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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA
TUCSON DIVISION

Jane Doe, *et al.*, Plaintiffs, v. Thomas C. Horne, in his official capacity as State Superintendent of Public Instruction, *et al.*, Defendants.	Case No. 4:23-cv-00185-JGZ **Notice of Filing Proposed Intervenors' Proposed Pleadings in Intervention**

Pursuant to Rule 24(c), Proposed Intervenor-Defendants Senator Warren Petersen, President of the Arizona State Senate, and Representative Ben Toma, Speaker of the Arizona House of Representatives, file their proposed pleadings in intervention, consisting of a proposed motion to dismiss, a proposed opposition to Plaintiffs' motion for preliminary injunction, and three expert declarations.

Dated: May 18, 2023

Respectfully submitted,

JAMES OTIS LAW GROUP, LLC

*/s/ Justin D. Smith*_________

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CERTIFICATE OF SERVICE

I hereby certify that, on May 18, 2023, I caused a true and correct copy of the foregoing to be filed by the Court's electronic filing system, to be served by operation of the Court's electronic filing system on counsel for all parties who have entered in the case.

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Jane Doe, *et al.*, Plaintiffs, v. Thomas C. Horne, in his official capacity as State Superintendent of Public Instruction, *et al.*, Defendants.	Case No. 4:23-cv-00185-JGZ **[Intervenors' Proposed] Motion to Dismiss**

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INTRODUCTION

Plaintiffs' Complaint should be dismissed for the same reasons set forth in the Legislative Leaders' Opposition to Plaintiffs' Motion for Preliminary Injunction: Plaintiffs' claims fail as a matter of law. The Legislative Leaders' opposition details why Plaintiffs' equal protection and Title IX claims fail.

Plaintiffs' claim under the Americans with Disabilities Act ("ADA") also fails. Congress excluded Plaintiffs' gender dysphoria from the definition of "disability" under the ADA. Plaintiffs do not provide factual allegations that their gender identity disorder results from a physical impairment. Plaintiffs also do not allege a major life activity has been substantially limited, and courts have concluded that playing sports is not a major life activity under the ADA.

The Court should dismiss Plaintiffs' Complaint.

LEGAL STANDARD

A complaint should be dismissed under Rule 12(b)(6) if it fails "to state a claim to relief that is plausible on its face." *Bell Atl. Corp. v. Twombly*, 550 U.S. 544, 570 (2007). "Dismissal can be based on the lack of a cognizable legal theory or the absence of sufficient facts alleged under a cognizable legal theory." *Balistreri v. Pacifica Police Dep't*, 901 F.2d 696, 699 (9th Cir. 1988) (internal citation omitted). "Conclusory allegations of law . . . are insufficient to defeat a motion to dismiss." *Lee v. City of Los Angeles*, 250 F.3d 668, 679 (9th Cir. 2001). "On a motion to dismiss, the court accepts the facts alleged in the complaint as true." *Balistreri*, 797 F.2d at 745.

ARGUMENT

I. Plaintiffs' Equal Protection Clause and Title IX claims should be dismissed.

The Court should dismiss Plaintiffs' equal protection and Title IX claims for the reasons set forth in the Legislative Leaders' opposition to Plaintiffs' motion for preliminary injunction. "[A] complaint cannot state a plausible claim for relief if there is no chance of success on the merits." *Angelotti Chiropractic, Inc. v. Baker*, 791 F.3d 1075, 1087 (9th Cir. 2015) (internal quotation omitted). The same arguments and the same legal reasoning undermine both Plaintiffs' complaint and motion for preliminary injunction. This overlap is because Plaintiffs have no chance of success on the merits. *See id.* "[R]egardless of what facts plaintiffs might prove during the course of litigation, 'a legislative choice is not subject to courtroom fact-finding and may be based on rational speculation unsupported by evidence or empirical data.'" *Id.* (quoting *F.C.C. v. Beach Commc'ns, Inc.*, 508 U.S. 307, 315 (1993)). For these reasons, the Legislative Leaders incorporate by reference all arguments raised in their opposition to the motion for preliminary injunction as if raised herein. *See* LRCiv 7.1(d)(2).

II. Plaintiffs' Americans with Disability Act claim should be dismissed.

A. Congress expressly excluded Plaintiffs' gender dysphoria—known at that time as gender identity disorder—from the definition of "disability" in the Americans with Disability Act.

When Congress enacted the Americans with Disability Act, it expressly excluded Plaintiffs' claimed disability. "[E]ven though being transgender was marked as a mental illness, coverage for transgender persons was excluded from the Americans with Disabilities Act of 1990 (ADA) after a floor debate in which two senators referred to these diagnoses as 'sexual behavior disorders.' The following year, Congress added an identical exclusion to the Rehabilitation Act of 1973, . . ." *Grimm v. Gloucester Cnty. Sch. Bd.*, 972 F.3d 586, 611 (4th Cir. 2020), *as amended* (Aug. 28, 2020) (quoting Kevin M. Barry et al., *A Bare Desire to Harm: Transgender People and the Equal Protection Clause*, 57 B.C. L. Rev. 507, 510, 556 (2016)).

In full, the statutory exclusion provide:

> (a) Homosexuality and bisexuality
>
> For purposes of the definition of "disability" in section 12102(2) of this title, homosexuality and bisexuality are not impairments and as such are not disabilities under this chapter.
>
> (b) Certain conditions
>
> Under this chapter, the term "disability" shall not include--

> (1) transvestism, *transsexualism*, pedophilia, exhibitionism, voyeurism, *gender identity disorders not resulting from physical impairments*, or other sexual behavior disorders;
>
> (2) compulsive gambling, kleptomania, or pyromania; or
>
> (3) psychoactive substance use disorders resulting from current illegal use of drugs.

42 U.S.C. § 12211 (emphasis added).

Courts interpret words in a statute "consistent with their ordinary meaning . . . at the time Congress enacted the statute." *Wisconsin Cent. Ltd. v. United States*, 138 S. Ct. 2067, 2070 (2018) (internal citation omitted). At the time Congress enacted the Americans with Disability Act and its statutory exclusion, "one could receive a diagnosis of 'transsexualism' or 'gender identity disorder,' 'indicat[ing] that the clinical problem was the discordant gender identity.'" *Grimm*, 972 F.3d at 611 (quoting John W. Barnhill, *Introduction*, *in DSM-5 Clinical Cases* 237–38 (John W. Barnhill ed., 2014)). As one court explained regarding the DSM-III that was operative at the time of the ADA's passage:

> Under the DSM-III, the 'gender identity disorders' subclass of psychosexual disorders was 'characterized by the individual's feelings of discomfort and inappropriateness about his or her anatomic sex and by persistent behaviors generally associated with the other sex.' The DSM-III further defined the 'essential feature' of the gender identity disorders subclass as 'an incongruence between anatomic sex and gender identity.' The descriptive term used in the DSM-III clearly includes the subsequently refined specific diagnosis of gender dysphoria.

Lange v. Houston Cnty., Georgia, 608 F. Supp. 3d 1340, 1362 (M.D. Ga. 2022) (quoting American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders – Third Edition*, at 261 (1980)).

"The clear result is that Congress intended to exclude from the ADA's protection both disabling and non-disabling gender identity disorders that do not result from a physical impairment. The majority of federal cases have concluded as much." *Parker v. Strawser Constr., Inc.*, 307 F. Supp. 3d 744, 754 (S.D. Ohio 2018) (citing *Gulley–Fernandez v. Wisconsin Dep't of Corr.*, No. 15–CV–995, 2015 WL 7777997, at *2 (E.D. Wis. Dec. 1, 2015); *Mitchell v. Wall*, No. 15–CV–108–WMC, 2015 WL 10936775, at *1 (W.D. Wis. Aug. 6, 2015); *Diamond v. Allen*, No. 7:14–CV–124 HL, 2014 WL 6461730, at *4 (M.D. Ga. Nov. 17, 2014); *Kastl v. Maricopa Cty. Cmty. Coll. Dist.*, No. CIV.02–1531PHX–SRB, 2004 WL 2008954, at *4 (D. Ariz. June 3, 2004)).

B. Plaintiffs do not provide factual allegations that their gender identity results from a physical impairment.

Plaintiffs cannot avoid the gender identity disorder exclusion unless their gender dysphoria came from a physical impairment. Plaintiffs conclusory allege that their gender dysphoria results from physical impairments. Comp., ¶ 84. However, Plaintiffs provide no factual allegations to substantiate this legal conclusion. Courts have skeptically viewed similar allegations and found no physical impairment was alleged. *See, e.g.*, *Lange v. Houston Cnty., Georgia*, 608 F. Supp. 3d 1340, 1362-63 (M.D. Ga. 2022); *Parker v. Strawser Constr., Inc.*, 307 F. Supp. 3d 744, 755 (S.D. Ohio 2018).

C. Plaintiffs do not allege a major life activity has been substantially limited.

Plaintiffs' claim falters even if they could somehow surmount the statutory exclusion. Under the ADA, "disability" is defined as "a physical or mental impairment that substantially limits one or more major life activities of such individual . . . ." 42 U.S.C. § 12102(1)(A). "Thus, to be disabled for purposes of the ADA, a person must have an impairment, that impairment must limit a major life activity, and the limitation on the major life activity must be substantial." *E.E.O.C. v. United Parcel Serv., Inc.*, 306 F.3d 794, 801 (9th Cir.), *opinion amended on denial of reh'g*, 311 F.3d 1132 (9th Cir. 2002).

Plaintiffs have not alleged that a major life activity has been impaired, nor which major life activity they believe has been impaired. But assuming from their complaint that playing sports is Plaintiffs' allegedly impaired major life activity, playing sports is not a "major life activity" under the ADA. Regulations define "major life activities" to include, but not be limited to, "Caring for oneself, performing manual tasks, seeing, hearing, eating, sleeping, walking, standing, sitting, reaching, lifting, bending, speaking, breathing, learning, reading, concentrating, thinking, communicating, interacting with others, and working." 29 C.F.R. 1630.2(i)(1)(i). Before amendments to the ADA in 2008, "courts consistently held that sporting activities . . . did not qualify as major life activities." *Marsh v. Terra Int'l (Oklahoma), Inc.*, 122 F. Supp. 3d 1267, 1279 (N.D. Okla. 2015) (citing *Griego v. Barton Leasing Inc.*, No. 08–cv2325, 2010 WL 618281, at *4 (D. Colo. Feb. 19, 2010) (holding that "participating in sports" and "playing sports with children" were not major life activities); *Robinson v. Lockheed Martin Co.*, No. 04–3143, 2006 WL 5629118, at *7 (E.D. Pa. Feb. 1, 2006) (holding that sporting activities were not major life activities); *Rosa v. Brink's Inc.*, 103 F.Supp.2d 287, 290 (S.D.N.Y.2000) (holding that sports activities "are not major life activities at all")). The federal court in *Marsh* concluded that even after the 2008 amendments, sporting activities "do not constitute major life activities." *Id.*

The intrinsic benefits sports can provide do not convert playing sports into a major life activity. "Unlike standing, sitting, breathing, thinking, communicating, interacting with others, or other examples in the regulation, a person can live (and many do) without ever participating in sports," reasoned the court. *Id.* "These activities may enhance one's life and may be important to particular individuals, but the ADA is ultimately aimed at fereting out discrimination and ensuring that employers provide reasonable accommodations to disabled individuals." *Id.* Other courts have reached the same conclusion that playing sports is not a major life activity under the ADA. *Pritchard v. Fla. High Sch. Athletic Ass'n, Inc.*, No. 2:19-CV-94-FTM-29MRM, 2020 WL 3542652, at *4 (M.D. Fla. June 30, 2020) ("From the outset, the Court finds that the inability to play sports does not constitute a substantial impairment of a major life activity.") (internal quotation omitted); *Walter v. Birdville Indep. Sch. Dist.*, No. 4:18-CV-301-A, 2018 WL 3974714, at

*3 (N.D. Tex. Aug. 20, 2018) ("Participating in sports is not a major life activity.).

Accordingly, because playing sports is not a major life activity under the ADA, Plaintiffs' ADA claim fails.

D. The Fourth Circuit's decision is unpersuasive and inconsistent with the statutory text.

A divided panel of the Fourth Circuit took a different course and held that gender dysphoria was not excluded as a "gender identity disorder" and that Plaintiffs had sufficiently alleged physical impairment to survive a motion to dismiss. *Williams v. Kincaid*, 45 F.4th 759, 765–74 (4th Cir. 2022). To reach its conclusion that gender dysphoria was not excluded as a "gender identity disorder," the majority hinged its analysis on the DSM-V definition of gender dysphoria in 2013. *Id.* at 767. But the court's "focus must be on what gender identity disorders meant in 1990, not what the APA did in 2013." *Id.* at 785 (Quattlebaum, J., dissenting). "Otherwise," reasoned the dissent, "we give organizations like the [American Psychiatric Association] to [*sic*] power to effectively modify statutes passed by Congress and signed into law by the President." *Id.*[1]

The majority's conclusion on physical impairment fares no better. The majority grasped at straws by suggesting that "the need for hormone therapy may well indicate that her gender dysphoria has some physical basis" and noting Plaintiffs' citations to "medical and scientific research identifying possible physical bases of gender dysphoria." *Id.* at 771. But the statute excludes gender identity disorders only if they are "resulting from physical impairments." It is insufficient to speculate whether a physical basis may exist.

CONCLUSION

Plaintiffs are not likely to succeed on their claims. The Court should dismiss Plaintiffs' Complaint.

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[1] The Fourth Circuit denied rehearing the case en banc 8-6. *Williams v. Kincaid*, 50 F.4th 429 (4th Cir. 2022). The defendant petitioned the Supreme Court of the United States, for a writ of certiorari. The Court has distributed the cert petition for review at two conferences in the last month, but it has not yet rendered a decision on if it will hear the case. *Kincaid v. Williams*, 22-633 (U.S.).

Dated: May 18, 2023

Respectfully submitted,

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Jane Doe, *et al.*, Plaintiffs, v. Thomas C. Horne, in his official capacity as State Superintendent of Public Instruction, *et al.*, Defendants.	Case No. 4:23-cv-00185-JGZ **[Intervenors' Proposed] Opposition to Plaintiffs' Motion for a Preliminary Injunction and Memorandum of Law in Support Thereof**

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INTRODUCTION

Arizona enacted the Save Women's Sports Act to promote sex equality and protect women. Arizona's legislature passed the Save Women's Sports Act because it recognized a "sports performance gap" existed because of physiological differences that gave biological males an advantage in athletic competition against biological females.

The performance gap is real. Athletic organizations, experts, and peer-reviewed studies have determined that biological males are stronger, faster, jump higher, throw harder, and kick farther than biological females. These physiological differences exist before, during, and after puberty, and they continue to exist even with puberty blockers or testosterone suppression. These differences place biological females at a competitive disadvantage and an increased risk of injury when competing against biological males.

Plaintiffs are not likely to succeed on their claims. Plaintiffs' equal protection claim fails because the Save Women's Sports Act designates sports teams based on biological sex, not gender identity. The Ninth Circuit already has rejected equal protection challenges to Arizona policies preventing boys from playing in girls' sports. Providing female athletes with fair competition and protecting them from injury is an important government objective, and excluding biological males from women's sports is substantially related to achieving that objective.

Plaintiffs' Title IX claim also fails. Title IX addresses biological sex, not gender identity, and it expressly allows schools to take sex into account in sports. In fact, Title IX allows for sex-based distinctions for sports teams because it sought to even the playing field for female athletes. So, too, does the Save Women's Sports Act.

Plaintiffs are not irreparably harmed because they remain able to compete on school sports teams, as they admit that their schools have male teams for all the sports in which they seek to participate. The public interest and balance of the equities favor the state law's protections for female athletes so that they may continue to enjoy the opportunities Title IX sought to deliver.

The Court should deny Plaintiffs' motion for preliminary injunction.

STATEMENT OF FACTS

I. Humans are biologically male or female.

Sex is an objective feature that is determined at the moment of conception. (Cantor Decl. ¶¶ 105-107; Brown Decl. ¶ 1.) In science, only objective factors matter to a valid definition. (Cantor Decl. ¶ 105.) Infants are born male or female, which can be ascertained by chromosomal analysis or visual inspection. (*Id.* ¶¶ 105, 107.) More than 6,500 protein-coding genes have significant Sex Differential Expression in at least one gene. (Brown Decl. ¶ 5.)

Gender identity, on the other hand, is subjective. (Cantor Decl. ¶ 105.) A person's declaration of their gender identity cannot be falsified or verified. (*Id.*) Gender identity also can change: "it has been the unanimous conclusion of every follow-up study of gender dysphoric children ever conducted, not only that gender identity does change, but also that it changes in the large majority of cases." (*Id.* ¶ 146.)

II. Biological males have large performance advantages over females.

Males have physiological differences from females that cause males to "substantially outperform comparably aged, gifted, and trained" females in athletic competition. (Brown Decl. ¶ 9.)

Men are stronger. Men have 60%-100% greater arm strength than women, 57% greater grip strength, and 25%-60% greater leg strength. (*Id.* ¶¶ 15-16, 20.) As an example of this difference, an under 20-year-old female who ranks in the 95th percentile for upper body strength can bench press 0.88 kg for every kg of body mass; an under 20-year-old male with the same bench press would be between the 15th and 20th percentile for males. (*Id.* ¶ 19.)

Men run faster. Men have a speed advantage of 10%-13% over women for both short sprints and longer distances. (*Id.* ¶ 25.) In just 2017, thousands of boys and men ran faster 400-meter times than three female Olympic champions' personal bests at that distance. (*Id.* ¶ 26.) Boys 15 years old and under have beaten female world records in running, jumping, and throwing events. (*Id.* ¶ 28.) Plaintiff Doe wants to try out for the girls' cross-country team. (J. Doe Decl. ¶ 9.) Last year in Arizona 6th grade track and field races, the first-place boy was faster than the first-place girl in all races except one, and the average performance of the top 10 boys was consistently faster than the average performance of the top 10 girls. (Brown Decl. ¶ 110.)

Men jump higher and farther. High school male high jumpers jumped an average of 18% higher than females. (*Id.* ¶ 33.) High school male long jumpers jumped an average of 24% farther than females. (*Id.*) Plaintiff Roe wants to try out for the girls' volleyball team. (M. Roe Decl. ¶ 7.) Research on elite volleyball players found that males jumped an average 50% higher than females during an "attack" at the net and spiked volleyballs 29%-34% harder. (Brown Decl. ¶ 32.)

Men throw, hit, and kick faster and farther. By 12 years old, boys' throwing velocity is between 3.5 and 4 standard deviations higher than girls'. (*Id.* ¶ 36.) The average 17-year-old male can throw a ball farther than 99% of 17-year-old females. (*Id.*) Plaintiff Doe wants to try out for the girls' soccer team. (J. Doe Decl. ¶ 9.) College males kick soccer balls with an average 20% greater velocity than females. (Brown Decl. ¶ 41.)

This research shows that "[a]t 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." (*Id.* ¶ p. 67.)

III. Biological males have large physiological differences from females.

Scientists have identified and measured a number of physiological differences between biological males and females. (Brown Decl. ¶ 46.) These physiological differences lead to athletic performance differences. (*Id.*)

Men are taller. Based on data from 20 countries, the 50th percentile for body height for women is five inches shorter than the 50th percentile for body height for men. (*Id.* ¶ 47.). Viewed another way, a woman in the 95th percentile for body height would be less than a quarter-inch taller than a man in the 50th percentile. (*Id.*)

Men have larger, longer, and stronger bones. Men are 7% to 8% taller than women, with an average of 10% more bone. (*Id.* ¶¶ 51, 53.) Research has found that men have "distinctively greater bone size, strength, and density than do women of the same age." (*Id.* ¶ 50.)

Men have much larger muscle mass. In the arms, women have 50%-60% of men's upper arm muscle cross-sectional area and 50%-60% of men's upper limb strength. (*Id.* ¶ 58.) In the legs, women have 65%-70% of men's thigh muscle cross-sectional area and 60%-80% of men's leg strength. (*Id.*) Young men average a skeletal muscle mass that is >12kg greater than age-matched women at any given body weight. (*Id.*)

Men also have other physiological advantages that manifest in sports. Men have a larger lung capacity and a greater cross-sectional area of the trachea. (*Id.* ¶ 68.) Men also can absorb more oxygen in the blood and have a 10% greater average maximal oxygen transfer. (*Id.* ¶¶ 69-70.) The average female heart size is 85% that of a male, resulting in men pumping 30% more blood through their circulatory system. (*Id.* ¶ 71.)

This research shows that "[b]iological 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." (*Id.* p. 67.)

IV. Puberty blockers and testosterone suppression do not even the playing field.

Before puberty even begins, boys have physiological advantages over girls. These advantages begin at birth: infant boys at birth and at five months have larger total body mass, body length, and fat-free mass and lower-percent body fat than infant girls. (Brown Decl. ¶ 79.) Boys ages 3-8 years old have significantly less fat, lower percentage body fat, and higher bone-free lean tissue. (*Id.*) From ages 7 to 17, boys have a higher aerobic power output based on heart rate, allowing boys to run, bike, or swim faster than similarly aged girls. (*Id.* ¶ 80.)

These physiological differences result in competitive advantages before, during, and after puberty. Boys ages 8 and under have faster record times than girls at all track and field distances. (*Id.* ¶ 107.) According to another study, a nine-year-old boy in the 50th percentile will run faster in the final stage of a 20 m shuttle run than a 17-year-old girl in the 50th percentile. (*Id.* ¶ 95.) Boys ages 11 to 15 in the 50th percentile also ran the mile 14.7% and 24.2% faster, respectively, than girls of the same age in the 50th percentile. (*Id.* ¶ 89.) Boys throw harder than girls by 1.5 standard deviations as young as ages four to seven, meaning the average four- to seven-year-old boy can out-throw 87% of girls his age. (*Id.* ¶ 106.) Boys also jump higher and farther than girls their age and girls older than their age. (*Id.* ¶¶ 99, 103-104.)

Puberty blockers and testosterone suppression do not eliminate these pre-existing advantages.[1] Puberty blockers and cross-sex hormone use did not decrease muscle strength, eliminate differences in lean body mass, or change growth rates in biological males. (*Id.* ¶¶ 117-125.) Biological males undergoing testosterone suppression still had greater hand grip strength, arm strength, leg strength, and faster running and swimming speed. (*Id.* ¶¶ 135-162.) The testosterone suppression also did not reverse the physiological advantages like longer and larger bones, lung and heart size, and muscle mass. (*Id.* ¶¶ 163-178.)

Because of this research, "many sports organizations have revised their policies [on transgender athletes] or are in the process of doing so." (*Id.* p. 69.)

V. Male physiological advantages increase risk of physical injury to females.

The physiological differences between men and women are relevant to safety for female athletes. Because men are taller and heavier, they bring more force to bear in a collision. (Carlson Decl. ¶ 43.) Because men are faster, they will be moving at faster speed at impact, causing a greater impact force. (*Id.* ¶ 46.) Because men are stronger, they can generate larger forces with their arms and upper body in the form of ball velocity, pushing power, or punching power. (*Id.* ¶¶ 50-56.)

The greater force generated by males will strike female athletes with more energy than normal. For example, men spike volleyballs 29%-34% harder than females and can

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[1] In addition, there are known and potential harms associated with administration of puberty blockers and cross-sex hormones to children and adolescents. (*See* Cantor Decl. ¶¶ 125-140.)

serve volleyballs 30% harder. (*Id.* ¶ 52.) A volleyball traveling 35% faster will deliver 82% more energy to a head upon impact. (*Id.* ¶ 53.) Because men have a 50% greater vertical jump during a volleyball "attack," female athletes "will likely be exposed to higher ball velocities that are outside the range of what is typically seen in women's volleyball." (*Id.* ¶¶ 54-55.) Similarly, males kick soccer balls 20% harder, which will deliver 44% more energy on head impact. (*Id.* ¶ 56.)

The increased force increases concussion injury risk. (*Id.* ¶¶ 58-69.) Females already are more likely than males to suffer concussions in sports: 79% higher in soccer, 31% higher in basketball, and 320% higher in softball/baseball. (*Id.* ¶¶ 58, 61.) On average, females also suffer more severe and longer lasting disability once a concussion does occur. (*Id.* ¶ 58.) Females who suffered concussions had a 170% higher frequency of cognitive impairment following the concussion than males. (*Id.* ¶ 64.) "The addition of biologically male athletes into women's contact sports will inevitably increase the risk of concussive injury to girls and women, . . ." (*Id.* ¶ 69.)

Male participation in female sports also increases the risk to female athletes of an Anterior Cruciate Ligament (ACL) tear. (*Id.* ¶¶ 70-78.) Female athletes have a 150%-300% increased risk for ACL injury compared to male athletes. (*Id.* ¶ 72.) Contact causes 20%-36% of all female ACL injuries. (*Id.* ¶ 77.) "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." (*Id.*)

This research demonstrates that "[i]n 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." (*Id.* p. 52.)

VI. Arizona enacted the Save Women's Sports Act to protect female athletes.

Arizona enacted S.B. 1165, the "Save Women's Sports Act," on March 30, 2022. The Act provides: "Athletic teams or sports designated for 'females,' 'women' or 'girls' may not be open to students of the male sex." A.R.S. § 15-120.02(B). The Act applies to all public schools or private schools whose students or teams compete against a public school. *Id.* at § 15-120.02(A). The Act covers all educational age levels, applying from kindergarten through grade twelve and to all institutions of higher education. *Id.* at § 15-120.02(I).

When the law passed S.B. 1165, the Arizona legislature made a series of legislative findings consistent with the research presented above: that inherent, physiological differences between biological males and females create a "sports performance gap" between males and females. *See* S.B. 1165, § 2(1), (5), (7), and (9) (2022). The legislature further found that "[h]aving separate sex-specific teams furthers efforts to promote sex equality by providing opportunities for female athletes to demonstrate their skill, strength and athletic abilities while also providing them with opportunities to obtain recognition, accolades, college scholarships and the numerous other long-term benefits that flow from success in athletic endeavors." *Id.* at § 2(14).

LEGAL STANDARD

"A plaintiff seeking a preliminary injunction must establish [1] that he is likely to succeed on the merits, [2] that he is likely to suffer irreparable harm in the absence of preliminary relief, [3] that the balance of equities tips in his favor, and [4] that an injunction is in the public interest." *Norbert v. City & Cnty. of San Francisco*, 10 F.4th 918, 927 (9th Cir. 2021) (citing *Winter v. Nat. Res. Def. Council, Inc.*, 555 U.S. 7, 20 (2008)). "[W]here the party seeking a preliminary injunction fails to satisfy any one of the *Winter* factors, the preliminary injunction must be denied." *Video Gaming Techs., Inc. v. Bureau of Gambling Control*, 356 F. App'x 89, 92 (9th Cir. 2009) (internal citation omitted). A preliminary injunction is "an extraordinary and drastic remedy, one that should not be granted unless the movant, *by a clear showing*, carries the burden of persuasion." *Lopez v. Brewer*, 680 F.3d 1068, 1072 (9th Cir. 2012) (quoting *Mazurek v. Armstrong*, 520 U.S. 968, 972 (1997) (per curiam)) (emphasis original).

ARGUMENT

I. Plaintiffs have failed to show they are likely to succeed on the merits.

"Likelihood of success on the merits is the most important factor; if a movant fails to meet this threshold inquiry, [the court] need not consider the other factors." *California v. Azar*, 911 F.3d 558, 575 (9th Cir. 2018) (internal quotations omitted). Because Plaintiffs have failed to show that they are likely to succeed on either their Equal Protection Clause or Title IX claims, no other factor needs to be considered.

A. Plaintiffs are not likely to succeed on their equal protection claim.

Plaintiffs argue that the Save Women's Sports Act "discriminates against Plaintiffs based on their transgender status." Pls.' Mot. for Prelim. Inj. at 1. But the Act does not even mention transgender status. Instead, the Act classifies athletes based on biological sex, a distinction that acknowledges "inherent differences between men and women." *United States v. Virginia*, 518 U.S. 515, 533 (1996); *see also Frontiero v. Richardson*, 411 U.S. 677, 686 (1973) ("sex, like race and national origin, is an immutable characteristic determined solely by the accident of birth"). Classifying by biological sex to protect girls playing school sports is constitutional.

The Equal Protection Clause is "implicated only when a classification treats persons similarly situated in different ways." *Clark, By & Through Clark v. Arizona Interscholastic Ass'n*, 695 F.2d 1126, 1128 (9th Cir. 1982) ("*Clark I*"). For the reasons noted above, biological males are not similarly situated to females when it comes to competitiveness and safety in sports. Intermediate scrutiny is given to gender classifications on an as-applied basis. *Id.* at 1129. "To withstand constitutional challenge, previous cases establish that classification by gender must serve important governmental objectives and must be substantially related to achievement of those objectives." *Id.* at 1129 (internal citation omitted).

i. The Save Women's Sports Act designates sports teams based on biological sex, not gender identity.

"The first step in equal protection analysis is to identify the state's classification of groups." *Country Classic Dairies, Inc. v. State of Mont., Dep't of Com. Milk Control Bureau*, 847 F.2d 593, 596 (9th Cir. 1988). The Save Women's Sports Act classifies based on biological sex, not gender identity, by providing that school athletic teams "shall be expressly designated . . . based on the biological sex of the students who participate on the team or in the sport . . . ." Ariz. Rev. Stat. § 15-120.02(A). "Athletic teams or sports designated for 'females', 'women' or 'girls' may not be open to students of the male sex." *Id.* at § 15-120.02(B). Transgender status is not mentioned. *See id.* The Act thus classifies students by biological sex, not gender identity.

This is consistent with the Act's legislative findings. The Arizona legislature made 14 separate findings when it passed the Save Women's Sports Act. *See* S.B. 1165, § 2 (2022). These findings relate to biological sex and physiological differences between men and women, not transgender status. *See id.* The Act is thus different from the cases relied upon by Plaintiffs in which courts found transgender individuals were singled out. *See Karnoski v. Trump*, 926 F.3d 1180 (9th Cir. 2019) (challenge to exclusion of transgender individuals from the military); *D.T. v. Chris*, 552 F. Supp. 3d 888 (D. Ariz. 2021) (challenge to sex change operation requirement to obtain a different gender birth certificate).

States have the ability to classify without violating the Equal Protection Clause. *Pers. Adm'r of Massachusetts v. Feeney*, 442 U.S. 256, 271 (1979). "Most laws classify, and many affect certain groups unevenly, even though the law itself treats them no differently from all other members of the class described by the law." *Id.* at 271-72. Sex is not a "proscribed classification." *United States v. Virginia*, 518 U.S. 515, 533 (1996). And "a policy can lawfully classify on the basis of biological sex without unlawfully discriminating on the basis of transgender status." *Adams by & through Kasper v. Sch. Bd. of St. Johns Cnty.*, 57 F.4th 791, 809 (11th Cir. 2022) (rejecting equal protection and Title

IX claims to school policy requiring students to use bathroom based on biological sex).

Importantly, the Save Women's Sports Act does not facially discriminate on the basis of transgender status. Because the Act classifies athletes on the basis of biological sex, both of which can inherently contain transgender students, "there is a 'lack of identity' between the policy and transgender status," since sports options are "equivalent to those provided to all students of the same biological sex." *Id.* (internal quotation and citations omitted). By not challenging the division on sex, but instead how Arizona defines sex, Plaintiffs are actually bringing an underinclusiveness challenge. Such a challenge is subject to rational basis scrutiny and fails to violate equal protection. *See, e.g., Jana-Rock Constr., Inc. v. New York Dep't of Econ. Dev.*, 438 F.3d 195 (2d Cir. 2006) (affirming a statute that did not include Spanish or Portuguese descent in the definition of "Hispanic").

ii. The Ninth Circuit has rejected equal protection challenges to Arizona policies preventing boys from playing in girls' sports.

Even if this were not an underinclusiveness challenge, it would be meritless. The Ninth Circuit already has resolved a strikingly similar challenge by holding an Arizona policy that excluded boys from playing on girls' volleyball teams did not violate the Equal Protection Clause. *See Clark I*, 695 F.2d 1126, 1131-32 (9th Cir. 1982). The Ninth Circuit found "[t]here is no question" that "redressing past discrimination against women in athletics and promoting equality of athletic opportunity between the sexes . . . is a legitimate and important governmental interest." *Id.* at 1131. The Ninth Circuit then found that excluding boys from girls' sports was substantially related to this interest because "[t]he record makes clear that due to average physiological differences, males would displace females to a substantial extent if they were allowed to compete for positions on the volleyball team." *Id.* The state policy excluding boys from girls' volleyball "is simply recognizing the physiological fact that males would have an undue advantage competing against women for positions on the volleyball team." *Id.*

The Ninth Circuit reaffirmed this decision a few years later in a case involving the *Clark I* plaintiff's brother. *Clark By & Through Clark v. Arizona Interscholastic Ass'n*, 886 F.2d 1191, 1193-94 (9th Cir. 1989) ("*Clark II*"). The *Clark II* plaintiff also brought an equal protection challenge to the Arizona policy prohibiting boys from participating on girls' volleyball teams because his school did not have a boys' volleyball team. *Id.* at 1192. The Ninth Circuit rejected this challenge as well, reasoning that "[i]f males are permitted to displace females on the school volleyball team even to the extent of one player like Clark, the goal of equal participation by females in interscholastic athletics is set back, not advanced." *Id.* at 1193.

The *Clark I* and *II* decisions control here. Similar to the Arizona policy challenged in the *Clark* cases preventing boys from playing girls' volleyball, Ariz. Rev. Stat. § 15-120.02 prohibits biological boys from playing on teams or sports designated for biological girls. Like the Clark brothers, Plaintiffs may dislike this result, and they may believe other alternatives are preferable. But "the existence of wiser alternatives than the one chosen does not serve to invalidate the policy here since it is substantially related to the goal." *Clark I*, 695 F.2d at 1132.

iii. The Save Women's Sports Act serves important government objectives, and thus it passes rational-basis or intermediate scrutiny.

Sex classifications can serve important government objectives because of the physiological differences between women and the discrimination against women historically. "Sex classifications may be used to compensate women for particular economic disabilities [they have] suffered, to promot[e] equal employment opportunity, to advance full development of the talent and capacities of our Nation's people." *United States v. Virginia*, 518 U.S. 515, 533 (1996). In fact, "Title IX was Congress's response to significant concerns about discrimination against women in education." *Neal v. Bd. of Trustees of California State Universities*, 198 F.3d 763, 766 (9th Cir. 1999) (internal citation omitted). In determining whether a challenged classification serves an important governmental objective, "the Supreme Court is willing to take into account actual differences between the sexes, including physical ones." *Clark I*, 695 F.2d 1126, 1129 (9th Cir. 1982).

The Ninth Circuit has specifically held that sex classification in sports serves an important governmental interest: "the governmental interest claimed is redressing past discrimination against women in athletics and promoting equality of athletic opportunity between the sexes. There is no question that this is a legitimate and important governmental interest." *Id.* at 1131. Other courts have reached the same conclusion. *See, e.g., B. P. J. v. W. Virginia State Bd. of Educ.*, No. 2:21-CV-00316, 2023 WL 111875, at *8 (S.D. W. Va. Jan. 5, 2023) (rejecting equal protection and Title IX claims to uphold, on the merits, state law prohibiting biological boys from playing in girls' sports).

The Save Women's Sports Act serves the same government interest the Ninth Circuit upheld in *Clark* I: to redress pass discrimination against women in athletics and promote equality of athletic opportunity between the sexes. In the Save Women's Sports Act, the legislature found a "sports performance gap between males and females, such that the physiological advantages conferred by biological sex appear, on assessment of performance data, insurmountable." S.B. 1165, § 2(9) (2022) (internal quotation omitted). The legislature also cited court decisions and studies finding that the physiological difference between males and females resulted in different athletic capabilities. *Id.* at § 2(4)-(13). Based on this evidence, the legislature concluded: "Having separate sex-specific teams furthers efforts to promote sex equality by providing opportunities for female athletes to demonstrate their skill, strength and athletic abilities while also providing them with opportunities to obtain recognition, accolades, college scholarships and the numerous other long-term benefits that flow from success in athletic endeavors." *Id.* at § 2(14). The Save Women's Sports Act serves important government objectives.

iv. The Save Women's Sports Act is substantially related to achievement of important government objectives.

Prohibiting biological boys from playing in girls' sports is substantially related to the important government objectives of redressing past discrimination against women in athletics and promoting equality of athletic opportunity between the sexes. As the Ninth Circuit found in *Clark I*, the Arizona policy was "simply recognizing the physiological fact that males would have an undue advantage competing against women for positions on the volleyball team." *Clark I*, 695 F.2d 1126, 1131 (9th Cir. 1982). This policy clearly provided "a substantial relationship between the exclusion of males from the team and the goal of redressing past discrimination and providing equal opportunities for women." *Id.*

Likewise, the Save Women's Sports Act recognizes the physiological fact that biological males will have an undue advantage competing against women. As the Ninth Circuit held in *Clark I*, excluding males from women's sports is substantially related to the important government objectives of redressing past discrimination and providing equal opportunities for women.

For these reasons, Plaintiffs are not likely to succeed on their equal protection claim.

B. Plaintiffs are not likely to succeed on their Title IX claim.

"Title IX levels the playing fields for female athletes." *Ollier v. Sweetwater Union High Sch. Dist.*, 768 F.3d 843, 871 (9th Cir. 2014). Title IX provides that "[n]o person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance." 20 U.S.C. § 1681(a). Title IX's regulations require schools to "provide equal athletic opportunity for members of both sexes." 34 C.F.R. § 106.41(c).

"[A] central aspect of Title IX's purpose was to *encourage* women to participate in sports." *Neal v. Bd. of Trustees of California State Universities*, 198 F.3d 763, 768 (9th Cir. 1999) (emphasis original). Although Title IX "applies equally to boys as well as girls, it would require blinders to ignore that the motivation for the promulgation of the regulation was to increase opportunities for women and girls in athletics." *B. P. J. v. W. Virginia State Bd. of Educ.*, No. 2:21-CV-00316, 2023 WL 111875, at *9 (S.D. W. Va. Jan. 5, 2023). "Title IX has enhanced, and will continue to enhance, women's opportunities to enjoy the thrill of victory, the agony of defeat, and the many tangible benefits that flow from just being given a chance to participate in intercollegiate athletics." *Neal*, 198 F.3d at 773.

Plaintiffs seek to reverse the gains that Title IX achieved for female athletes. But Plaintiffs' argument directly contradicts the statutory text of Title IX. Arizona's law does not discriminate against Plaintiffs based on sex.

i. Title IX addresses biological sex, not gender identity.

Title IX prohibits discrimination in school activities like sports "on the basis of sex." 20 U.S.C. § 1681(a). Since Title IX does not define "sex," courts interpret statutory terms "in accord with the ordinary public meaning . . . at the time of its enactment." *Bostock v. Clayton Cnty., Georgia*, 140 S. Ct. 1731, 1738 (2020). "To determine the plain meaning of a statute, we traditionally refer to dictionaries in use at the time of the statute's enactment." *Gollehon v. Mahoney*, 626 F.3d 1019, 1023 (9th Cir. 2010) (citation omitted).

Dictionary definitions demonstrate that Congress' use of "sex" meant "biological sex." "Reputable dictionary definitions of 'sex' from the time of Title IX's enactment show that when Congress prohibited discrimination on the basis of 'sex' in education, it meant biological sex, *i.e.*, discrimination between males and females." *Adams by & through Kasper v. Sch. Bd. of St. Johns Cnty.*, 57 F.4th 791, 812 (11th Cir. 2022) (quoting contemporaneous dictionary definitions). The Supreme Court confirmed this understanding contemporaneously just one year after Congress passed Title IX: "sex, like race and national origin, is an immutable characteristic determined solely by the accident of birth . . ." *Frontiero v. Richardson*, 411 U.S. 677, 686 (1973).

Interpreting "sex" as something other than biological sex would be illogical. A statute "should be construed so that effect is given to all its provisions, so that no part will be inoperative or superfluous, void or insignificant." *Stand Up for California! v. U.S. Dep't of the Interior*, 959 F.3d 1154, 1159 (9th Cir. 2020) (internal quotation omitted). Title IX repeatedly discusses sex as a binary concept. *See, e.g.*, 20 U.S.C. § 1681(a)(5) ("only students of one sex"); 20 U.S.C. § 1681(a)(6) ("limited to persons of one sex"); 20 U.S.C. § 1686 ("living facilities for the different sexes"); 34 C.F.R. § 106.34(a)(1) ("separation of students by sex within physical education classes"). Title IX's sports regulations also contemplate two sexes: "separate teams for members of each sex" and "provide equal athletic opportunity for . . . both sexes" to "effectively accommodate the interests and abilities of members of both sexes." 34 C.F.R. § 106.41(b), (c). Title IX's provisions only make sense if sex means biological sex.

Plaintiffs misstate the Ninth Circuit's decision in *Doe v. Snyder*. First, *Doe* discussed *Bostock* only in dicta. *Doe v. Snyder*, 28 F.4th 103, 113 (9th Cir. 2022). Dicta is not binding precedent. *See Exp. Grp. v. Reef Indus., Inc.*, 54 F.3d 1466, 1472 (9th Cir. 1995) ("[T]hese statements were not necessary to the decision and thus have no binding or precedential impact in the present case"). Second, the *Doe* dicta narrowly disagreed with the district court that *Bostock* did not need to be considered in a Title IX claim simply by noting that *Bostock* only involved Title VII. *Doe*, 28 F.4th at 114. Third, the *Doe* dicta did not resolve whether a law precluding coverage for gender reassignment surgeries discriminated based on sex because the district court had not yet addressed it.[2] *Id.* at 114. Thus, Plaintiffs are not correct in saying that "the Ninth Circuit has held that discrimination based on transgender status also constitutes impermissible discrimination under Title IX." Pls.' Mot. for Prelim. Inj. at 9.

Title IX prohibits discrimination based on biological sex. Plaintiffs' Title IX claim thus fails.

ii. Title IX allows for sex-based distinctions for sports teams.

Title IX's structure also works against Plaintiffs. Unlike the Supreme Court in *Bostock*, which only decided under Title VII "whether discrimination based on transgender status necessarily equates to discrimination on the basis of sex," Title IX "includes express statutory and regulatory carve-outs for differentiating between the sexes . . . ." *Adams by & through Kasper v. Sch. Bd. of St. Johns Cnty.*, 57 F.4th 791, 811 (11th Cir. 2022). For example, Title IX allows schools to "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." 34 C.F.R. § 106.41(b). Title IX expressly allows schools to

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[2] The plaintiff dismissed the case before the district court conducted this analysis. *See* Stipulation of Dismissal, Doc. 162, No. 4:20-cv-00335-SHR (D. Ariz. July 25, 2022).

take sex into account in creating sports teams.

Title IX does not prohibit consideration of sex, but instead prohibits "exclusion from participation," "denial of benefits," or "discrimination" "on the basis of sex." 20 U.S.C. § 1681(a). To "exclude" meant "to shut out," "hinder the entrance of," or "bar from participation, enjoyment, consideration, or inclusion." WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 793 (1966). To "deny" meant "to turn down or give a negative answer to." *Id*. at 603. Through these provisions, Congress sought to prevent female students from being shut out, barred, or turned down from educational benefits, including activities such as sports. That is what Arizona's law does.

Plaintiffs admit that separate teams are available to both sexes on the sports at issue. Plaintiff Doe's school has soccer, basketball, and cross-country teams for both boys and girls. (Decl. of J. Doe, Doc. 6, ¶ 9.) Plaintiff Roe's school has volleyball teams for both boys and girls. (Decl. of M. Roe, Doc. 8, ¶¶ 7, 9). Plaintiffs thus are not being excluded from participation, denied benefits, or discriminated "on the basis of sex."

Title IX does not require states or schools to eliminate sex-separated teams or change the criteria for participating in sex-separated teams, to allow students to compete on a team that is different from their biological sex. The Ninth Circuit recognized the converse of this point by holding that Title IX authorizes, but does not require, sex-segregated facilities that exclude transgender students. *Parents for Priv. v. Barr*, 949 F.3d 1210, 1227 (9th Cir. 2020). The Ninth Circuit did not say, however, that Title IX *requires* a state or school to ignore biological sex in favor of a transgender student. *See id.* Forcing girls to compete against boys is antithetical to Title IX's purpose and threatens to reverse Title IX's progress. *See, e.g.*, *Neal v. Bd. of Trustees of California State Universities*, 198 F.3d 763, 769 (9th Cir. 1999) ("Title IX has altered women's preferences, making them more interested in sports, and more likely to become student athletes. Adopting Appellees' interest-based test for Title IX compliance would hinder, and quite possibly reverse, the steady increases in women's participation and interest in sports that have followed Title IX's enactment.") (internal citation omitted).

For these reasons, Plaintiffs are not likely to succeed on their Title IX claim.

II. The Plaintiffs have not shown they are irreparably harmed.

Plaintiffs rely heavily on the argument that violation of the law and deprivation of their rights constitute irreparable harm. Pls.' Mot. for Prelim. Inj. at 12. But as previously set forth, the Arizona law does not violate the law or deprive Plaintiffs of their rights. This refutes the central pillar of Plaintiffs' irreparable harm argument.

The Court also must consider the irreparable harm Arizona would suffer if the Save Women's Sports Act is enjoined. "[A]ny time a State is enjoined by a court from effectuating statutes enacted by representatives of its people, it suffers a form of irreparable injury." *Maryland v. King*, 567 U.S. 1301, 1303 (2012) (Roberts, C.J., in chambers) (internal quotation omitted); *see also Coal. for Econ. Equity v. Wilson*, 122 F.3d 718, 719 (9th Cir. 1997) ("it is clear that a state suffers irreparable injury whenever an enactment of its people or their representatives is enjoined"). Arizona and its citizens will be irreparably harmed if the Save Women's Sports Act is enjoined.

III. The public interest and balance of equities disfavors a preliminary injunction.

The people of Arizona have an interest in the effectiveness of laws passed by their elected officials. Women in Arizona also have an interest in not competing against, or being displaced by, men in women's sports. Accordingly, the public interest and balance of equities favor a preliminary injunction.

CONCLUSION

The Court should deny Plaintiffs' motion for preliminary injunction. Plaintiffs are not likely to succeed on their equal protection claim because the Save Women's Sports Act relates to an important government interest and is substantially related to achieving that interest. Plaintiffs also are not likely to succeed on their Title IX claim because Title IX addresses biological sex and expressly allows schools to take it into account. Plaintiffs are not irreparably harmed, and the public interest and balance of the equities favor the state law's protections for female athletes. Accordingly, Plaintiffs' motion for preliminary injunction should be denied.

Dated: May 18, 2023

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that, on May 18, 2023, I caused a true and correct copy of the foregoing to be filed by the Court's electronic filing system, to be served by operation of the Court's electronic filing system on counsel for all parties who have entered in the case.

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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA
TUCSON DIVISION

Jane Doe, *et al.*, Plaintiffs, v. Thomas C. Horne, in his official capacity as State Superintendent of Public Instruction, *et al.*, Defendants.	Case No. 4:23-cv-00185-JGZ **Declaration of Dr. Gregory A. Brown, Ph.D., FACSM, in Support of [Intervenors' Proposed] Opposition to Plaintiffs' Motion for a Preliminary Injunction**

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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 50 refereed publications and more than 70 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 30 professional journals, including *The American Journal of Physiology*, the *International Journal of Exercise Science*, the *Journal of Strength and Conditioning Research*, *Therapeutic Advances in Endocrinology and Metabolism, Sports Medicine*, 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, assessment of various athletic training modes in males and females, and sex-based differences in athletic performance. Articles that I have published that are closely related to topics that I discuss in this expert report 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, and a May 2023 entry for the PECOP Blog titled "The Olympics, sex, and gender in the physiology classroom (part 2): Are there sex based differences in athletic performance before puberty?" I have also authored an April 17, 2023 post for the Center on Sport Policy and Conduct titled "Should Transwomen be allowed to Compete in Women's Sports? A view from an Exercise Physiologist."
- A presentation at the 2022 annual meeting of the American College of Sports Medicine titled "Comparison of Running Performance Between Division and Sex in NCAA Outdoor Track Running Championships 2010-2019." And a presentation at the 2023 annual meeting of the American College of Sports Medicine titled "Boys and Girls Differ in Running and Jumping Track and Field Event Performance Before Puberty."

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 Proposed Intervenors Senator Warren Petersen, President of the Arizona Senate, and Representative Ben Toma, Speaker of the Arizona House of Representatives in the matter of *Doe and Roe v. Horne 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 written declarations and depositions in the cases of *Soule vs. CIAC* in the state of Connecticut, *B.P.J. vs. West Virginia State Board of Education* in the state of West Virginia, and *L.E. vs. Lee* in the state of Tennessee, 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 $200 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 equally aged, trained, and gifted 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 equally aged, trained, and gifted 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 equally aged, trained, and gifted 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 May 5, 2023). 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.) The importance of distinguishing between the two is exemplified by the World Athletics Council updating "…the eligibility regulations for transgender and DSD athletes to compete in the female category" in March 2023. (World Athletics)

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." As stated out by O'Connor (2023, at 2, quoting Institute of Medicine) "not every difference observed between male and female cells can be attributed to differences in exposure to sex hormones."

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, gifted, and trained 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

[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.

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 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), "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 and could be a potential danger to the health and safety of athletes." (840)
- 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 the neighborhood of 2/3 greater grip strength than females. (Handelsman 2017 Figure 3, summarizing Silverman 2011 Table 1.)[3]

17. Liguori et al. (2021), in the *ACSM's Guidelines for Exercise Testing and Prescription* which is the flagship textbook for the American College of Sports Medicine and is considered the industry standard for information on evaluating physical fitness in adults, demonstrates that across all age groups and percentiles when comparing males and females, male handgrip strength is 66.2% higher than females (Table 3.10 at 95). To help illustrate this sex-based difference in handgrip strength, a 20–24-year-old male who ranks in the 95th percentile has 55 kg for handgrip strength in the dominant hand while a 20–24-year-old female who ranks in the 95th percentile has 34 kg for handgrip strength in the dominant hand. For comparison, a 20–24-year-old male with a handgrip strength of 34 kg would be in the 10th percentile for males.

18. In an evaluation of maximal isometric handgrip strength in 1,654 healthy men, 533

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[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.

[3] Citing Silverman, *The secular trend for grip strength in Canada and the United States*, J. Ports Sci. 29:599-606 (2011).

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.)

19. Liguori et al. (2021), in the *ACSM's Guidelines for Exercise Testing and Prescription* indicates that when measuring upper body strength using bench press and expressing strength as the maximal weight lifted relative to body weight, males exhibit 64% greater strength (Table 3.11 at 96-97). To help illustrate this sex-based difference in upper body strength, an under 20-year-old male who ranks in the 95th percentile can bench press 1.76 kg for every kg of body mass while an under 20-year-old female who ranks in the 95th percentile can bench press 0.88 kg for every kg of body mass. For comparison, an under 20-year-old male with a bench press strength of 0.88 kg per kg of body mass would be between the 15th and 20th percentile for males.

20. 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.)

21. Liguori et al. (2021), in the *ACSM's Guidelines for Exercise Testing and Prescription* (Table 3.12 at 98), across all age groups and percentiles when comparing males and females, when measuring leg press strength as the maximal weight lifted relative to body weight, males exhibit 39% greater strength. To help illustrate this sex-based difference in lower body strength, a 20–29-year-old male who ranks in the 90th percentile can leg press 2.27 kg for every kg of body mass while a 20–29-year-old female who ranks in the 90th percentile can leg press 1.82 kg for every kg of body mass. For comparison, a 20–29-year-old male who can leg press 1.82 kg for every kg of body mass would be between the 30th and 40th

percentiles for males.

22. 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.)

23. 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]

B. Men run faster.

24. 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.

25. 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

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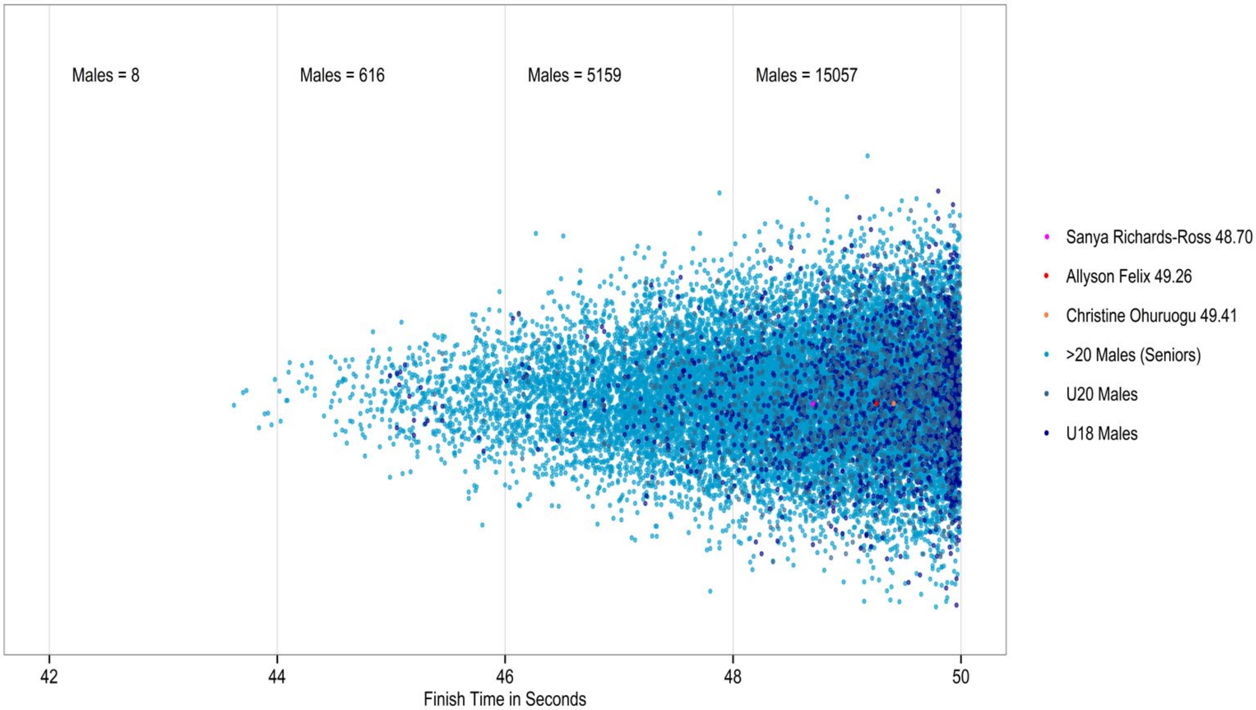
[4] http://whoatv.com/exclusive-fallon-foxs-latest-opponent-opens-up-to-whoatv/ (last accessed May 5, 2023).

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.)

26. 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 May 5, 2023, 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



27. Professor Coleman and her colleague Wicklyffe Shreve also created the table below (last accessed on May 5, 2023, 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

28. 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.)

29. Similarly, Coleman and Shreve created the table below (last accessed on May 5, 2023, 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

30. 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 I, Division II, and Division III 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 I 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 I 100 m race. Importantly, the only overlap between men's and women's performance occurred only when a male performed exceptionally poorly (Brown et al. presented at the 2022 Annual Meeting of the American College of Sports Medicine.)

31. 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 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.

32. 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).)

33. 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).

34. 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.

35. 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.

36. 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.)

37. 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.)

38. More specifically, Marshall and Llewellyn (at 957) reported that female collegiate golfers at an NCAA Division III school have an average drive distance that is 46 yards (16.5%) fewer than males, a maximal drive distance of 33.2 yards (11.1%) fewer, an average club head speed that is 21.9 mph (20.4%) slower, and a maximum

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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

club head speed that is 18 mph (15.3%) slower. Using 3D motion analysis to evaluate the kinematics of 7 male and 5 female golfers with a mean handicap of 6, Egret (at 463) concluded that "The results of this study show that there is a specific swing for women." Horan used 3D motion analysis to evaluate the kinematics of 19 male and 19 female golfers with a handicap less than or equal to 4 and concluded "the results suggest that male and female skilled golfers have different kinematics for thorax and pelvis motion" and "What might be considered optimal swing characteristics for male golfers should not be generalized to female golfers." (at 1456).

39. Males are able to throw a javelin more than 30% farther than females. (Lombardo 2018 Table 2; Hilton 2021 at 203.)

40. 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.)

41. 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.)

E. Males exhibit faster reaction times.

42. 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.)

43. 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).

44. 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.)

45. 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.

46. 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

47. 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 50^{th} percentile for body height for women is 164.7 cm (5 ft 5 inches) and the 50^{th} 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). Thus, while some women are taller than some men, the tallest men are taller than the tallest women (Roser 2013.)

48. To look at a specific athletic population, an evaluation of NCAA Division I 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.

49. 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.)

50. "Men have distinctively greater bone size, strength, and density than do women of the same age." (Handelsman 2018 at 818.)

51. "[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.)

52. 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.)

53. 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.)

54. 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.)

55. 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)

56. 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.

57. 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.

58. "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.)

59. "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.)

60. As stated in the National Strength and Conditioning Association's *Guide to Tests and Assessments* "Sport performance is highly dependent on the health- and skill-related components of fitness (power, speed, agility, reaction time, balance, and Body Composition coordination) in addition to the athlete's technique and level of competency in sport-specific motor skills. All fitness components depend on body composition to some extent. An increase in lean body mass contributes to strength and power development. … Thus, an increase in lean body mass enables the athlete to generate more force in a specific period of time. A sufficient level of lean body mass also contributes to speed, quickness, and agility performance (in the development of force applied to the ground for maximal acceleration and deceleration)." (https://www.nsca.com/education/articles/kinetic-select/sport-performance-and-body-composition/ last accessed May 10, 2023)

61. Once again, looking at specific and comparable populations of athletes, an evaluation of NCAA Division I 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.

62. 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.)

63. Looking once again to Liguri (2021) in the *ACSM's Guidelines for Exercise Testing and Prescription* (Tables 3.4 and 3.5 at 73 and 74), a 20–29-year-old male in the 99th percentile will have 4.2% body fat, while a 20–29-year-old female in the 99th percentile will have 11.4% body fat, meaning the female has 170% more fat relative to body mass than the male. Comparing a 20–29-year-old male and female in the 50th percentile (that is "average") the male will have 16.7% body fat and the female will have 21.8% body fat, meaning that the female has 30% more fat relative to total body mass than the male.

64. "[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.)

65. 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.

66. 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.

67. 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.

68. 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.)

69. 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.)

70. "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.)

71. 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.)

72. 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.)

73. "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 "$V0_2$max," 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

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[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.

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.

74. 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 May 5, 2023).

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.

75. 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 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 May 5, 2023).

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

76. 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.

77. 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)

78. 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.

79. 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 an evaluation of bone mineral density in 1,432 boys and 1,483 girls who were an average of 6.2 years old Medina-Gomez (2016) observed that the boys had 7.6% more lean body mass, 15.6% less fat mass, and ~5% higher bone mineral density than the girls (Table 1, at 1102), and concluded that (at 1099), "bone sexual dimorphism is already present at 6 years of age, with boys having stronger bones than girls, the relation of which is influenced by body composition." 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.)

80. 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 to 17, 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.

81. 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).

82. 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).

83. 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.

84. 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		
	10th	50th	90th	10th	50th	90th	10th	50th	90th
Age	%ile	%ile	%ile	%ile	%ile	%ile	%ile	%ile	%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%

85. 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.

86. 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.

87. 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.)

88. 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.)

89. 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		
	10th	50th	90th	10th	50th	90th	10th	50th	90th
Age	%ile	%ile	%ile	%ile	%ile	%ile	%ile	%ile	%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%

90. 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.)

91. 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.

92. 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%

93. 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.

94. 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		
	10th	50th	90th	10th	50th	90th	10th	50th	90th
Age	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%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%

95. 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.

96. 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.

97. 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.

98. 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.

99. 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**		
	10th	**50th**	**90th**	**10th**	**50th**	**90th**	**10th**	**50th**	**90th**
Age	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%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%

100. 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.)

101. 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.)

102. 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)

103. 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**		
	10th	**50th**	**90th**	**10th**	**50th**	**90th**	**10th**	**50th**	**90th**
Age	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%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%

104. 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**		
	10th	**50th**	**90th**	**10th**	**50th**	**90th**	**10th**	**50th**	**90th**
Age	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%ile**	**%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%

105. 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.)

106. 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.

107. 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%

108. 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%

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[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

109. 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.

110. Similarly, using Athletic.net, for 2022 Track & Field data for boys and girls in the 6th grade for the state of Arizona, I have compiled tables, which appear below, 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 (with the exception of the 1600-m in which the first place girl was 0.9% faster) 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 the 1st place girl in the 6th grade in Arizona in the 400-m race, the boy was 7.1 seconds (10.9%) faster than the girl. Extrapolating the running time to a running pace, the boy would be expected to finish 49 m in front of the fastest girl in a single lap race on a standard 400-m track, or almost the length of ½ of a football field. In comparison, the 1st place boy would finish 8 m in front of the 2nd place boy, and the 1st place girl would finish 10 m in front of the 2nd place girl.

Top 10 Arizona boys and girls 6th grade outdoor track for 2022 (time in seconds)

	100 m			**200 m**			**400 m**		
	Boys	**Girls**		**Boys**	**Girls**		**Boys**	**Girls**	
1	12.60	12.71	Difference	25.53	26.01	Difference	58.40	65.54	Difference
2	13.14	13.44	between #1	26.84	28.20	between #1	59.59	67.04	between #1
3	13.35	13.60	boy and # 1	27.30	28.77	boy and # 1	61.74	68.27	boy and # 1
4	13.44	14.14	girl	27.44	29.10	girl	62.32	68.64	girl
5	13.44	14.15	0.9%	28.61	29.52	1.8%	63.14	69.87	10.9%
6	13.47	14.4		28.68	30.06		66.38	70.12	
7	13.54	14.41	Average	29.04	30.15	Average	66.46	80.22	Average
8	13.59	14.44	difference	29.14	30.17	difference	66.50	70.73	difference
9	13.78	14.50	boys vs girls	29.17	30.19	boys vs girls	67.35	72.09	boys vs girls
10	13.84	14.53	4.4%	29.59	30.34	3.8%	67.36	72.43	9.3%

	800 m			**1600 m**			**3200 m**		
	Boys	**Girls**		**Boys**	**Girls**		**Boys**	**Girls**	
1	146.67	154.55	Difference	333.71	331.01	Difference	793.27	835.76	Difference
2	149.47	157.70	between #1	335.23	340.22	between #1	816.60	904.96	between #1
3	150.70	159.31	boy and # 1	338.70	351.70	boy and # 1	818.87	947.81	boy and # 1
4	151.29	165.49	girl	340.97	360.44	girl	840.17	1064.43	girl
5	152.56	167.00	5.1%	344.90	362.47	-0.9%	842.58	1090.2	5.1%
6	153.70	169.89		350.19	369.10		859.92		
7	158.30	170.00	Average	352.20	371.88	Average	861.74		Average
8	158.45	172.40	difference	360.30	375.66	difference	866.30		difference
9	158.70	173.64	boys vs girls	361.31	382.29	boys vs girls	Only 8	Only 5	boys vs girls
10	159.83	173.90	7.5%	364.00	384.00	4.1%	times	times	13.5%
							listed	listed	

111. 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%.

112. 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 I, Division II, and Division III 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, presented at the 2022 Annual Meeting of the American College of Sports Medicine.)

113. 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

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[10] This term would include testosterone and estrogens.

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.

114. 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.)

115. 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.

116. 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 United 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 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.

117. 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).

118. 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.

119. Nokoff et al. (2021) observed that teenage natal males who identified as female, (average of 13.7 ± 1.7 years) and who were on puberty blockers for an average of 11.3 ± 7 months, had numerically higher percent lean body mass and lower percent body fat than the comparison group of natal females (figure 1 at 116). (These authors did not statistically compare the natal males who identified as female to the natal females).

120. Navabi et al. (2021) observed that teenage natal males who identify as female (average of 15.4 ± 2.0 years), had 9.5 kg more lean body mass than did teenage natal

females (15.2 ± 1.8 years) who identified as male (at 4). After 355.2 ± 96.7 days of puberty blockers the natal males who identified as female still had 5.7 kg more lean body mass than did the natal females who identified as male (at 5). It is worth noting that the natal males lost 2.57 kg lean body mass and the natal females gained 1.21 kg lean body mass.

121. Nokoff et al. (2020) observed that in 14 teenage natal males who identified as female (average of 16.3 ± 1.4 years) and "were taking an average estradiol dose of 1.5 ± 1.0 mg/day with an average treatment duration of 12.3 ± 9.9 months (5 on oral, 9 on sublingual). Four were on a GnRHa at the time of the study visit and a total of 6 had been on a GnRHa in the past. Seven were on spironolactone for androgen blockade and 1 was on IM medroxyprogesterone acetate for puberty suppression." (at e707) the natal males had higher lean body mass and lower body fat than the comparison group of natal females (at e708).

122. 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. 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.

123. Schulmeister et al. (2022) evaluated natal males with an average age of 11.9 (range 10.2 – 14.5) years at the start of puberty blockade and concluded that "youth treated with GnRHa for 12 months have growth rates similar to those of prepubertal

youth" (at 5).

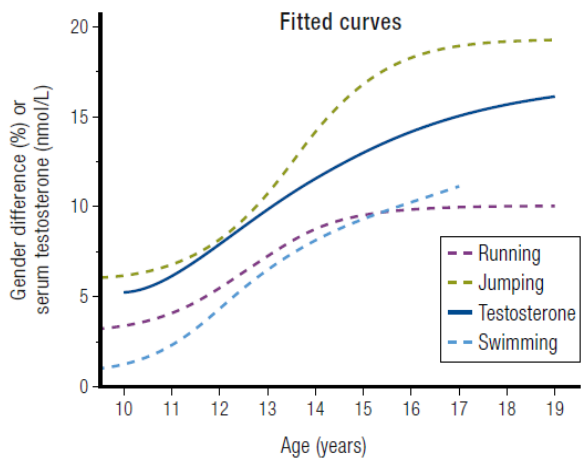
124. In Boogers et al. (2022), the researchers studied the effects of puberty suppression followed by cross-sex hormone therapy on the adult height of natal males who identify as female. Analyzing retrospective data collected from 1972 to 2018, they concluded that "although P[uberty] S[upression] and [cross-sex hormones] alter the growth pattern, they have little effect on adult height." (9) In other words, natal males who followed a normal course of puberty suppression followed by cross-sex hormone therapy reached an adult height at or near their predicted height in the absence of such therapy.

125. The findings from Schulmeister et al. (2022) and Boogers et al. (2022) are relevant to the question of whether puberty suppression eliminates sex-based performance advantages because these finding provide evidence that an important component of that advantage - male vs. female height - is not eliminated, or even meaningfully affected, by an ordinary course of puberty suppression or puberty suppression followed by cross-sex hormone therapy.

B. The rapid increase in testosterone across male puberty drives characteristic male physiological changes and the increasing performance advantages.

126. 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.

127. 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.)



128. 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.)

129. 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.)

130. 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 <u>not</u> substantially eliminate the male athletic advantage.

131. 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.)

132. 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.)

133. 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.

134. 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

135. 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.

136. 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.)

137. 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).

138. 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.)

139. A fourth study (Auer et al. 2016) reported no change in handgrip strength in 13 transwomen below the age of 45 years following 12 months of cross sex hormone therapy (Table 1, at 3).

140. A fifth study (Yun et al. 2021) observed that handgrip strength in the right hand decreased from 31.5 ± 5.8 kg to 29.9 ± 7.4 kg and in the left hand decreased from 31.8 ± 6.5 kg to 30.1 ± 6.9 kg during 6 months of cross sex hormone therapy in 11 males aged 28.5 ± 8.1 years who identify as women or nonbinary (Table 4, at 63). It is worth noting that the reduced grip strength in these male bodied individuals would rate in 75th percentile for females (Liguri, at 95).

141. 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).

142. Alvares et al (2022) is a cross-sectional study on cardiopulmonary capacity and muscle strength in biological males who identify as female and have undergone long-term cross-sex hormone therapy. All of the study subjects that were biological males who identify as female had testosterone suppressed through medication (cyproterone acetate) or gonadectomy. (Supplementary materials) And they had taken exogenous estrogen for an average of 14.4 years with a standard deviation of 3.5 years. Compared to a control group of cisgender women, the study subjects exhibited 18% higher handgrip strength, confirming the findings of previous studies but extending the information to a longer time period. It is worth noting that the grip strength in these male bodied individuals would rate between the 90th and 95th percentile for females (Liguri, at 95).

143. 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

144. 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.

145. Roberts et al. have 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.

146. 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.)

147. Chiccarelli et al. (2022) also published a longitudinal study which considered biological males who began testosterone suppression and cross-sex hormones while serving in the United States Air Force and concluded "Transgender females'

performance … remained superior in push-ups at the study's 4-year endpoint." (at 1) with the transwomen completing 16% more pushups than comparable women after 4 years of GAHT.

148. It is interesting that Roberts et al. (2020) and Chiccarelli et al. (2022) were comparing the same performance measurements in the same population and came to differing conclusions, which may be due to different sample sizes and study durations

Leg Strength

149. 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.)

150. 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 and Swimming speed

151. The most striking finding of the recent Roberts et al. study concerned running

[11] Isometric strength measures muscular force production for a given amount of time at a specific joint angle but with no joint movement.

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.)

152. Chiccarelli (2022) reported that "Transgender females' performance showed statistically significantly better performance than cisgender females until 2 years of GAHT in run times…" (at 1) and yet the 1.5 mile run time was, on average, 45 seconds (5%) faster in the transwomen at years 2 and 3 than the Air Force female average.

153. 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 II men. "Craig" Telfer did not qualify for the National Championships in any events. Telfer did not compete in the 2018 season while undergoing testosterone suppression (per NCAA policy). In 2019 Cece Telfer competed on the Franklin Pierce University *women's* team, qualified for the NCAA Division II 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-transgender-hurdler-wi/ (last accessed May 5, 2023). https://triblive.com/sports/biological-male-wins-ncaa-womens-track-championship/ (last accessed May 25, 2023.)

154. 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 5, 2023).

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

155. 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.

156. 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.

157. 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."

158. 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.

159. 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.)

160. 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).

161. The well-publicized case of Lia Thomas is also worth noting. 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.

162. Senefeld et al. (2023) compared "the performance times of a transgender woman (male sex, female gender identity) who competed in both men's and women's NCAA freestyle swimming and contextualized her performances relative to the performances of both world class and contemporary NCAA swimmers" (at 1035) 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 13th in the 100-yard, 3rd in the 200-yard, 1st in the 500-yard, and 13th in the 1650-yard women's freestyle. The performance times swimming as a female, when compared to swimming as a male, were 0.5% slower in the 100-yard, 2.6% slower in the 200-yard, 5.6% slower in the 500-yard, and 7.3% slower in the 1650-yard events than when swimming as a male (at 1034). The authors concluded "…these data suggest there may be a prolonged "legacy effect" (greater than 2 yr) associated with endogenous male testosterone concentrations or male puberty on freestyle swimming performances after feminizing GAHT, particularly for shorter event distances (100, 200, and 500 yards), which are closely associated with anthropometrics and maximal skeletal muscle strength and power" (at 1036).

B. Testosterone suppression does not reverse important male physiological advantages.

163. 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.

164. 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.)

165. 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.

166. 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

167. 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

168. 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]

169. In what is, to date, the only evaluation of VO_2max is a cross-sectional study on cardiopulmonary capacity and muscle strength in biological males who identify as female and have undergone long-term cross-sex hormone therapy (Alvares 2022). All of the study subjects that were biological males who identify as female had testosterone suppressed through medication (cyproterone acetate) or gonadectomy. (Supplementary materials) And they had taken exogenous estrogen for an average of 14.4 years with a standard deviation of 3.5 years. Compared to a control group of cisgender women, even after 14 years of testosterone suppression and estrogen administration the biological males who identify as female exhibited advantages in cardio-respiratory capacity measured as higher VO_2 peak and higher O_2 pulse, which suggests that male advantages are retained in events that are influenced by cardio-respiratory endurance (e.g. distance running, cycling, swimming, etc.).

170. On the other hand, the evidence is mixed as to hemoglobin concentration,

[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.)

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.)

171. I have not found any study of the effect of testosterone suppression on the male advantage in mitochondrial biogenesis.

Muscle mass

172. 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.)

173. 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. 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)

174. Alvares et al. (2022) In a cross-sectional study of 15 natal males aged 34.2 ± 5.2 years who had taken exogenous estrogen for an average of 14.4 ± 3.5 years, and compared to a control group of comparably aged females, the transwomen exhibited a 40% advantage in skeletal muscle mass confirming the findings of previous studies regarding the minimal reduction in muscle mass due to transgender hormone therapy, but extending the information to a longer time period (Table 3 at 5).

175. Other papers including Auer. et al (2016), Auer et al. (2018), Elbers et al. (1999), Gava et al. (2016), Haraldsen et al. (2007), Klaver et al. (2018), Klaver et al. (2017), Lapauw et al. (2008), Mueller et al. (2018), Wiercks (et al. (2014), and Yun et al. (2021) have evaluated the changes in body composition in males undergoing transgender hormone therapy with a common finding that there are large retained male advantages in lean body mass.

176. 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.)

177. 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.

178. 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.

179. 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.

180. 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.

181. 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.

182. I excerpt the key conclusions from important recent peer-reviewed papers below.

183. 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)

184. 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)

185. 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)

186. 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)

187. Hamilton et al. 2021, “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.” (840)

188. 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.”

189. Heather (2022) is another peer-reviewed literature review examining the evidence to date on whether testosterone suppression eliminates the physiological building blocks of male athletic advantage. In this review, Dr. Heather studied the existing literature on male advantages in brain structure, muscle mass, bone structure, and the cardio-respiratory system, and the effects of testosterone suppression on those advantages. She concluded:

Given that the percentage difference between medal placings

> at the elite level is normally less than 1%, there must be confidence that an elite transwoman athlete retains no residual advantage from former testosterone exposure, where the inherent advantage depending on sport could be 10-30%. Current scientific evidence can not provide such assurances and thus, under abiding rulings, the inclusion of transwomen in the elite female division needs to be reconsidered for fairness to female-born athletes. (8)

190. Nokoff et al. (2023) is another peer-reviewed literature review examining the evidence to date on whether Gender Affirming Hormone Therapy in transwomen eliminates male sex-based athletic advantages and concludes that "reductions of lean body mass and muscle cross-sectional area in the first 12 to 36 months of GAHT … are associated with small reductions or no change in limb strength assessed by hand grip or knee flexion/extension." And "After pubertal change begin, sex segregation for sports involving endurance, power, and strength, … allow adolescent girls and women to excel."

191. Outside the forum of peer-reviewed journals, respected voices in sport are reaching the same conclusion.

192. 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

[13] https://womenssportspolicy.org/wp-content/uploads/2021/02/Congressional-Briefing-WSPWG-Transgender-Women-Sports-2.27.21.pdf

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.

193. Among other things, the Women's Sports Policy Working Group concluded:

- "[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)

194. 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.

195. 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.

196. 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)

197. 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)

198. 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.)

199. 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.)

200. 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.)

201. FINA, the international aquatics (swimming and diving) federation, issued a new policy in June 2022 allowing biological males to compete in the female category of aquatics only if they can establish that they "had male puberty suppressed beginning at Tanner Stage 2 or before age 12, whichever is later, and they have since continuously maintained their testosterone levels in serum (or plasma) below 2.5 nmol/L." FINA Policy on Eligibility for the Men's and Women's Categories § F.4.b.ii. A biologically male athlete who cannot meet these criteria is prohibited from competing in the female category. Id.

- This policy is based on the review of the scientific literature conducted by an independent panel of experts in physiology, endocrinology, and human performance, including specialists in transgender medicine. This panel concluded:

> [I]f gender-affirming male-to-female transition consistent with the medical standard of care is initiated after the onset of puberty, it will blunt some, but not all, of the effects of testosterone on body structure, muscle function, and other determinants of performance, but there will be persistent legacy effects that will give male-to-female transgender athletes (transgender women) a relative performance advantage over biological females. A biological female athlete cannot overcome that advantage through training or nutrition.

> Nor can they take additional testosterone to obtain the same advantage, because testosterone is a prohibited substance under the World Anti-Doping Code. (2)

202. In June 2022, British Triathlon adopted a new policy limiting competition in the female category to "people who are the female sex at birth." British Triathlon Transgender Policy § 7.2.

- This policy is based on its review of the scientific literature and conclusions that "the scientific community broadly agrees that the majority of the physiological/biological advantages brought about by male puberty are retained (either wholly or partially) by transwomen post transition" and that testosterone suppression does not "sufficiently remove[] the retained sporting performance advantage of transwomen." British Triathlon Transgender Policy § 2 (emphasis in original).

203. In June 2022, UCI, the world cycling federation, changed its eligibility criteria for males who identify as female competing in the female category from 12 months of testosterone suppression to the level of 5 nmol/L to 24 months of testosterone suppression to the level of 2.5 nmol/L. UCI Rules § 13.5.015.

- In releasing the new policy, UCI cited a position paper by Prof. Xavier Bigard (2022), which concluded that the "potential [male] advantage on muscle strength / power cannot be erased before a period of 24 months." (15) Notably, Prof. Bigard did not assert that the best available evidence shows that male advantage is actually erased after 24 months; he merely asserted that the evidence shows that male advantage is not erased before 24 months.
- It was reported by Sean Ingle in the Guardian on Thursday, May 4, 2023, that UCI may reconsider its transgender participation policy after a male who identifies as a female won the Tour of the Gila in New Mexico “The UCI also hears the voices of female athletes and their concerns about an equal playing field for competitors, and will take into account all elements, including the

evolution of scientific knowledge."

204. In July 2022, England's Rugby Football Union and Rugby Football League both approved new policies limiting the female category to players whose sex recorded at birth is female for contact rugby for the under 12 age group and above. Rugby Football League Gender Participation Policy § 4.2(d); Rugby Football Union Gender Participation Policy § 4.2(d).

- In August 2022, the Irish Rugby Football Union adopted the same policy. Irish Rugby Football Union Gender Participation Policy §§ 4.5(b) & (f).
- In September 2022, the Welsh Rugby Union also adopted the same policy.
- These bodies based their policy on a review of the scientific research, which showed that male advantage "cannot be sufficiently addressed even with testosterone suppression." Rugby Football Union Gender Participation Policy § 3.4; see also Rugby Football League Gender Participation Policy § 3.4; Irish Rigby Football Union Gender Participation Policy § 4.3.

205. In August 2022, the World Boxing Council issued a new policy requiring athletes to compete in accordance with their natal sex. World Boxing Council Statement/Guidelines Regarding Transgender Athletes Participation in Professional Combat Sports. The WBC concluded that any other policy would raise "serious health and safety concerns." Id.

206. In August 2022, World Triathlon issued a new policy limiting the female category to biological females and to biological males who have suppressed circulating testosterone to 2.5 nmol/L for at least 24 months and have not competed in the male category in at least 48 months. World Triathlon Transgender Policy Process § 3. Previously, it had followed the old IOC guidelines of requiring testosterone suppression to 10 nmol/L for at least 12 months.

- In issuing this policy, World Triathlon stated that "the potential advantage in muscle strength/power of Transgender women cannot be erased before two years of testosterone suppression." World Triathlon Transgender Policy Process § 3.

Notably, World Triathlon did not assert that two years of testosterone suppression actually erases male performance advantage, nor did it cite any evidence that would support such a proposition.

- Although World Triathlon listed sports scientists Drs. Emma Hilton and Ross Tucker as consultants in developing the new policy, both immediately criticized the policy as allowing male advantage into female triathlon competitions.
- Another sports scientist listed as a consultant to World Triathlon, Dr. Alun Williams, has opined that basing eligibility on circulating testosterone levels is not evidence-based policymaking because of the lack of evidence that testosterone suppression eliminates male performance advantage.

207. In March 2023, the World Athletics Council, the governing body for world class track & field competition issued new transgender and DSD (Disorders of Sex Development) regulations. The transgender participation policy is very similar to the policies of World Rugby, World Boxing, and FINA by stating "In regard to transgender athletes, the Council has agreed to exclude male-to-female transgender athletes who have been through male puberty from female World Rankings competition from 31 March 2023." And "For DSD athletes, the new regulations will require any relevant athletes to reduce their testosterone levels below a limit of 2.5 nmol/L for a minimum of 24 months to compete internationally in the female category in any event."

- These policies are particularly noteworthy as there is a clear separation of the concerns regarding athletes who are transgender and those who have a DSD.

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.

I swear or affirm under penalty of perjury that the foregoing is true and correct.

Dated: May 18, 2023 Signed: _/s/ Dr. Gregory A. Brown, Ph.D., FACSM_

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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**		
	50th	**85th**	**50th**	**85th**		**50th**	**85th**
Age	**%ile**	**%ile**	**%ile**	**%ile**	**Age**	**%ile**	**%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 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	10.87	12.10	Difference	11.37	12.08	Difference
2	13.54	14.41	#1 boy vs #	10.91	12.24	#1 boy vs #	11.61	12.43	#1 boy vs #
3	13.73	14.44	1 girl	11.09	12.63	1 girl	11.73	12.51	1 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	21.77	25.36	Difference	20.66	25.03	Difference
2	24.03	28.87	#1 boy vs #	22.25	25.50	#1 boy vs #	22.91	25.18	#1 boy vs #
3	28.07	29.92	1 girl	22.48	25.55	1 girl	23.14	25.22	1 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	49.29	56.80	Difference	51.96	55.70	Difference
2	66.88	67.67	#1 boy vs #	50.47	58.57	#1 boy vs #	55.52	57.08	#1 boy vs #
3	67.59	67.74	1 girl	52.28	60.65	1 girl	55.58	57.60	1 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	120.8	141.4	Difference	127.8	138.5	Difference
2	155.2	164.6	#1 boy vs #	124.0	142.2	#1 boy vs #	129.7	143.1	#1 boy vs #
3	161.0	164.9	1 girl	125.1	148.8	1 girl	130.5	144.2	1 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	307.4	319.3	Difference	297.3	313.8	Difference
2	378.3	400.9	#1 boy vs #	313.7	322.2	#1 boy vs #	298.4	317.1	#1 boy vs #
3	378.4	405.6	1 girl	315.0	322.6	1 girl	307.0	319.9	1 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	602.3	679.2	Difference	556.6	623.7	Difference
2	856.3		#1 boy vs #	644.9	709.7	#1 boy vs #	591.6	649.5	#1 boy vs #
3			1 girl	646.6	714.2	1 girl	600.8	651.6	1 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	256.8	213.8	Difference	224.0	201.3	Difference
2	156.0	163.8	#1 boy vs #	247.0	212.0	#1 boy vs #	222.5	197.3	#1 boy vs #
3	155.0	153.0	1 girl	241.0	210.8	1 girl	220.5	195.8	1 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	150.5	No Further Data	1.4%	219.0	187.5	13.2%	204.5	189.0	9.1%

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	72.0	58.0	Difference	63.0	56.0	Difference
2	38.0	34.0	#1 boy vs #	70.0	58.0	#1 boy vs #	61.0	56.0	#1 boy vs #
3	36.0	32.0	1 girl	65.8	57.0	1 girl	60.0	57.0	1 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	No	Average	61.0	54.0	Average	59.0	54.0	Average
8	32.0	further	difference	60.0	54.0	difference	58.0	54.0	difference
9	59.0	Data	boys vs girls	59.0	No	boys vs girls	57.8	56.0	boys vs girls
10			21.6%		Further	12.5%			6.9%
	56.0			56.0	Data		57.8	56.0	

Appendix 2 – Scholarly Publications

Refereed Publications

1. Shaw BS. Breukelman G, Millard L, Moran J, Brown G, & Shaw I. Effects of a maximal cycling all-out anaerobic test on visual performance. Clin Exp Optom. https://doi.org/10.1080/08164622.2022.2153583, 2022
2. 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.
3. 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.
4. 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.)
5. 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.
6. 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
7. 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
8. 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
9. 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

10. Shaw BS, Shaw I, & Brown GA. Resistance Exercise is Medicine. Int J Ther Rehab. 22: 233-237, 2015.
11. 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
12. 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
13. 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
14. 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
15. 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
16. 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
17. 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
18. 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

19. 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.

20. 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. Steinman PM, Steinman PC, Brown GA. Knowledge Of The Female Athlete Triad In Female High School Athletes In Rural Nebraska. Accepted for presentation at the 70th Annual Meeting of the American College of Sports Medicine. Denver CO. May 30 – June 2, 2023.
2. Steinman PC, Steinman PM, Brown GA. Female Athlete Triad Knowledge Among Sports Medicine Rehabilitation Clinicians In Nebraska. Accepted for presentation at the 70th Annual Meeting of the American College of Sports Medicine. Denver CO. May 30 – June 2, 2023.
3. Brown GA, Brown CJ, Shaw I, Shaw B. Boys And Girls Differ In Running And Jumping Track And Field Event Performance Before Puberty. Accepted for presentation at the 70th Annual Meeting of the American College of Sports Medicine. Denver CO. May 30 – June 2, 2023.
4. Brown GA, Orr T, Shaw BS, Shaw I. Comparison of Running Performance Between Division and Sex in NCAA Outdoor Track Running Championships 2010-2019. 54(5), 2146. 69th Annual Meeting of the American College of Sports Medicine. San Diego, CA. May 31 - June 4, 2022.
5. Shaw BS, Lloyd R, Da Silva M, Coetzee D, Millard L, Breukelman G, Brown GA, Shaw I. Analysis Of Physiological Determinants During A Single Bout Of German Volume Training. 54(5), 886. 69th Annual Meeting of the American College of

Sports Medicine. San Diego, CA. May 31 - June 4, 2022.

6. Shaw I, Turner S, Brown GA, Shaw BS. Effects Of Resistance Exercise Modalities On Chest Expansion, Spirometry And Cardiorespiratory Fitness In Untrained Smokers. Med Sci Sport Exerc. 54(5), 889. 69th Annual Meeting of the American College of Sports Medicine. San Diego, CA. May 31 - June 4, 2022.
7. Elton D, Brown GA, Orr T, Shaw BS, Shaw I. Comparison Of Running Performance Between Division And Sex In NCAA Outdoor Track Running Championships 2010-2019. Northland Regional Meeting of the American College of Sports Medicine. Held Virtually. April 8, 2022
8. 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.
9. 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.
10. 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.
11. 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.
12. 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.

13. 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.
14. 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.
15. 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.
16. 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.
17. 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.
18. 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.

19. 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.
20. 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.
21. 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.
22. 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.
23. 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.
24. 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.
25. 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.

26. Shaw BS, Shaw I, Fourie M, Gildenhuys M, and Brown GA. Variances In The Body Composition Of Elderly Woman Following Progressive Mat Pilates. Med Sci Sport Exerc. 46(5), 558. 61st Annual Meeting of the American College of Sports Medicine. Orlando, FL June 2014.

27. Brown GA, Shaw I, Shaw BS, and Bice M. Online Quizzes Enhance Introductory Anatomy & Physiology Performance on Subsequent Tests, But Not Examinations. Med Sci Sport Exerc. 46(5), 1655. 61st Annual Meeting of the American College of Sports Medicine. Orlando, FL June 2014.

28. Kahle, A. and Brown, G.A. Electromyography in the Gastrocnemius and Tibialis Anterior, and Oxygen Consumption, Ventilation, and Heart Rate During Minimalist versus Traditionally Shod Running. 27th National Conference on Undergraduate Research (NCUR). La Crosse, Wisconsin USA. April 11-13, 2013

29. Shaw, I., Shaw, B.S., and Brown, G.A. Resistive Breathing Effects on Pulmonary Function, Aerobic Capacity and Medication Usage in Adult Asthmatics Med Sci Sports Exerc 45 (5). S1602 2013. 60th Annual Meeting of the American College of Sports Medicine, Indianapolis, IN USA, May 26-30 3013

30. Shaw, B.S. Gildenhuys, G.A., Fourie, M. Shaw I, and Brown, G.A. Function Changes In The Aged Following Pilates Exercise Training. Med Sci Sports Exerc 45 (5). S1566 60th Annual Meeting of the American College of Sports Medicine, Indianapolis, IN USA, May 26-30 2013

31. Brown, G.A., Abbey, B.M., Ray, M.W., Shaw B.S., & Shaw, I. Changes in Plasma Free Testosterone and Cortisol Concentrations During Plyometric Depth Jumps. Med Sci Sports Exerc 44 (5). S598, 2012. 59th Annual Meeting of the American College of Sports Medicine. May 29 - June 2, 2012; San Francisco, California

32. Shaw, I., Fourie, M., Gildenhuys, G.M., Shaw B.S., & Brown, G.A. Group Pilates Program and Muscular Strength and Endurance Among Elderly Woman. Med Sci Sports Exerc 44 (5). S1426. 59th Annual Meeting of the American College of Sports Medicine. May 29 - June 2, 2012; San Francisco, California

33. Shaw B.S., Shaw, I., & Brown, G.A. Concurrent Inspiratory-Expiratory and Aerobic Training Effects On Respiratory Muscle Strength In Asthmatics. Med Sci Sports Exerc 44 (5). S2163. 59th Annual Meeting of the American College of Sports Medicine. May 29 - June 2, 2012; San Francisco, California
34. Scheer, K., Siebrandt, S., Brown, G.A, Shaw B.S., & Shaw, I. Heart Rate, Oxygen Consumption, and Ventilation due to Different Physically Active Video Game Systems. Med Sci Sports Exerc 44 (5). S1763. 59th Annual Meeting of the American College of Sports Medicine. May 29 - June 2, 2012; San Francisco, California
35. Jarvi M.B., Shaw B.S., Shaw, I., & Brown, G.A. (2012) Paintball Is A Blast, But Is It Exercise? Heart Rate and Accelerometry In Boys Playing Paintball. Med Sci Sports Exerc 44 (5). S3503. 59th Annual Meeting of the American College of Sports Medicine. May 29 - June 2, 2012; San Francisco, California

Book Chapters

1. Shaw BS, Shaw I, Brown G.A. Importance of resistance training in the management of cardiovascular disease risk. In Cardiovascular Risk Factors. IntechOpen, 2021.
2. Brown, G.A. Chapters on Androstenedione and DHEA. In: Nutritional Supplements in Sport, Exercise and Health an A-Z Guide. edited by Linda M. Castell, Samantha J. Stear, Louise M. Burke. Routledge 2015.

Refereed Web Content

1. Brown GA and Lundberg TL. Should Transwomen be allowed to Compete in Women's Sports? A view from an Exercise Physiologist Center on Sport Policy and Conduct (accepted on April 18, 2023) https://www.sportpolicycenter.com/news/2023/4/17/should-transwomen-be-allowed-to-compete-in-womens-sports
2. Brown GA. The Olympics, sex, and gender in the physiology classroom (part 2): Are there sex based differences in athletic performance before puberty? Physiology Educators Community of Practice blog (PECOP Blog), managed by the Education

group of the American Physiological Society. (May 16, 2022) https://blog.lifescitrc.org/pecop/2022/05/16/the-olympics-sex-and-gender-in-the-physiology-classroom-2/

3. Brown GA. Looking back and moving forward. The importance of reflective assessment in physiology education. (January 13, 2022) https://blog.lifescitrc.org/pecop/2022/01/13/looking-back-and-moving-forward-the-importance-of-reflective-assessment-in-physiology-education/

4. Brown GA. The Olympics, sex, and gender in the physiology classroom. Physiology Educators Community of Practice, managed by the Education group of the American Physiological Society (August 18, 2021) https://blog.lifescitrc.org/pecop/2021/08/18/the-olympics-sex-and-gender-in-the-physiology-classroom/

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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA
TUCSON DIVISION

Jane Doe, *et al.*, Plaintiffs, v. Thomas C. Horne, in his official capacity as State Superintendent of Public Instruction, *et al.*, Defendants.	Case No. 4:23-cv-00185-JGZ **Declaration of James M. Cantor, Ph.D., in Support of [Intervenors' Proposed] Opposition to Plaintiffs' Motion for a Preliminary Injunction**

TABLE OF CONTENTS

I. Credentials and Qualifications

A. Education and professional background

1. I am a sexual behavior scientist, with an internationally recognized record studying the development of human sexualities, and an expert in research methodology of sexuality. My curriculum vitae is attached as Appendix 1 to this report. My publication record includes both biological and non-biological influences on sexuality, ranging from pre-natal brain development, through adulthood, to senescence. The primary, but not exclusive, focus of my own research studies has been the development of atypical sexualities. In addition to the studies I myself have conducted, I am regularly consulted to evaluate the research methods, analyses, and proposals from sexual behavior scientists throughout the world. The methodologies I am qualified to assess span the neurochemical and neuroanatomic level, individual behavioral level, and social and interpersonal levels.

2. I am trained as a clinical psychologist and neuroscientist, and I am the author of over 50 peer-reviewed articles in my field, spanning the development of sexual orientation, gender identity, hypersexuality, and atypical sexualities collectively referred to as *paraphilias*. Although I have studied many atypical sexualities, the most impactful of my work has been MRI and other biological studies of the origins of pedophilia. That work has revolutionized several aspects of the sex offender field, both with regard to the treatment of offenders and to the prevention of sexual abuse of children. In 2022, I received the Distinguished Contribution Award from the Association for the Treatment and Prevention of Sexual Abuse in recognition of my research and its integration into public policy. My efforts in this regard have been the subject of several documentary films.

3. Over my academic career, my posts have included Senior Scientist and Psychologist at the Centre for Addiction and Mental Health (CAMH), and Head of Research for CAMH's Sexual Behaviour Clinic. I was on the Faculty of Medicine of the University of Toronto for 15 years and have served as Editor-in-Chief of the peer reviewed journal, *Sexual Abuse*. That journal is one of the top-impact, peer-reviewed journals in sexual behavior science and is the official journal of the Association for the Treatment and

Prevention of Sexual Abuse. In that appointment, I was charged to be the final arbiter for impartially deciding which contributions from other scientists in my field merited publication. I believe that appointment indicates not only my extensive experience evaluating scientific claims and methods, but also the faith put in me by the other scientists in my field. I have also served on the Editorial Boards of *The Journal of Sex Research*, the *Archives of Sexual Behavior*, and *Journal of Sexual Aggression*. I am currently the Director of the Toronto Sexuality Centre in Canada. Thus, although I cannot speak for other scientists, I regularly interact with and am routinely exposed to the views and opinions of most of the scientists active in our field today, within the United States and throughout the world.

4. For my education and training, I received my Bachelor of Science degree from Rensselaer Polytechnic Institute, where I studied mathematics, physics, and computer science. I received my Master of Arts degree in psychology from Boston University, where I studied neuropsychology. I earned my doctoral degree in psychology from McGill University, which included successfully defending my doctoral dissertation studying the effects of psychiatric medication and neurochemical changes on sexual behavior, and included a clinical internship assessing and treating people with a wide range of sexual and gender identity issues.

5. I have a decades-long, international, and award-winning history of advocacy for destigmatizing people with atypical sexualities. While still a trainee in psychology, I founded the American Psychological Association's (APA) Committee for Lesbian, Gay, and Bisexual Graduate Students. Subsequently, I have served as the Chair for the Committee on Science Issues for APA's Division for the Psychology of Sexual Orientation and Gender Diversity and was appointed to its Task Force on Transgender Issues. Throughout my career, my writings and public statements have consistently supported rights for transgender populations and the application of science to help policy-makers best meet their diverse needs. Because my professional background also includes neurobiological research on the development of other atypical sexualities, I have become

recognized as an international leader also in the destigmatizing of the broader range of human sexuality patterns.

6. I am highly experienced in the application of sex research to forensic proceedings: I have served as the Head of Research for the Law and Mental Health Program of the University of Toronto's psychiatric teaching hospital, the Centre for Addiction and Mental Health, where I was appointed to the Faculty of Medicine.

7. I have served as an expert witness in 32 cases in the past four years, as listed on my *curriculum vitae*. These cases included criminal, civil, and custody proceedings, preliminary injunction and Frye hearings, as well as trials. I have testified in courts in Canada and throughout the U.S., including Alabama, Arizona, Florida, Illinois, Indiana, Kansas, Kentucky, Massachusetts, New York, Texas, Utah, and West Virginia. I have provided expert testimony concerning the nature and origins of atypical sexualities, as well as concerning gender dysphoria and gender identity in children.

8. For my work in this case, I am being compensated at the hourly rate of $400 per hour. My compensation does not change based on the conclusions and opinions that I provide here or later in this case or on the outcome of this lawsuit.

B. Clinical expertise vs. scientific expertise

9. In clinical science, there are two kinds of expertise: Clinicians' expertise regards applying general principles to the care of an individual patient and the unique features of that case. A scientist's expertise is the reverse, accumulating information about many individual cases and identifying the generalizable principles that may be applied to all cases. Thus, different types of decisions may require different kinds of experts, such that questions about whether a specific patient represents an exception to the general rule might be better posed to a physician's expertise, whereas questions about establishing the general rules themselves might be better posed to a scientist's.

10. In legal matters, the most familiar situation pertains to whether a given clinician correctly employed relevant clinical standards. Often, it is other clinicians who practice in that field who will be best equipped to speak to that question. When it is the clinical

standards that are themselves in question, however, it is the experts in the assessment of scientific studies who are the relevant experts.

C. The professional standard to evaluate treatment models is to rely on objective assessors, not treatment model users in a conflict of interest with its results.

11. I describe in a later section the well-recognized procedures for conducting reviews of literature in medical and scientific fields to evaluate the strength of evidence for particular procedures or treatments. Importantly, the standard procedure is for such evaluations to be conducted by objective assessors with expertise in the science of assessment, and not by those with an investment in the procedure being assessed. Because the people engaged in providing clinical services are necessarily in a conflict of interest when claiming that their services are effective, formal evaluations of evidence are routinely conducted by those *without* direct professional involvement and thus without financial or other personal interest in whether services are deemed to be safe or effective. This routine practice standard is exemplified by all of the only three systematic, comprehensive research reviews that have been conducted concerning the safety and efficacy of puberty blockers and cross-sex hormones as treatments for gender dysphoria in children.

12. In 2020, England's National Health Service (NHS) commissioned a major review of the use of puberty blockers and cross-sex hormones in children and young people and appointed prominent pediatrician Dr. Hilary Cass to lead that review, explicating that "Given the increasingly evident polarization among clinical professionals, Dr. Cass was asked to chair the group as a senior clinician with *no prior involvement* or fixed views in this area." (Cass 2022 at 35, italics added.) Dr. Cass's committee in turn commissioned formal systematic reviews of evidence from the England National Institute for Health & Care Excellence (NICE), a government entity of England's Department of Health and Social Care, established to provide guidance to health care policy, such as by conducting systematic reviews of clinical research, but without direct involvement in providing treatment to gender dysphoric individuals. (https://www.nice.org.uk/.) Similarly, the

Finnish health care council commissioned its systematic review to an external firm, Summaryx Oy. (Pasternack 2019.) Summaryx Oy is a "social enterprise" (a Finnish organization analogous to a non-profit think-tank) that conducts systematic research reviews and other analyses for supporting that nation's medical and social systems. Its reviews are conducted by assessment professionals, not by clinicians providing services. (www.summaryx.eu/en/.) The systematic review by Sweden's National Board of Health and Welfare (NBHW) included four experts. (SBU Scoping Review 2019.) In addition to their own research fields, they provided clinical services in areas adjacent to but apart from gender dysphoric children, such as physical disorders of sexual development (Dr. Berit Kriström) or gender dysphoria in adults (Dr. Mikael Landén).

13. My own most-cited peer-reviewed paper relating to gender dysphoria in minors illustrates the expertise in the evaluation of scientific evidence that I have and am recognized for. That is, that paper provided not clinical advice or a clinical study, but rather a review and interpretation of the available evidence concerning desistance in children who suffer from gender dysphoria, as well as of evidence (and lack of evidence) concerning the safety and efficacy of medical transition to treat gender dysphoria in minors. (Cantor 2019.)

14. My extensive background in the assessment of sexuality research and in the development of human sexuality places me in exactly the position of objectivity and freedom from conflict-of-interest required by the universal standards of medical research science.

15. I do not offer opinions about the best public policy. Multiple jurisdictions have attempted multiple different means of implementing that science into various public policies. Although I accept as an axiom that good public policy must be consistent with the scientific evidence, science cannot objectively assess societal values and priorities. Therefore, my opinions summarize and assess the science on which public policy is based, but I can offer no opinion regarding which public policy mechanisms would be best in light of that science.

II. Multiple international health care systems that had initially expanded

medicalized transition to include minors have reversed that policy, as research on safety and effectiveness accumulated, in a growing international trend against the medicalized transition of minors.

16. Medicalized interventions for minors originated in European clinics (most prominently in the Netherlands and Sweden), and these precedents (and in particular the so-called "Dutch Protocol") are frequently cited by American clinicians. However, growing concerns about safety together with the continuing absence of reliable evidence of benefit even after more than 20 years of experience have led respected and far-from "conservative" European health care ministries to step back and discourage or even cease providing medicalized transition of minors, other than in exceptional and carefully limited circumstances, such as within registered and approved research trials. Instead, these authorities now endorse psychotherapy as the treatment of choice for minors, with medical interventions representing a method of last resort, if permitted at all. These range from medical advisories to outright bans on the medical transition of minors. I provide details concerning these policy changes below, and provide additional details regarding the underlying systematic reviews in Section II and VI below.

A. England

17. The National Health Service (NHS) of the United Kingdom centralized gender counselling and transitioning services into a single clinic, the Gender Identity Development Service (GIDS) of the Tavistock and Portman NHS Foundation Trust. Between 2008 and 2018, the number of referrals to the clinic had increased by a factor of 40, leading to a government inquiry into the causes. (Rayner 2018.) The GIDS was repeatedly accused of approving and endorsing medical transition in minors without adequate justification, including by 35 members of the GIDS own staff, who resigned by 2019. (BBC News 2021; Donnelly 2019). An ex-governor and psychotherapist of the Trust who resigned, Marcus Evans, said staff feared being called transphobic, which was impacting their objectivity in their work. (Doward 2019).

18. In 2020, a former patient of the GIDS, Keira Bell, brought a lawsuit alleging that

the GIDS practices with respect to prescribing puberty blockers for minors were unproven and potentially harmful in ways that meant that it was impossible for minors to give meaningful informed consent. After taking extensive expert evidence, the trial court concluded that puberty blockers might have "potentially irreversible" and "life-changing" effects on a young person (*Bell v. Tavistock*, [2020] EWHC 3274 (Admin), ¶148, 151), that there was "very limited evidence as to its efficacy" (¶134) such that "it is right to call the treatment experimental" (¶148), and that use of puberty blockers almost always led to use of cross-sex hormones that "may well lead to a loss of fertility" (¶¶ 137-138). While an appeals court later concluded that the trial court had exceeded the proper role of the court in making factual findings on these questions, the appeals court acknowledged that "Medical opinion is far from unanimous about the wisdom of embarking on treatment before adulthood. The question raises not only clinical medical issues but also moral and ethical issues, all of which are the subject of intense professional and public debate." (Bell v. Tavistock 2021 at ¶3.)

19. Perhaps prompted by the Kiera Bell litigation, also in 2020 the English National Health Service ("NHS") commissioned the thorough independent review of the use of puberty blockers and cross-sex hormones to be chaired by Dr. Cass that I have described above. After an extensive process that included obtaining the systematic reviews of all published studies bearing on safety or efficacy of these hormonal interventions in minors as well as "extensive" listening sessions with clinicians, patients, and families, in February 2022 Dr. Cass issued an extensive "Interim Report" summarizing the state of the relevant medical science and in particular highlighting the presence of serious but unstudied risks, and the lack of strong evidence of efficacy. I will quote specific items from Dr. Cass's Report as relevant to specific topics below. At a high level, Dr. Cass concluded that to date there has been "very limited research on the sexual, cognitive, or broader developmental outcomes" from the use of puberty blockers for gender dysphoria (Cass 2022 at 19), that it is an unanswered question "whether the evidence for the use and safety of [puberty blockers] is strong enough as judged by reasonable clinical standards" (at 37), and that "the

available evidence was not strong enough to form the basis of a policy position" with regard to use of both puberty blockers and cross-sex hormones in minors (at 35).

20. Following issuance of Dr. Cass's Interim Report, the English NHS has published a consultation document concerning a proposed revised service specification under which "NHS England will only commission [puberty blockers] in the context of a formal research protocol." (NHS Interim Service Specification at 12.)

B. Finland

21. In Finland, minors were made eligible for medicalized transition in 2011 by that country's health care service, the Council for Choices in Health Care in Finland (COHERE). Assessments of mental health and preparedness were centralized by law into two research clinics, Helsinki University Central Hospital and Tampere University Hospital.

22. In 2019, the Service Selection Council (Palko) of the Finnish Ministry of Social Affairs and Health commissioned a systematic review of the effectiveness and safety of medicalized transition (Pasternack 2019), and in 2020, Finnish researchers published an analysis of the outcomes of adolescents diagnosed with transsexualism and receiving cross-sex hormone treatment in Finland's Tampere University Hospital. (Kaltiala 2020.) Despite the purpose of medical transition being to improve mental health, the study showed:

> Medical gender reassignment is not enough to improve functioning and relieve psychiatric comorbidities among adolescents with gender dysphoria. Appropriate interventions are warranted for psychiatric comorbidities and problems in adolescent development. (Kaltiala 2020 at 213.)

They concluded that the youth who were functioning well after transition were those who were already functioning well before transition, and those who were functioning poorly before transition continued to function poorly after transition.

23. Importantly, the results of this study exemplify why correlations reported from surveys cannot be interpreted as evidence of causality. Mental health assessment would exclude the most poorly functioning youth from among those permitted to transition, but

transition itself did not improve the functioning of those who were permitted to transition.

24. Consistent with the results of the independent evidence review by Summaryx Oy and analysis of the ethical issues involved, Finland's health care service ended the surgical transition of minors, ruling in 2020 that "Surgical treatments are not part of the treatment methods for dysphoria caused by gender-related conflicts in minors." (COHERE Summary 2020.) The review of the research concluded that "[N]o conclusions can be drawn on the stability of gender identity during the period of disorder caused by a psychiatric illness with symptoms that hamper development." (COHERE Summary 2020.) COHERE also greatly restricted access to puberty-blocking and cross-sex hormonal treatments, explicating that they may be considered for minors "only if it can be ascertained that their identity as the other sex is of a permanent nature and causes severe dysphoria," and only "if the need for it continues *after* [any] other psychiatric symptoms have *ceased* and adolescent development is progressing normally." (COHERE Summary 2020, italics added.) They restricted the procedures to their centralized research clinics. The council was explicit in noting the lack of research needed for decision-making, "There is also a need for more information on the disadvantages of procedures and on people who regret them." (COHERE Summary 2020.) In light of the special developmental and ethical considerations surrounding minors, COHERE recommended that "no decisions should be made that can permanently alter a still-maturing minor's mental and physical development." (COHERE Recommendation 2020 at 7.)

C. Sweden

25. Sweden's national health care policy regarding trans issues has developed quite similarly to that of the UK. Already in place 20 years ago, Swedish health care policy permitted otherwise eligible minors to receive puberty-blockers beginning at age 14 and cross-sex hormones at age 16. At that time, only small numbers of minors sought medical transition services. An explosion of referrals ensued in 2013–2014. Sweden's Board of Health and Welfare ("Socialstyrelsen") reported that, in 2018, the number of diagnoses of gender dysphoria was 15 times higher than 2008 among girls ages 13–17. (Swedish

Socialstyrelsen Support 2022 at 15.)

26. Sweden has long been very accepting with regard to sexual and gender diversity. In 2018, a law was proposed to lower the age of eligibility for surgical care from age 18 to 15, remove the requirement for parental consent, and lower the legal age for change of gender to age 12. A series of cases of regret and suicide following medical transition were reported in the Swedish media. (Orange 2020.) In 2019, the Swedish Agency for Health Technology Assessment and Assessment of Social Services (SBU) therefore initiated its own systematic review of the research. The SBU released English-language results first as a summary and then published as a peer reviewed article. (Ludvigsson et al., 2023.) Like the UK, the Swedish investigation employed standardized review methods to ensure the encapsulation of the all the relevant evidence and came to the same conclusions: "This systematic review of almost 10 000 screened abstracts suggests that long-term effects of hormone therapy on psychosocial and somatic health are unknown, except that GnRHa treatment seems to delay bone maturation and gain in bone mineral density." (Ludvigsson 2023 at 12.) They emphasized, "The absence of long-term studies is worrying because many individuals start treatment as minors (<18 years) and CSHT is lifelong." (Ludvigsson 2023 at 10.) Regarding the full set of studies, "No randomised controlled trials were found, but we could identify 24 relevant observational studies. However, these were limited by methodological weaknesses, for instance lack of or inappropriate control group, lack of intra-individual analyses, high attrition rates that precluded conclusion to be drawn." (Ludvigsson 2023 at 9–10.)

27. In 2021, the leading Swedish pediatric gender clinic, at the Karolinska Institute, issued a new policy statement in which it stated that the Swedish evidence review "showed a lack of evidence for both the long-term consequences of the treatments, and the reasons for the large influx of patients in recent years." (Karolinska 2021.) The Karolinska Institute further stated that "These treatments are potentially fraught with extensive and irreversible adverse consequences such as cardiovascular disease, osteoporosis, infertility, increased cancer risk, and thrombosis." In a dramatic reversal of its policy, the Institute announced

that "In light of the above, and based on the precautionary principle, which should always be applied, it has been decided that hormonal treatments (i.e., puberty blocking and cross-sex hormones) will not be initiated in gender dysphoric patients under the age of 16." Further, the Karolinska clinic announced that patients ages 16–18 would receive such treatments *only* within research settings (clinical trials monitored by the appropriate Swedish research ethics board). (Karolinska 2021.)

28. In 2022, the Swedish National Board of Health and Welfare published a major new national policy document concerning "Support, investigation and hormone therapy in gender incongruence in children and youth," including an English-language summary. (Swedish Socialstyrelsen Support 2022.) The National Board of Health noted "the continued lack of reliable scientific evidence concerning the efficacy and the safety of both [puberty blockers and cross-sex hormones]," and concluded (based on the commissioned evidence reviews) that "the evidence on treatment efficacy and safety is still insufficient and inconclusive for all reported outcomes. Further, it is not possible to determine how common it is for adolescents who undergo gender-affirming treatment to later change their perception of their gender identity or interrupt an ongoing treatment." As a result, the Board of Health concluded that, "[f]or adolescents with gender incongruence, the . . . risks of puberty suppressing treatment with GnRH-analogues and gender-affirming hormonal treatment currently outweigh the possible benefits." (Swedish Socialstyrelsen Support 2022 at 10-12.) Accordingly, the Swedish Board of Health and Welfare "recommends restraint when it comes to hormone treatment." (Swedish Socialstyrelsen Updated Recommendations 2/22/22.)

D. France

29. While medical authorities in France have not issued any actual restriction, in 2022, the Académie Nationale de Médecine of France issued a strongly worded statement, citing the Swedish ban on hormone treatments:

> [A] great medical caution must be taken in children and adolescents, given the vulnerability, particularly psychological, of this population and the many

> undesirable effects, and even serious complications, that some of the available therapies can cause…such as impact on growth, bone fragility, risk of sterility, emotional and intellectual consequences and, for girls, symptoms reminiscent of menopause." (Académie Nationale de Médecine 2022.)

For hormones, the Académie concluded "the greatest reserve is required in their use," and for surgical treatments, "[T]heir irreversible nature must be emphasized." The Académie warned "the risk of over-diagnosis is real, as shown by the increasing number of transgender young adults wishing to 'detransition'." Rather than medical interventions, it advised health care providers "to extend as much as possible the psychological support phase." The Académie reviewed and emphasized the evidence indicating the very large and very sudden increase in youth requesting medical transition. It attributed the change, not to society now being more accepting of sexual diversity, but to social media, "underlining the addictive character of excessive consultation of social networks which is both harmful to the psychological development of young people and responsible, for a very important part, of the growing sense of gender incongruence." (Académie Nationale de Médecine 2022.)

E. Norway

30. In 2022, Norway's Healthcare Investigation Board (Ukom) began a review of that country's guidelines for the medicalized transition of minors. (Block, Norway's Guidance, 2023.) In 2023, it released its report, which concluded that the evidence for the use of puberty blockers and cross-sex hormone treatments in youth was insufficient, and acknowledged the international recognition of the dearth of evidence of safety and effectiveness. The report deemed medicalized transition to be experimental. (Ukom 2023, Summary and Section 11.) The report faulted the existing Norwegian guidelines, published in 2020, for concentrating on "equality and rights" while "deviating from the requirements for the development of knowledge-based guidelines." (Ukom 2023, Summary.)

31. The Norwegian report concluded that "The knowledge base, especially research-based knowledge for gender-affirming treatment (hormonal and surgical), is insufficient and the long-term effects are little known" and that "This applies particularly to the teenage

population, which accounts for a large part of the increase in referrals to the specialist health service in the last decade." (Ukom 2023, Summary and Section 7.)

32. In an interview about the report with the *British Medical Journal,* the Ukom Medical Director, Stine Marit Moen, said, "We're concerned that there may be undertreatment, overtreatment, and the wrong treatment" and added:

> We've seen a marked increase in referrals to specialised healthcare services in Norway for teenagers, as seen in many other western countries, and nobody knows the reason. The stability of the gender dysphoria of these teenagers is not known, and the evidence of long term effects of gender affirming treatments for this young population is insufficient. (Block, Norway's Guidance, 2023.)

33. Ukom noted that referrals to its national treatment service increased by a factor of eight between 2007 and 2018, and that this increase was largely from young biological females. Seventy-five percent of the referrals to its National Treatment Service had other co-morbid psychiatric diagnoses, including not only depression and anxiety but also autism spectrum disorders, ADHD, and Tourette's Syndrome. (Ukom 2023, Summary and Section 7.)

F. Assertions by U.S. organizations and officials that there is 'no debate' over medicalized transition are false.

34. The international consensus is clearly demonstrated by the multiple recent analyses, statements, and policy decisions from the health care service systems around the world. These include England's National Health Service, which noted the "Scarce and inconclusive evidence to support clinical decision making [which] has led to a lack of clinical consensus on what the best model of care for children and young people experiencing gender incongruence and dysphoria should be." (NHS 2022 at 5.)

35. As these several recent national policy reviews, statements, and recommendations make very clear, there is a great deal of doubt and debate among the sophisticated international medical and mental health community as to whether the administration of puberty blockers and cross-sex hormones to children and young people

is the best clinical practice, and as to whether these treatments have been shown to be safe and effective. Indeed, the lack of scientifically reliable data concerning safety and efficacy highlighted by the systematic evidence reviews commissioned by the English National Health Service, by the Swedish National Board of Health and Welfare, and by the Finnish Council for Choices in Health Care in Finland have caused those national health authorities and others to move sharply away from approving puberty blockers, cross-sex hormones, or surgery for minors.

36. In this report, I explain the evidence and lack of evidence behind that doubt, that debate, and the emerging international consensus of caution reflected in the several recent European policy statements or changes.

37. I note that the plaintiffs' experts have excluded all mention of the international reversals of policy, falsely suggesting a consensus. In fact, practices at U.S. gender clinics and statements by U.S. advocacy voices increasingly represent an outlier view, failing to update policy despite the mounting evidence.

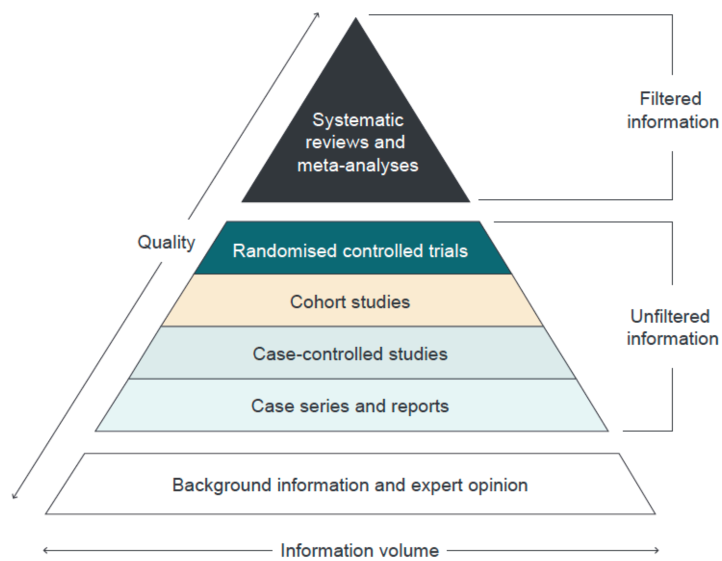
III. Clinical research has a standard *Pyramid of Evidence* that summarizes the relative strength of potential sources of information.

38. The widely accepted starting point in evidence-based medicine is the recognition that clinical experiences and recollections of individual practitioners (often called "expert opinion" or "clinical anecdote") do not and cannot provide a reliable, scientific basis for treatment decisions. Rather, in evidence-based medicine, clinical decision-making is based on objectively demonstrated evidence of outcomes from the treatment options. An essential first step in evidence-based medicine is identifying the relevant findings from among the immense flood of clinical journal articles published each year. Those studies and the evidence they report are then assessed according to the strength offered by the research methods used in each study. The research methods used in a study determine its reliability and generalizability, meaning the confidence one may have that using the same treatment again will have the same result again on other people. In this section, I explain the well-accepted criteria for evaluating the evidentiary value of clinical studies.

A. Clinical research comprises a standard *Pyramid of Evidence*, wherein studies from higher levels of evidence outrank even more numerous studies from lower levels of research.

39. The accepted hierarchy of reliability for assessing clinical outcomes research is routinely represented as a "Pyramid of Evidence" (Figure 1). Scientific questions are not resolved by the number of studies coming to one versus another conclusion. Studies representing higher levels of evidence outrank studies from lower levels. Even large numbers of lower-level studies cannot overcome a study representing a higher level of evidence. Indeed, because lower-level studies are generally faster and less expensive to conduct, it is typical for them to outnumber higher level studies. This is the property meant to be reflected by the pyramid's shape, which is larger at the base and smaller at the apex.

Figure 1: Pyramid of Standards of Evidence



Source: OpenMD. Retrieved from https: //openmd.com/guide/levels-of-evidence.

B. The highest level of evidence for safety and effectiveness research is the systematic review of clinical experiments.

40. The most reliable and conclusive method of determining what is actually known or not known with respect to a particular treatment is the *systematic review.* Systematic

reviews employ standardized procedures to assess comprehensively all available evidence on an issue, minimizing opportunities for bias in gathering and evaluating research evidence. As described by Dr. Gordon Guyatt, the internationally recognized pioneer in medical research who invented the term *evidence-based medicine,* "A fundamental principle to the hierarchy of evidence [is] that optimal clinical decision making requires systematic summaries of the best available evidence." (Guyatt 2015 at xxvi.)

1. Systematic reviews prevent the 'cherry-picking' of studies that favor a particular result.

41. Because systematic reviews are designed to prevent researchers from including only the studies they favor and other biases, systematic reviews are the routine starting point for developing clinical practice guidelines. (Moher 2009.) The methods of a systematic review include:

- Define the scope, including the "PICO": Population/Patient, Intervention, Comparison/Control, and Outcome(s);
- Select and disclose the keywords used to search the (massive) available clinical research database(s) for potentially relevant articles, identify the databases they were applied to, and the date(s) of the searches, including any subsequent updates;
- Select and disclose the inclusion/exclusion criteria to be used to filter the "hits" from the keyword searches to identify research studies to be included in the detailed review;
- Review abstracts to select the final set of studies, using at least two independent reviewers to allow for measuring inter-rater reliability on the criteria;
- Code each study's results impacting the research question(s), disclosing the list of all studies and the results coded from each;
- Evaluate the reliability of the results [risk of bias] of each included study, applying uniform criteria across them all.

2. Systematic reviews prevent biased assessment of individual studies by uniformly applying standard criteria to each study reviewed. The most widely used criteria set is "GRADE."

42. In order to produce unbiased assessment of the studies within the systematic review, all the studies must be evaluated using the same evaluation criteria. Without such criteria, assessments can become influenced by researchers who, intentionally or not, hold the evaluative bar higher or lower for studies according to whether the studies' conclusions support or challenge that researcher's perspective. Several such systems have been developed. The most widely used system is the "Grading of Recommendations, Assessment, Development and Evaluations" (GRADE). (Goldet & Howick 2013.) In the GRADE system, studies' findings are downgraded for:

- Risk of bias:[1]
    - Lack of clearly randomized allocation sequence,
    - Lack of blinding,
    - Lack of allocation concealment,
    - Failure to adhere to intention-to-treat analysis,
    - Trial is cut short,
    - Large losses to follow-up;
- Inconsistency;
- Indirectness of evidence;
- Imprecision; and
- Publication bias (when studies with 'negative' findings remain unpublished).

Studies' ratings are upgraded if their findings identify:

- A large effect of the treatment;
- A dose-response relationship (the size of the effect has a systematic association with

[1] In science, including in the GRADE system, the term "bias" refers to any external influence leading to a systematic over- or underreporting of the outcome being measured. That is, in this context "bias" is not used in the sociopolitical sense of personal values.

the dose of the treatment given); or

- That all plausible biases only *reduce* the apparent effect of the treatment (necessarily making the estimated effect sizes conservative estimates).

43. GRADE assessments yield a four-point score representing the certainty that a reported treatment effect is true. These certainty scores are (GRADE Handbook, Section 5):

Certainty	**Meaning**
High	We are very confident that the true effect lies close to that of the estimate of the effect.
Moderate	We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low	Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect.
Very Low	We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect.

C. The highest level experimental study of clinical safety and effectiveness is the Randomized Controlled Trial (RCT). RCTs can demonstrate that a given treatment causes (rather than only correlates with) a given outcome.

44. Randomized Controlled Trials are the gold standard method of assessing the effects caused by an experimental treatment. The great scientific weight of RCTs follows from the randomization: People do not pick which research group they are in—a treatment group or a control group. Without random group assignment, it is not possible to identify which, if any, changes are due to the treatment itself or to the factors that led to who did and did not receive treatment.

45. Levels of evidence lower than RCTs are unable to distinguish when changes are caused by the experimental treatment, or by factors that can mimic treatment effects, such

as 'regression to the mean' and the placebo effect.

46. In the absence of evidence that X causes Y, it is a scientific error to use language indicating there is causal relationship. In the absence of evidence of causality, it is scientifically unsupportable to describe a correlation with terms such as: increases, improves, benefits, elevates, leads to, alters, influences, results in, is effective for, causes, changes, contributes to, leads to, yields, impacts, decreases, harms, and depresses. Scientifically valid terms for correlations include: relates to, is associated with, predicts, and varies with.

1. RCTs, but not lower levels of evidence, overcome biases representing 'regression to the mean' and other factors that can mimic clinical improvement.

47. 'Regression to the mean' arises when researching issues, such as mood, depression, or levels of emotional distress that typically fluctuate over time. People are more likely to seek out treatment during low points rather than high points in their emotional lives. Thus, when tracking emotional states over time, the average of a group of people in a treatment group may often show an increase; however, without an untreated control group to which to compare them, researchers cannot know whether the group average would have increased anyway, with only the passage of time.

48. Blinding or masking participants in an RCT from which group they are in has been described as a preferred strategy since the 1950s, in order to exclude the possibility that a person's expectations of change caused any changes observed (the "placebo effect"). In practice, however, it has often made little or no significant difference. For example, a study using very high quality methods—meta-analysis of meta-analysis research—has revealed no statistical difference in the sizes of the effects detected by blinded/placebo-controlled studies from non-blinded/non-placebo-controlled studies of depression. (Moustgaard 2019.) That is, the pre-/post- treatment differences found in placebo groups are not as attributable to participants' expectations of improvement as they are to expectable regression to the mean. (Hengartner 2020.)

2. When a 'no treatment control group' is untenable, RCTs use an 'active comparator' group instead.

49. It is not always possible to compare a group receiving a treatment to a group receiving only an inactive procedure, such as a placebo treatment or no treatment at all. In such situations, the standard, ethical, clinical research method is to compare two active treatments with each other.

50. The systematic reviews from England explicitly called for 'active comparator' studies to test whether medicalized transition of minors shows mental health benefits superior to those obtained from psychotherapy. (NICE 2020a at 40; NICE 2020b at 47.) Risk:benefit analysis cannot justify the greater risks associated with medicalization without evidence of correspondingly greater benefit.

D. Cohort studies are the highest level of evidence about medicalized transition currently available.

51. The highest-level study of medicalized transition of minors conducted thus far are cohort studies: gathering a sample of individuals who chose to undergo treatment and tracking them over time. Cohort studies are able to answer some questions that lower-level studies cannot, such as whether a high-functioning group improved over time versus having been composed of people who were already high-functioning. Cohort studies are, however, unable to demonstrate causality, to identify how much of any change was due to regression to the mean, or to detect any placebo effects.

E. Expert opinion represents the least reliable evidence.

52. As Figure 1 illustrates, evidence-based medicine opinion based on clinical experience is identified as the *least* reliable source of medical knowledge. Among other reasons, this is because non-systematic recollections of unstructured clinical experiences with self-selected clientele in an uncontrolled setting is the most subject to bias. Indeed, mere "clinical experience" was long the basis of most medical and mental health clinical decisions, and it was precisely the scientific and clinical inadequacy of this type of "knowledge" that led to the development and widespread acceptance of the importance of

evidence-based medicine. As Dr. Guyatt has written, "EBM places the unsystematic observations of individual clinicians lowest on the hierarchy," both because EBM "requires awareness of the best available evidence," and because "clinicians fall prey to muddled clinical reasoning and to neglect or misunderstanding of research findings." (Guyatt 2015 at 10, 15.)

F. Surveys and cross-sectional studies cannot demonstrate treatment effectiveness.

53. Surveys represent observational research rather than experimental research. (In science, experiments are studies involving a manipulation, not merely observation, by the researcher.) Surveys and cross-sectional studies can provide only correlational data and cannot demonstrate causality. (See Section IV below.) It is not possible for a survey to yield evidence that a treatment is effective. No number of surveys can test a treatment, advancing it from 'experimental' to 'established' status.

54. Survey studies do not even appear on the *pyramid of evidence.* In accordance with the routine standards, systematic reviews of treatment studies exclude surveys.

IV. Methodological defects limit or negate the evidentiary value of many studies of treatments for gender dysphoria in minors.

A. In science, to be valid, a claim must be objective, testable, and falsifiable.

55. In behavioral science, people's self-reports do not represent objective evidence. It is when emotional and other pressures are strongest that the distinction between and need for objective over subjective evidence is greatest. Surveys do not represent objective evidence. This is especially true of non-random surveys and polls, recruited through online social networks of the like-minded.

B. Correlation does not imply causation.

56. Studies representing lower levels of evidence are often used because they are faster and less expensive than studies representing higher levels. A disadvantage, however, is that they are often limited to identifying which features are *associated* with which other

features, but they cannot show which ones are *causing* which. It is a standard property of statistical science that when a study reports a correlation, there are necessarily three possible explanations. Assuming the correlation actually exists (rather than represents a statistical fluke or bias), it is possible that X causes Y, that Y causes X, or that there is some other variable, Z, that causes both X and Y. (More than one of these can be true at the same time.) To be complete, a research analysis of a correlation must explore all three possibilities.

57. For example, assuming a correlation between treatment of gender dysphoria in minors and mental health actually exists (rather than is a fluke): (1) It is *possible* that treatment causes improvement in mental health. (2) Yet, it is also possible that having good mental health is (part of) what enabled transition to occur in the first place. That is, because of gate-keeping procedures in the clinical studies, those with the poorest mental health are typically not permitted to transition, causing the higher mental health scores to be sorted into the transitioned group. (See Section IV.E on *Selection Bias*.) (3) It is also possible that a third factor, such as wealth or socioeconomic status, causes both the higher likelihood of transitioning (by being better able to afford it) and the likelihood of mental health (such as by avoiding the stresses of poverty or affording psychotherapy).

58. This principle of scientific evidence is why surveys do not (cannot) represent evidence of treatment effectiveness: Surveys are limited to correlations. (See Section III.F. on *Surveys*.)

C. When two or more treatments are provided at the same time, one cannot know which treatment caused observed changes (i.e., 'confounding').

59. Confounding is a well-known issue in clinical research design. As detailed in the present report, it applies throughout treatment studies of gender dysphoria. Patients who undergo medical transition procedures in research clinics routinely undergo mental health treatment (psychotherapy) at the same time. Without explicit procedures to distinguish them, it cannot be known which treatment produced which outcome (or in what proportions). Indeed, that mental health improvement came from mental health treatment

is a more parsimonious (and therefore, scientifically superior) conclusion than is medicalized treatment causing mental health improvement.

D. Extrapolation to dissimilar populations and dissimilar conditions.

60. The purpose of clinical science is to establish from a finite sample of study participants information about the effectiveness and safety, or other variables, of a treatment that can be generalized to other people. Such extrapolation is only scientifically justified with populations matched on all relevant variables. The identification of those variables can itself be a complicated question, but when an experimental sample differs from another group on variables already known to be related, extrapolation cannot be assumed but must be demonstrated directly and explicitly.

61. Each of the systematic reviews from the UK, Sweden, and Finland emphasized that the recently observed, greatly increased numbers of youth coming to clinical attention are a population different in important respects from the subjects of often-cited research studies. Conclusions from studies of adult-onset gender dysphoria and from childhood-onset gender dysphoria cannot be assumed to apply to the current patient populations of adolescent-onset gender dysphoria. The Cass Report correctly advised:

> It is also important to note that any data that are available do not relate to the current predominant cohort of later-presenting birth-registered female teenagers. This is because the rapid increase in this subgroup only began from around 2014-15. Since young people may not reach a settled gender expression until their mid-20s, it is too early to assess the longer-term outcomes of this group. (Cass 2022 at 36.)

The report also indicated:

> [I]t is important that it is not assumed that outcomes for, and side effects in, children treated for precocious puberty will necessarily be the same in children or young people with gender dysphoria. (Cass 2022 at 63.)

62. Finland's review repeated the observation of greatly (20 times) increased numbers, an entirely different demographic of cases, and increased proportions of psychiatric co-morbidities. (Finnish Palko Preparation Memo at 4-6.) The Swedish review

highlighted "the uncertainty that follows from the yet unexplained increase in the number of care seekers, an increase particularly large among adolescents registered as females at birth." (Swedish Socialstyrelsen Support 2022 at 11.)

63. It is well known that males and females differ dramatically in the incidence of many mental health conditions and in their responses to treatments for mental health conditions. Thus, research from male-to-female transitioners (the predominant population until recent years) cannot be extrapolated to female-to-male transitioners (the predominant population presenting at clinics today). Outcomes from patients who experienced clear pre-pubertal childhood gender dysphoria cannot be extrapolated to patients who first manifest diagnosable gender dysphoria well into puberty. Outcomes from clinics employing rigorous and openly reported gate-keeping procedures cannot be extrapolated to clinics or clinicians employing only minimal or perfunctory assessments without external review. Developmental trajectories and outcomes from before the social media era cannot be assumed to apply to those of the current era or the future. Research from youth with formal diagnoses and attending clinics cannot be extrapolated to self-identifying youth and those responding to surveys advertised on social media sites.

64. Further, treatment of gender dysphoria in children and adolescents presents novel-use cases very dissimilar to the contexts in which puberty blockers and cross-sex hormones have previously been studied. Whereas use of puberty blockers to treat precocious puberty *avoids* the medical risks caused by undergoing puberty growth before the body is ready (thus outweighing other risks), use of blockers to treat gender dysphoria in patients already at their natural puberty pushes them *away* from the mean age of the healthy population. Instead of avoiding an objective problem, one is created: Among other things, patients become subject to the issues and risks associated with being late-bloomers, *very* late-bloomers. This transforms the risk:benefit balance, where the offsetting benefit is primarily (however validly) cosmetic.

65. Similarly, administering testosterone to an adult male to treat testosterone deficiency addresses both a different condition and a different population than

administration of that same drug to an adolescent female to treat gender dysphoria; the benefits and harms observed in the first case cannot be extrapolated to the second.

E. Mental health assessment used for gate-keeping medicalized transition establishes a *selection bias,* creating a statistical illusion of mental health improvement among the selected.

66. Importantly, clinics are expected to conduct mental health assessments of applicants seeking medicalized transition, disqualifying from medical services patients with poor mental health. (The adequacy of the assessment procedures of specific clinics and clinicians remains under debate, however.) Such gate-keeping—which was also part of the original "Dutch Protocol" studies—can lead to misinterpretation of data unless care is explicitly taken. A side-effect of excluding those with significant mental health issues from medical transition is that when a researcher compares the average mental health of the gender dysphoric individuals first presenting to a clinic with the average mental health of those who completed medical transition, then the post-transition group would show better mental health—but only because of the *selection bias*, (Larzelere 2004; Tripepi 2010) even when the transition had no effect at all.

V. Childhood-onset gender dysphoria (prepubertal-onset) is characterized by high rates of desistance in the absence of social or medical transition. Of the 11 existing cohort studies, all showed the majority to desist feeling gender dysphoric upon follow-up after puberty.

67. Currently, the studies of outcomes among children who experience gender dysphoria before puberty that provide the most evidentiary strength available are only "cohort studies," which follow people over time, recording the outcomes of the treatments they have undergone. Such studies supersede (i.e., overrule) the outcomes of surveys, which are much more prone to substantial error. As I have explained above, however, cohort studies can describe developmental pathways, but cannot provide evidence of causation.

68. In total, there have been 11 cohort studies showing the outcomes for these

children, listed in Table 2. I first published this comprehensive list of studies in my own peer-reviewed article on the topic. (Cantor 2019.)

Table 2. Cohort studies of gender dysphoric, prepubescent children.

Count	Group	Study
2/16 4/16 10/16	gay trans-/crossdress straight/uncertain	Lebovitz, P. S. (1972). Feminine behavior in boys: Aspects of its outcome. *American Journal of Psychiatry, 128,* 1283–1289.
2/16 2/16 12/16	trans- uncertain gay	Zuger, B. (1978). Effeminate behavior present in boys from childhood: Ten additional years of follow-up. *Comprehensive Psychiatry, 19,* 363–369.
0/9 9/9	trans- gay	Money, J., & Russo, A. J. (1979). Homosexual outcome of discordant gender identity/role: Longitudinal follow-up. *Journal of Pediatric Psychology, 4,* 29–41.
2/45 10/45 33/45	trans-/crossdress uncertain gay	Zuger, B. (1984). Early effeminate behavior in boys: Outcome and significance for homosexuality. *Journal of Nervous and Mental Disease, 172,* 90–97.
1/10 2/10 3/10 4/10	trans- gay uncertain straight	Davenport, C. W. (1986). A follow-up study of 10 feminine boys. *Archives of Sexual Behavior, 15,* 511–517.
1/44 43/44	trans- cis-	Green, R. (1987). The "sissy boy syndrome" and the development of homosexuality. New Haven, CT: Yale University Press.
0/8 8/8	trans- cis-	Kosky, R. J. (1987). Gender-disordered children: Does inpatient treatment help? *Medical Journal of Australia, 146,* 565–569.
21/54 33/54	trans- cis-	Wallien, M. S. C., & Cohen-Kettenis, P. T. (2008). Psychosexual outcome of gender-dysphoric children. *Journal of the American Academy of Child and Adolescent Psychiatry, 47,* 1413–1423.
3/25 6/25 16/25	trans- lesbian/bi- straight	Drummond, K. D., Bradley, S. J., Badali-Peterson, M., & Zucker, K. J. (2008). A follow-up study of girls with gender identity disorder. *DevelopmentalPsychology, 44*, 34–45.
47/127 80/127	trans- cis-	Steensma, T. D., McGuire, J. K., Kreukels, B. P. C., Beekman, A. J., & Cohen-Kettenis, P. T. (2013). Factors associated with desistence and persistence of childhood gender dysphoria: A quantitative follow-up study. *Journal of the American Academy of Child and Adolescent Psychiatry, 52,* 582–590.
17/139 122/139	trans- cis-	Singh, D., Bradley, S. J., Zucker, K. J. (2021). A follow-up study of boys with Gender Identity Disorder. *Frontiers in Psychiatry*, 12:632784.

*For brevity, the list uses “gay” for “gay and cis-”, “straight” for “straight and cis-”, etc.

69. The children in these studies were receiving professional mental health support during the study period, but did not "socially transition." In sum, despite coming from a variety of countries, conducted by a variety of labs, using a variety of methods, at various times across four decades, every study without exception has come to the identical conclusion: among prepubescent children who feel gender dysphoric, the majority cease to want to be the other gender over the course of puberty—ranging from 61–88% desistance across the large, prospective studies. Such cases are often referred to as "desisters," whereas children who continue to feel gender dysphoric are often called "persisters."

70. This interpretation of these studies is widely accepted, including by the Endocrine Society, which concluded:

> In most children diagnosed with GD/gender incongruence, it did not persist into adolescence. . . . [T]he large majority (about 85%) of prepubertal children with a childhood diagnosis did not remain GD/gender incongruent in adolescence. (Hembree 2017 at 3879.)

The developers of the Dutch Protocol, at the Vrije University gender clinic, likewise concluded based on these studies that "Although the persistence rates differed between the various studies…the results unequivocally showed that the gender dysphoria remitted after puberty in the vast majority of children." (Steensma & Cohen-Kettenis 2011 at 2.)

VI. Systematic reviews of safety and effectiveness have been conducted by the health care ministries/departments of several governments. They *unanimously* concluded the evidence on medicalized transition in minors to be of poor quality.

A. Understanding safety and efficacy.

71. At the outset, it is important to understand the meaning of "safety" in the clinical context. The criteria for assessing safety involve two independent components, and

discussion of the safety of hormonal interventions on the natural development of children requires consideration of both of them. The term *safety* in the clinical context represents a "risk:benefit ratio," not an absolute statement that can be extrapolated across applications. In clinical research, assessing safety requires simultaneous consideration of both components of the risk:benefit ratio. That is, treatments are not deemed simply "safe" or "unsafe." These dual components are reflected in FDA regulation:

> There is reasonable assurance that a device is safe when it can be determined, based upon valid scientific evidence, that *the probable benefits* to health from use of the device for its intended uses and conditions of use, when accompanied by adequate directions and warnings against unsafe use, outweigh *any probable risks*. (Code of Federal Regulations Title 21 Sec. 860.7, italics added.)

72. Thus, for example, as I explain in further detail below, because the Endocrine Society did not undertake (or rely on) any systematic review of the efficacy of hormonal interventions to relieve gender dysphoria in minors (i.e., their benefits), and WPATH did not undertake (or rely on) any systematic review of the safety of hormonal interventions in minors (i.e., their risks), neither gathered the evidence necessary to assess the risk:benefit ratio of medicalized transition in minors.

73. In fact, as I also review below, after conducting systematic reviews, the English, Finnish, and Swedish national health care institutions all concluded that there is insufficient evidence to determine that hormonal interventions as treatments for gender dysphoria in minors are safe. Reasons for these consistent conclusions include lack of research, insufficient research quality among the existing investigations, and insufficient investigation of long-term safety.

74. To understand the uniform conclusions of these national health care bodies, it is

important to understand that—at least where there is *prima facie* reason to be concerned that certain harms may result—when the research has not been done, the absence of evidence cannot be taken as evidence of the absence of such harms. "We don't know" does not permit the conclusion "It is safe."

B. The McMaster University systematic review of systematic reviews.

75. McMaster University is recognized as a center of expertise in the performance of methodologically sound systematic reviews. In 2022, authors associated with that McMaster University team (Dr. Romina Brignardello-Petersen and Dr. Wojtek Wiercioch) conducted a systematic review, "Effects of gender affirming therapies in people with gender dysphoria: evaluation of the best available evidence," spanning all the available systematic reviews in this area, including their methodological strength, the evidence they cited, and the conclusions they reached. (Brignardello-Petersen & Wiercioch 2022.) Applying carefully disclosed criteria and methods, they identified on-point systematic reviews, and graded the methodological quality of each on-point review as high, moderate, low, or critically low. With regard to systematic reviews relating to the effects of puberty blockers or cross-sex hormones, the authors included in their analysis all reviews that achieved at least a "low" rating of methodological quality, while excluding those rated as "very low." No systematic reviews earned a "high" methodological rating, except a review performed by the highly respected Cochrane Library of the effects of cross-sex hormones on transitioning natal males (Haupt 2020), but that most careful review in turn found *no* published studies on this topic of sufficient methodological soundness to satisfy its inclusion criteria and thus merit review. After this careful review of the data and analysis contained in available systematic reviews, the McMaster authors concluded:

> Due to important limitations in the body of evidence, there is great uncertainty about the effects of puberty blockers, cross-sex hormones, and surgeries in young people with gender dysphoria. This evidence alone is not sufficient to support

whether using or not using these treatments. (Brignardello-Petersen & Wiercioch 2022 at 5.)

C. The quality of the systematic reviews from governmental bodies and professional associations.

76. To ensure consideration of all available evidence, I compiled into a single table all the cohort studies of safety and effectiveness included by any of the systematic reviews from the international health care systems and (although they were incomplete) by the U.S.-based clinical associations issuing guidelines or standards. I discuss their specific findings in the following sections.

77. New studies continue to be conducted and published. I have identified two additional studies that were published after these reviews were released, but that meet their inclusion criteria: Tordoff, *et al.,* 2022, and Chen, *et al.,* 2023. The findings from both these studies are consistent with those already included and are noted here for completeness.

Table 1. Cohort studies of effectiveness and safety of puberty-blockers and cross-sex hormones in minors.

	Finland (2019)	NICE (2020a,b)	Sweden (2022)	E.S. (2017)	AAP (2018)	Baker (2021) (WPATH)
Effectiveness GnRHa	Costa et al, 2015 de Vries et al, 2011	Costa et al, 2015 de Vries et al, 2011	Becker-Hebly et al, 2020 Carmichael et al, 2021 Costa et al, 2015 *** Hisle-Gorman et al, 2021			de Vries et al, 2011
Effectiveness Sex Hormones	de Vries et al, 2014*	Achille et al, 2020 Allen et al, 2019 Kaltiala et al, 2020 Lopez de Lara et al, 2020	*** *** Cantu et al, 2020* de Vries et al, 2014* ***			Achille et al, 2020 de Vries et al, 2014* López de Lara et al, 2020
Safety (Bones) GnRHa		Brik et al, 2020 Joseph et al, 2019 Khatchadourian et al, 2014 Klink et al, 2015 Vlot et al, 2017	Joseph et al, 2019 Klink et al, 2015 Navabi et al, 2021 Schagen et al, 2020 Stoffers et al, 2019 Vlot et al, 2017 Lee et al, 2020 van der Loos et al, 2021			
Safety (Bloods) GnRHa		Klaver et al, 2020 Schagen et al, 2016	Klaver et al, 2018 Klaver et al, 2020 Nokoff et al, 2020 Perl et al, 2020 Schagen et al, 2016 Schulmeister et al, 2021			
Safety (Bones) Sex Hormones	****	Khatchadourian et al, 2014 Klaver et al, 2020 Klink et al, 2015 Kuper et al, 2020 Stoffers et al, 2019 Vlot et al, 2017		Klink et al, 2015		
Safety (Bloods) Sex Hormones			Jarin, 2017 Mullins et al, 2021 Tack et al, 2016			

*Included both puberty-blockers and cross-sex hormones.
**The Endocrine Society review included bone/skeletal health, but did not explicate whether the scope included minors.
***Sweden explicitly excluded due to high risk of bias: Achille, *et al.,* (2020), Allen, *et al.* (2019), de Vries, *et al.,* (2011), and López de Lara, *et al.,* (2020).
****The Finnish review adopted the Endocrine Society review, but did not indicate whether minors were included.

D. United Kingdom

78. The National Health Service (NHS) of the United Kingdom conducted an independent review of its services for minors with gender dysphoria. (Cass 2022.) Included in that process were two systematic, comprehensive reviews of the research literature, conducted by England's National Institute for Health Care Excellence (NICE) in 2020. One regarded the efficacy, safety, and cost-effectiveness of Gonadotrophin-Releasing Hormone (GnRH) analogs (or "puberty blockers") in minors. (NICE 2020a.) The other regarded the efficacy, safety, and cost-effectiveness of cross-sex hormones, or "gender-affirming hormones," in minors. (NICE 2020b.) (Only efficacy and safety are relevant to the present report.)

79. The puberty-blocker review was tasked with reviewing the research on two relevant questions. For one:

> *In children and adolescents with gender dysphoria, what is the clinical effectiveness of treatment with GnRH analogues compared with one or a combination of psychological support, social transitioning to the desired gender or no intervention?* (NICE 2020a at 4.)

Clinical effectiveness of puberty-blockers was composed of three factors deemed "critical outcomes": impact on gender dysphoria, impact on mental health, and impact on quality of life. The second question addressed in the review was:

> *In children and adolescents with gender dysphoria, what is the short-term and long-term safety of GnRH analogues compared with one or a combination of psychological support, social transitioning to the desired gender or no intervention?* (NICE 2020a at 6.)

Puberty-blocker safety was assessed as its effect on three categories of health: bone density, cognitive development or functioning, and "other."

80. The second review, for cross-sex hormone treatment, was tasked with the corresponding questions. For one:

> *In children and adolescents with gender dysphoria, what is the clinical effectiveness of treatment with gender-affirming hormones compared with one or a combination of psychological support, social transitioning to the desired gender or no intervention?* (NICE 2020b at 4.)

The critical outcomes were again deemed to be impact on gender dysphoria, on mental health, and on quality of life. The impact on mental health was composed of indicators of depression, anxiety, and suicidality and self-injury. The second question was:

> *In children and adolescents with gender dysphoria, what is the short-term and long-term safety of gender-affirming hormones compared with one or a combination of psychological support, social transitioning to the desired gender or no intervention?* (NICE 2020b at 7.)

Cross-sex hormone treatment safety was assessed as its effect on bone density and on "clinical parameters," which included insulin, cholesterol, and blood pressure levels.

81. These two reviews included a systematic consolidation of all the research evidence, following established procedures for preventing the "cherry-picking" or selective citation favouring or down-playing any one conclusion, carefully setting out the criteria for including or excluding specific studies from the review, and providing detailed analyses of each included study. The whole was made publicly available, consistent with good practice.

82. The reviews' results were unambiguous: For both puberty blockers and cross-sex hormones, "The critical outcomes for decision making are the impact on gender dysphoria, mental health and quality of life." The quality of evidence for these outcomes was assessed as "very low" using the established GRADE procedures for assessing clinical research evidence. (NICE 2020a at 4; NICE 2020b at 4.) The reviews also assessed as "very low" the quality of evidence regarding "body image, psychosocial impact, engagement with health care services, impact on extent of satisfaction with surgery and stopping treatment" or (in the case of cross-sex hormones) of "detransition." (NICE 2020a at 5; NICE 2020b at 6.) The review of puberty blockers concluded that of the existing research, "The studies included in this evidence review are all small, uncontrolled observational

studies, which are subject to bias and confounding," "They suggest little change with GnRH analogues [puberty blockers] from baseline to follow-up." (NICE 2020a at 13.) The cross-sex hormone review likewise reported a lengthy list of methodological defects or limitations affecting all available studies. (NICE 2020b at 13-14.)

83. The NHS changed the language on its website describing puberty blockers and cross sex hormones. It removed the statement that "The effects of treatment with GnRH analogues are considered to be fully reversible,"[2] replacing that text with:[3]

> Little is known about the long-term side effects of hormone or puberty blockers in children with gender dysphoria. . . . [I]t is not known what the psychological effects may be. It's also not known whether hormone blockers affect the development of the teenage brain or children's bones.

84. As mentioned in the McMaster review, the highly respected Cochrane Library, based in England, undertook a systematic review of studies of the safety and efficacy of the administration of cross-sex hormones to natal males. That review focused primarily on adults (age 16 and older). The results, including a detailed explanation of methodology and inclusion criteria, were published in 2020. Unfortunately, but importantly, the Cochrane review found *zero* studies, globally, that were sufficiently reliable to meet the inclusion criteria even at a "very low" level of evidentiary quality. The authors reported:

> Despite more than four decades of ongoing efforts to improve the quality of hormone therapy for women in transition, we found that no RCTs or suitable cohort studies have yet been conducted to investigate the efficacy and safety of hormonal treatment approaches for transgender women in transition….We found insufficient evidence to determine the efficacy or safety of hormonal treatment approaches…for transgender women in transition. The evidence is very incomplete, demonstrating

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[2] BBC. Retrieved from https://www.bbc.co.uk/sounds/play/m000kgsj; Kurkup, J. (2020, June 4). *The Spectator.* Available from https://www.spectator.co.uk/article/the-nhs-has-quietly-changed-its-trans-guidance-to-reflect-reality/

[3] NHS. Retrieved from https://www.nhs.uk/conditions/gender-dysphoria/treatment/

> a gap between current clinical practice and clinical research. (Haupt 2020 at 10-11.)

The authors' frustration at the total lack of reliable research was evident: "The lack of reliable data on hormone therapy for transitioning transgender women should encourage the development of well-planned RCTs and cohort studies to evaluate widespread empirical practice in the treatment of gender dysphoria." (Haupt 2020 at 10.)

E. Sweden

85. Sweden similarly commissioned a systematic review, published in 2022 and charged with addressing these three questions:

> *Are there any scientific studies explaining the increase in numbers seeking for gender dysphoria?*
>
> *Are there any scientific studies on long-term effects of treatment for gender dysphoria?*
>
> *What scientific papers on diagnosis and treatment of gender dysphoria has been published after the National Board of Health and Welfare in Sweden issued its national support for managing children and adolescents with gender dysphoria in 2015?* (SBU Scoping Review Summary 2019.)

The databases searched included CINAHL (EBSCO), Cochrane Library (Wiley), EMBASE (Embase.com), PsychINFO (EBASCO), PubMed (NLM), Scopus (Elsevier), and SocINDEX (EBSCO). A total of 8,867 abstracts were identified, from which 315 full text articles were assessed for eligibility. The review concluded that "literature on management and long-term effects in children and adolescents is sparse," that no RCTs have been conducted, and that there remains no explanation for the recent and dramatic increases in numbers of minors presenting with gender dysphoria. (SBU Scoping Review Summary 2019.) I have quoted other conclusions from the Swedish systematic review in Section II above.

F. Finland

86. Finland's Ministry of Social Affairs and Health commissioned a systematic review, completed in 2019, of the effectiveness and safety of medicalized transition.

(COHERE Recommendation 2020.) The review spanned both minors and adults and included both puberty blockers and cross-sex hormones (Pasternack 2019). Three reviewers tabulated the results. In total, 38 studies were identified, of which two pertained to minors: de Vries (2011) and Costa (2015). The report noted that, because the methodological quality of the studies was already "weak" (no study including any control groups), the assessors declined detailed quality assessment of the existing studies. (Pasternack 2019 at 3.) I have quoted other conclusions from the Finnish systematic review in Section II above.

G. Norway

87. Norway's investigation of its health care policy for gender dysphoric minors also revealed substantial safety concerns:

> There are unsettled questions related to puberty blockers in young people. A published study shows that puberty-inducing hormones cause slower height growth and a slower increase in bone density. It is also noted that the effects on cognitive development have not been mapped. Unexplained side effects and long-term effects of both puberty blockers (hormone treatment) and gender-affirming hormone treatments are increasingly being questioned. However, experience with other patient groups shows that long-term use of sex hormones can affect disease risk. When people with gender incongruence are treated, it is with significantly longer duration and intensity of hormone treatment than hormone treatments for other conditions. (Ukom 2023.)

VII. The Endocrine Society, WPATH, and the American Academy of Pediatrics did not conduct systematic reviews of safety and efficacy in establishing clinical guidelines, despite systematic reviews being the foundation and gold standard of evidence-based care.

88. I have also examined the reviews conducted by the U.S.-based professional associations that have published standards and guidelines for the treatment of gender dysphoric youth. As detailed herein, and unlike the European reviews, none of the U.S.-

based professional associations conducted a systematic review of both effectiveness and safety, without which they are unable to assess the risk:benefit ratio posed by medicalized transition of minors.

A. The Endocrine Society reviewed cross-sex hormones, but not puberty blockers. They reviewed safety, but did not review effectiveness research.

89. The Endocrine Society appointed a task force which commissioned two systematic reviews as part of updating their 2009 recommendations. (Hembree 2017.) The scopes of the two reviews were limited to physiological effects of cross-sex hormones, narrowly defined: "The first one aimed to summarize the available evidence on the effect of sex steroid use in transgender individuals on lipids and cardiovascular outcomes….The second review summarized the available evidence regarding the effect of sex steroids on bone health in transgender individuals." (Hembree 2017 at 3873.) As described in the Endocrine Society Guidelines, those reviews did not, however, include the effectiveness of any treatment on mental health (quality of life, suicidality, rates of detransition, cosmetic or functional outcomes, or improvements in feelings of gender dysphoria). What appears to be the referenced review of lipids and cardiovascular outcomes (Maraka 2017) did not identify any study of adolescents, noting "literature addressing this clinical question in the pediatric/adolescent population is completely lacking." (Maraka at 3921.) What appears to be the referenced review of bone health (Singh-Ospina 2017) identified only one small study on adolescents, involving 15 male-to-female and 19 female-to-male cases. (Klink 2015.) Notably, the median duration of puberty-blocker administration was 1.2 years, leaving unknown the effects on children receiving blockers from puberty onset (usually age 9–10) to age 14 or 16.

90. Further, the Endocrine Society does not claim to have conducted or consulted any systematic review of the efficacy of puberty blockers or cross-sex hormones to reduce gender dysphoria or increase mental health or well-being by any metric. Nor does it claim to have conducted or consulted any systematic review of safety of any of these treatments

for minors with respect to brain development, future fertility, actual reversibility, or any other factor of safety or adverse event other than cardiovascular disease and bone strength.

91. For all these reasons, I concur with the opinion of Dr. Guyatt, who has said that he finds "serious problems" with the Endocrine Society guidelines, among other reasons because the only systematic reviews those guidelines refer to did not look at the efficacy of the recommended hormonal interventions to improve gender dysphoria, which he termed "the most important outcome." (Block, Gender Dysphoria 2023 at 4.)

92. The current Endocrine Society guidelines, released in 2017, include this disclaimer:

> The Endocrine Society makes no warranty, express or implied, regarding the guidelines and specifically excludes any warranties of merchantability and fitness for a particular use or purpose. The Society shall not be liable for direct, indirect, special, incidental, or consequential damages related to the use of the information contained herein. (Hembree 2017 at 3895.)

The previous, 2009, version included no disclaimers. (Hembree 2009.)

B. WPATH reviewed effectiveness, but not the safety of medicalized transition of minors.

93. WPATH engaged in a multi-step process in updating its Standards of Care from version 7 to version 8. That process included commissioning a systematic review, which was published as Baker, *et al.* (2021) which included the disclaimer "The authors are responsible for its content. Statements in this report do not necessarily reflect the official views of or imply endorsement by WPATH." (Baker 2021 at 14.)

94. The literature search was completed in June 2020, and spanned 13 questions. Two questions related to the effectiveness of medicalized transition of minors: Question #10 was "[W]hat are the effects of suppressing puberty with GnRH agonists on quality of life?", and question #11 was "[W]hat are the psychological effects (including quality of life) associated with hormone therapy?"(Sharma 2018; Baker 2021.) That is, the review included studies of the effectiveness of puberty blockers and cross-sex hormones, but,

remarkably did not include any effort to determine the *safety* of either.

95. Baker (2021) identified that among all experimental evidence published on medicalized transition, a total of “Three studies focused on adolescents.” (Baker 2021 at 1.) These were Achille, *et al.* (2020), López de Lara, *et al.* (2020), and de Vries, *et al.* (2011, 2014). (Baker 2021 considered the two de Vries articles as a single study, because the later one included the subset of patients from the earlier one who continued in treatment. I will refer to this set as four studies, however, to be consistent with the other reviews.) Notably, in contrast with WPATH’s review, the Swedish review entirely excluded Achille *et al.* (2020), López de Lara *et al.* (2020), and de Vries *et al.* (2011) due to their high risks of bias. (SBU Scoping Review Appendix 2.) The Baker team did not used the GRADE system for assessing the quality of evidence, instead using the Methods Guide for Conducting Comparative Effectiveness Reviews.

96. The Baker team noted “no study reported separate results by gender identity for transgender youth.” (Baker 2021 at 3.) They also found that “No study reported on hormone therapy among nonbinary people.” (at 3.) (Despite this finding, WPATH SOC-8 now includes recommendations for people who identify as nonbinary.)

97. My assessment of the Baker review revealed that there were substantial discrepancies and misleading ambiguities in their reporting: Baker, *et al.* indicated in the abstract that “Hormone therapy was associated with increased QOL [quality of life], decreased depression, and decreased anxiety” (Baker 2021 at 1,) and that “Associations were similar across gender identity and age” (Baker 2021 at 12). This is not what its actual data tables showed, however. Table 2 presented the only study of QOL specifically among adolescents included in the review and indicated that “Mean QOL scores did *not* change.” (Baker 2021 at 7, italics added.)

98. The review, however, did not rate the quality of the studies of adolescents on their own, instead combining them with the studies of adults. (at 10, italics added.) Table 4 of that study presented three analyses of anxiety: One showed a decrease, and on the other two, “Mean anxiety score did *not* change.” (at 11, italics added.) Finally, the review

also concluded, "It was impossible to draw conclusions about the effects of hormone therapy on death by suicide." (at 12.) Even for the combined set, the review read the strength of evidence to be "low" for each of QOL, depression, and anxiety, and to be "insufficient" for death by suicide. (Baker 2021 at 13, Table 6.) Specifically, the review indicated, "There is insufficient evidence to draw a conclusion about the effect of hormone therapy on death by suicide among transgender people." (at 13, Table 6.) Overall, "The strength of evidence for these conclusions is low due to methodological limitations." (at 12.) Of particular concern was that "Uncontrolled confounding was a major limitation in this literature." (at 12.)

99. Additionally, although WPATH commissioned the Baker review, WPATH did not follow its results. Baker 2021 indicated the use of two systematic quality assessment methods, called RoB 2 and ROBINS-I (Baker 2021 at 3); however, WPATH modified the conclusions that that process yielded. WPATH SOC-8 states, "This evidence is not only based on the published literature (direct as well as background evidence) but also on consensus-based expert opinion." (Coleman 2022 at S8.) Moreover:

> Recommendations in the SOC-8 are based on available evidence supporting interventions, a discussion of risks and harms, as well as feasibility and acceptability within different contexts and country settings. Consensus on the final recommendations was attained using the Delphi process that included all members of the guidelines committee and required that recommendation statements were approved by at least 75% of members. (Coleman 2022 at S8.)

100. By allowing "consensus-based expert opinion" to modify or overrule conclusions supported by systematic reviews that apply accepted criteria of evidentiary strength, WPATH has explicitly abandoned evidence-based medicine. As indicated already by the Pyramid of Evidence, "expert opinion" represents the *lowest* level of evidence in science, whereas systematic review, the highest. (Also, it is unclear what the authors mean by "background evidence.") To modify systematic results according to committee opinion is to re-introduce the very biases that the systematic process is meant to overcome. The

WPATH document attempts to claim the authority of a systematic review, while reserving the ability to "overrule" results that WPATH members did not like.

101. As to evidence supporting hormonal interventions in minors, WPATH asserted that "a systematic review regarding outcomes of [hormonal] treatment in adolescents is not possible" due to the lack of "outcome studies that follow youth into adulthood." (Coleman 2022 at S46.) WPATH is correct that essential outcome studies have not been done, but incorrect that this authorizes issuance of guidelines or standards in the absence of a systematic review. As Dr. Guyatt has stated, "systematic reviews are always possible"—and indeed an important conclusion from such a review may be (as here) that insufficient evidence exists to support any evidence-based guideline. As Dr. Guyatt further elaborated, if an organization issues recommendations without performing an on-point systematic review, "they'd be violating standards of trustworthy guidelines." (Block, Dysphoria Rising, 2023 at 3.)

102. Finally, the WPATH SOC-8 were revised immediately after their release, removing all age minimums to all recommendations. None of these studies and none of these reviews support such a change, and WPATH cites no studies or other document in support of the change.

103. In sum, the WPATH SOC8 cannot be called evidence-based guidelines under any accepted meaning of that term.

C. The American Academy of Pediatrics did not conduct a systematic review either of safety or effectiveness.

104. While the AAP policy statement is often referenced, the AAP did not report conducting any systematic review of any aspect of transgender care in producing its policy statement on gender-diverse children and adolescents. (Rafferty 2018.) Further, the AAP policy statement on its face is the work of a single author rather than of any committee or the membership more broadly (Dr. Rafferty "conceptualized," "drafted," "reviewed," "revised," and "approved" the statement), and the statement explicitly states that it does not "indicate an exclusive course of treatment" nor "serve as a standard of medical care."

(Rafferty 2018 at 1.)

VIII. Definitions of sex, gender identity, and gender dysphoria.

A. Sex and sex-assigned-at-birth represent objective features.

105. Sex is an *objective* feature: It can be ascertained regardless of any declaration by a person, such as by chromosomal analysis or visual inspection. Gender identity, however, is *subjective:* There exists no means of either falsifying or verifying people's declarations of their gender identities. In science, it is the objective factors—and only the objective factors—that matter to a valid definition. Objectively, sex can be ascertained, not only in humans or only in the modern age, but throughout the animal kingdom and throughout its long history in natural evolution.

106. I use the term "sex" in this report with this objective meaning, which is consistent with definitions articulated by multiple medical organizations:

Endocrine Society (Bhargava 2021 at 220.)

> "Sex is dichotomous, with sex determination in the fertilized zygote stemming from unequal expression of sex chromosomal genes."

American Academy of Pediatrics (Rafferty 2018 at 2 Table 1.):

> "An assignment that is made at birth, usually male or female, typically on the basis of external genital anatomy but sometimes on the basis of internal gonads, chromosomes, or hormone levels."

American Psychological Association (APA Answers 2014):

> "Sex is assigned at birth, refers to one's biological status as either male or female, and is associated primarily with physical attributes such as chromosomes, hormone prevalence, and external and internal anatomy."

American Psychological Association (APA Resolution 2021 at 1):

> "While gender refers to the trait characteristics and behaviors culturally associated with one's sex assigned at birth, in some cases, gender may be distinct from the physical markers of biological sex (e.g., genitals, chromosomes)."

American Psychiatric Association (Am. Psychiatric Ass'n Guide):

> "Sex is often described as a biological construct defined on an anatomical, hormonal, or genetic basis. In the U.S., individuals are assigned a sex at birth based on external genitalia."

107. The phrases "assigned male at birth" and "assigned female at birth" are increasingly popular, but they lack any scientific merit. Science is the systematic study of natural phenomena, and nothing objective changes upon humans' labelling or re-labelling it. That is, the objective sex of a newborn was the same on the day before as the day after the birth. Indeed, the sex of a fetus is typically known by sonogram or amniocentesis many months before birth. The use of the term "assign" insinuates that the label is arbitrary and that it was possible to have been assigned a different label that is equally objective and verifiable, which is untrue. Infants were born male or female before humans invented language at all. Indeed, it is exactly because an expected child's sex is known before birth that there can exist the increasingly popular "gender reveal" events. Biologically, the sex of an individual (for humans and almost all animal species) as male or female is irrevocably determined at the moment it is conceived. Terms such as "assign" obfuscate rather than clarify the objective evidence.

B. Gender identity refers to subjective feelings that cannot be defined, measured, or verified by science.

108. It is increasingly popular to define gender identity as a person's "inner sense," however, neither "inner sense" nor any similar phrase is scientifically meaningful. In science, a valid construct must be both objectively measurable and falsifiable with objective testing. The concept of an "inner sense" fits none of these requirements.

IX. Suicide and suicidality are distinct phenomena representing different mental health issues and indicating different clinical needs.

109. *Suicide* refers to completed suicides and the sincere intent to die. It is substantially associated with impulsivity, using more lethal means, and being a biological male. (Freeman 2017.) *Suicidality* refers to *para*-suicidal behaviors, including suicidal

ideation, threats, and gestures.

A. Rates of suicidality among all adolescents have skyrocketed with the advent of social media.

110. The CDC's 2019 Youth Risk Behavior Survey found that 24.1% of female and 13.3% of male high school students reported "seriously considering attempting suicide." (Ivey-Stephenson 2020 at 48.)

111. The CDC survey reported not only that these already alarming rates of suicide attempt were still increasing (by 8.1%–11.0% per year), but also that this increase was occurring only among female students. No such trend was observed among male students. That is, the demographic increasingly reporting suicidality is the same demographic increasingly reporting gender dysphoria. (Ivey-Stephenson 2020 at 51.)

112. The U.S. Substance Abuse and Mental Health Services Administration (SAMHSA) produces a series of evidence-based resource guides which includes their Treatment for Suicidal Ideation, Self-Harm, and Suicide Attempts Among Youth. It noted (italics added):

> [F]rom 1999 through 2018, the suicide death rate doubled for females aged 15 to 19 and 20 to 24. For youth aged 10 to 14, the suicide death rate more than tripled from 2001 to 2018. Explanations for the increase in suicide may include bullying, social isolation, increase in technology and *social media*, increase in *mental illnesses*, and economic recession. (SAMHSA 2020 at 5.)

The danger potentially posed by social media follows from suicidality spreading as a social contagion, as suicidality increases after media reports, occurs in clusters of social groups, and in adolescents after the death of a peer. (Gould & Lake 2013.)

113. Social media voices today loudly advocate "hormones-on-demand" while issuing hyperbolic warnings that teens will commit suicide unless this is not granted. Both adolescents and parents are exposed to the widely circulated slogan that "I'd rather have a living son than a dead daughter," and such baseless threats or fears are treated as a justification for referring to affirming gender transitions as 'life-saving' or 'medically

necessary'. Such claims grossly misrepresent the research literature, however. Indeed, they are unethical: Suicide prevention research and public health campaigns repeatedly warn against circulating messages that can be taken to publicize or even glorify suicide, due to the risk of copy-cat behavior they encourage. (Gould & Lake 2013.)

114. Systematic review of 44 studies of suicidal thoughts and behaviors in LGBTQ youth and suicidality found only a small association between suicidality and sexual minority stress. (Hatchel 2021.) The quantitative summary of the studies (an especially powerful type of systematic review called *meta-analysis*) found no statistically significant association between suicidality and any of having an unsupportive school climate, stigma and discrimination, or outness/openness. There were, however, significant associations between suicidality and indicators of social functioning problems, including violence from intimate partners, victimization from LGBT peers and from non-LGBT peers, and sexual risk taking.

B. ***Suicidality* is substantially more common among females, and *suicide,* among males. Sexual orientation is strongly associated with suicidality, but much less associated with suicide.**

115. Notwithstanding public misconceptions about the frequency of suicide and related behaviors, the highest rates of death by suicide are among middle-aged and elderly men in high income countries. (Turecki & Brent 2016 at 3.) Males are at three times greater risk of death by suicide than are females, whereas suicidal ideation, plans, and attempts are three times more common among females. (Klonsky 2016; Turecki & Brent 2016.) In contrast with completed suicides, the frequency of suicidal ideation, plans, and attempts is highest during adolescence and young adulthood, with reported ideation rates spanning 12.1–33%. (Borges 2010; Nock 2008.) Relative to other countries, Americans report elevated rates of each of suicidal ideation (15.6%), plans (5.4%), and attempts (5.0%). (Klonsky 2016.) Suicide attempts occur up to 30 times more frequently than completed suicides. (Bachmann 2018.) The rate of completed suicides in the U.S. population is 14.5 per 100,000 people. (WHO 2022.)

116. There is substantial research associating sexual orientation with suicidality, but much less so with completed suicide. (Haas 2014.) More specifically, there is some evidence suggesting gay adult men are more likely to die by suicide than are heterosexual men, but there is less evidence of an analogous pattern among lesbian women. Regarding suicidality, surveys of self-identified LGB Americans repeatedly report rates of suicidal ideation and suicide attempts 2–7 times higher than their heterosexual counterparts. Because of this association of suicidality with sexual orientation, one must apply caution in interpreting findings allegedly about gender identity: because of the overlap between people who self-identify as non-heterosexual and as transgender or gender diverse, correlations detected between suicidality and gender dysphoria may instead reflect (be confounded by) sexual orientation. Indeed, other authors have made explicit their surprise that so many studies, purportedly of gender identity, entirely omitted measurement or consideration of sexual orientation, creating the situation where features that seem to be associated with gender identity instead reflect the sexual orientation of the members of the sample. (McNeil 2017.)

C. There is no evidence that medicalized transition reduces rates of suicide or suicidality.

117. It is repeatedly asserted that despite the known risks, despite the lack of research into the reality or severity of unquantified risks, it is essential and "the only ethical response" to provide medical transition to minors because medical transition is known to reduce the likelihood of suicide among minors who suffer from gender dysphoria. This is simply untrue. *No studies* have documented any reduction in suicide rates in minors (or any population) as a result of medical transition. No methodologically sound studies have provided meaningful evidence that medical transition reduces suicidality in minors. Instead, multiple studies show tragically high rates of suicide after medical transition, with that rate beginning to spike several years after medical transition.

118. Among post-transition adults, completed suicide rates remain elevated. (Wiepjes 2020.) Among post-operative transsexual adults in Sweden's highly tolerant society, death

by suicide is 19 times higher than among the cisgendered. (Dhejne 2011.) Systematic review of 17 studies of suicidality in transsexual adults confirmed suicide rates remain elevated even after complete transition. (McNeil 2017.) Among post-operative patients in the Netherlands, long-term suicide rates of six times to eight times that of the general population were observed depending on age group. (Asscheman 2011 at 638.) Also studying patients in the Netherlands, Wiepjes et al. (2020) reported the “important finding” that “suicide occurs similarly” before and after medical transition. (Wiepjes 2020 at 490.) In other words, *transition did not reduce suicide*. A very large dataset from the U.K. GIDS clinic showed that those referred to the GIDS clinic for evaluation and treatment for gender dysphoria committed suicide at a rate five times that of the general population, both before and after commencement of medical transition (Biggs 2022). Finally, in a still-ongoing longitudinal study of U.S. patients, Chen *et al.* have reported a shockingly high rate of completed suicide among adolescent subjects in the first two years *after* hormonal transition, although they provide no pre-treatment data for this population to compare against. (Chen 2023 at 245.)

119. WPATH’s systematic review of the effectiveness of puberty blockers and cross-sex hormones on suicide in minors concluded that “It was impossible to draw conclusions about the effects of [either] hormone therapy on death by suicide.” (Baker 2021 at 12.) In short, I am aware of no respected voice that asserts that medical transition reduces suicide among minors who suffer from gender dysphoria.

120. As to the separate and far more common phenomenon of suicidality, of course, that claim is widely made. McNeil’s systematic review revealed, however, a complicated set of interrelated factors rather than supporting the common hypothesis that rates of suicidal ideation and suicidal attempts would decrease upon transition. Rates of suicidal ideation did not show the same pattern as suicide attempts, male-to-female transitioners did not show the same patterns as female-to-male transitioners, and social transition did not show the same patterns as medical transition. Importantly, the review included one study that reported “a positive relationship between higher levels of social support from

leaders (e.g., employers or teachers) and increased suicide attempt, which they suggested may be due to attempts instigating increased support from those around the person, rather than causing it." (McNeil 2017 at 348.)

121. Moreover, the 2020 Kuper, *et al.* cohort study of minors receiving hormone treatment found *increases* in each of suicidal ideation (from 25% to 38%), attempts (from 2% to 5%), and non-suicidal self-injury (10% to 17%). (Kuper 2020 at Table 5.) Research has found social support to be associated with *increased* suicide attempts, suggesting the reported suicidality may represent attempts to evoke more support. (Bauer 2015; Canetto 2021.)

122. Overall, the research evidence is only minimally consistent with the hypothesis that an absence of transition causes mental health issues and suicide, but very strongly consistent with the hypothesis that mental health issues, such as *Borderline Personality Disorder* (BPD), cause both suicidality and unstable identity formation (including gender identity confusion). BPD is repeatedly documented to be greatly elevated among sexuality minorities (Reuter 2016; Rodriguez-Seiljas 2021; Zanarini 2021), and both suicidality and identity confusion are symptoms of that disorder. Thus, diverting distressed youth towards transition necessarily diverts youth away from receiving the psychotherapies designed for treating the issues actually causing their distress.

123. Despite that mental health issues, including suicidality, are repeatedly required by clinical standards of care to be resolved before transition, threats of suicide are instead oftentimes used as the very justification for labelling transition a "medical necessity". However plausible it might seem that failing to affirm transition causes suicidality, the epidemiological evidence does not support that hypothesis.

X. Neuroimaging studies have associated brain features with sex and with sexual orientation, but not gender identity.

124. Claims that transgender identity is an innate property resulting from brain structure remain unproven. Neuroimaging and other studies of brain anatomy repeatedly identify patterns distinguishing male from female brains, but when analyses search for

those patterns among transgender individuals, "gender identity and gender incongruence could not be reliably identified." (Baldinger-Melich 2020 at 1345.) Although much smaller than male/female differences, statistically significant neurological differences are repeatedly associated with sexual orientation (termed "homosexual" vs "nonhomosexual" in the research literature). Importantly, despite the powerful associations between transsexuality and homosexuality, as explicated by Blanchard, many studies analyzing gender identity failed to control for sexual orientation, representing a problematic and centrally important confound. I myself pointed this out in the research literature, noting that neuroanatomical differences attributed to gender dysphoria should instead be attributed to sexual orientation. (Cantor 2011, Cantor 2012.) A more recent review of the science, by Guillamon, et al. (2016), agreed, stating:

> Following this line of thought, Cantor (2011, 2012, but also see Italiano, 2012) has recently suggested that Blanchard's predictions have been fulfilled in two independent structural neuroimaging studies. Specifically, Savic and Arver (2011) using VBM on the cortex of untreated nonhomosexual MtFs and another study using DTI in homosexual MtFs (Rametti et al., 2011b) illustrate the predictions. *Cantor seems to be right*". (Guillamon 2016 at 1634, italics added; see also Italiano 2012.)

In addition to this confound, because snapshot neurobiological studies can provide only correlational data, it would not be possible for such studies to distinguish whether brain differences cause gender identity or if gender atypical behavior modifies the brain over time, such as through neuroplasticity. As noted by one team of neuroscientists, "[I]t remains unclear if the differences in brain phenotype of transgender people may be the result of a sex-atypical neural development or of a lifelong experience of gender non-conformity." (Fisher 2020 at 1731.) In sum, at present assertions that transgender identity is caused by neurology represent faith, not science.

XI. Known and potential harms associated with administration of puberty blockers and cross-sex hormones to children and adolescents.

A. Hormonal treatments during puberty interfere with neurodevelopment and cognitive development.

125. It is well known that pubertal hormone levels drive important stages of neural development and resulting capabilities, although the mechanisms are not yet well understood. Dr. John Strang (Research Director of the Gender Development Program at Children's National Hospital in Washington, D.C.) (Terhune 2022), the Cass Report from the U.K., and the systematic review from Finland all reiterated the central importance and unknown effects of GnRH-agonists on windows, or "sensitive periods," in brain development, notably including adolescence. As Dr. Cass put it:

> A further concern is that adolescent sex hormone surges may trigger the opening of a critical period for experience-dependent rewiring of neural circuits underlying executive function (i.e. maturation of the part of the brain concerned with planning, decision making and judgement). If this is the case, brain maturation may be temporarily or permanently disrupted by puberty blockers, which could have significant impact on the ability to make complex risk-laden decisions, as well as possible longer-term neuropsychological consequences. To date, there has been very limited research on the short-, medium- or longer-term impact of puberty blockers on neurocognitive development. (Cass Review Letter 2022 at 6.)

126. In a meta-analysis (a highly rigorous type of systematic review) of studies of neuropsychological performance, non-transsexual males undergoing puberty earlier show a different cognitive profile than those underdoing puberty later. The association of brain development with age of pubertal onset exists in humans as well as non-human animals. (Shirazi 2022.)

127. Even in adults, neuroscience studies employing MRI and other methods have shown that the blockade of normal levels of hormones associated with puberty and adulthood degrade brain performance. Thus, when GnRH-agonists are administered to

adult biological women, several brain networks decrease in activity and cognitive performance, such as in working memory, declines. (Craig 2007; Grigorova 2006.)

128. In light of this science, multiple voices have expressed concern that blocking the process of puberty during its natural time could have a negative and potentially permanent impact on brain development (Cass 2022 at 38–39; Chen 2020; Hembree 2017 at 3874.) As Chen *et al.* (2020) observed:

> [I]t is possible these effects are temporary, with youth 'catching up'…However, pubertal suppression may prevent key aspects of development during a sensitive period of brain organization. Neurodevelopmental impacts might emerge over time, akin to the 'late effects' cognitive findings associated with certain [other] oncology treatments. (Chen 2020 at 249.)

Chen et al. (2020) noted that no substantial studies have been conducted to identify such impacts outside "two small studies" (at 248) with conflicting results. I have not identified any systematic review of neurodevelopment or cognitive capacity.

129. A related concern is that by slowing or preventing stages of neural development, puberty blockers may impair precisely the mature cognitive capabilities that would be necessary to evaluation of, and meaningful informed consent to, the type of life-changing impacts that accompany cross-sex hormones.

B. Substantially delayed puberty is associated with medical harms.

130. The research cited by the WPATH Standards of Care includes the evidence that children whose natural puberty started very late (top 2.3% in age) have elevated risks of multiple health issues in adulthood. (Zhu & Chan 2017.) These include elevations in metabolic and cardiovascular disease, lower height, and decreased bone mineral density. It has not been studied whether these correlations also occur in children whose puberty is chemically delayed. Undergoing puberty much later than one's peers is also associated with poorer psychosocial functioning and lesser educational achievement. (Koerselman & Pekkarinen 2018.)

C. Reduced bone density.

131. The systematic reviews by Sweden, Finland, and England all included bone health as an outcome. *The New York Times* also recently commissioned its own independent review of the available studies. (Twohey & Jewett 2022.) These reviews all identified subsets of the same group of eight studies of bone health. (Carmichael 2021; Joseph 2019; Klink 2015; Navabi 2021; Schagen 2020; Stoffers 2019; van der Loos 2021; Vlot 2017.) These studies repeatedly arrived at the same conclusion. As described by *The New York Times* review:

> [I]t's increasingly clear that the drugs are associated with deficits in bone development. During the teen years, bone density typically surges by about 8 to 12 percent a year. The analysis commissioned by *The Times* examined seven studies from the Netherlands, Canada and England involving about 500 transgender teens from 1998 through 2021. Researchers observed that while on blockers, the teens did not gain any bone density, on average—and lost significant ground compared to their peers.[4] (Twohey & Jewett 2022.)

132. There is some evidence that some of these losses of bone health are regained in some of these youth when cross-sex hormones are later administered. The rebounding appears to be limited to female-to-male cases, while bone development remains deficient among male-to-female cases.

133. The long-term effects of the deficient bone growth of people who undergo hormonal interventions at puberty remain unstudied. The trajectory of bone quality over the human lifetime includes decreases during aging in later adulthood. Because these individuals may enter their senior years with already deficient bone health, greater risks of fracture and other issues are expectable in the long term. As the *New York Times'* analysts summarized, "That could lead to heightened risk of debilitating fractures earlier than would be expected from normal aging—in their 50s instead of 60s." Such harms, should they

[4] The eighth study was Lee, *et al.,* 2020, which reported the same deficient bone development.

occur, would not be manifest during the youth and younger adulthood of these individuals. This distinction also represents one of the differences between adult transitioners and childhood transitioners and why their experiences cannot be extrapolated between them.

134. There does not exist an evidence-based method demonstrated to prevent these outcomes. The recommendations offered by groups endorsing puberty blockers are quite limited. As summarized by *The Times:*

> A full accounting of blockers' risk to bones is not possible. While the Endocrine Society recommends baseline bone scans and then repeat scans every one to two years for trans youths, WPATH and the American Academy of Pediatrics provide little guidance about whether to do so. Some doctors require regular scans and recommend calcium and exercise to help to protect bones; others do not. Because most treatment is provided outside of research studies, there's little public documentation of outcomes. (Twohey & Jewett 2022.)

D. Short-term/Immediate side-effects of puberty blockers include sterile abscesses, leg pain, headache, mood swings, and weight gain.

135. The Cass Report summarized that "In the short-term, puberty blockers may have a range of side effects such as headaches, hot flushes, weight gain, tiredness, low mood and anxiety, all of which may make day-to-day functioning more difficult for a child or young person who is already experiencing distress." (Cass 2022 at 38.)

136. In 2016, the U.S. FDA began requiring drug manufacturers to add a warning about the psychiatric side effects, after reports of suicidal ideation and a suicide attempt began to emerge among children prescribed GnRH-agonists (for precocious puberty).[5] The warning label on Lupron reads that "Psychiatric events have been reported in patients…such as crying, irritability, impatience, anger and aggression."

137. Other than the suicide attempt, such adverse effects may seem minor relative to the major health and developmental risks I have reviewed above, and they may be

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[5] Reuters Special Report; 2022, Oct. 6. Retrieved from https://www.reuters.com/investigates/special-report/usa-transyouth-care/

dismissed by children and by parents confronted by fears of suicidality and an urgent hope that transition will resolve the child's unhappiness and mental health issues. However, when assessing risk:benefit ratio for "safety" against the undemonstrated benefits claimed for hormonal interventions, these observed harms should not be ignored.

E. Long-term use of cross-sex hormones in adult transsexuals is associated with unfavorable lipid profiles (cholesterol and triglycerides) and other issues.

138. As the Cass Report correctly and succinctly indicated, "Sex hormones have been prescribed for transgender adults for several decades, and the long-term risks and side effects are well understood. These include increased cardiovascular risk, osteoporosis, and hormone-dependent cancers." (Cass 2022 at 36.)

139. Minors who begin puberty blockers and proceed to cross-sex hormones—as almost all do—will require continuing treatment with cross-sex hormones for life, unless they go through the very difficult process of detransition. Because a lifetime dependence on cross-sex hormones is the expected course, the known adverse effects of cross-sex hormones on adults must also be part of the risk:benefit analysis of the "safety" of putting a minor on cross-sex hormones (and indeed, of the initial decision to put a child on puberty blockers).

140. Systematic review identified 29 studies of the effects of cross-sex hormone treatment on cardiovascular health in adults. (Maraka 2017.) By the two-year follow-up mark among female-to-male transitioners, hormone administration was associated with increased serum triglycerides (indicating poorer health), increased low-density-lipid (LDL) cholesterol (indicating poorer health), and decreased high-density-lipid (HDL) cholesterol (indicating poorer health). Among male-to-female transitioners at the two-year mark, cross-sex hormone treatment was associated with increased serum triglycerides (indicating poorer health).

XII. Assessment of plaintiffs' experts' reports.

141. Dr. Shumer indicated he was an expert witness for the plaintiffs in the following

cases, for which I am an expert witness for the defense: Dekker v Weida, Boe v Marshall, Roe v Utah High School Activities Association, Bridge v Oklahoma Department of Education.

142. Dr. Budge indicated she was an expert witness for the plaintiffs in Bridge v Oklahoma Department of Education. I am an expert witness for the defense in that case, which is currently in process.

A. Dr. Shumer's declaration does not include the evidence upon which an expert would rely for developing an expert opinion.

143. Dr. Shumer's entire declaration included exactly one citation, providing no support whatsoever for the many assertions he asserted. His submission does not provide evidence of meeting any expert or professional standard.

144. In his declaration, Dr. Shumer asserted specific conclusions about the medical status of specific people not under his care, which is a violation of medical ethics. The plaintiffs are not Dr. Shumer's patients. He has not examined them or their medical records. Dr. Shumer has made explicit that his information about them is "based solely on the information that I have been provided by Plaintiff's attorneys." (Shumer ¶15.) He is not able to diagnose their pubertal, hormonal, transgender, or mental health status versus their having been misdiagnosed by the health care providers who did.

B. Dr. Shumer's are unsupported by the research literature and contradict the research literature.

145. Dr. Shumer claimed without support that gender identity "has a strong biological basis" (Shumer ¶19) and is a "largely biological phenomenon" (Shumer ¶22), citing no support for his assertion. As already noted herein, the research has demonstrated a biological basis for sexual orientation, not gender identity. (See Section X. *Neuroimaging Studies.*)

146. Dr. Shumer claimed gender identity "cannot be changed by medical or psychological intervention" (Shumer ¶23). He cites no support for this assertion. In actual clinical practice, that is rarely the relevant issue. The far more typical situation is youth

who are *mistaken* about their gender identity, wherein youth misinterpret their experiences to indicate they are transgender. Moreover, it has been the unanimous conclusion of every follow-up study of gender dysphoric children ever conducted, not only that gender identity does change, but also that it changes in the large majority of cases. (See Section V. *Childhood-Onset Gender Dysphoria.*)

147. Dr. Shumer similarly claimed "attempts to 'cure' transgender individuals…are harmful and ineffective" (Shumer ¶25), citing no support for the assertion. Activists and social media increasingly, but erroneously, apply the term "conversion therapy," moving farther and farther from what the research has reported. "Conversion therapy" (or "reparative therapy" and other names) has referred to efforts to change a person's sexual orientation. More recently, any therapy failing to provide affirmation-on-demand is labeled "conversion therapy." (D'Angelo, *et al.,* 2020.) Although the media and social media habitually add "T" to "GLB" in discussing these issues, the research on "conversion therapy" has investigated only sexual orientation, and its results cannot be extrapolated to gender identity by mere analogy.

148. Dr. Shumer claimed that "a person's sex is comprised of several components, including…gender identity" (Shumer ¶26), citing no support for his claim. As already indicated herein, however, gender identity is in fact excluded from the definitions of sex. (See Section VIII.A. *Sex and Sex Assigned-at-Birth*.) (See also ¶160 herein.)

149. Dr. Shumer claimed "The WPATH Standards of Care represent expert consensus" and is "based on the best science" (Shumer ¶31). As detail already, expert consensus is the *lowest* level of evidence in clinical research (see Section III.E. *Expert Opinion*), and WPATH did not engage in any systematic review of the safety of transition. (See Section VII.B. *WPATH.*)

150. Dr. Shumer claimed the Endocrine Society (and WPATH) "establish the prevailing standards" for the treatment of gender dysphoria. (Shumer ¶32–33), citing no evidence for his claim. That the Endocrine Society did not engage in any systematic review of the effectiveness of transition and that the E.S. explicitly indicated the evidence for its

safety to be low is already reviewed herein. (See Section VII.A. *Endocrine Society.*)

151. Dr. Shumer claimed that "before puberty, there are no significant differences in athletic performance between girls and boys." (Shumer ¶38.) Peer reviewed research studies from around the world have repeatedly demonstrated the very opposite. Although the differences increase upon puberty, biological males already show even before puberty a 2–5% advantage in swimming, running, jumping, and a range of strength tests. Such differences have been repeatedly identified in studies of children from Australia (Catley 2013), Germany (Woll 2011), Norway (Tønnessen 2015), Spain (Gulias-González 2014), and Latvia (Sauka 2011). Dr. Shumer's declaration did not contest or mention the research studies cited among the legislative findings.

152. The single source cited within Dr. Shumer's entire declaration was Handelsman et al. (2018), to support the claim that testosterone was the "driver" of the post-pubertal male advantage in muscle mass and strength. Missing from the Shumer report, however, was the other study from Handelsman (2017), which reported, again, that the male advantage already existed *before* puberty:

> In track and field athletics, the effects of age on running performance… showed that the *prepubertal differences of 3.0%* increased to a plateau of 10.1% with an onset (ED20) at 12.4 years and reaching midway (ED50) at 13.9 years. For jumping,…the *prepubertal difference of 5.8%* increased to 19.4% starting at 12.4 years and reaching midway at 13.9 years. (Handelsman 2017 at 70, italics added)

C. Dr. Budge's assertions are unsupported by the research literature and contradict the research literature.

153. In referring to the basis of her assertions, Dr. Budge claimed she relied on "the same types of material that experts in my field of study regularly rely upon." (Budge ¶13.) The contents of her declaration show the opposite. Dr. Budge's asserted very many claims about transgender youth (Budge ¶¶17–22) and the medical care for transgender youth (Budge ¶¶23–34). Her claims are entirely unsupported, failing to include even a single peer reviewed research article to support even a single claim about the nature, causes, diagnosis,

or treatment of gender dysphoria. The materials upon which experts in this field rely is the peer reviewed literature, culminating in systematic reviews of their findings. (See Section III. *Clinical Research Pyramid of Evidence.*) Dr. Budge did not cite or indicate considering the conclusions of any of the systematic reviews conducted by the international health care bodies. (See Section VI *Systematic Reviews of Safety and Effectiveness.*)

154. Dr. Budge misrepresents "APA" and the "DSM." In ¶10 of her declaration, she refers to the "American *Psychological* Association" as "APA," and she notes affiliations she has with that organization. (Budge ¶11.) Her declaration subsequently refers to aspects of the diagnostic category "which the *APA* calls gender dysphoria." (Budge ¶23 line 22, italics added.) That organization, however, is the American *Psychiatric* Association, of which Dr. Budge is not a member: She clearly identified herself as a psychologist, not a psychiatrist. (Budge ¶3.) In the next sentence, Dr. Budge cites "APA's Diagnostic and Statistical Manual of Mental Disorders (DSM-5)" (Budge ¶23), from 2013, by the American *Psychiatric* Association. That edition is outdated, having been superseded by its text revision (the DSM-5-TR), published by American *Psychiatric* Association in 2022.

155. Dr. Budge asserted without support that "gender identity is well-established in psychology and medicine." (Budge ¶17.) Her claim does not reflect the status of the field. Indeed, the DSM-5-TR itself says the very opposite: "The area of sex and gender is highly controversial and has led to a proliferation of terms whose meanings vary over time and within and between disciplines." (American Psychiatric Association 2022 at 511.) (See also Section VIII.A. *Sex and Sex-Assigned-at-Birth.*)

156. Dr. Budge claimed that "sex" is comprised of multiple characteristics, and she included among them "gender identity." (Budge ¶19.) As already indicated herein, gender identity is *excluded* from the definition of sex. (See also Section VIII.B. *Subjective feelings.*) The same is true of the DSM-5-TR, which also says the opposite of Dr. Budge's unsourced claim:

> In this chapter [on gender dysphoria], *sex* and *sexual* refer to the biological indicators of male and female (understood in the context of reproductive capacity),

> such as in sex chromosomes, gonads, sex hormones, and nonambiguous internal and external genitalia. (American Psychiatric Association at 511, italics in original.)

157. Dr. Budge's unsourced claim that gender identity is innate (Budge ¶20) is untrue. The peer reviewed research shows *sexual orientation* is innate, not gender identity. (See Section X. *Neuroimaging.*)

158. Dr. Budge offers a brief summary indicating potential benefits to participating in school-sponsored athletics (Budge ¶¶35–37), which is not in contention. The large majority of transgender adolescents are biologically female, and under SB-1165, continue to be permitted to participate on male designated teams, and these benefits remain available to them. Because SB-1165 explicitly permits participation in coed and mixed teams, such benefits remain available to everyone else. Moreover, the majority of adolescents who identify as transgender specifically identify as "non-binary" or "gender fluid." Teams designated mixed or coed represent a *closer* match to such identities than those designated female.

159. Dr. Budge was explicit that her opinion about SB-1165 being "psychological damaging" was "based on my experience working with transgender youth." (Budge ¶39). As indicated in the present report, such opinions represent the very lowest level of evidence. (See Section III.E. *Expert Opinion.*) In the absence of studies comparing participation on female designated teams versus coed- or mixed- teams, it is not possible for Dr. Budge to know what she claims.

160. Dr. Budge included no evidence to support her dramatic claim "irreversible and severe damage" including trauma, suicidal ideation, and suicide attempts. (Budge ¶39.) Dr. Budge's citation of Hughes et al. (2022) insinuates that Hughes to have been a study showing those results; however, it was not a study of impact at all. Rather, it was a survey of physicians and nurses providing the very hormones and other procedures whose safety and effectiveness are being challenged by the international health care community. (See Section VI. *Systematic Reviews of Safety and Effectiveness.*) As noted herein, such surveys

do not constitute meaningful scientific evidence (See Section III.F. *Surveys*), and this survey in particular made no effort to hide its political rather than objective purpose of the four questions it asked:

> Participants were asked to provide their thoughts about these proposed laws in four separate open-ended survey questions: ''What do laws like this mean to you as a gender-affirming care provider for transgender and gender diverse youth?'' ''How do you think laws like this would impact your practice?'' ''How do you think laws like this would impact your patients?'' ''What steps, if any, do you think would be helpful to ensure transgender and gender diverse youth are not banned from participating in sports?'' (Hughes 2022 at 248.)

161. Dr. Budge conveyed a warning "that the physical consequences for transgender youth of not being able to participate in sports include worse cardiovascular outcomes, poor bone mineral density, and poor neurocognitive development when compared to non-transgender youth" (Budge ¶39), citing Barrera et al. (2022). First, Barrera et al. (2022) is an editorial, not a peer-reviewed research finding. Second, the protection of mixed and coed activities prevents the situation Barrera warns against. Finally, and perhaps most relevantly, the listed health consequences are not caused by lack of exercise—They are caused by the *puberty-blockers and cross-sex hormones* used on the children. As Barrera wrote: "Increased access to physical activity for TGD [(transgender and gender-diverse)] youth is important for improving cardiovascular risk and mediating *the expected changes that occur with GAH* [(gender affirming hormones)]." (Barrera 2022 at 223, italics added.) (See also Section XI. *Known and Potential Harms.*)

162. The three remaining sources cited by Dr. Budge (Tebbe 2021; Kosciw 2022; McLemore 2015) are all surveys as well. They do not represent empirical research capable of demonstrating the causal connections which Dr. Budge attributes to them. They reflect the beliefs and political views of the people taking the surveys, not the accuracy of those views and beliefs. The recent Washington Post-Kaiser Family Foundation survey found both that a majority of Americans support laws prohibiting discrimination against trans

people *and at that same time* support restricting female sports teams to biological females. (Meckler & Clement 2023.)

D. Dr. Budge's report did not contest, or even address, the pertinent scientific or psychological issues or their implications.

163. Dr. Budge's declaration did not address the legislative findings of SB-1165 acknowledging the biological differences between males and females. Her declaration did not address any of the peer reviewed studies cited in SB1165 and did not cite any peer reviewed studies with conclusions that contradict the conclusions of the studies in SB-1165. Dr. Budge's analysis did not include any issues regarding competitive fairness from including people other than biological females on teams of biological females. It is not possible to develop an objective balance by considering only one side of such an issue.

164. Dr. Budge's analysis did not include the psychological effects on biological females of the participation of biological males. Because adolescents do not typically undergo genital surgery until adulthood, people with an intact penis and testicles would be present in the females' showers, locker rooms, and other areas designated female-only.

165. Dr. Budge's analysis did not address the capacity of mixed or coed teams to prevent the potential negative effects she postulated.

I swear or affirm under penalty of perjury that the foregoing is true and correct.

Dated: May 18, 2023 Signed: */s/ Dr. James M. Cantor, Ph.D.*

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LIST OF APPENDICES

Appendix 1

Curriculum Vita

Appendix 2

Cantor, J. M. (2020). Transgender and gender diverse children and adolescents: Fact-checking of AAP policy. *Journal of Sex & Marital Therapy, 46,* 307–313. doi: 10.1080/0092623X.2019.1698481

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EDUCATION

Postdoctoral Fellowship — Jan., 2000–May, 2004
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Doctor of Philosophy — Sep., 1993–Jun., 2000
Psychology • McGill University • Montréal, Canada

Master of Arts — Sep., 1990–Jan., 1992
Psychology • Boston University • Boston, MA

Bachelor of Science — Sep. 1984–Aug., 1988
Interdisciplinary Science • Rensselaer Polytechnic Institute • Troy, NY
Concentrations: Computer science, mathematics, physics

EMPLOYMENT HISTORY

Director — Feb., 2017–Present
Toronto Sexuality Centre • Toronto, Canada

Senior Scientist (Inaugural Member) — Aug., 2012–May, 2018
Campbell Family Mental Health Research Institute
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Senior Scientist — Jan., 2012–May, 2018
Complex Mental Illness Program
Centre for Addiction and Mental Health • Toronto, Canada

Head of Research — Nov., 2010–Apr. 2014
Sexual Behaviours Clinic
Centre for Addiction and Mental Health • Toronto, Canada

Research Section Head — Dec., 2009–Sep. 2012
Law & Mental Health Program
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Psychologist — May, 2004–Dec., 2011
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Clinical Psychology Intern Sep., 1998–Aug., 1999
Centre for Addiction and Mental Health • Toronto, Canada

Teaching Assistant Sep., 1993–May, 1998
Department of Psychology
McGill University • Montréal, Canada

Pre-Doctoral Practicum Sep., 1993–Jun., 1997
Sex and Couples Therapy Unit
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Pre-Doctoral Practicum May, 1994–Dec., 1994
Department of Psychiatry
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ACADEMIC APPOINTMENTS

Associate Professor Jul., 2010–May, 2019
Department of Psychiatry
University of Toronto Faculty of Medicine • Toronto, Canada

Adjunct Faculty Aug. 2013–Jun., 2018
Graduate Program in Psychology
York University • Toronto, Canada

Associate Faculty (Hon) Oct., 2017–Dec., 2017
School of Behavioural, Cognitive & Social Science
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Assistant Professor Jun., 2005–Jun., 2010
Department of Psychiatry
University of Toronto Faculty of Medicine • Toronto, Canada

Adjunct Faculty Sep., 2004–Jun., 2010
Clinical Psychology Residency Program
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PUBLICATIONS

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2. Cantor, J. M. (2020). Transgender and gender diverse children and adolescents: Fact-checking of AAP policy. *Journal of Sex & Marital Therapy, 46,* 307–313. doi: 10.1080/0092623X.2019.1698481
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61. Cantor, J. M., Binik, Y. M., & Pfaus, J. G. (1999). Chronic fluoxetine inhibits sexual behavior in the male rat: Reversal with oxytocin. *Psychopharmacology*, *144*, 355–362.
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65. Pilkington, N. W., & Cantor, J. M. (1996). Perceptions of heterosexual bias in professional psychology programs: A survey of graduate students. *Professional Psychology: Research and Practice*, *27*, 604–612.

PUBLICATIONS

LETTERS AND COMMENTARIES

1. Cantor, J. M. (2015). Research methods, statistical analysis, and the phallometric test for hebephilia: Response to Fedoroff [Editorial Commentary]. *Journal of Sexual Medicine, 12,* 2499–2500. doi: 10.1111/jsm.13040
2. Cantor, J. M. (2015). In his own words: Response to Moser [Editorial Commentary]. *Journal of Sexual Medicine, 12,* 2502–2503. doi: 10.1111/jsm.13075
3. Cantor, J. M. (2015). Purported changes in pedophilia as statistical artefacts: Comment on Müller et al. (2014). *Archives of Sexual Behavior, 44,* 253–254. doi: 10.1007/s10508-014-0343-x
4. McPhail, I. V., & Cantor, J. M. (2015). Pedophilia, height, and the magnitude of the association: A research note. *Deviant Behavior, 36,* 288–292. doi: 10.1080/01639625.2014.935644
5. Soh, D. W., & Cantor, J. M. (2015). A peek inside a furry convention [Letter to the Editor]. *Archives of Sexual Behavior, 44,* 1–2. doi: 10.1007/s10508-014-0423-y
6. Cantor, J. M. (2012). Reply to Italiano's (2012) comment on Cantor (2011) [Letter to the Editor]. *Archives of Sexual Behavior, 41,* 1081–1082. doi: 10.1007/s10508-012-0011-y
7. Cantor, J. M. (2012). The errors of Karen Franklin's *Pretextuality* [Commentary]. *International Journal of Forensic Mental Health, 11,* 59–62. doi: 10.1080/14999013.2012.672945
8. Cantor, J. M., & Blanchard, R. (2012). White matter volumes in pedophiles, hebephiles, and teleiophiles [Letter to the Editor]. *Archives of Sexual Behavior, 41, 749–752.* doi: 10.1007/s10508-012-9954-2
9. Cantor, J. M. (2011). New MRI studies support the Blanchard typology of male-to-female transsexualism [Letter to the Editor]. *Archives of Sexual Behavior, 40*, 863–864. doi: 10.1007/s10508-011-9805-6
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11. Cantor, J. M. (2003, Summer). Review of the book *The Man Who Would Be Queen* by J. Michael Bailey. *Newsletter of Division 44 of the American Psychological Association, 19*(2), 6.
12. Cantor, J. M. (2003, Spring). What are the hot topics in LGBT research in psychology? *Newsletter of Division 44 of the American Psychological Association, 19*(1), 21–24.
13. Cantor, J. M. (2002, Fall). Male homosexuality, science, and pedophilia. *Newsletter of Division 44 of the American Psychological Association, 18*(3), 5–8.
14. Cantor, J. M. (2000). Review of the book *Sexual Addiction: An Integrated Approach. Journal of Sex and Marital Therapy, 26*, 107–109.

EDITORIALS

1. Cantor, J. M. (2012). Editorial. *Sexual Abuse: A Journal of Research and Treatment, 24*.

2. Cantor, J. M. (2011). Editorial note. *Sexual Abuse: A Journal of Research and Treatment, 23,* 414.
3. Barbaree, H. E., & Cantor, J. M. (2010). Performance indicates for *Sexual Abuse: A Journal of Research and Treatment* (SAJRT) [Editorial]. *Sexual Abuse: A Journal of Research and Treatment, 22,* 371–373.
4. Barbaree, H. E., & Cantor, J. M. (2009). *Sexual Abuse: A Journal of Research and Treatment* performance indicators for 2007 [Editorial]. *Sexual Abuse: A Journal of Research and Treatment, 21,* 3–5.
5. Zucker, K. J., & Cantor, J. M. (2009). Cruising: Impact factor data [Editorial]. *Archives of Sexual Research, 38,* 878–882.
6. Barbaree, H. E., & Cantor, J. M. (2008). Performance indicators for *Sexual Abuse: A Journal of Research and Treatment* [Editorial]. *Sexual Abuse: A Journal of Research and Treatment, 20,* 3–4.
7. Zucker, K. J., & Cantor, J. M. (2008). The *Archives* in the era of online first ahead of print[Editorial]. *Archives of Sexual Behavior, 37,* 512–516.
8. Zucker, K. J., & Cantor, J. M. (2006). The impact factor: The *Archives* breaks from the pack [Editorial]. *Archives of Sexual Behavior, 35,* 7–9.
9. Zucker, K. J., & Cantor, J. M. (2005). The impact factor: "Goin' up" [Editorial]. *Archives of Sexual Behavior, 34,* 7–9.
10. Zucker, K., & Cantor, J. M. (2003). The numbers game: The impact factor and all that jazz [Editorial]. *Archives of Sexual Behavior, 32,* 3–5.

FUNDING HISTORY

Principal Investigators:	Doug VanderLaan, Meng-Chuan Lai
Co-Investigators:	James M. Cantor, Megha Mallar Chakravarty, Nancy Lobaugh, M. Palmert, M. Skorska
Title:	*Brain function and connectomics following sex hormone treatment in adolescents experience gender dysphoria*
Agency:	Canadian Institutes of Health Research (CIHR), Behavioural Sciences-B-2
Funds:	$650,250 / 5 years (July, 2018)

Principal Investigator:	Michael C. Seto
Co-Investigators:	Martin Lalumière , James M. Cantor
Title:	*Are connectivity differences unique to pedophilia?*
Agency:	University Medical Research Fund, Royal Ottawa Hospital
Funds:	$50,000 / 1 year (January, 2018)

Principal Investigator:	Lori Brotto
Co-Investigators:	Anthony Bogaert, James M. Cantor, Gerulf Rieger
Title:	*Investigations into the neural underpinnings and biological correlates of asexuality*
Agency:	Natural Sciences and Engineering Research Council (NSERC), Discovery Grants Program
Funds:	$195,000 / 5 years (April, 2017)

Principal Investigator:	Doug VanderLaan
Co-Investigators:	Jerald Bain, James M. Cantor, Megha Mallar Chakravarty, Sofia Chavez, Nancy Lobaugh, and Kenneth J. Zucker
Title:	*Effects of sex hormone treatment on brain development: A magnetic resonance imaging study of adolescents with gender dysphoria*
Agency:	Canadian Institutes of Health Research (CIHR), Transitional Open Grant Program
Funds:	$952,955 / 5 years (September, 2015)

Principal Investigator:	James M. Cantor
Co-Investigators:	Howard E. Barbaree, Ray Blanchard, Robert Dickey, Todd A. Girard, Phillip E. Klassen, and David J. Mikulis
Title:	*Neuroanatomic features specific to pedophilia*
Agency:	Canadian Institutes of Health Research (CIHR)
Funds:	$1,071,920 / 5 years (October, 2008)

Principal Investigator:	James M. Cantor
Title:	*A preliminary study of fMRI as a diagnostic test of pedophilia*
Agency:	Dean of Medicine New Faculty Grant Competition, Univ. of Toronto
Funds:	$10,000 (July, 2008)

Principal Investigator:	James M. Cantor
Co-Investigator:	Ray Blanchard
Title:	*Morphological and neuropsychological correlates of pedophilia*
Agency:	Canadian Institutes of Health Research (CIHR)
Funds:	$196,902 / 3 years (April, 2006)

KEYNOTE AND INVITED ADDRESSES

1. Cantor, J. M. (2022, December 5). The science of gender dysphoria and transgenderism. Lund University, Latvia. https://files.fm/f/4bzznufvb
2. Cantor, J. M. (2021, September 28). *No topic too tough for this expert panel: A year in review.* Plenary Session for the 40th Annual Research and Treatment Conference, Association for the Treatment of Sexual Abusers.
3. Cantor, J. M. (2019, May 1). *Introduction and Q&A for 'I, Pedophile.'* StopSO 2nd Annual Conference, London, UK.
4. Cantor, J. M. (2018, August 29). *Neurobiology of pedophilia or paraphilia? Towards a 'Grand Unified Theory' of sexual interests.* Keynote address to the International Association for the Treatment of Sexual Offenders, Vilnius, Lithuania.
5. Cantor, J. M. (2018, August 29). *Pedophilia and the brain: Three questions asked and answered.* Preconference training presented to the International Association for the Treatment of Sexual Offenders, Vilnius, Lithuania.
6. Cantor, J. M. (2018, April 13). *The responses to* I, Pedophile *from We, the people.* Keynote address to the Minnesota Association for the Treatment of Sexual Abusers, Minneapolis, Minnesota.
7. Cantor, J. M. (2018, April 11). *Studying atypical sexualities: From vanilla to* I, Pedophile. Full day workshop at the Minnesota Association for the Treatment of Sexual Abusers, Minneapolis, Minnesota.
8. Cantor, J. M. (2018, January 20). *How much sex is enough for a happy life?* Invited lecture to the University of Toronto Division of Urology Men's Health Summit, Toronto, Canada.
9. Cantor, J. M. (2017, November 2). Pedophilia as a phenomenon of the brain: Update of evidence and the public response. Invited presentation to the 7th annual SBC education event, Centre for Addiction and Mental Health, Toronto, Canada.
10. Cantor, J. M. (2017, June 9). Pedophilia being in the brain: The evidence and the public's reaction. Invited presentation to *SEXposium at the ROM: The science of love and sex,* Toronto, Canada.
11. Cantor, J. M., & Campea, M. (2017, April 20). *"I, Pedophile" showing and discussion.* Invited presentation to the 42nd annual meeting of the Society for Sex Therapy and Research, Montréal, Canada.
12. Cantor, J. M. (2017, March 1). *Functional and structural neuroimaging of pedophilia: Consistencies across methods and modalities.* Invited lecture to the Brain Imaging Centre, Royal Ottawa Hospital, Ottawa, Canada.
13. Cantor, J. M. (2017, January 26). *Pedophilia being in the brain: The evidence and the public reaction.* Inaugural keynote address to the University of Toronto Sexuality Interest Network, Toronto, Ontario, Canada.
14. Cantor, J. M. (2016, October 14). *Discussion of CBC's "I, Pedophile."* Office of the Children's Lawyer Educational Session, Toronto, Ontario, Canada.
15. Cantor, J. M. (2016, September 15). *Evaluating the risk to reoffend: What we know and what we don't.* Invited lecture to the Association of Ontario Judges, Ontario Court of Justice Annual Family Law Program, Blue Mountains, Ontario, Canada. [Private link only: https://vimeo.com/239131108/3387c80652]
16. Cantor, J. M. (2016, April 8). *Pedophilia and the brain: Conclusions from the second*

generation of research. Invited lecture at the 10th annual Risk and Recovery Forensic Conference, Hamilton, Ontario.

17. Cantor, J. M. (2016, April 7). *Hypersexuality without the hyperbole.* Keynote address to the 10th annual Risk and Recovery Forensic Conference, Hamilton, Ontario.
18. Cantor, J. M. (2015, November). *No one asks to be sexually attracted to children: Living in Daniel's World.* Grand Rounds, Centre for Addiction and Mental Health. Toronto, Canada.
19. Cantor, J. M. (2015, August). *Hypersexuality: Getting past whether "it" is or "it" isn't.* Invited address at the 41st annual meeting of the International Academy of Sex Research. Toronto, Canada.
20. Cantor, J. M. (2015, July). *A unified theory of typical and atypical sexual interest in men: Paraphilia, hypersexuality, asexuality, and vanilla as outcomes of a single, dual opponent process.* Invited presentation to the 2015 Puzzles of Sexual Orientation conference, Lethbridge, AL, Canada.
21. Cantor, J. M. (2015, June). *Hypersexuality.* Keynote Address to the Ontario Problem Gambling Provincial Forum. Toronto, Canada.
22. Cantor, J. M. (2015, May). *Assessment of pedophilia: Past, present, future.* Keynote Address to the International Symposium on Neural Mechanisms Underlying Pedophilia and Child Sexual Abuse (NeMUP). Berlin, Germany.
23. Cantor, J. M. (2015, March). *Prevention of sexual abuse by tackling the biggest stigma of them all: Making sex therapy available to pedophiles.* Keynote address to the 40th annual meeting of the Society for Sex Therapy and Research, Boston, MA.
24. Cantor, J. M. (2015, March. *Pedophilia: Predisposition or perversion?* Panel discussion at Columbia University School of Journalism. New York, NY.
25. Cantor, J. M. (2015, February). *Hypersexuality.* Research Day Grand Rounds presentation to Ontario Shores Centre for Mental Health Sciences, Whitby, Ontario, Canada.
26. Cantor, J. M. (2015, January). *Brain research and pedophilia: What it means for assessment, research, and policy.* Keynote address to the inaugural meeting of the Netherlands Association for the Treatment of Sexual Abusers, Utrecht, Netherlands.
27. Cantor, J. M. (2014, December). *Understanding pedophilia and the brain: Implications for safety and society.* Keynote address for The Jewish Community Confronts Violence and Abuse: Crisis Centre for Religious Women, Jerusalem, Israel.
28. Cantor, J. M. (2014, October). *Understanding pedophilia & the brain.* Invited full-day workshop for the Sex Offender Assessment Board of Pennsylvania, Harrisburg, PA.
29. Cantor, J. M. (2014, September). *Understanding neuroimaging of pedophilia: Current status and implications.* Invited lecture presented to the Mental Health and Addition Rounds, St. Joseph's Healthcare, Hamilton, Ontario, Canada.
30. Cantor, J. M. (2014, June). *An evening with Dr. James Cantor.* Invited lecture presented to the Ontario Medical Association, District 11 Doctors' Lounge Program, Toronto, Ontario, Canada.
31. Cantor, J. M. (2014, April). *Pedophilia and the brain.* Invited lecture presented to the University of Toronto Medical Students lunchtime lecture. Toronto, Ontario, Canada.
32. Cantor, J. M. (2014, February). *Pedophilia and the brain: Recap and update.* Workshop presented at the 2014 annual meeting of the Washington State Association for the Treatment of Sexual Abusers, Cle Elum, WA.

33. Cantor, J. M., Lafaille, S., Hannah, J., Kucyi, A., Soh, D., Girard, T. A., & Mikulis, D. M. (2014, February). *Functional connectivity in pedophilia.* Neuropsychiatry Rounds, Toronto Western Hospital, Toronto, Ontario, Canada.
34. Cantor, J. M. (2013, November). *Understanding pedophilia and the brain: The basics, the current status, and their implications.* Invited lecture to the Forensic Psychology Research Centre, Carleton University, Ottawa, Canada.
35. Cantor, J. M. (2013, November). *Mistaking puberty, mistaking hebephilia.* Keynote address presented to the 32nd annual meeting of the Association for the Treatment of Sexual Abusers, Chicago, IL.
36. Cantor, J. M. (2013, October). *Understanding pedophilia and the brain: A recap and update.* Invited workshop presented at the 32nd annual meeting of the Association for the Treatment of Sexual Abusers, Chicago, IL.
37. Cantor, J. M. (2013, October). *Compulsive-hyper-sex-addiction: I don't care what we all it, what can we* do*?* Invited address presented to the Board of Examiners of Sex Therapists and Counselors of Ontario, Toronto, Ontario, Canada.
38. Cantor, J. M. (2013, September). *Neuroimaging of pedophilia: Current status and implications.* McGill University Health Centre, Department of Psychiatry Grand Rounds presentation, Montréal, Québec, Canada.
39. Cantor, J. M. (2013, April). *Understanding pedophilia and the brain.* Invited workshop presented at the 2013 meeting of the Minnesota Association for the Treatment of Sexual Abusers, Minneapolis, MN.
40. Cantor, J. M. (2013, April). *The neurobiology of pedophilia and its implications for assessment, treatment, and public policy.* Invited lecture at the 38th annual meeting of the Society for Sex Therapy and Research, Baltimore, MD.
41. Cantor, J. M. (2013, April). *Sex offenders: Relating research to policy.* Invited roundtable presentation at the annual meeting of the Academy of Criminal Justice Sciences, Dallas, TX.
42. Cantor, J. M. (2013, March). *Pedophilia and brain research: From the basics to the state-of-the-art.* Invited workshop presented to the annual meeting of the Forensic Mental Health Association of California, Monterey, CA.
43. Cantor, J. M. (2013, January). *Pedophilia and child molestation.* Invited lecture presented to the Canadian Border Services Agency, Toronto, Ontario, Canada.
44. Cantor, J. M. (2012, November). *Understanding pedophilia and sexual offenders against children: Neuroimaging and its implications for public safety.* Invited guest lecture to University of New Mexico School of Medicine Health Sciences Center, Albuquerque, NM.
45. Cantor, J. M. (2012, November). *Pedophilia and brain research.* Invited guest lecture to the annual meeting of the Circles of Support and Accountability, Toronto, Ontario, Canada.
46. Cantor, J. M. (2012, January). *Current findings on pedophilia brain research.* Invited workshop at the San Diego International Conference on Child and Family Maltreatment, San Diego, CA.
47. Cantor, J. M. (2012, January). *Pedophilia and the risk to re-offend.* Invited lecture to the Ontario Court of Justice Judicial Development Institute, Toronto, Ontario, Canada.
48. Cantor, J. M. (2011, November). *Pedophilia and the brain: What it means for assessment, treatment, and policy.* Plenary Lecture presented at the Association for the Treatment of Sexual Abusers, Toronto, Ontario, Canada.

49. Cantor, J. M. (2011, July). *Towards understanding contradictory findings in the neuroimaging of pedophilic men.* Keynote address to 7th annual conference on Research in Forensic Psychiatry, Regensberg, Germany.
50. Cantor, J. M. (2011, March). *Understanding sexual offending and the brain: Brain basics to the state of the art.* Workshop presented at the winter conference of the Oregon Association for the Treatment of Sexual Abusers, Oregon City, OR.
51. Cantor, J. M. (2010, October). *Manuscript publishing for students.* Workshop presented at the 29th annual meeting of the Association for the Treatment of Sexual Abusers, Phoenix, AZ.
52. Cantor, J. M. (2010, August). *Is sexual orientation a paraphilia?* Invited lecture at the International Behavioral Development Symposium, Lethbridge, Alberta, Canada.
53. Cantor, J. M. (2010, March). *Understanding sexual offending and the brain: From the basics to the state of the art.* Workshop presented at the annual meeting of the Washington State Association for the Treatment of Sexual Abusers, Blaine, WA.
54. Cantor, J. M. (2009, January). *Brain structure and function of pedophilia men.* Neuropsychiatry Rounds, Toronto Western Hospital, Toronto, Ontario.
55. Cantor, J. M. (2008, April). *Is pedophilia caused by brain dysfunction?* Invited address to the University-wide Science Day Lecture Series, SUNY Oswego, Oswego, NY.
56. Cantor, J. M., Kabani, N., Christensen, B. K., Zipursky, R. B., Barbaree, H. E., Dickey, R., Klassen, P. E., Mikulis, D. J., Kuban, M. E., Blak, T., Richards, B. A., Hanratty, M. K., & Blanchard, R. (2006, September). *MRIs of pedophilic men.* Invited presentation at the 25th annual meeting of the Association for the Treatment of Sexual Abusers, Chicago.
57. Cantor, J. M., Blanchard, R., & Christensen, B. K. (2003, March). *Findings in and implications of neuropsychology and epidemiology of pedophilia.* Invited lecture at the 28th annual meeting of the Society for Sex Therapy and Research, Miami.
58. Cantor, J. M., Christensen, B. K., Klassen, P. E., Dickey, R., & Blanchard, R. (2001, July). *Neuropsychological functioning in pedophiles.* Invited lecture presented at the 27th annual meeting of the International Academy of Sex Research, Bromont, Canada.
59. Cantor, J. M., Blanchard, R., Christensen, B., Klassen, P., & Dickey, R. (2001, February). *First glance at IQ, memory functioning and handedness in sex offenders.* Lecture presented at the Forensic Lecture Series, Centre for Addiction and Mental Health, Toronto, Ontario, Canada.
60. Cantor, J. M. (1999, November). *Reversal of SSRI-induced male sexual dysfunction: Suggestions from an animal model.* Grand Rounds presentation at the Allan Memorial Institute, Royal Victoria Hospital, Montréal, Canada.

PAPER PRESENTATIONS AND SYMPOSIA

1. Cantor, J. M. (2020, April). "I'd rather have a trans kid than a dead kid": Critical assessment of reported rates of suicidality in trans kids. *Paper presented at the annual meeting of the Society for the Sex Therapy and Research.* Online in lieu of in person meeting.
2. Stephens, S., Lalumière, M., Seto, M. C., & Cantor, J. M. (2017, October). *The relationship between sexual responsiveness and sexual exclusivity in phallometric profiles.* Paper presented at the annual meeting of the Canadian Sex Research Forum, Fredericton, New Brunswick, Canada.
3. Stephens, S., Cantor, J. M., & Seto, M. C. (2017, March). *Can the SSPI-2 detect hebephilic sexual interest?* Paper presented at the annual meeting of the American-Psychology Law Society Annual Meeting, Seattle, WA.
4. Stephens, S., Seto, M. C., Goodwill, A. M., & Cantor, J. M. (2015, October). *Victim choice polymorphism and recidivism.* Symposium Presentation. Paper presented at the 34th annual meeting of the Association for the Treatment of Sexual Abusers, Montréal, Canada.
5. McPhail, I. V., Hermann, C. A., Fernane, S. Fernandez, Y., Cantor, J. M., & Nunes, K. L. (2014, October). *Sexual deviance in sexual offenders against children: A meta-analytic review of phallometric research.* Paper presented at the 33rd annual meeting of the Association for the Treatment of Sexual Abusers, San Diego, CA.
6. Stephens, S., Seto, M. C., Cantor, J. M., & Goodwill, A. M. (2014, October). *Is hebephilic sexual interest a criminogenic need?: A large scale recidivism study.* Paper presented at the 33rd annual meeting of the Association for the Treatment of Sexual Abusers, San Diego, CA.
7. Stephens, S., Seto, M. C., Cantor, J. M., & Lalumière, M. (2014, October). *Development and validation of the Revised Screening Scale for Pedophilic Interests (SSPI–2).* Paper presented at the 33rd annual meeting of the Association for the Treatment of Sexual Abusers, San Diego, CA.
8. Cantor, J. M., Lafaille, S., Hannah, J., Kucyi, A., Soh, D., Girard, T. A., & Mikulis, D. M. (2014, September). *Pedophilia and the brain: White matter differences detected with DTI.* Paper presented at the 13th annual meeting of the International Association for the Treatment of Sexual Abusers, Porto, Portugal.
9. Stephens, S., Seto, M., Cantor, J. M., Goodwill, A. M., & Kuban, M. (2014, March). *The role of hebephilic sexual interests in sexual victim choice.* Paper presented at the annual meeting of the American Psychology and Law Society, New Orleans, LA.
10. McPhail, I. V., Fernane, S. A., Hermann, C. A., Fernandez, Y. M., Nunes, K. L., & Cantor, J. M. (2013, November). *Sexual deviance and sexual recidivism in sexual offenders against children: A meta-analysis.* Paper presented at the 32nd annual meeting of the Association for the Treatment of Sexual Abusers, Chicago, IL.
11. Cantor, J. M. (2013, September). *Pedophilia and the brain: Current MRI research and its implications.* Paper presented at the 21st annual World Congress for Sexual Health, Porto Alegre, Brazil. [Featured among Best Abstracts, top 10 of 500.]
12. Cantor, J. M. (Chair). (2012, March). *Innovations in sex research.* Symposium conducted at the 37th annual meeting of the Society for Sex Therapy and Research, Chicago.
13. Cantor, J. M., & Blanchard, R. (2011, August). fMRI versus phallometry in the diagnosis of pedophilia and hebephilia. In J. M. Cantor (Chair), *Neuroimaging of men's object*

preferences. Symposium presented at the 37th annual meeting of the International Academy of Sex Research, Los Angeles, USA.

14. Cantor, J. M. (Chair). (2011, August). *Neuroimaging of men's object preferences.* Symposium conducted at the 37th annual meeting of the International Academy of Sex Research, Los Angeles.
15. Cantor, J. M. (2010, October). A meta-analysis of neuroimaging studies of male sexual arousal. In S. Stolerú (Chair), *Brain processing of sexual stimuli in pedophilia: An application of functional neuroimaging.* Symposium presented at the 29th annual meeting of the Association for the Treatment of Sexual Abusers, Phoenix, AZ.
16. Chivers, M. L., Seto, M. C., Cantor, J. C., Grimbos, T., & Roy, C. (April, 2010). *Psychophysiological assessment of sexual activity preferences in women.* Paper presented at the 35th annual meeting of the Society for Sex Therapy and Research, Boston, USA.
17. Cantor, J. M., Girard, T. A., & Lovett-Barron, M. (2008, November). *The brain regions that respond to erotica: Sexual neuroscience for dummies.* Paper presented at the 51st annual meeting of the Society for the Scientific Study of Sexuality, San Juan, Puerto Rico.
18. Barbaree, H., Langton, C., Blanchard, R., & Cantor, J. M. (2007, October). *The role of age-at-release in the evaluation of recidivism risk of sexual offenders.* Paper presented at the 26th annual meetingof the Association for the Treatment of Sexual Abusers, San Diego.
19. Cantor, J. M., Kabani, N., Christensen, B. K., Zipursky, R. B., Barbaree, H. E., Dickey, R., Klassen, P. E., Mikulis, D. J., Kuban, M. E., Blak, T., Richards, B. A., Hanratty, M. K., & Blanchard, R. (2006, July). *Pedophilia and brain morphology.* Abstract and paper presented at the 32nd annual meeting of the International Academy of Sex Research, Amsterdam, Netherlands.
20. Seto, M. C., Cantor, J. M., & Blanchard, R. (2006, March). *Child pornography offending is a diagnostic indicator of pedophilia*. Paper presented at the 2006 annual meeting of the American Psychology-Law Society Conference, St. Petersburg, Florida.
21. Blanchard, R., Cantor, J. M., Bogaert, A. F., Breedlove, S. M., & Ellis, L. (2005, August). *Interaction of fraternal birth order and handedness in the development of male homosexuality.* Abstract and paper presented at the International Behavioral Development Symposium, Minot, North Dakota.
22. Cantor, J. M., & Blanchard, R. (2005, July). *Quantitative reanalysis of aggregate data on IQ in sexual offenders.* Abstract and poster presented at the 31st annual meeting of the International Academy of Sex Research, Ottawa, Canada.
23. Cantor, J. M. (2003, August). *Sex reassignment on demand: The clinician's dilemma.* Paper presented at the 111th annual meeting of the American Psychological Association, Toronto, Canada.
24. Cantor, J. M. (2003, June). *Meta-analysis of VIQ–PIQ differences in male sex offenders.* Paper presented at the Harvey Stancer Research Day, Toronto, Ontario, Canada.
25. Cantor, J. M. (2002, August). *Gender role in autogynephilic transsexuals: The more things change…* Paper presented at the 110th annual meeting of the American Psychological Association, Chicago.

26. Cantor, J. M., Christensen, B. K., Klassen, P. E., Dickey, R., & Blanchard, R. (2001, June). *IQ, memory functioning, and handedness in male sex offenders.* Paper presented at the Harvey Stancer Research Day, Toronto, Ontario, Canada.
27. Cantor, J. M. (1998, August). *Convention orientation for lesbian, gay, and bisexual students*. Papers presented at the 106th annual meeting of the American Psychological Association.
28. Cantor, J. M. (1997, August). *Discussion hour for lesbian, gay, and bisexual students*. Presented at the 105th annual meeting of the American Psychological Association.
29. Cantor, J. M. (1997, August). *Convention orientation for lesbian, gay, and bisexual students*. Paper presented at the 105th annual meeting of the American Psychological Association.
30. Cantor, J. M. (1996, August). *Discussion hour for lesbian, gay, and bisexual students*. Presented at the 104th annual meeting of the American Psychological Association.
31. Cantor, J. M. (1996, August). *Symposium: Question of inclusion: Lesbian and gay psychologists and accreditation*. Paper presented at the 104th annual meeting of the American Psychological Association, Toronto.
32. Cantor, J. M. (1996, August). *Convention orientation for lesbian, gay, and bisexual students*. Papers presented at the 104th annual meeting of the American Psychological Association.
33. Cantor, J. M. (1995, August). *Discussion hour for lesbian, gay, and bisexual students*. Presented at the 103rd annual meeting of the American Psychological Association.
34. Cantor, J. M. (1995, August). *Convention orientation for lesbian, gay, and bisexual students*. Papers presented at the 103rd annual meeting of the American Psychological Association.
35. Cantor, J. M. (1994, August). *Discussion hour for lesbian, gay, and bisexual students*. Presented at the 102nd annual meeting of the American Psychological Association.
36. Cantor, J. M. (1994, August). *Convention orientation for lesbian, gay, and bisexual students*. Papers presented at the 102nd annual meeting of the American Psychological Association.
37. Cantor, J. M., & Pilkington, N. W. (1992, August). *Homophobia in psychology programs: A survey of graduate students.* Paper presented at the Centennial Convention of the American Psychological Association, Washington, DC. (ERIC Document Reproduction Service No. ED 351 618)
38. Cantor, J. M. (1991, August). *Being gay and being a graduate student: Double the memberships, four times the problems*. Paper presented at the 99th annual meeting of the American Psychological Association, San Francisco.

POSTER PRESENTATIONS

1. Klein, L., Stephens, S., Goodwill, A. M., Cantor, J. M., & Seto, M. C. (2015, October). *The psychological propensities of risk in undetected sexual offenders.* Poster presented at the 34th annual meeting of the Association for the Treatment of Sexual Abusers, Montréal, Canada.
2. Pullman, L. E., Stephens, S., Seto, M. C., Goodwill, A. M., & Cantor, J. M. (2015, October). *Why are incest offenders less likely to recidivate?* Poster presented at the 34th annual meeting of the Association for the Treatment of Sexual Abusers, Montréal, Canada.
3. Seto, M. C., Stephens, S. M., Cantor, J. M., Lalumiere, M. L., Sandler, J. C., & Freeman, N. A. (2015, August). *The development and validation of the Revised Screening Scale for Pedophilic Interests (SSPI-2).* Poster presentation at the 41st annual meeting of the International Academy of Sex Research. Toronto, Canada.
4. Soh, D. W., & Cantor, J. M. (2015, August). *A peek inside a furry convention.* Poster presentation at the 41st annual meeting of the International Academy of Sex Research. Toronto, Canada.
5. VanderLaan, D. P., Lobaugh, N. J., Chakravarty, M. M., Patel, R., Chavez, S. Stojanovski, S. O., Takagi, A., Hughes, S. K., Wasserman, L., Bain, J., Cantor, J. M., & Zucker, K. J. (2015, August). *The neurohormonal hypothesis of gender dysphoria: Preliminary evidence of cortical surface area differences in adolescent natal females.* Poster presentation at the 31st annual meeting of the International Academy of Sex Research. Toronto, Canada.
6. Cantor, J. M., Lafaille, S. J., Moayedi, M., Mikulis, D. M., & Girard, T. A. (2015, June). *Diffusion tensor imaging (DTI) of the brain in pedohebephilic men: Preliminary analyses.* Harvey Stancer Research Day, Toronto, Ontario Canada.
7. Newman, J. E., Stephens, S., Seto, M. C., & Cantor, J. M. (2014, October). *The validity of the Static-99 in sexual offenders with low intellectual abilities.* Poster presentation at the 33rd annual meeting of the Association for the Treatment of Sexual Abusers, San Diego, CA.
8. Lykins, A. D., Walton, M. T., & Cantor, J. M. (2014, June). *An online assessment of personality, psychological, and sexuality trait variables associated with self-reported hypersexual behavior.* Poster presentation at the 30th annual meeting of the International Academy of Sex Research, Dubrovnik, Croatia.
9. Stephens, S., Seto, M. C., Cantor, J. M., Goodwill, A. M., & Kuban, M. (2013, November). *The utility of phallometry in the assessment of hebephilia.* Poster presented at the 32nd annual meeting of the Association for the Treatment of Sexual Abusers, Chicago.
10. Stephens, S., Seto, M. C., Cantor, J. M., Goodwill, A. M., & Kuban, M. (2013, October). *The role of hebephilic sexual interests in sexual victim choice.* Poster presented at the 32nd annual meeting of the Association for the Treatment of Sexual Abusers, Chicago.
11. Fazio, R. L., & Cantor, J. M. (2013, October). *Analysis of the Fazio Laterality Inventory (FLI) in a population with established atypical handedness.* Poster presented at the 33rd annual meeting of the National Academy of Neuropsychology, San Diego.
12. Lafaille, S., Hannah, J., Soh, D., Kucyi, A., Girard, T. A., Mikulis, D. M., & Cantor, J. M. (2013, August). *Investigating resting state networks in pedohebephiles.* Poster presented at the 29th annual meeting of the International Academy of Sex Research, Chicago.

13. McPhail, I. V., Lykins, A. D., Robinson, J. J., LeBlanc, S., & Cantor, J. M. (2013, August). *Effects of prescription medication on volumetric phallometry output.* Poster presented at the 29th annual meeting of the International Academy of Sex Research, Chicago.
14. Murray, M. E., Dyshniku, F., Fazio, R. L., & Cantor, J. M. (2013, August). *Minor physical anomalies as a window into the prenatal origins of pedophilia.* Poster presented at the 29th annual meeting of the International Academy of Sex Research, Chicago.
15. Sutton, K. S., Stephens, S., Dyshniku, F., Tulloch, T., & Cantor, J. M. (2013, August). *Pilot group treatment for "procrasturbation."* Poster presented at 39th annual meeting of the International Academy of Sex Research, Chicago.
16. Sutton, K. S., Pytyck, J., Stratton, N., Sylva, D., Kolla, N., & Cantor, J. M. (2013, August). *Client characteristics by type of hypersexuality referral: A quantitative chart review.* Poster presented at the 39th annual meeting of the International Academy of Sex Research, Chicago.
17. Fazio, R. L., & Cantor, J. M. (2013, June). *A replication and extension of the psychometric properties of the Digit Vigilance Test.* Poster presented at the 11th annual meeting of the American Academy of Clinical Neuropsychology, Chicago.
18. Lafaille, S., Moayedi, M., Mikulis, D. M., Girard, T. A., Kuban, M., Blak, T., & Cantor, J. M. (2012, July). *Diffusion Tensor Imaging (DTI) of the brain in pedohebephilic men: Preliminary analyses.* Poster presented at the 38th annual meeting of the International Academy of Sex Research, Lisbon, Portugal.
19. Lykins, A. D., Cantor, J. M., Kuban, M. E., Blak, T., Dickey, R., Klassen, P. E., & Blanchard, R. (2010, July). *Sexual arousal to female children in gynephilic men.* Poster presented at the 38th annual meeting of the International Academy of Sex Research, Prague, Czech Republic.
20. Cantor, J. M., Girard, T. A., Lovett-Barron, M., & Blak, T. (2008, July). *Brain regions responding to visual sexual stimuli: Meta-analysis of PET and fMRI studies.* Abstract and poster presented at the 34th annual meeting of the International Academy of Sex Research, Leuven, Belgium.
21. Lykins, A. D., Blanchard, R., Cantor, J. M., Blak, T., & Kuban, M. E. (2008, July). *Diagnosing sexual attraction to children: Considerations for DSM-V.* Poster presented at the 34th annual meeting of the International Academy of Sex Research, Leuven, Belgium.
22. Cantor, J. M., Blak, T., Kuban, M. E., Klassen, P. E., Dickey, R. and Blanchard, R. (2007, October). *Physical height in pedophilia and hebephilia.* Poster presented at the 26th annual meeting of the Association for the Treatment of Sexual Abusers, San Diego.
23. Cantor, J. M., Blak, T., Kuban, M. E., Klassen, P. E., Dickey, R. and Blanchard, R. (2007, August). *Physical height in pedophilia and hebephilia.* Abstract and poster presented at the 33rd annual meeting of the International Academy of Sex Research, Vancouver, Canada.
24. Puts, D. A., Blanchard, R., Cardenas, R., Cantor, J., Jordan, C. L., & Breedlove, S. M. (2007, August). *Earlier puberty predicts superior performance on male-biased visuospatial tasks in men but not women.* Abstract and poster presented at the 33rd annual meeting of the International Academy of Sex Research, Vancouver, Canada.
25. Seto, M. C., Cantor, J. M., & Blanchard, R. (2005, November). *Possession of child pornography is a diagnostic indicator of pedophilia.* Poster presented at the 24th annual meeting of the Association for the Treatment of Sexual Abusers, New Orleans.

26. Blanchard, R., Cantor, J. M., Bogaert, A. F., Breedlove. S. M., & Ellis, L. (2005, July). *Interaction of fraternal birth order and handedness in the development of male homosexuality.* Abstract and poster presented at the 31st annual meeting of the International Academy of Sex Research, Ottawa, Canada.
27. Cantor, J. M., & Blanchard, R. (2003, July). *The reported VIQ–PIQ differences in male sex offenders are artifactual?* Abstract and poster presented at the 29th annual meeting of the International Academy of Sex Research, Bloomington, Indiana.
28. Christensen, B. K., Cantor, J. M., Millikin, C., & Blanchard, R. (2002, February). *Factor analysis of two brief memory tests: Preliminary evidence for modality-specific measurement.* Poster presented at the 30th annual meeting of the International Neuropsychological Society, Toronto, Ontario, Canada.
29. Cantor, J. M., Blanchard, R., Paterson, A., Bogaert, A. (2000, June). *How many gay men owe their sexual orientation to fraternal birth order?* Abstract and poster presented at the International Behavioral Development Symposium, Minot, North Dakota.
30. Cantor, J. M., Binik, Y., & Pfaus, J. G. (1996, November). *Fluoxetine inhibition of male rat sexual behavior: Reversal by oxytocin*. Poster presented at the 26th annual meeting of the Society for Neurosciences, Washington, DC.
31. Cantor, J. M., Binik, Y., & Pfaus, J. G. (1996, June). *An animal model of fluoxetine-induced sexual dysfunction: Dose dependence and time course*. Poster presented at the 28th annual Conference on Reproductive Behavior, Montréal, Canada.
32. Cantor, J. M., O'Connor, M. G., Kaplan, B., & Cermak, L. S. (1993, June). *Transient events test of retrograde memory: Performance of amnestic and unimpaired populations*. Poster presented at the 2nd annual science symposium of the Massachusetts Neuropsychological Society, Cambridge, MA.

EDITORIAL AND PEER-REVIEWING ACTIVITIES

Editor-in-Chief

Sexual Abuse: A Journal of Research and Treatment	Jan., 2010–Dec., 2014

Editorial Board Memberships

Journal of Sexual Aggression	Jan., 2010–Dec., 2021
Journal of Sex Research, The	Jan., 2008–Aug., 2020
Sexual Abuse: A Journal of Research and Treatment	Jan., 2006–Dec., 2019
Archives of Sexual Behavior	Jan., 2004–Present
The Clinical Psychologist	Jan., 2004–Dec., 2005

Ad hoc Journal Reviewer Activity

American Journal of Psychiatry
Annual Review of Sex Research
Archives of General Psychiatry
Assessment
Biological Psychiatry
BMC Psychiatry
Brain Structure and Function
British Journal of Psychiatry
British Medical Journal
Canadian Journal of Behavioural Science
Canadian Journal of Psychiatry
Cerebral Cortex
Clinical Case Studies
Comprehensive Psychiatry
Developmental Psychology
European Psychologist
Frontiers in Human Neuroscience
Human Brain Mapping
International Journal of Epidemiology
International Journal of Impotence Research
International Journal of Sexual Health
International Journal of Transgenderism
Journal of Abnormal Psychology
Journal of Clinical Psychology
Journal of Consulting and Clinical Psychology
Journal of Forensic Psychology Practice
Journal for the Scientific Study of Religion
Journal of Sexual Aggression
Journal of Sexual Medicine
Journal of Psychiatric Research
Nature Neuroscience
Neurobiology Reviews
Neuroscience & Biobehavioral Reviews
Neuroscience Letters
Proceedings of the Royal Society B (Biological Sciences)
Psychological Assessment
Psychological Medicine
Psychological Science
Psychology of Men & Masculinity
Sex Roles
Sexual and Marital Therapy
Sexual and Relationship Therapy
Sexuality & Culture
Sexuality Research and Social Policy
The Clinical Psychologist
Traumatology
World Journal of Biological Psychiatry

GRANT REVIEW PANELS

2017–2021 Member, College of Reviewers, *Canadian Institutes of Health Research,* Canada.

2017 Committee Member, Peer Review Committee—Doctoral Research Awards A. *Canadian Institutes of Health Research*, Canada.

2017 Member, International Review Board, Research collaborations on behavioural disorders related to violence, neglect, maltreatment and abuse in childhood and adolescence. *Bundesministerium für Bildung und Forschung [Ministry of Education and Research],* Germany.

2016 Reviewer. National Science Center [*Narodowe Centrum Nauki*], Poland.

2016 Committee Member, Peer Review Committee—Doctoral Research Awards A. *Canadian Institutes of Health Research*, Canada.

2015 Assessor (Peer Reviewer). Discovery Grants Program. *Australian Research Council,* Australia.

2015 Reviewer. *Czech Science Foundation,* Czech Republic.

2015 Reviewer, "Off the beaten track" grant scheme. *Volkswagen Foundation,* Germany.

2015 External Reviewer, Discovery Grants program—Biological Systems and Functions. *National Sciences and Engineering Research Council of Canada*, Canada

2015 Committee Member, Peer Review Committee—Doctoral Research Awards A. *Canadian Institutes of Health Research*, Canada.

2014 Assessor (Peer Reviewer). Discovery Grants Program. *Australian Research Council,* Australia.

2014 External Reviewer, Discovery Grants program—Biological Systems and Functions. *National Sciences and Engineering Research Council of Canada*, Canada.

2014 Panel Member, Dean's Fund—Clinical Science Panel. *University of Toronto Faculty of Medicine*, Canada.

2014 Committee Member, Peer Review Committee—Doctoral Research Awards A. *Canadian Institutes of Health Research*, Canada.

2013 Panel Member, Grant Miller Cancer Research Grant Panel. *University of Toronto Faculty of Medicine*, Canada.

2013	Panel Member, Dean of Medicine Fund New Faculty Grant Clinical Science Panel. *University of Toronto Faculty of Medicine,* Canada.
2012	Board Member, International Review Board, Research collaborations on behavioural disorders related to violence, neglect, maltreatment and abuse in childhood and adolescence (2nd round). *Bundesministerium für Bildung und Forschung [Ministry of Education and Research],* Germany.
2012	External Reviewer, University of Ottawa Medical Research Fund. *University of Ottawa Department of Psychiatry*, Canada.
2012	External Reviewer, Behavioural Sciences—B. *Canadian Institutes of Health Research*, Canada.
2011	Board Member, International Review Board, Research collaborations on behavioural disorders related to violence, neglect, maltreatment and abuse in childhood and adolescence. *Bundesministerium für Bildung und Forschung [Ministry of Education and Research],* Germany.

TEACHING AND TRAINING

PostDoctoral Research Supervision
Law & Mental Health Program, Centre for Addiction and Mental Health, Toronto, Canada

Dr. Katherine S. Sutton	Sept., 2012–Dec., 2013
Dr. Rachel Fazio	Sept., 2012–Aug., 2013
Dr. Amy Lykins	Sept., 2008–Nov., 2009

Doctoral Research Supervision
Centre for Addiction and Mental Health, Toronto, Canada

Michael Walton • University of New England, Australia	Sept., 2017–Aug., 2018
Debra Soh • York University	May, 2013–Aug, 2017
Skye Stephens • Ryerson University	April, 2012–June, 2016

Masters Research Supervision
Centre for Addiction and Mental Health, Toronto, Canada

Nicole Cormier • Ryerson University	June, 2012–present
Debra Soh • Ryerson University	May, 2009–April, 2010

Undergraduate Research Supervision
Centre for Addiction and Mental Health, Toronto, Canada

Kylie Reale • Ryerson University	Spring, 2014
Jarrett Hannah • University of Rochester	Summer, 2013
Michael Humeniuk • University of Toronto	Summer, 2012

Clinical Supervision (Doctoral Internship)
Clinical Internship Program, Centre for Addiction and Mental Health, Toronto, Canada

Katherine S. Sutton • Queen's University	2011–2012
David Sylva • Northwestern University	2011–2012
Jordan Rullo • University of Utah	2010–2011
Lea Thaler • University of Nevada, Las Vegas	2010–2011
Carolin Klein • University of British Columbia	2009–2010
Bobby R. Walling • University of Manitoba	2009–2010

TEACHING AND TRAINING

Clinical Supervision (Doctoral- and Masters- level practica)
Centre for Addiction and Mental Health, Toronto, Canada

Tyler Tulloch • Ryerson University	2013–2014
Natalie Stratton • Ryerson University	Summer, 2013
Fiona Dyshniku • University of Windsor	Summer, 2013
Mackenzie Becker • McMaster University	Summer, 2013
Skye Stephens • Ryerson University	2012–2013
Vivian Nyantakyi • Capella University	2010–2011
Cailey Hartwick • University of Guelph	Fall, 2010
Tricia Teeft • Humber College	Summer, 2010
Allison Reeves • Ontario Institute for Studies in Education/Univ. of Toronto	2009–2010
Helen Bailey • Ryerson University	Summer, 2009
Edna Aryee • Ontario Institute for Studies in Education/Univ. of Toronto	2008–2009
Iryna Ivanova • Ontario Institute for Studies in Education/Univ. of Toronto	2008–2009
Jennifer Robinson • Ontario Institute for Studies in Education/Univ. of Toronto	2008–2009
Zoë Laksman • Adler School of Professional Psychology	2005–2006
Diana Mandelew • Adler School of Professional Psychology	2005–2006
Susan Wnuk • York University	2004–2005
Hiten Lad • Adler School of Professional Psychology	2004–2005
Natasha Williams • Adler School of Professional Psychology	2003–2004
Lisa Couperthwaite • Ontario Institute for Studies in Education/Univ. of Toronto	2003–2004
Lori Gray, née Robichaud • University of Windsor	Summer, 2003
Sandra Belfry • Ontario Institute for Studies in Education/Univ. of Toronto	2002–2003
Althea Monteiro • York University	Summer, 2002
Samantha Dworsky • York University	2001–2002
Kerry Collins • University of Windsor	Summer, 2001
Jennifer Fogarty • Waterloo University	2000–2001
Emily Cripps • Waterloo University	Summer, 2000
Lee Beckstead • University of Utah	2000

PROFESSIONAL SOCIETY ACTIVITIES

OFFICES HELD

2018–2019 Local Host. Society for Sex Therapy and Research.

2015 Member, International Scientific Committee, World Association for Sexual Health.

2015 Member, Program Planning and Conference Committee, Association for the Treatment of Sexual Abusers

2012–2013 Chair, Student Research Awards Committee, Society for Sex Therapy & Research

2012–2013 Member, Program Planning and Conference Committee, Association for the Treatment of Sexual Abusers

2011–2012 Chair, Student Research Awards Committee, Society for Sex Therapy & Research

2010–2011 Scientific Program Committee, International Academy of Sex Research

2002–2004 Membership Committee • APA Division 12 (Clinical Psychology)

2002–2003 Chair, Committee on Science Issues, APA Division 44

2002 Observer, Grant Review Committee • Canadian Institutes of Health Research Behavioural Sciences (B)

2001–2009 Reviewer • APA Division 44 Convention Program Committee

2001, 2002 Reviewer • APA Malyon-Smith Scholarship Committee

2000–2005 Task Force on Transgender Issues, APA Division 44

1998–1999 Consultant, APA Board of Directors Working Group on Psychology Marketplace

1997 Student Representative • APA Board of Professional Affairs' Institute on TeleHealth

1997–1998 Founder and Chair • APA/APAGS Task Force on New Psychologists' Concerns

1997–1999 Student Representative • APA/CAPP Sub-Committee for a National Strategy for Prescription Privileges

1997–1999 Liaison • APA Committee for the Advancement of Professional Practice

1997–1998 Liaison • APA Board of Professional Affairs

1993–1997 Founder and Chair • APA/APAGS Committee on LGB Concerns

PROFESSIONAL SOCIETY ACTIVITIES

MEMBERSHIPS

2017–2021 Member • *Canadian Sex Research Forum*

2009–Present Member • *Society for Sex Therapy and Research*

2007–Present Fellow • *Association for the Treatment and Prevention of Sexual Abuse*

2006–Present Full Member (elected) • *International Academy of Sex Research*

2006–Present Research and Clinical Member • *Association for the Treatment and Prevention of Sexual Abuse*

2003–2006 Associate Member (elected) • *International Academy of Sex Research*

2002 Founding Member • CPA Section on Sexual Orientation and Gender Identity

2001–2013 Member • *Canadian Psychological Association* (CPA)

2000–2015 Member • *American Association for the Advancement of Science*

2000–2015 Member • *American Psychological Association* (APA)

APA Division 12 (Clinical Psychology)

APA Division 44 (Society for the Psychological Study of LGB Issues)

2000–2020 Member • *Society for the Scientific Study of Sexuality*

1995–2000 Student Member • *Society for the Scientific Study of Sexuality*

1993–2000 Student Affiliate • *American Psychological Association*

1990–1999 Member, American Psychological Association of Graduate Students (APAGS)

CLINICAL LICENSURE/REGISTRATION

Certificate of Registration, Number 3793
College of Psychologists of Ontario, Ontario, Canada

AWARDS AND HONORS

2022 Distinguished Contribution Award
Association for the Treatment and Prevention of Sexual Abuse (ATSA)

2011 Howard E. Barbaree Award for Excellence in Research
Centre for Addiction and Mental Health, Law and Mental Health Program

2004 fMRI Visiting Fellowship Program at Massachusetts General Hospital
American Psychological Association Advanced Training Institute and NIH

1999–2001 CAMH Post-Doctoral Research Fellowship
Centre for Addiction and Mental Health Foundation and Ontario Ministry of Health

1998 Award for Distinguished Contribution by a Student
American Psychological Association, Division 44

1995 Dissertation Research Grant
Society for the Scientific Study of Sexuality

1994–1996 McGill University Doctoral Scholarship

1994 Award for Outstanding Contribution to Undergraduate Teaching
"TA of the Year Award," from the McGill Psychology Undergraduate Student Association

MAJOR MEDIA

(Complete list available upon request.)

Feature-length Documentaries

Vice Canada Reports. *Age of Consent.* 14 Jan 2017.
Canadian Broadcasting Company. *I, Pedophile.* Firsthand documentaries. 10 Mar 2016.

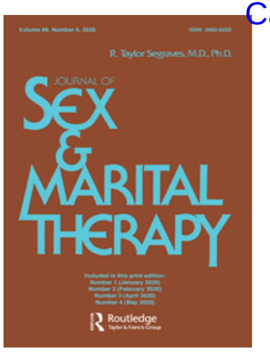
Appearances and Interviews

11 Mar 2020. Ibbitson, John. It is crucial that Parliament gets the conversion-therapy ban right. *The Globe & Mail.*
25 Jan 2020. Ook de hulpvaardige buurman kan verzamelaar van kinderporno zin. *De Morgen.*
3 Nov 2019. Village of the damned. *60 Minutes Australia.*
1 Nov 2019. HÅKON F. HØYDAL. Norsk nettovergriper: – Jeg hater meg selv: Nordmannen laster ned overgrepsmateriale fra nettet – og oppfordrer politiet til å gi amnesti for slike som ham.
10 Oct 2019. Smith, T. Growing efforts are looking at how—or if—#MeToo offenders can be reformed. *National Public Radio.*
29 Sep 2019. Carey, B. Preying on Children: The Emerging Psychology of Pedophiles. *New York Times.*
29 Apr 2019. Mathieu, Isabelle. La poupée qui a troublé les Terre-Neuviens. *La Tribune.*
21 Mar 2019. Pope Francis wants psychological testing to prevent problem priests. But can it really do that? *The Washington Post.*
12 Dec 2018. Child sex dolls: Illegal in Canada, and dozens seized at the border. Ontario Today with Rita Celli. *CBC.*
12 Dec 2018. Celli, R. & Harris, K. Dozens of child sex dolls seized by Canadian border agents. *CBC News.*
27 Apr 2018. Rogers, Brook A. The online 'incel' culture is real–and dangerous. *New York Post.*
25 Apr 2018. Yang, J. Number cited in cryptic Facebook post matches Alek Minassian's military ID: Source. *Toronto Star.*
24 Ap 2018 Understanding 'incel'. *CTV News.*
27 Nov 2017. Carey, B. Therapy for Sexual Misconduct? It's Mostly Unproven. *New York Times.*
14 Nov 2017. Tremonti, A. M. The Current. *CBC.*
9 Nov2017. Christensen, J. Why men use masturbation to harass women. *CNN.* http://www.cnn.com/2017/11/09/health/masturbation-sexual-harassment/index.html
7 Nov 2017. Nazaryan, A. Why is the alt-right obsessed with pedophilia? *Newsweek.*
15 Oct 2017. Ouatik, B. Déscouvre. Pédophilie et science. *CBC Radio Canada.*
12 Oct 2017. Ouatik, B. Peut-on guérir la pédophilie? *CBC Radio Canada.*
11 Sep 2017. Burns, C. The young paedophiles who say they don't abuse children. *BBC News.*
18 Aug 2017. Interview. *National Post Radio.* Sirius XM Canada.
16 Aug 2017. Blackwell, Tom. Man says he was cured of pedophilia at Ottawa clinic: 'It's like a weight that's been lifted': But skeptics worry about the impact of sending pedophiles into the world convinced their curse has been vanquished. *National Post.*
26 Apr 2017. Zalkind, S. Prep schools hid sex abuse just like the catholic church. *VICE.*
24 Apr 2017. Sastre, P. Pédophilie: une panique morale jamais n'abolira un crime. *Slate France.*
12 Feb 2017. Payette, G. Child sex doll trial opens Pandora's box of questions. *CBC News.*
26 Nov 2016. Det morke uvettet ["The unknown darkness]". *Fedrelandsvennen.*
13 July 2016. Paedophilia: Shedding light on the dark field. *The Economist.*

1 Jul 2016. Debusschere, B. Niet iedereen die kinderporno kijkt, is een pedofiel: De mythes rond pedofilie ontkracht. *De Morgen.*
12 Apr 2016. O'Connor, R. Terence Martin: The Tasmanian MP whose medication 'turned him into a paedophile'. *The Independent.*
8 Mar 2016. Bielski, Z. 'The most viscerally hated group on earth': Documentary explores how intervention can stop pedophiles. *The Globe and Mail.*
1 Mar 2016. Elmhirst, S. What should we do about paedophiles? *The Guardian.*
24 Feb 2016. The man whose brain tumour 'turned him into a paedophile'. *The Independent.*
24 Nov 2015. Byron, T. The truth about child sex abuse. *BBC Two.*
20 Aug 2015. The Jared Fogle case: Why we understand so little about abuse. *Washington Post.*
19 Aug 2015. Blackwell, T. Treat sex offenders for impotence—to keep them out of trouble, Canadian psychiatrist says. *National Post.*
2 Aug 2015. Menendez, J. BBC News Hour. *BBC World Service.*
13 Jul 2015. The nature of pedophilia. *BBC Radio 4.*
9 Jul 2015. The sex-offender test: How a computerized assessment can help determine the fate of men who've been accused of sexually abusing children. *The Atlantic.*
10 Apr 2015. NWT failed to prevent sex offender from abusing stepdaughter again. *CBC News.*
10 Feb 2015. Savage, D. "The ethical sadist." In Savage Love. *The Stranger.*
31 Jan 2015. Begrip voor/van pedofilie [Understanding pedophilia]. *de Volkskrant.*
9 Dec 2014. Carey, B. When a rapist's weapon is a pill. *New York Times*.
1 Dec 2014. Singal, J. Can virtual reality help pedophiles? *New York Magazine.*
17 Nov2014. Say pedófile, busco aydua. *El Pais.*
4 Sep 2014. Born that way? *Ideas, with Paul Kennedy.* CBC Radio One.
27 Aug 2014. Interrogating the statistics for the prevalence of paedophilia. BBC.
25 Jul 2014. Stephenson, W. The prevalence of paedophilia. *BBC World Service.*
21 Jul 2014. Hildebrandt, A. Virtuous Pedophiles group gives support therapy cannot. *CBC.*
26 Jan 2014. Paedophilia a result of faulty wiring, scientists suggest. *Daily Mail.*
22 Dec 2013. Kane, L. Is pedophilia a sexual orientation? *Toronto Star.*
21 Jul 2013. Miller, L. The turn-on switch: Fetish theory, post-Freud. *New York Magazine.*
1 Jul 2013. Morin, H. Pédophilie: la difficile quête d'une origine biologique. *Le Monde.*
2 Jun 2013. Malcolm, L. The psychology of paedophilia. *Australian National Radio.*
1 Mar 2013. Kay, J. The mobbing of Tom Flanagan is unwarranted and cruel. *National Post.*
6 Feb 2013. Boy Scouts board delays vote on lifting ban on gays. *L.A. Times.*
31 Aug 2012. CNN Newsroom interview with Ashleigh Banfield. *CNN.*
24 Jun 2012. CNN Newsroom interview with Don Lemon. *CNN.*

EXPERT WITNESS TESTIMONY

1. 2023 L.W. v Dept of Health	Middle District, TN
2. 2023 K.C. v Medical Lic Board of Indiana	Southern District, IN
3. 2022 Baunee v Dept of Corrections	Onondaga County, NY
4. 2022 Bridge v Oklahoma State Dept of Education	Western District, OK
5. 2022 Dekker, et al. v Florida Agency for Health Care Admin	Tallahassee, FL
6. 2022 Roe v Utah High School Activities Assn.	Salt Lake County, UT
7. 2022 A.M. v Indiana Public Schools	Southern District, IN
8. 2022 Ricard v Kansas	Geery County, KS
9. 2022 Re Commitment of Baunee	Syracuse, NY
10. 2022 Hersom & Doe v WVa Health & Human Services	Southern District, WV
11. 2022 Eknes-Tucker v Alabama	Montgomery Cnty, AL
12. 2022 PFLAG, et al. v Texas	Travis County, TX
13. 2022 Doe v Texas	Travis County, TX
14. 2022 BPJ v West Virginia Board of Education	Southern District, WV
15. 2021 Cross et al. v Loudoun School Board	Loudoun, VA
16. 2021 Cox v Indiana Child Services	Child Services, IN
17. 2021 Josephson v University of Kentucky	Western District, KY
18. 2021 Re Commitment of Michael Hughes (Frye Hearing)	Cook County, IL
19. 2021 Arizona v Arnett Clifton	Maricopa County, AZ
20. 2019 US v Peter Bright	Southern District, NY
21. 2019 Spiegel-Savoie v Savoie-Sexten (Custody Hearing)	Boston, MA
22. 2019 Re Commitment of Steven Casper (Frye Hearing)	Kendall County, IL
23. 2019 Re Commitment of Inger (Frye Hearing)	Poughkeepsie, NY
24. 2019 Canada vs John Fitzpatrick (Sentencing Hearing)	Toronto, ON, Canada
25. 2018 Re Commitment of Little (Frye Hearing)	Utica, NY
26. 2017 Re Commitment of Nicholas Bauer (Frye Hearing)	Lee County, IL
27. 2017 US vs William Leford (Presentencing Hearing)	Warnock, GA
28. 2015 Florida v Jon Herb	Naples, FL
29. 2010 Re Detention of William Dutcher	Seattle, WA



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Transgender and Gender Diverse Children and Adolescents: Fact-Checking of AAP Policy

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ABSTRACT
The American Academy of Pediatrics (AAP) recently published a policy statement: *Ensuring comprehensive care and support for transgender and gender-diverse children and adolescents*. Although almost all clinics and professional associations in the world use what's called the *watchful waiting* approach to helping gender diverse (GD) children, the AAP statement instead rejected that consensus, endorsing *gender affirmation* as the only acceptable approach. Remarkably, not only did the AAP statement fail to include any of the actual outcomes literature on such cases, but it also misrepresented the contents of its citations, which repeatedly said the very opposite of what AAP attributed to them.

The American Academy of Pediatrics (AAP) recently published a policy statement entitled, *Ensuring comprehensive care and support for transgender and gender-diverse children and adolescents* (Rafferty, AAP Committee on Psychosocial Aspects of Child and Family Health, AAP Committee on Adolescence, AAP Section on Lesbian, Gay, Bisexual, and Transgender Health and Wellness, 2018). These are children who manifest discontent with the sex they were born as and desire to live as the other sex (or as some alternative gender role). The policy was quite a remarkable document: Although almost all clinics and professional associations in the world use what's called the *watchful waiting* approach to helping transgender and gender diverse (GD) children, the AAP statement rejected that consensus, endorsing only *gender affirmation*. That is, where the consensus is to delay any transitions after the onset of puberty, AAP instead rejected waiting before transition. With AAP taking such a dramatic departure from other professional associations, I was immediately curious about what evidence led them to that conclusion. As I read the works on which they based their policy, however, I was pretty surprised—rather alarmed, actually: These documents simply did not say what AAP claimed they did. In fact, the references that AAP cited as the basis of their policy instead outright contradicted that policy, repeatedly endorsing *watchful waiting*.

The AAP statement was also remarkable in what it left out—namely, the actual outcomes research on GD children. In total, there have been 11 follow-up studies of GD children, of which AAP cited one (Wallien & Cohen-Kettenis, 2008), doing so without actually mentioning the outcome data it contained. The literature on outcomes was neither reviewed, summarized, nor subjected to meta-analysis to be considered in the aggregate—It was merely disappeared. (The list of all existing studies appears in the appendix.) As they make clear, *every* follow-up study of GD children, without exception, found the same thing: Over puberty, the majority of GD children cease to want to transition. AAP is, of course, free to establish whatever policy it likes on

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whatever basis it likes. But any assertion that their policy is based on evidence is demonstrably false, as detailed below.

AAP divided clinical approaches into three types—conversion therapy, watchful waiting, and gender affirmation. It rejected the first two and endorsed *gender affirmation* as the only acceptable alternative. Most readers will likely be familiar already with attempts to use conversion therapy to change sexual orientation. With regard to gender identity, AAP wrote:

> "[C]onversion" or "reparative" treatment models are used to prevent children and adolescents from identifying as transgender or to dissuade them from exhibiting gender-diverse expressions.… Reparative approaches have been proven to be not only unsuccessful[38] but also deleterious and are considered outside the mainstream of traditional medical practice.[29,39–42]

The citations were:

38. Haldeman DC. The practice and ethics of sexual orientation conversion therapy. *J Consult Clin Psychol.* 1994;62(2):221–227.

29. Adelson SL; American Academy of Child and Adolescent Psychiatry (AACAP) Committee on Quality Issues (CQI). Practice parameter on gay, lesbian, or bisexual sexual orientation, gender nonconformity, and gender discordance in children and adolescents. *J Am Acad Child Adolesc Psychiatry.* 2012;51(9):957–974.

39. Byne W. Regulations restrict practice of conversion therapy. *LGBT Health.* 2016;3(2):97–99.

40. Cohen-Kettenis PT, Delemarrevan de Waal HA, Gooren LJ. The treatment of adolescent transsexuals: changing insights. *J Sex Med.* 2008;5(8):1892–1897.

41. Bryant K. Making gender identity disorder of childhood: historical lessons for contemporary debates. *Sex Res Soc Policy.* 2006;3(3):23–39.

42. World Professional Association for Transgender Health. *WPATH De-Psychopathologisation Statement.* Minneapolis, MN: World Professional Association for Transgender Health; 2010.

AAP's claims struck me as odd because *there are no studies of conversion therapy for gender identity.* Studies of conversion therapy have been limited to *sexual orientation,* and, moreover, to the sexual orientation *of adults,* not to gender identity and not of children in any case. The article AAP cited to support their claim (reference number 38) is indeed a classic and well-known review, but it is a review of sexual orientation research *only.* Neither gender identity, nor even children, received a single mention in it. Indeed, the narrower scope of that article should be clear to anyone reading even just its title: "The practice and ethics of *sexual orientation* conversion therapy" [italics added].

AAP continued, saying that conversion approaches for GD children have already been rejected by medical consensus, citing five sources. This claim struck me as just as odd, however—I recalled associations banning conversion therapy for sexual orientation, but not for gender identity, exactly because there is no evidence for generalizing from adult sexual orientation to childhood gender identity. So, I started checking AAP's citations for that, and these sources too pertained only to sexual orientation, not gender identity (specifics below). What AAP's sources *did* repeatedly emphasize was that:

A. Sexual orientation of adults is unaffected by conversion therapy and any other [known] intervention;
B. Gender dysphoria in childhood before puberty desists in the majority of cases, becoming (cis-gendered) homosexuality in adulthood, again regardless of any [known] intervention; and
C. Gender dysphoria in childhood persisting after puberty tends to persist entirely.

That is, in the context of GD children, it simply makes no sense to refer to externally induced "conversion": The majority of children "convert" to cisgender or "desist" from transgender *regardless* of any attempt to change them. "Conversion" only makes sense with regard to adult sexual orientation because (unlike childhood gender identity), adult homosexuality never or nearly never spontaneously changes to heterosexuality. Although gender identity and sexual orientation may often be analogous and discussed together with regard to social or political values and to civil rights, they are nonetheless distinct—with distinct origins, needs, and responses to medical and mental health care choices. Although AAP emphasized to the reader that "gender identity is not synonymous with 'sexual orientation'" (Rafferty et al., 2018, p. 3), they went ahead to treat them as such nonetheless.

To return to checking AAP's fidelity to its sources: Reference 29 was a practice guideline from the Committee on Quality Issues of the American Academy of Child and Adolescent Psychiatry (AACAP). Despite AAP applying this source to *gender identity,* AACAP was quite unambiguous regarding their intent to speak to sexual orientation and *only* to sexual orientation: "Principle 6. Clinicians should be aware that there is no evidence that *sexual orientation* can be altered through therapy, and that attempts to do so may be harmful. There is no established evidence that change in a predominant, enduring *homosexual* pattern of development is possible. Although sexual fantasies can, to some degree, be suppressed or repressed by those who are ashamed of or in conflict about them, sexual desire is not a choice. However, behavior, social role, and—to a degree—identity and self-acceptance are. Although operant conditioning modifies sexual fetishes, it does not alter *homosexuality*. Psychiatric efforts to alter *sexual orientation* through 'reparative therapy' *in adults* have found little or no change in *sexual orientation,* while causing significant risk of harm to self-esteem" (AACAP, 2012, p. 967, italics added).

Whereas AAP cites AACAP to support gender affirmation as the only alternative for treating GD children, AACAP's actual view was decidedly neutral, noting the lack of evidence: "Given the lack of empirical evidence from randomized, controlled trials of the efficacy of treatment aimed at eliminating gender discordance, the potential risks of treatment, and longitudinal evidence that gender discordance persists in only a small minority of untreated cases arising in childhood, further research is needed on predictors of persistence and desistence of childhood gender discordance as well as the long-term risks and benefits of intervention before any treatment to eliminate gender discordance can be endorsed" (AACAP, 2012, p. 969). Moreover, whereas AAP rejected watchful waiting, what AACAP recommended was: "In general, it is desirable to help adolescents who may be experiencing gender distress and dysphoria to defer sex reassignment until adulthood" (AACAP, 2012, p. 969). So, not only did AAP attribute to AACAP something AACAP never said, but also AAP withheld from readers AACAP's actual view.

Next, in reference 39, Byne (2016) also addressed only sexual orientation, doing so very clearly: "Reparative therapy is a subset of conversion therapies based on the premise that *same-sex attraction* are reparations for childhood trauma. Thus, practitioners of reparative therapy believe that exploring, isolating, and repairing these childhood emotional wounds will often result in reducing *same-sex attractions*" (Byne, 2016, p. 97). Byne does not say this of gender identity, as the AAP statement misrepresents.

In AAP reference 40, Cohen-Kettenis et al. (2008) did finally pertain to gender identity; however, this article never mentions conversion therapy. (!) Rather, in this study, the authors presented that clinic's lowering of their minimum age for cross-sex hormone treatment from age 18 to 16, which they did on the basis of a series of studies showing the high rates of success with this age group. Although it did strike me as odd that AAP picked as support against conversion therapy an article that did not mention conversion therapy, I could imagine AAP cited the article as an example of what the "mainstream of traditional medical practice" consists of (the logic being that conversion therapy falls outside what an 'ideal' clinic like this one provides). However, what this clinic provides is the very *watchful waiting* approach that AAP rejected. The approach espoused by Cohen-Kettenis (and the other clinics mentioned in the source—Gent, Boston, Oslo, and now formerly, Toronto) is to make puberty-halting interventions available at age 12 because: "[P]ubertal suppression may give adolescents, together with the attending health professional, more time to explore their gender identity, without the distress of the developing secondary sex characteristics. The precision of the diagnosis may thus be improved" (Cohen-Kettenis et al., 2008, p. 1894).

Reference 41 presented a very interesting history spanning the 1960s–1990s about how feminine boys and tomboyish girls came to be recognized as mostly pre-homosexual, and how that status came to be entered into the DSM at the same time as homosexuality was being *removed* from the DSM. Conversion therapy is never mentioned. Indeed, to the extent that Bryant mentions treatment at all, it is to say that treatment is entirely irrelevant to his analysis: "An important omission from the *DSM* is a discussion of the kinds of treatment that GIDC children should receive. (This omission is a general orientation of the DSM and not unique to GIDC)" (Bryant, 2006, p. 35). How this article supports AAP's claim is a mystery. Moreover, how AAP could cite a 2006 history discussing events of the 1990s and earlier to support a claim about the *current* consensus in this quickly evolving discussion remains all the more unfathomable.

Cited last in this section was a one-paragraph press release from the World Professional Association for Transgender Health. Written during the early stages of the American Psychiatric Association's (APA's) update of the DSM, the statement asserted simply that "The WPATH Board of Directors strongly urges the de-psychopathologisation of gender variance worldwide." Very reasonable debate can (and should) be had regarding whether gender dysphoria should be removed from the DSM as homosexuality was, and WPATH was well within its purview to assert that it should. Now that the DSM revision process is years completed however, history has seen that APA ultimately retained the diagnostic categories, rejecting WPATH's urging. This makes AAP's logic entirely backwards: That WPATH's request to depathologize gender dysphoria was *rejected* suggests that it is *WPATH's* view—and therefore the AAP policy—which fall "outside the mainstream of traditional medical practice." (!)

AAP based this entire line of reasoning on their belief that conversion therapy is being used "to prevent children and adolescents from identifying as transgender" (Rafferty et al., 2018, p. 4). That claim is left without citation or support. In contrast, what is said by AAP's sources is "delaying affirmation should *not* be construed as conversion therapy or an attempt to change gender identity" in the first place (Byne, 2016, p. 2). Nonetheless, AAP seems to be doing exactly that: simply relabeling any alternative approach as equivalent to conversion therapy.

Although AAP (and anyone else) may reject (what they label to be) conversion therapy purely on the basis of political or personal values, there is no evidence to back the AAP's stated claim about the existing science on gender identity at all, never mind gender identity of children.

AAP also dismissed the watchful waiting approach out of hand, not citing any evidence, but repeatedly calling it "outdated." The criticisms AAP provided, however, again defied the existing evidence, with even its own sources repeatedly calling watchful waiting the current standard. According to AAP:

> [G]ender affirmation is in contrast to the outdated approach in which a child's gender-diverse assertions are held as "possibly true" until an arbitrary age (often after pubertal onset) when they can be considered valid, an approach that authors of the literature have termed "watchful waiting." This outdated approach does not serve the child because critical support is withheld. Watchful waiting is based on binary notions of gender in which gender diversity and fluidity is pathologized; in watchful waiting, it is also assumed that notions of gender identity become fixed at a certain age. The approach is also influenced by a group of early studies with validity concerns, methodologic flaws, and limited follow-up on children who identified as TGD and, by adolescence, did not seek further treatment ("desisters").[45,47]

The citations from AAP's reference list are:

45. Ehrensaft D, Giammattei SV, Storck K, Tishelman AC, Keo-Meier C. Prepubertal social gender transitions: what we know; what we can learn—a view from a gender affirmative lens. *Int J Transgend.* 2018;19(2):251–268

47. Olson KR. Prepubescent transgender children: what we do and do not know. *J Am Acad Child Adolesc Psychiatry.* 2016;55(3):155–156.e3

I was surprised first by the AAP's claim that watchful waiting's delay to puberty was somehow "arbitrary." The literature, including AAP's sources, repeatedly indicated the pivotal importance of puberty, noting that outcomes strongly diverge at that point. According to AAP reference 29, in "*prepubertal* boys with gender discordance—including many without any mental health treatment—the cross gender wishes usually fade over time and do not persist into adulthood, with only 2.2% to 11.9% continuing to experience gender discordance" (Adelson & AACAP, 2012, p. 963, italics added), whereas "when gender variance with the desire to be the other sex is present *in adolescence,* this desire usually does persist through adulthood" (Adelson & AACAP, 2012, p. 964, italics added). Similarly, according to AAP reference 40, "Symptoms of GID *at prepubertal ages* decrease or even disappear in a considerable percentage of children (estimates range from 80–95%). Therefore, any intervention in childhood would seem premature and inappropriate. However, GID persisting *into early puberty* appears to be highly persistent" (Cohen-Kettenis et al., 2008, p. 1895, italics added). That follow-up studies of prepubertal transition differ from postpubertal transition is the very meaning of non-arbitrary. AAP gave readers exactly the reverse of what was contained in its own sources. If AAP were correct in saying that puberty is an arbitrarily selected age, then AAP will be able to offer another point to wait for with as much empirical backing as puberty has.

Next, it was not clear on what basis AAP could say that watchful waiting withholds support—AAP cited no support for its claim. The people in such programs often receive substantial support during this period. Also unclear is on what basis AAP could already know exactly which treatments are "critical" and which are not—Answering that question is the very purpose of this entire endeavor. Indeed, the logic of AAP's claim appears entirely circular: It is only if one were already pre-convinced that gender affirmation is the only acceptable alternative that would make watchful waiting seem to withhold critical support—What it delays is gender affirmation, the method one has already decided to be critical.

Although AAP's next claim did not have a citation appearing at the end of its sentence, binary notions of gender were mentioned both in references 45 and 47. Specifically, both pointed out that existing outcome studies have been about people transitioning from one sex to the other, rather than from one sex to an in-between status or a combination of masculine/feminine features. Neither reference presented this as a reason to reject the results from the existing studies of complete transition however (which is how AAP cast it). Although it is indeed true that the outcome data have been about complete transition, some future study showing that partial transition shows a different outcome would not invalidate what is known about complete transition. Indeed, data showing that partial transition gives better outcomes than complete transition would, once again, support the watchful waiting approach which AAP rejected.

Next was a vague reference alleging concerns and criticisms about early studies. Had AAP indicated what those alleged concerns and flaws were (or which studies they were), then it would be possible to evaluate or address them. Nonetheless, the argument is a red herring: Because all of the later studies showed the same result as did the early studies, any such allegation is necessarily moot.

Reference 47 was a one-and-a-half page commentary in which the author off-handedly mentions criticisms previously made of three of the eleven outcome studies of GD children, but does not provide any analysis or discussion. The only specific claim was that studies (whether early or late) had limited follow-up periods—the logic being that had outcome researchers lengthened the follow-up period, then people who seemed to have desisted might have returned to the clinic as cases of "persistence-after-interruption." Although one could debate the merits of that prediction, AAP instead simply withheld from the reader the result from the original researchers having tested that very prediction directly: Steensma and Cohen-Kettenis (2015) conducted another analysis of their cohort, by then ages 19–28 (mean age 25.9 years), and found that 3.3% (5 people of the sample of 150) later returned. That is, in long-term follow-up, the childhood sample showed 66.7% desistence instead of 70.0% desistance.

Reference 45 did not support the claim that watchful-waiting is "outdated" either. Indeed, that source said the very opposite, explicitly referring to watchful waiting as the *current* approach: "Put another way, if clinicians are straying from SOC 7 guidelines for social transitions, not abiding by the watchful waiting model *favored by the standards,* we will have adolescents who have been consistently living in their affirmed gender since age 3, 4, or 5" (Ehrensaft et al., 2018, p. 255). Moreover, Ehrensaft et al. said there are cases in which they too would still use watchful waiting: "When a child's gender identity is unclear, the watchful waiting approach can give the child and their family time to develop a clearer understanding and is not necessarily in contrast to the needs of the child" (p. 259). Ehrensaft et al. are indeed critical of the watchful waiting model (which they feel is applied too conservatively), but they do not come close to the position the AAP policy espouses. Where Ehrensaft summaries the potential benefits and potential risks both to transitioning and not transitioning, the AAP presents an ironically binary narrative.

In its policy statement, AAP told neither the truth nor the whole truth, committing sins both of commission and of omission, asserting claims easily falsified by anyone caring to do any fact-checking at all. AAP claimed, "This policy statement is focused specifically on children and youth that identify as TGD rather than the larger LGBTQ population"; however, much of that evidence was about sexual orientation, not gender identity. AAP claimed, "Current available research and expert opinion from clinical and research leaders … will serve as the basis for recommendations" (pp. 1–2); however, they provided recommendations entirely unsupported and even in direct opposition to that research and opinion.

AAP is advocating for something far in excess of mainstream practice and medical consensus. In the presence of compelling evidence, that is just what is called for. The problems with Rafferty, however, do not constitute merely a misquote, a misinterpretation of an ambiguous statement, or a missing reference or two. Rather, AAP's statement is a systematic exclusion and misrepresentation of entire literatures. Not only did AAP fail to provide compelling evidence, it failed to provide the evidence at all. Indeed, AAP's recommendations are *despite* the existing evidence.

Disclosure statement

No potential conflict of interest was reported by the author.

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Rafferty, J., AAP Committee on Psychosocial Aspects of Child and Family Health, AAP Committee on Adolescence, AAP Section on Lesbian, Gay, Bisexual, and Transgender Health and Wellness. (2018). Ensuring comprehensive care and support for transgender and gender-diverse children and adolescents. *Pediatrics*, *142*(4), e20182162 doi:10.1542/peds.2018-2162

Steensma, T. D., & Cohen-Kettenis, P. T. (2015). More than two developmental pathways in children with gender dysphoria? *Journal of the American Academy of Child and Adolescent Psychiatry*, *52*, 147–148. doi:10.1016/j.jaac.2014.10.016

Wallien, M. S. C., & Cohen-Kettenis, P. T. (2008). Psychosexual outcome of gender-dysphoric children. *Journal of the American Academy of Child and Adolescent Psychiatry*, *47*, 1413–1423. doi:10.1097/CHI.0b013e31818956b9

Appendix

Count	Group	Study
2/16 4/16 10/16	gay* trans-/crossdress straight*/uncertain	Lebovitz, P. S. (1972). Feminine behavior in boys: Aspects of its outcome. *American Journal of Psychiatry, 128,* 1283–1289.
2/16 2/16 12/16	trans- uncertain gay	Zuger, B. (1978). Effeminate behavior present in boys from childhood: Ten additional years of follow-up. *Comprehensive Psychiatry, 19,* 363–369.
0/9 9/9	trans- gay	Money, J., & Russo, A. J. (1979). Homosexual outcome of discordant gender identity/role: Longitudinal follow-up. *Journal of Pediatric Psychology, 4,* 29–41.
2/45 10/45 33/45	trans-/crossdress uncertain gay	Zuger, B. (1984). Early effeminate behavior in boys: Outcome and significance for homosexuality. *Journal of Nervous and Mental Disease, 172,* 90–97.
1/10 2/10 3/10 4/10	trans- gay uncertain straight	Davenport, C. W. (1986). A follow-up study of 10 feminine boys. *Archives of Sexual Behavior, 15,* 511–517.
1/44 43/44	trans- cis-	Green, R. (1987). *The "sissy boy syndrome" and the development of homosexuality*. New Haven, CT: Yale University Press.
0/8 8/8	trans- cis-	Kosky, R. J. (1987). Gender-disordered children: Does inpatient treatment help? *Medical Journal of Australia, 146,* 565–569.
21/54 33/54	trans- cis-	Wallien, M. S. C., & Cohen-Kettenis, P. T. (2008). Psychosexual outcome of gender-dysphoric children. *Journal of the American Academy of Child and Adolescent Psychiatry, 47,* 1413–1423.
3/25 6/25 16/25	trans- lesbian/bi- straight	Drummond, K. D., Bradley, S. J., Badali-Peterson, M., & Zucker, K. J. (2008). A follow-up study of girls with gender identity disorder. *Developmental Psychology, 44*, 34–45.
17/139 122/139	trans- cis-	Singh, D. (2012). *A follow-up study of boys with gender identity disorder*. Unpublished doctoral dissertation, University of Toronto.
47/127 80/127	trans- cis-	Steensma, T. D., McGuire, J. K., Kreukels, B. P. C., Beekman, A. J., & Cohen-Kettenis, P. T. (2013). Factors associated with desistence and persistence of childhood gender dysphoria: A quantitative follow-up study. *Journal of the American Academy of Child and Adolescent Psychiatry, 52,* 582–590.

*For brevity, the list uses "gay" for "gay and cis-", "straight" for "straight and cis-", etc.

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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA
TUCSON DIVISION

Jane Doe, *et al.*, Plaintiffs, v. Thomas C. Horne, in his official capacity as State Superintendent of Public Instruction, *et al.*, Defendants.	Case No. 4:23-cv-00185-JGZ **Declaration of Dr. Chad Thomas Carlson, M.D., FACSM in Support of [Intervenors' Proposed] Opposition to Plaintiffs' Motion for a Preliminary Injunction**

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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 sports such as swimming or track and field, 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]

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.

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[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 (accessed 5/24/22); 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)

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 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 I 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 served as 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 2023. 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 testified as an expert witness by deposition in *B.P.J. v. West Virginia*, S.D. W.V., No. 2:21-cv-00316 and *LE. v. Lee*, No. 3:21-cv-00835.

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 or 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.

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[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.

b. Injury in sport is somewhat predictable based on modeling assumptions that take into account relevant internal and external risk factors.

c. Males exhibit large average advantages in size, weight, and physical capacity over females—often falling far outside female ranges. Even before puberty, males demonstrate a performance advantage over females in most athletic endeavors. 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

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[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.

(Viviers 2018), lacrosse (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)

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.

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[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).

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. Thus, some national sport governing bodies have tightened their policies recently to restrict some transgender athletes who began transition at eleven or twelve years of age from competing in future sanctioned events in their identified gender. (McLarnon 2023)

17. Global population-based fitness testing over wide geographical regions reveals consistent measurable performance advantages of boys over girls in tests measuring speed, upper and lower body limb strength and power. (Kasovic 2021; De Miguel-Etayo 2014; Tambalis 2016; Catley 2013.) Prospective data involving the training of eight-year-old boys and girls in kicking and throwing ability shows consistently higher performance of boys over girls at baseline, and similar gains from baseline in both sexes after coaching. (Dohrmann 1964.) I have reviewed the expert declaration of Gregory A. Brown, Ph.D., FACM of February 23, 2022, provided in West Virginia's 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 into a given pool (e.g. an adult onto

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[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.

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 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.

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[11] $2 \times 2^2 = 8$

[12] $1.2 \times (1.15)^2 = 1.587$

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 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 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

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[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.

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

[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.

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. 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 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

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[15] https://bjj-world.com/transgender-mma-fighter-fallon-fox-breaks-skull-of-her-female-opponent/

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 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

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[16] http://age-records.125mb.com/.

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 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

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[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)."

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 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,

[18] https://www.nata.org/press-release/062421/middle-school-sports-have-overall-higher-rate-concussion-reported-high-school.

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 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.

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[19] Valgus force at the knee is a side-applied force that gaps the medial knee open.

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.

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

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[20] https://www.ncaa.org/sports/2016/3/2/lesbian-gay-bisexual-transgender-and-questioning-lgbtq.aspx

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.) Indeed, next to breast tissue,

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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.

there is no tissue in the human body with more sex-differentiated genetic expression than skeletal muscle. (Gershoni 2017)

83. Assuming that active treatment with gender-affirming therapies actually result in full testosterone suppression – the evidence for which is mixed – (Heather 2022) 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; DeVarona 2021; Harper 2021.) As a medical doctor, I will focus on those specific sex-based characteristics of males who have 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 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

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[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

testosterone suppression cannot mitigate sex-based performance differences, the IOC's new policy remains aspirational and opaque, and has come into early criticism by other Sports Medicine Federations, many of which, such as World Athletics, FINA, and the International Cyclist Union, have since issued policy changes further restricting biological males from participating against natal females.[24] (Pigozzi 2022.) 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. Bone density

88. 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.

89. 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).

B. Size and weight

90. 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

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[24] World Athletics Council decides on Russia, Belarus and female eligibility | PRESS-RELEASES | World Athletics

Transgender athletes | UCI

FINA Restricts Transgender Women From Competing at Elite Level - The New York Times (nytimes.com) females will suffer more abrupt deceleration in collisions with larger bodies, creating heightened injury risk for impacted females.

91. 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. Studies looking at the effect of GAHT on lean mass are generally split between those showing modest decreases, or no statistical change. (Ford 2021.) Researchers looking at transitioning adolescents found that the weight of biological male subjects *increased* rather than decreased after treatment with an antiandrogen testosterone suppressor, with no significant loss of muscle cross-sectional area. (Tack 2018.) Adolescent biological male subjects who were exposed to puberty-halting medications prior to institution of testosterone suppression presented with lean body mass 2.5 standard deviations higher than biological girls, and maintained gains of between 1–2 standard deviations at age 22. (Klaver 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.) Finally, a 2022 study comparing biological males on an average of 14.4 years of GAHT to cisgender men and women showed that, despite testosterone levels that were in female range, both skeletal muscle mass and appendicular skeletal mass adjusted for height, as well as handgrip strength, remained statistically greater than cisgender controls. Activity in this study was controlled for, and did not differ between examined groups. (Alvares 2022)

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 will leave 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.) 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.) A similar study in 2022 looking at 228 biologically male, transitioning Air Force personnel showed that these individuals retained statistical advantage over cis-gender females up to four years for sit-ups, and indefinitely for push-ups, despite the fact that this group started GAHT underperforming to cisgender males in push-ups at baseline. (Chiccarelli 2022) An 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, and torque-generating ability actually increased, 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.)

93. 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.)

94. 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 studies I mention above were physically fit and engaged in regular physical training. But neither those studies, nor 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 in patients undergoing recent androgen deprivation, 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.) Another study of patients on chronic androgen deprivation therapy (mean 1136 days) showed that a 20 week progressive resistance training program moving from concentric toward eccentric load training resulted in 41% improvements in both chest press and seated rows, and a 96% improvement in leg press. (Galvao 2006)

95. 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

96. 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;[25] 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 (DeVarona 2021), when a biologically-male collegiate swimmer transitions and moves from 65th place in the men's 500 m event, to NCAA champion in the women's 500 meter race, (Senefeld, JW., 2023) 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.

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. (Johns 2017; Herman 2017.)

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,

[25] https://en.wikipedia.org/wiki/Cece_Telfer (accessed 6/20/21)

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, 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.

I swear or affirm, under penalty of perjury, that the foregoing is true and correct.

Dated: May 18, 2023

/s/ Chad Carlson, M.D., FACSM

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