surface contact or player-equipment contact in virtually any sport. However, sudden impact via a player-to-player collision, with rapid deceleration and the transmission of linear or rotational forces through the brain, is also a common cause of concussion injury. (Covassin 2012; Marar 2012; Barth 2001; Blumenfeld 2016; Boden 1998; Harmon 2013 at 4.)

61. A large retrospective study of U.S. high school athletes showed a higher rate of female concussions in soccer (79% higher), volleyball (0.6 concussions/10,000 exposures, with 485,000 reported exposures, vs. no concussions in the male cohort), basketball (31% higher), and softball/baseball (320% higher). (Marar 2012.) A similarly-sized, similarly-designed study comparing concussion rates between NCAA male and female collegiate athletes showed, overall, a concussion rate among females 40% higher than that of

males. Higher rates of injury were seen across individual sports as well, including ice hockey (10% higher); soccer (54% higher); basketball (40% higher); and softball/baseball (95% higher). (Covassin 2016.) The observations of these authors, my own observations from clinical practice, and the acknowledgment of our own Society's Position Statement (Harmon 2013), all validate the higher frequency and severity of sport-related concussions in women and girls.

62. Most epidemiological studies to date looking at sport-related concussion in middle schoolers show that more boys than girls are concussed. There are fewer studies estimating concussion *rate*. This is, in part, because measuring injury rate is more time and labor-intensive. Researchers at a childrens' hospital, for example, could analyze the number of children presenting to the emergency department with sport-related concussion and publish findings of absolute number. However, to study concussion incidence, athlete exposures also have to be recorded. Generally speaking, an athlete exposure is a single practice or game where an athlete is exposed to playing conditions that could reasonably supply the necessary conditions for an injury to occur. Rates of athletic injury, concussion among them, are then, by convention, expressed in terms of injury rate per 1000 athletic exposures. More recently, some studies have been published that analyze the rates of concussion in the middle school population. Looking at the evidence, the conclusion can be made that females experience increased susceptibility to concussive injuries before puberty. For example, Ewing-Cobbs, et al. (2018) found elevated post-

concussion symptoms in girls across all age ranges studied, including children between the ages of 4 and 8. Kerr's 2017 study of middle school students showed over three times the rate of female vs male concussion in students participating in sex-comparable sports [0.18 v. 0.66/1000 A.E.'s]. (Kerr 2017.) This is the first study I am aware of that mimics the trends seen in adolescent injury epidemiology showing a higher rate of concussion in girls than boys in comparable sports.

63. More recent research looking at the incidence of sport-related concussions in U.S. middle schoolers between 2015 and 2020, found that the rate of concussion was higher in middle school athletes than those in high school. In this study, girls had more than twice the rate of concussion injury (0.49/1000 athletic exposures vs 0.23/1000 AE) in analyzed sports (baseball/softball, basketball, soccer and track), as well as statistically greater time loss. (Hacherl 2021 (Journal of Athletic Training); Hacherl 2021 (Archives of Clinical Neuropsychology).) The authors hypothesized that the increasing incidence of concussion in middle school may relate to "other distinct differences associated with the middle school sport setting itself, such as, the large variations in player size and skill."[18]

64. In addition, females on average suffer materially greater cognitive impairment than males when they do suffer a concussion. Group differences in

[18] https://www.nata.org/press-release/062421/middle-school-sports-have-overall-higher-rate-concussion-reported-high-school.

cognitive impairment between females and males who have suffered concussion have been extensively studied. A study of 2340 high school and collegiate athletes who suffered concussions determined that females had a 170% higher frequency of cognitive impairment following concussions, and that in comparison with males, female athletes had significantly greater declines in simple and complex reaction times relative to their preseason baseline levels. Moreover, the females experienced greater objective and subjective adverse effects from concussion even after adjusting for potentially protective effect of helmets used by some groups of male athletes. (Broshek 2005 at 856, 861; Colvin 2009; Covassin 2012.)

65. This large discrepancy in frequency and severity of concussion injury is consistent with my own observations across many years of clinical practice. The large majority of student athletes who have presented at my practice with severe and long-lasting cognitive disturbance have been adolescent girls. I have seen girls remain symptomatic for over a year, and lose ground academically and become isolated from their peer groups due to these ongoing symptoms. For patients who experience these severe effects, post-concussion syndrome can be life-altering.

66. Some of the anatomical and physiological differences that we have considered between males and females help to explain the documented differences in concussion rates and in symptoms between males and females. (Covassin 2016; La Fountaine 2019; Lin 2019; Tierney 2005; Wunderle 2014.)

Anatomically, there are significant sex-based differences in head and neck anatomy, with females exhibiting in the range of 30% to 40% less head-neck segment mass and neck girth, and 49% lower neck isometric strength. This means that when a female athlete's head is subjected to the same load as an analogous male, there will be a greater tendency for head acceleration, and resultant injury. (Tierney 2005 at 276-277.)

67. When modeling the effect of the introduction of male mass, speed, and strength into women's rugby, World Rugby gave particular attention to the resulting increases in forces and acceleration (and injury risk) experienced in the head and neck of female players. Their analysis found that "the magnitude of the known risk factors for head injury are . . . predicted by the size of the disparity in mass between players. The addition of [male] speed as a biomechanical variable further increases these disparities," and their model showed an increase of up to 50% in neck and head acceleration that would be experienced in a typical tackle scenario in women's rugby. As a result, "a number of tackles that currently lie beneath the threshold for injury would now exceed it, causing head injury." (World Rugby Transgender Women Guidelines 2020.) While rugby is notoriously contact-intensive, similar increases to risk of head and neck injury to women are predictable in any sport context in which males and females collide at significant speed, as happens from time to time in sports including soccer, softball, and basketball.

68. In addition, even when the heads of female and male athletes are subjected to identical accelerative forces, there are sex-based differences in neural anatomy and physiology, cerebrovascular organization, and cellular response to concussive stimuli that make the female more likely to suffer concussive injury, or more severe concussive injury. For instance, hypothalamic-pituitary disruption is thought to play a role in post-concussion symptomatology that differentially impacts women. (McGroarty 2020; Broshek 2005 at 861.) Another study found that elevated progesterone levels during one portion of the menstrual cycle were associated with more severe post-concussion symptomatology that differentially impacted women. (Wunderle 2014.)

69. As it stands, when females compete against each other, they already have higher rates of concussive injury than males, across most sports. The addition of biologically male athletes into women's contact sports will inevitably increase the risk of concussive injury to girls and women, for the multiple reasons I have explained above, including, but not limited to, the innate male advantage in speed and lean muscle mass. Because the effects of concussion can be severe and long-lasting, particularly for biological females, we can predict with some confidence that if participation by biological males in women's contact sports based on gender identity becomes more common, more biological females will suffer substantial concussive injury and the potential for long-term harm as a result.

B. Anterior Cruciate Ligament injuries

70. The Anterior Cruciate Ligament ("ACL") is a key knee stabilizer that prevents anterior translation of the tibia relative to the femur and also provides rotatory and valgus knee stability.[19] (Lin 2019 at 4.) Girls and women are far more vulnerable to ACL injuries than are boys and men. The physics of injury that we have reviewed above makes it inevitable that the introduction of biologically male athletes into the female category will increase still further the occurrence of ACL injuries among girls or women who encounter these players on the field.

71. Sports-related injury to the ACL is so common that it is easy to overlook the significance of it. But it is by no means a trivial injury, as it can end sports careers, require surgery, and usually results in early-onset, post-traumatic osteoarthritis, triggering long-term pain and mobility problems later in life. (Wang 2020.)

72. Even in the historic context in which girls and women limit competition to (and so only collide with) other girls and women, the rate of ACL injury is substantially higher among female than male athletes. (Flaxman 2014; Lin 2019; Agel 2005.) One meta-analysis of 58 studies reports that female athletes have a 150% relative risk for ACL injury compared with male athletes, with other estimates suggesting as much as a 300% increased risk. (Montalvo 2019; Sutton 2013.) Particularly in those sports designated as contact sports, or

[19] Valgus force at the knee is a side-applied force that gaps the medial knee open.

sports with frequent cutting and sharp directional changes (basketball, field hockey, lacrosse, soccer), females are at greater risk of ACL injury. In basketball and soccer, this risk extends across all skill levels, with female athletes between two and eight times more likely to sustain an ACL injury than their male counterparts. (Lin 2019 at 5.) These observations are widely validated, and consistent with the relative frequencies of ACL injuries that I see in my own practice.

73. When the reasons underlying the difference in the incidence of ACL injury between males and females were first studied in the early 1990s, researchers speculated that the difference might be attributable to females' relative inexperience in contact sports, or to their lack of appropriate training. However, a follow-up 2005 study looking at ACL tear disparities reported that, "Despite vast attention to the discrepancy between anterior cruciate ligament injury rates between men and women, these differences continue to exist." (Agel 2005 at 524.) Inexperience and lack of training do not explain the differences. Sex seems to be an independent predictor of ACL tear risk.

74. In fact, as researchers have continued to study this discrepancy, they have determined that multiple identifiable anatomical and physiological differences between males and females play significant roles in making females more vulnerable to ACL injuries than males. (Flaxman 2014; Lin 2019; Wolf 2015.) Summarizing the findings of a number of separate studies, one researcher recently cited as anatomical risk factors for ACL injury smaller ligament size,

decreased femoral notch width, increased posterior-inferior slope of the lateral tibia plateau, increased knee and generalized laxity, and increased body mass index (BMI). With the exception of increased BMI, each of these factors is more likely to occur in female than male athletes. (Lin 2019 at 5.) In addition, female athletes often stand in more knee valgus (that is, in a "knock-kneed" posture) due to wider hips and a medially-oriented femur. Often, this is also associated with a worsening of knee valgus during jump landings. The body types and movement patterns associated with these valgus knee postures are more common in females and increase the risk for ACL tear. (Hewett 2005.)

75. As with concussion, the cyclic fluctuation of sex-specific hormones in women is also thought to be a possible risk factor for ACL injury. Estrogen acts on ligaments to make them more lax, and it is thought that during the ovulatory phase of menses (when estrogen levels peak), the risk of ACL tear is higher. (Chidi-Ogbolu 2019 at 1; Herzberg 2017.)

76. Whatever the factors that increase the injury risk for ACL tears in women, the fact that a sex-specific difference in the rate of ACL injury exists is well established and widely accepted.

77. Although non-contact mechanisms are the most common reason for ACL tears in females, tears related to contact are also common, with ranges reported across multiple studies of from 20%-36% of all ACL injuries in women. (Kobayashi 2010 at 672.) For example, when a soccer player who is kicking a ball is struck by another player in the lateral knee of the stance leg, medial and

rotational forces can tear the medial collateral ligament (MCL), the ACL, and the meniscus. Thus, as participation in the female category based on identity rather than biology becomes more common (entailing the introduction of athletes with characteristics such as greater speed and lean muscle mass), and as collision forces suffered by girls and women across the knee increase accordingly, the risk for orthopedic injury and in particular ACL tears among impacted girls and women will inevitably rise.

78. Of course there exists variation in all these factors within a given group of males or females. However, it is also true that within sex-specific pools, size differential is somewhat predictable and bounded, even considering outliers. When males are permitted to enter into the pool of female athletes based on gender identity rather than biological sex, there is an increased possibility that a statistical outlier in terms of size, weight, speed, and strength—and potentially an extreme outlier—is now entering the female pool. Although injury is not guaranteed, risks to female participants will increase. And as I discuss later, the available evidence together suggests that this will be true even with respect to males who have been on testosterone suppression for a year or more. World Rugby relied heavily upon this when they were determining their own policy, and I think it is important to reiterate that this policy, rooted in concern for athlete safety, is justifiable based upon current evidence from medical research and what we know about biology.

VII. TESTOSTERONE SUPPRESSION WILL NOT PREVENT THE HARM TO FEMALE SAFETY IN ATHLETICS

79. A recent editorial in the New England Journal of Medicine opined that policies governing transgender participation in female athletics "must safeguard the rights of all women—whether cisgender or transgender." (Dolgin 2020.) Unfortunately, the physics and medical science reviewed above tell us that this is not practically possible. If biological males are given a "right" to participate in the female category based on gender identity, then biological women will be denied the right to reasonable expectations of safety and injury risk that have historically been guaranteed by ensuring that females compete (and collide) only with other females.

80. Advocates of unquestioning inclusion based on gender identity often contend that hormonal manipulation of a male athlete can feminize the athlete enough that he is comparable with females for purposes of competition. The NCAA's Office of Inclusion asserts (still accessible on the NCAA website as of this writing) that "It is also important to know that any strength and endurance advantages a transgender woman arguably may have as a result of her prior testosterone levels dissipate after about one year of estrogen or testosterone suppression therapy."[20] (NCAA 2011 at 8.) Whether or not this is true is a critically important question.

[20] https://www.ncaa.org/sports/2016/3/2/lesbian-gay-bisexual-transgender-and-questioning-lgbtq.aspx

81. At the outset, we should note that while advocates sometimes claim that testosterone suppression *can* eliminate physiological advantages in a biological male, none of the relevant transgender eligibility policies that I am aware of prior to 2021 requires any demonstration that it has *actually* achieved that effect in a particular male who seeks admission into the female category. The Connecticut policy that is currently at issue in ongoing litigation permits admission to the female category at the high school level without requiring any testosterone suppression at all. Prior to their new policy, just announced in January 2022, the NCAA's policy required no demonstration of any reduction of performance capability, change in weight, or regression of any other physical attribute of the biological male toward female levels. It did not require achievement of any particular testosterone level, and did not provide for any monitoring of athletes for compliance. Moving forward, through a phasing process, the NCAA will ultimately require athletes in each sport to meet requirements of their sport's national governing body (NGB). If no policy exists, the policy of that sport's international governing body applies, or, finally, if no policy exists there, the 2015 policy of the International Olympic Committee (IOC) will apply. The 2015 IOC policy requires no showing of any diminution of any performance capability or physical attribute of the biological male, and requires achievement and compliance monitoring only of a testosterone level below 10nmol/liter—a level far above levels occurring in normal biological

females (0.06 to 1.68 nmol/L).[21] Indeed, female athletes with polycystic ovarian disorder—a condition that results in elevated testosterone levels—rarely exceed 4.8 nmol/L, which is the basis for setting the testing threshold to detect testosterone *doping* in females at 5.0 nmol/L. Thus, males who qualify under the 2015 IOC policy to compete as transgender women may have testosterone levels—even after hormone suppression—*double* the level that would disqualify a biological female for doping with testosterone.[22]

82. As Dr. Emma Hilton has observed, the fact that there are over 3000 sex-specific differences in skeletal muscle alone makes the hypothesis that sex-linked performance advantages are attributable solely to current circulating testosterone levels improbable at best. (Hilton 2021 at 200-01.)

83. In fact, the available evidence strongly indicates that no amount of testosterone suppression can eliminate male physiological advantages relevant to performance and safety. Several authors have recently reviewed the science and statistics from numerous studies that demonstrate that one year (or more) of testosterone suppression does not substantially eliminate male performance advantages. (Hilton 2021; De Varona 2021; Harper 2021.) As a medical doctor, I will focus on those specific sex-based characteristics of males who have

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[21] Normal testosterone range in a healthy male averages between 7.7 and 29.4 nmol/L.

[22] In November 2021, the IOC released new guidelines, deferring decision-making about a given sport's gender-affectedness to its governing body. The current NCAA policy, however, still utilizes the 2015 IOC policy to determine an athlete's eligibility in event that the sport's national and international governing bodies lack policies to determine eligibility.

undergone normal sex-determined pubertal skeletal growth and maturation that are relevant to the *safety* of female athletes. Here, too, the available science tells us that testosterone suppression does not eliminate the increased risk to females or solve the safety problem.

84. The World Rugby organization reached this same determination based on the currently available science, concluding that male physiological advantages that "create risks [to female players] appear to be only minimally affected" by testosterone suppression. (World Rugby Transgender Women Guidelines 2020.)

85. Surprisingly, so far as public information reveals, the NCAA's Committee on Competitive Safeguards is not monitoring and documenting instances of transgender participation on women's teams for purposes of injury reporting. In practice, the NCAA is conducting an experiment which in theory predicts an increased frequency and severity of injuries to women in contact sports, while at the same time failing to collect the relevant data from its experiment.

86. In their recent guidelines, UK Sport determined that, "based upon current evidence, testosterone suppression is unlikely to guarantee fairness between transgender women and natal females in gender-affected sports." (UK Sports Councils' Equality Group Guidance 2021 at 7.) They also warned that migration to a scenario by NGBs where eligibility is determined through case-by-case assessment "is unlikely to be practical nor verifiable for entry into

gender-affected sports," in part because "many tests related to sports performance are volitional," and incentives on the part of those tested would align with intentional poor performance. (UK Sports Councils' Equality Group Guidance 2021 at 8.)

87. Despite these concerns, this appears to be exactly the route that the IOC is taking, as reflected in their Framework on Fairness, Inclusion and Non-Discrimination on the Basis of Gender Identity, released in November of 2021.[23] In it, the IOC lists two disparate goals. First, that "where sports organizations elect to issue eligibility criteria for men's and women's categories for a given competition, they should do so with a view to . . . [p]roviding confidence that no athlete within a category has an unfair and disproportionate competitive advantage . . . [and] preventing a risk to the physical safety of other athletes." (IOC Framework 2021 § 4.1.) At the same time, governing bodies are not to preclude any athlete from competing until evidence exists based upon "robust and peer-reviewed research that . . . demonstrates a consistent, unfair, disproportionate competitive advantage in performance and/or an unpreventable risk to the physical safety of other athletes" – research moreover that "is largely based on data collected *from a demographic group that is consistent in gender and athletic engagement with the group that the eligibility*

[23] The IOC Framework on Fairness, Inclusion and Non-Discrimination on the Basis of Gender Identity and Sex Variations is available at https://stillmed.olympics.com/media/Documents/News/2021/11/IOC-Framework-Fairness-Inclusion-Non-discrimination-2021.pdf?_ga=2.72651665.34591192.1645554375-759350959.1644946978

criteria aim to regulate." (IOC Framework 2021 § 6.1) Finally, affected athletes may appeal any evidence-based decision-making process through a further "appropriate internal mediation mechanism, such as a Court of Arbitration for Sport." (IOC Framework 2021 § 6.1.) Rather than cite any of the growing evidence that testosterone suppression cannot mitigate sex-based performance differences, the IOC's new policy remains aspirational and opaque. And yet the research relating to hormonal suppression in transgender athletes, as confirmed by World Rugby and UK Sport, already speaks very clearly to the fact that males retain a competitive advantage over women that cannot be eliminated through testosterone suppression alone. What follows is a brief summary of some of these retained differences as they relate to sport safety.

A. Size and weight

88. Males are, on average, larger and heavier. As we have seen, these facts alone mean that males bring more kinetic energy into collisions, and that lighter females will suffer more abrupt deceleration in collisions with larger bodies, creating heightened injury risk for impacted females.

89. I start with what is obvious and so far as I am aware undisputed—that after the male pubertal growth spurt, suppression of testosterone does not materially *shrink* bones so as to eliminate height, leverage, performance, and weight differences that follow from simply having longer, larger bones, and being subsequently taller.

90. In addition, multiple studies have found that testosterone suppression may modestly reduce, but does not come close to eliminating the male advantage in muscle mass and lean body mass, which together contribute to the greater average male weight. Researchers looking at transitioning adolescents found that the weight of biological male subjects *increased* rather than decreased after treatment with an antiandrogen testosterone suppressor. (Tack 2018.) In one recent meta-analysis, researchers looking at the musculoskeletal effects of hormonal transition found that even after males had undergone 36 months of therapy, their lean body mass and muscle area remained above those of females. (Harper 2021.) Another group in 2004 studied the effects of testosterone suppression to less than 1 nmol/L in men after one or more years, but still found only a 12% total loss of muscle area by the end of thirty-six months. (Gooren 2004.)

B. Bone density

91. Bone mass (which includes both size and density) is maintained over *at least* two years of testosterone suppression (Singh-Ospina 2017; Fighera 2019), and one study found it to be preserved even over a median of 12.5 years of suppression (Hilton 2021; Ruetsche 2005).

C. Strength

92. A large number of studies have now observed minimal or no reduction in strength in male subjects following testosterone suppression. In one recent meta-analysis, strength loss after twelve months of hormone therapy

ranged from negligible to 7%. (Harper 2021.) Given the baseline male strength advantage in various muscle groups of from approximately 25% to 100% above female levels that I have noted in Section V.D above, even a 7% reduction leaves a large retained advantage in strength. Another study looking at handgrip strength—which is a proxy for general strength—showed a 9% loss of strength after two years of hormonal treatment in males who were transitioning, leaving a 23% retained advantage over the female baseline. (Hilton 2021.) Yet another study which found a 17% retained grip strength advantage noted that this placed the median of the group treated with hormone therapy in the 95th percentile for grip strength among age-matched females. (Scharff 2019.) Researchers looking at transitioning adolescents showed no loss of grip strength after hormone treatment. (Tack 2018.)

93. One recent study on male Air Force service members undergoing transition showed that they retained more than two thirds of pretreatment performance advantage over females in sit-ups and push-ups after between one and two years of testosterone-reducing hormonal treatment. (Roberts 2020.) Another recently-published observational cohort study looked at thigh strength and thigh muscle cross-sectional area in men undergoing hormonal transition to transgender females. After one year of hormonal suppression, this group saw only a 4% decrease in thigh muscle cross-sectional area, and a negligible decrease in thigh muscle strength. (Wiik 2020.) Wiik and colleagues looked at isokinetic strength measurements in individuals who had undergone at least 12

months of hormonal transition and found that muscle strength was comparable to baseline, leaving transitioned males with a 50% strength advantage over reference females. (Wiik 2020.) Finally, one cross-sectional study that compared men who had undergone transition at least three years prior to analysis, to age-matched, healthy males found that the transgender individuals had retained enough strength that they were still outside normative values for women. This imbalance continued to hold even after *eight* years of hormone suppression. The authors also noted that since males who identify as women often have lower baseline (i.e., before hormone treatment) muscle mass than the general population of males, and since baseline measures for this study were unavailable, the post-transition comparison may actually represent an overestimate of muscle mass regression in transgender females. (Lapauw 2008; Hilton 2021.)

94. World Rugby came to the same conclusion based on its own review of the literature, reporting that testosterone suppression "does not reverse muscle size to female levels," and in fact that "studies assessing [reductions in] mass, muscle mass, and/or strength suggest that reduction in these variables range between 5% and 10%. Given that the typical male vs female advantages range from 30% to 100%, these reductions are small." (World Rugby Transgender Women Guidelines 2020.)

95. It is true that most studies of change in physical characteristics or capabilities over time after testosterone suppression involve untrained subjects

rather than athletes, or subjects with low to moderate training. It may be assumed that all of the Air Force members who were subjects in the study I mention above were physically fit and engaged in regular physical training. But neither that study nor those studies looking at athletes quantify the volume or type of strength training athletes are undergoing. The important point to make is that the only effect strength training could have on these athletes is to *counteract* and reduce the limited loss of muscle mass and strength that does otherwise occur to some extent over time with testosterone blockade. There has been at least one study that illustrates this, although only over a short period, measuring strength during a twelve-week period where testosterone was suppressed to levels of 2 nmol/L. During that time, subjects actually increased leg lean mass by 4%, and total lean mass by 2%, and subject performance on the 10 rep-max leg press improved by 32%, while their bench press performance improved by 17%. (Kvorning 2006.)

96. The point for safety is that superior strength enables a biological male to apply greater force against an opponent's body during body contact, or to throw, hit, or kick a ball at speeds outside the ranges normally encountered in female-only play, with the attendant increased risks of injury that I have already explained.

D. Speed

97. As to speed, the study of transitioning Air Force members found that these males retained a 9% running speed advantage over the female control

group after one year of testosterone suppression, and their average speed had not declined significantly farther by the end of the 2.5 year study period. (Roberts 2020.) Again, I have already explained the implications of greater male speed on safety for females on the field and court, particularly in combination with the greater male body weight.

CONCLUSION

Since the average male athlete is larger and exerts greater power than the average female athlete in similar sports, male–female collisions will produce greater energy at impact, and impart greater risk of injury to a female, than would occur in most female-female collisions. Because of the well-documented physiological testing and elite performance differences in speed and strength, as well as differences in lean muscle mass that exist across all age ranges, the conclusions of this paper can apply to a certain extent before, as well as during, and after puberty. We have seen that males who have undergone hormone therapy in transition toward a female body type nevertheless retain musculoskeletal "legacy" advantages in muscle girth, strength, and size. We have also seen that the additive effects of these individual advantages create multiplied advantages in terms of power, force generation and momentum on the field of play. In contact or collision sports, sports involving projectiles, or sports where a stick is used to strike something, the physics and physiology reviewed above tell us that permitting male-bodied athletes to compete against, or on the same team as females—even when undergoing testosterone suppression—must be expected to create predictable, identifiable, substantially increased, and unequal risks of injuries to the participating women.

Based on its independent and extensive analysis of the literature coupled with injury modeling, World Rugby recognized the inadequacy of the International Olympic Committee's policy to preserve safety for female athletes in their contact sport (the NCAA policy is even more lax in its admission of biological males into the female category). Among the explicit findings of the World Rugby working group were the following:

- Forces and inertia faced by a smaller and slower player during collisions are significantly greater when in contact with a larger, faster player.

- Discrepancies in mass and speed (such as between two opponents in a tackle) are significant determinants of various head and other musculoskeletal injury risks.

- The risk of injury to females is increased by biological males' greater ability to exert force (strength and power), and also by females' reduced ability to receive or tolerate that force.

- Testosterone suppression results in only "small" reductions in the male physiological advantages. As a result, heightened injury risks remain for females who share the same field or court with biological males.

- These findings together predict a significant increase in injury rates for females in rugby if males are permitted to participate based on gender identity, *with or without testosterone suppression*, since the magnitude of forces and energy transfer during collisions will increase substantially, directly correlated to the differences in physical attributes that exist between the biological sexes.

Summarizing their work, the authors of the World Rugby Guidelines said that, "World Rugby's number one stated priority is to make the game as safe as possible, and so World Rugby cannot allow the risk to players to be increased to such an extent by allowing people who have the force and power advantages conferred by testosterone to play with and against those who do not." (World Rugby Transgender Guidelines 2020.) As my own analysis above makes clear, I agree with the concerns of UK Sport and the conclusions of World Rugby regarding risk to female athletes. Importantly, I also agree that it must be a high priority for sports governing bodies (and other regulatory or governmental bodies governing sports) to make each sport as safe as reasonably possible. And in my view, medical practitioners with expertise in this area have an obligation to advocate for science-based policies that promote safety.

The *performance* advantages retained by males who participate in women's sports based on gender identity are readily recognized by the public. When an NCAA hurdler who ranked 200th while running in the collegiate male division transitions and immediately leaps to a number one ranking in the women's division;[24] when a high school male sprinter who ranked 181st in the state running in the boys' division transitions and likewise takes first place in the girls' division (De Varona 2021), the problem of fairness and equal opportunities for girls and women is immediately apparent, and indeed this problem is being widely discussed today in the media.

[24] https://en.wikipedia.org/wiki/Cece_Telfer (accessed 6/20/21)

The causes of sports injuries, however, are multivariate and not always as immediately apparent. While, as I have noted, some biological males have indeed competed in a variety of girls' and women's contact sports, the numbers up till now have been small. But recent studies have reported very large increases in the number of children and young people identifying as transgender compared to historical experience. For example, an extensive survey of 9th and 11th graders in Minnesota found that 2.7% identified as transgender or gender-nonconforming— well over 100 times historical rates (Rider 2018), and many other sources likewise report this trend.[25]

Faced with this rapid social change, it is my view as a medical doctor that policymakers have an important and pressing duty not to wait while avoidable injuries are inflicted on girls and women, but instead to proactively establish policies governing participation of biological males in female athletics that give proper and scientifically-based priority to safety in sport for these girls and women. Separating participants in contact sports based on biological sex preserves competitive equity, but also promotes the safety of female athletes by protecting them from predictable and preventable injury. Otherwise, the hard science that I have reviewed in this white paper leaves little doubt that eligibility policies based on ideology or gender identity rather than science, will,

[25] https://www.nytimes.com/2016/07/01/health/transgender-population.html?.?mc=aud_dev&ad-keywords=auddevgate&gclid=Cj0KCQjwkZiFBhD9ARIsAGxFX8BV5pozB9LI5Ut57OQzuMhurWThv BMisV9NyN9YTXIzWl7OAnGT6VkaAu0jEALw_wcB&gclsrc=aw.ds (accessed 6/20/21)

over time, result in increased, and more serious, injuries to girls and women who are forced to compete against biologically male transgender athletes. When basic science and physiology both predict increased injury, then leagues, policy-makers, and legislators have a responsibility to act to protect girls and women before they get hurt.

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APPENDIX – LIST OF PUBLICATIONS

Publications of Dr. Chad Thomas Carlson, M.D., FACSM

Sports Medicine CAQ Study Guide, Healthy Learning, 2021 [editor].

SEXUAL VIOLENCE IN SPORT: AMERICAN MEDICAL SOCIETY FOR SPORTS MEDICINE POSITION STATEMENT. Published in Curr Sports Med Reports June 2020;19(6):232-4; Clin J Sports Med June 8 2020; Br J Sports Med 2020;0:1-3.

Traveling with Medication. NCAA Sports Science Institute Bulletin, 2015 http://www.ncaa.org/sport-science-institute/traveling-medication.

A SURVEY OF STATE MEDICAL LICENSING BOARDS: CAN THE TRAVELING TEAM PHYSICIAN PRACTICE IN YOUR STATE? 2013. Jan (47)1:60-62.

AXIAL BACK PAIN IN THE ATHLETE: PATHOPHYSIOLOGY AND APPROACH TO REHABILITATION. Curr Rev Musculoskel Med. 2009 (2):88-93.

THE NATURAL HISTORY AND MANAGEMENT OF HAMSTRING INJURIES. Curr Rev Musculoskel Med 2008 (1):120-128.

SPONDYLOLYSIS AND THE ATHLETE. Athletic Ther Today. 2007 (12)4:37-39.

"ACUTE SUBDURAL HEMATOMA IN A HIGH SCHOOL FOOTBALL PLAYER," J Athl Training, 38;2(63), 2003.

THE RELATIONSHIP OF EXCESSIVE WEIGHT LOSS TO PERFORMANCE IN HIGH SCHOOL WRESTLERS – A PILOT STUDY; presented at the AMSSM national meeting, San Diego, CA, 2000; Clinical Journal of Sport Medicine 10(4):310, October, 2000.

CURRICULUM VITAE (ABBREVIATED)

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Work Address: Stadia Sports Medicine
6000 University Ave.
Suite 250
West Des Moines, IA, 50266
Phone (515) 221-1102

Active professional licenses: IA, NE, CA, TX, TN, NC, AZ, FL (telemed)

Board certified family medicine, ABMS 1998; recertified 2005, 2012

Board certified sports medicine, ABMS 1999; recertified 2009, 2019

EDUCATION:

- Fellowship: Sports Medicine -- Ball Memorial Hospital/Central Indiana Orthopedics, 1997-1999; Completed 4/99
- Residency: University of Michigan Department of Family Medicine,1994-97
- University of Nebraska College of Medicine
  M.D. obtained May 1994
- University of Nebraska at Lincoln
  B.S. with majors in history (emphasis American) and biology obtained May 1990

EMPLOYMENT HISTORY:

- Physician Owner, Stadia Sports Medicine, West Des Moines, IA, 2006 - present
- Staff Physician, University of Illinois, 9/04-6/06
- Director, Carle Sports Medicine, Carle Foundation Hospital, Urbana, IL, 2001-2004; Team physician, University of Illinois.
- Private practice, Ionia County Hospital, Ionia, MI, 1999-2001.

HOSPITAL AFFILIATIONS:

- Iowa Methodist Hospital, Des Moines
- Mercy Medical Center, Des Moines

PROFESSIONAL HONORS/AWARDS:

- Appointed to Board of Directors, Physical Activity Alliance, 2020
- Appointed to joint AMSSM/NCAA COVID-19 Working Group, March 2020-present
  - Medical advisory panel, 2021 Women's Division I NCAA Basketball Tournament
- AMSSM Founders Award 2019, awarded once annually for the Sports Medicine Physician nationally who best exemplifies the practice of Sports Medicine
- Fellow designation, American Medical Society for Sports Medicine, 2019
- Elected to Executive Committee, American Medical Society for Sports Medicine, 2017-21
  - **President of AMSSM, 2019-2020**

- Practice/Policy Committee, AMSSM, 2007-2016 (Former Chair)
    - Author of US HR 921, the Sports Medicine Licensure Clarity Act, which passed the US House of Representatives and Senate in January 2017, and was signed into law by President Trump, 2017
- Appointed member of physician liaison group to the NCAA to discuss return to sport strategies in the COVID-19 pandemic, 2020
- Appointed to Board of Directors, Running the Race, 2018-present
- Sports Ultrasound Committee, Policy Co-Chair, AMSSM, 2015-2017
- Elected to Board of Directors, American Medical Society for Sports Medicine, 2009-2013.
- Member, Health and Science Policy Committee, ACSM, 2010-present
    - Chair, Clinical Medicine Subcommittee, HSPC, ACSM, 2012-2015
- Iowa Medical Society Leadership Development Committee, 2022
- Member of Sports Medicine Subcommittee for the Iowa State Medical Society, 2007-present
    - Iowa designate to National Youth Sports Safety Summit
        - New York City – 2015
        - Indianapolis – 2016
        - Kansas City – 2017
- AMSSM designate for the American Academy of Orthopaedic Surgeons' Knee Osteoarthritis Quality Measure review committee, 2014-2016
- Associate Editor, Current Reviews in Musculoskeletal Medicine, 2006-2010.
- Fellow, American College of Sports Medicine: Designated in 2004

SPECIAL QUALIFICATIONS:

- Prior legal consulting work in cases with both local and national reach
- Extensive training in office musculoskeletal injury
- Oversight of treadmill stress testing/metabolic stress testing
- Independent consultation regarding establishment of individual exercise programs consistent with revised ACSM guidelines
- Proficient at evaluation/management of bone mineral density problems at all ages

- Qualified procedurally for:
  Ultrasound diagnostic testing and guided injections
  Joint injection/aspiration
  Percutaneous tenotomy (TENEX)
  Rotator cuff barbotage
  Lactate/Anaerobic threshold, $VO_{2\ MAX}$/ exercise testing
  Laryngoscopy for vocal cord assessment
  Compartment pressure assessment
  Ultrasound-guided nerve blocks
- Extensive experience speaking to large national groups on issues pertaining to sports medicine, including, but not limited to:
    - Overuse Injury
    - Head and Neck Injuries on the Field
    - Exercise-Induced Asthma
    - The Shoulder Exam
    - Principles of Exercise Prescription
    - Traumatic Brain Injury in Sport
    - The Knee Exam
    - The Ankle Exam
    - The Hip Exam
    - The Pre-Participation Exam
    - Cardiopulmonary Exercise Testing for Determination of Training Zone Estimates and to Identify Causes of Exercise-Related Dyspnea
    - Athletic Amenorrhea
    - Advocacy in Sports Medicine
    - Medical Practice Economics

PUBLICATIONS/RESEARCH:

- Sports Medicine CAQ Study Guide, Healthy Learning, Monterey, CA. 2021.[editor].
- AXIAL BACK PAIN IN THE ATHLETE: PATHOPHYSIOLOGY AND APPROACH TO REHABILITATION. Curr Rev Musculoskel Med. 2009 (2):88-93
- SPONDYLOLYSIS AND THE ATHLETE. Athletic Ther Today. 2007 (12)4:37-39.
- THE NATURAL HISTORY AND MANAGEMENT OF HAMSTRING INJURIES. Curr Rev Musculoskel Med 2008 (1):120-128.
- A SURVEY OF STATE MEDICAL LICENSING BOARDS: CAN THE TRAVELING TEAM PHYSICIAN PRACTICE IN YOUR STATE? BJSM. 2013. Jan (47)1:60-62.
- SEXUAL VIOLENCE IN SPORT: AMERICAN MEDICAL SOCIETY FOR SPORTS MEDICINE POSITION STATEMENT
    - Curr Sports Med Reports June 2020;19(6):232-4.
    - Clin J Sports Med June 8 2020;
    - Br J Sports Med 2020;0:1-3
- “ACUTE SUBDURAL HEMATOMA IN A HIGH SCHOOL FOOTBALL PLAYER,” J Athl Training, 38;2(63), 2003
- Traveling with Medication. NCAA Sports Science Institute Bulletin, 2015 http://www.ncaa.org/sport-science-institute/traveling-medication
- THE RELATIONSHIP OF EXCESSIVE WEIGHT LOSS TO PERFORMANCE IN HIGH SCHOOL WRESTLERS – A PILOT STUDY; presented at the AMSSM national meeting, San Diego, CA, 2000 Clinical Journal of Sport Medicine 10(4):310, October, 2000

EXHIBIT 16

1:22-cv-1075

A.M., by her mother and next friend, E.M., Plaintiff.

v.

INDIANAPOLIS PUBLIC SCHOOLS; SUPERINTENDENT, INDIANAPOLIS PUBLIC SCHOOLS, in her official capacity, Defendants.

Expert Witness Declaration

Nancy Hogshead-Makar, J.D.

Introduction and overview of qualifications

1. My name is Nancy Hogshead-Makar. I am the Chief Operating Officer of Champion Women, a non-profit that provides legal advocacy for girls and women in sports and one of the founding members of the Women's Sports Policy Working Group.

2. I am a civil rights lawyer, representing girls and women in sports. This includes opportunities to participate, receive scholarships, and equal treatment, as compared with men's sports. We continue to conduct extensive research on the depth of the intentional sex discrimination that schools perpetrate against girls and women. www.TitleIXSchools.com. A third of our work at Champion Women involves protecting athletes from sexual abuse.

3. I was a world-class athlete for nine years. I am a two-time Olympian; I won three gold medals and one silver medal in swimming at the 1984 Los Angeles Olympics.

4. After graduating from college in 1986, I went to work for the Women's Sports Foundation. I held numerous volunteer positions, eventually becoming President, Legal Advisor, and then as a paid consultant, their Senior Director of Advocacy.

5. I have served in a variety of leadership roles for organizations promoting girls' and women's sports, provided numerous speeches and presentations on the subject of women's sports, and assisted in drafting legislation to amend the Ted Stevens Olympic and Amateur Sports Act.

6. For a full list of my qualifications, please see my full CV which is attached.

7. The WSPWG seeks to assure that the girls' and women's competitive sport category is reserved for females. Our online policies are currently being updated to reflect that male puberty cannot be rolled back.

8. I initiated surveys of people within sport about whether they supported policies that were fair to biological girls and women, when considering transgender eligibility rules. Survey results of our petitions are available at this link: tinyurl.com/3wh35dbr.

9. I have been asked by counsel for the State of Indiana to provide expert testimony regarding the impact of Indiana House Enrolled Act 1041 from my perspective as an elite woman athlete, as a rape survivor and as a women's sports advocate.

10. This statement is based on my own experiences as an athlete, my own and others' scientific findings and knowledge regarding anti-doping efforts and transgender inclusion efforts and on my own professional opinion, which is based on my disciplinary training and research experience.

Summary of expert opinion

11. The main expert opinion I offer is as follows: To ensure competitive fairness and athlete safety, transgender girls should not be permitted automatic inclusion in competitive girls' sports. Otherwise, biological girls and women will lose opportunities to compete fairly and will lose related opportunities for elevation, advancement, and, sadly, recovery from sexual violence.

Personal Experiences

12. I started competitive swimming when I was seven, at a club in Gainesville, Florida. I was very good, and I frequently won my races against other girls, but did not break any girls' records. My first coach was Eddie Reese, who is now considered one of the greatest coaches of all time.[1]

13. From ages 7-12, I was encouraged to participate in many sports like gymnastics, tennis, golf, and other activities like music and dance. I did not specialize. My mother encouraged Eddie Reese to push me to break the girls' 10-and-under record. He said, "If I push her, she will quit swimming. Just let her have fun." I did not break a record until age 12.

14. When I was eleven, in 1974, our family moved to Jacksonville, Florida, and Randy Reese (Eddie's brother) became my coach on the "Randy Reese Swim Team." Around that time, Randy Reese told me that I could be the best in the world.

15. The pursuit of excellence and winning made me work enormously hard. From 7th grade until I graduated from high school, I trained two hours of swimming prior to school, an hour during school of lifting weights and "dry land" exercises, and then two more hours after school back in the pool.

16. We trained about 25 hours a week. In the hard part of the year, from September to January, we swam about 800 laps per day, or just under 13 miles a day. At that time, a swimmer swam further than a marathon runner. We trained between 48 and 50 weeks out of the year.

17. I remember the way my father looked at me as a kid; he was so proud of how hard I worked and my athletic accomplishments.

18. It was about age 12 that I first experienced "flow;" the sense of giftedness that is out-of-body. These were shared moments with God. The wins, the records, the

[1] Eddie Reese has been coaching the men's swimming team at the University of Texas since 1978. His teams have won 15 NCAA championships. He has been the Head Men's Coach for the U.S. Olympic Swimming Team in 2004 and 2008. He was an Assistant U.S. Olympic Coach in 1992, 1996, 2000 and 2012

family pride, the ability to have an environment that allowed me to thrive all made that hard work feel like it was a purpose I was living into.[2]

19. By the time I was 12 and in 7th grade in 1975, I had qualified for U.S. Senior Nationals. Also, I held the national age group record. Our team had seven high school males on it, and nine females.

20. At 18, I qualified for the 1980 Olympic Team. The U.S.-led boycott of those Games held in Moscow means I did not compete.

21. At 22, I won three gold medals and one silver medal at the 1984 Olympics.

22. Major awards include the *Nathan Mallison Award*, given to Florida's outstanding athlete, and the *Kiphuth Award*, given to America's best all-around swimmer nationally. *Sports Illustrated* ranked me as Florida's 13th greatest athlete of the 20th Century, Florida's 3rd greatest woman athlete. I have been inducted into eleven sports halls of fame, including the International Swimming Hall of Fame and the International Women's Sports Hall of Fame.

23. Having competitions that were female-only gave me the opportunity to win and set records, as well as access to a full athletic scholarship to college, accolades, and leadership opportunities.

24. Being an Olympic Champion has opened hundreds of doors, and it continues to give me a platform to make a difference in diverse areas as asthma education, anti-drowning, anti-drug use, concussion-education, sex discrimination in sport, sexual violence, and pregnancy and employment discrimination, to name a few.

25. Without formal sex-segregation in sports, I might have qualified for my high school team, but I would have never become an elite swimmer, much less earned a college scholarship or been inducted into a Hall of Fame.

26. Title IX of the Education Amendments of 1972,[3] ("Title IX") the federal law that prohibits sex discrimination, and the 1975 regulations interpreting it regarding athletics,[4] expressly permits formal sex-segregation in sport.

27. Current law allows schools to formally segregate people by their biological sex in sports competitions. Biology and science guide the rules allowing sex-segregation in sports all over the world; it isn't "sex discrimination" to exclude biological men from playing on women's teams or from setting women's world records.

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[2] Book Chapter, *Success Is A Learned Skill*; in AWAKEN THE OLYMPIAN WITHIN, (2000). Edited by John Naber.
[3] 20 U.S.C. §§ 1681
[4] 34 C.F.R. § 106.41

28. The IOC Charter declares that "The practice of sport is a human right. Every individual must have the possibility of practicing sport, without discrimination of any kind and in the Olympic spirit, which requires mutual understanding with a spirit of friendship, solidarity and fair play."

29. Rules that define eligibility and create competitive categories based on, for example, age, weight, equipment, and biological sex, are all in accord with this Olympic ideal.

30. The legal permissibility of formal sex-segregation in sports is a positive good, but only if based on science and biology. Sports where testosterone and male-puberty are irrelevant, like equestrian, sailing and motorsports, are already sex-neutral.

31. If "sex discrimination" were to become equal to "gender identity discrimination" – and biology were not the foundational, bedrock explanation for sports' formal sex-segregation—women as a biological category would probably lose the right to demand equality for our athletic programs.

32. Any effort to permit trans girls to participate in girls' sports would require administration of drugs aimed at controlling testosterone. I have worked hard over my career to get performance enhancing drugs out of sport, particularly those aimed at controlling testosterone.

33. I swam on the U.S. National Team for nine years, from 1976–1984, the same years that East German swimmers dominated women's competitions by cheating with anabolic steroids.

34. Over the years, I competed against the East German women many times. If the goal was to bring admiration for the country's athletic accomplishments, and thereby reflected glory onto the country, their doping program created just the opposite. We knew they were doping and it bred disdain, a contempt for my competitors and the country.

35. In all those years of competing against doped up East German women, none of them were competitive against men in the men's categories.

36. Just months before the 1984 Los Angeles Olympic Games, the Soviet Union and most of the Eastern Bloc announced it was going to boycott. It was an enormous joy and relief to me and my peers; I knew I would have a fair shot at winning. In the event, I was able to win three Olympic gold medals and a silver medal in Los Angeles, because of the boycott by cheaters.

37. Because of my personal experiences competing against athletes who used performance enhancing drugs, I got involved in combatting their presence in competition.

38. In 1999, I testified before the U.S. Senate in support of the creation of the U.S. Anti-Doping Agency and the World Anti-Doping Agency with an eye toward requiring the International Olympic Committee to crack down on performance enhancing drugs.

39. I served an evaluator for the United States Anti-Doping Agency ("USADA") for missed and positive drug tests from 2003-2014.

40. Elite athletes value fairness above privacy and convenience; they demand the most sensitive tests that catch the most minute amounts of substances and the harshest sanctions for those found with positive drug tests.

41. The WSPWG and Champion Women have hosted a number of webinars with some of the world's best physicians and researchers. Dr. Mike Joyner with the Mayo Clinic spoke to the leadership of women athletes on May 23, 2022.[5] In addition, we hosted a webinar with Dr. Ross Tucker with the Women's Clearinghouse on Women's Issues on May 24th, 2022.[6] Neither audience was familiar with the science, the biology of sex and testosterone lowering agents. These scientists, looking across research studies, conclude that it is impossible for transgender women to compete fairly against biological women.

42. In December 2021, I became aware of transgender woman Lia Thomas' competition and her times. I calculated the percentage difference between Lia Thomas' times and rankings pre- and post-transition. As the chart below shows, Lia Thomas did not move laterally from the men's category to the women's category. Lia did not mitigate her male-puberty advantage, as measured by her rankings or by the percentage she got slower. It is important to note that Lia did not change coaches, facilities, general medical care, or teammates. These times and rankings are consistent with the science referenced earlier; that the shorter the distance, the more difficult it would be for a transgender woman to mitigate male-puberty advantage. Lia did not swim the 1650 yard freestyle at the NCAA Swimming National competition,[7] even though it was her best event pre-transition. By moving to shorter, more explosive events, she was taking advantage of her male puberty advantage.

[5] Available at: https://www.youtube.com/watch?v=5aJg7eDzmAc

[6] Available at: https://www.youtube.com/watch?v=69WIe-ENDAg

[7] I would expect a 2.5% faster time when she was fully rested and shaved.

Lia Thomas: Swimming Event	Best Women's Time 2021-22	Pre-Transition Men's Time	Percent difference (negative = slower now)	Expected difference bt men's/ women's times	NCAA D-I Women's Ranking as of 3-19-22	D-I Men's 2018-19 Ranking Swim Cloud
100y freestyle	47.37	47.15*	-.4%	-12.61%	# 11	N/A – Did not swim the event
200y freestyle	1:42.09 102:09	1:39.31 99.31	-2.79%	-10.22%	# 5	# 465
500y freestyle	4:33.2 273.2	4:18.72 258.72	-5.59%	-8.98%	# 1	# 65
1650y freestyle	959.71	894.76	-7.26%	-7.20%	# 11	# 32

43. Based on these results and by the science that was shared with me, I concluded that the goal of fairness should be prioritized and could not coexist with the goal of inclusion. Fairness is a higher-order value than inclusion. Fairly against biological women

44. If a fair playing field is not protected, women will lose their protection to access athletic competition. The consequence will be not only erosion of fair competition for women, but also re-direction of an important channel of recovery for sex-based violence particular to biological women.

45. Just before Thanksgiving in 1981, I was violently raped while out for a run.

46. I suffered from serious mental health issues; what is now called Post Traumatic Stress Syndrome, or PTSD.

47. It was difficult to feel safe. I had a heightened need to control my environment and I went to elaborate lengths to feel safe. Among other insecurities, I was particularly aware of any risk of harm in my environment. I cannot imagine the psychological consequences if I had been required to change in front of biological males. This is not to suggest that transwomen are more likely to commit sexual violence; only that I could not have been in that space.

48. I red-shirted the rest of that academic year, 1981 – 1982; meaning I did not swim competitively or train during that time, but was still given my athletic scholarship. I thought my swimming career was over.

49. My Duke coach, Bob Thompson, offered me my scholarship back in the fall of 1982 if I just "showed up at the meets." I was so proud of having earned that scholarship that I committed myself to returning. It was the athletic scholarship that got me back into the pool.

50. Serious training, and the pursuit of fulfilling my life's purpose, helped me heal from the sexual violence. This was all possible by having a sport category I could compete and win in, the "women's" sport category.

    A. When I got back into serious training, it healed my PTSD; the hard exercise calmed my brain.

    B. I could work out my emotions under the water during those long hours of training.

    C. I recovered my sense of bodily integrity, the sense that I was in control of my body and my destiny with hard training and the pursuit of winning amidst indisputably fair competition.

51. Females are not slower, weaker, inferior versions of men. Women are perfectly made for the purposes evolution created them for; we are not defined in opposite to male bodies. It is our different bodies that makes formal sex-segregation imperative in sports. Physical differences between males and females should be celebrated, not blurred.

52. Female sports categories allow opportunities for biological females, half the world's population, to have a place in sport where they can succeed. It is similar to weight categories, age categories, or categories based on ability. Sport has dozens of types of categories. Without strict enforcement of these different types of categories, men in their 20s would dominate all sports competitions.

53. Allowing transgender girls to compete head-to-head with biological females hurts girls of color and girls with low economic resources the most; they rely on school-based sports, rather than expensive travel teams or the separate Olympic system to move up through the pipeline and to have more opportunities in high school, college, Olympic and professional athletics.[8]

54. Transgender inclusion for those with male advantages does not operate in a vacuum; girls and women athletes are already seriously short-changed by every measurable criteria: opportunities, scholarships and treatment. High schools offer girls over a million fewer sports opportunities than they offer boys. Colleges and universities offer women over 200,000 fewer varsity sports opportunities as compared to their male peers, and over a billion dollars less in athletic scholarships. Competitive sports are a rationed type of educational experience, and girls and women are already provided far less than their male peers, in quantity and quality.

[8] "Sports in the Public Interest," Sports and Society Aspen Institute, available at: Sports & Society Program - The Aspen Institute. *See also*: "Game On" by Tom Farrey and "The Most Expensive Game in Town: The Rising Cost of Youth Sports and the Toll on Today's Families" by Mark Hyman.

www.TitleIXSchools.com Girls are denied over 1.1 million opportunities to play in high school sports.[9]

55. Transgender inclusion into female sports is a zero-sum game for females. Transgender women can compete into the female categories, but transgender men are not competitive with the males.

56. Trans girls suffering serious mental health challenges must be cared for by experts on an individual basis. The solution to the vulnerability of trans girls and women is not unconditional inclusion in the "girls' and women's" sports category, to the detriment of biological females who have benefitted to such a great degree from Title IX over the past 50 years.

57. Women's sports have led the way in breaking down sex-stereotypes that serve to limit women's experiences and opportunities throughout society. Only by maintaining enforceable boundaries for the "girls and women's" categories can we continue that trend.

Nancy Hogshead-Makar

[9] National Federation of State High School Associations, 2018 – 1019 High School Athletics Participation Survey, available at: https://www.nfhs.org/media/1020412/2018-19_participation_survey.pdf