No. 23-16026 c/w No. 23-16030

IN THE UNITED STATES COURT OF APPEALS FOR THE NINTH CIRCUIT

HELEN DOE, parent and next friend of Jane Doe; et al.,

Plaintiffs-Appellees,

v.

THOMAS C. HORNE, in his official capacity as State Superintendent of Public Instruction; et al.,

Defendants-Appellants,

and

WARREN PETERSEN, Senator, President of the Arizona State Senate; BEN TOMA, Representative, Speaker of the Arizona House of Representatives,

Intervenor-Defendants-Appellants.

On Appeal from the United States District Court for the District of Arizona

EXCERPTS OF RECORD – VOLUME 1

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF ARIZONA

Helen Doe, et al., Plaintiffs, v. Thomas C Horne, et al., Defendants.	No. CV-23-00185-TUC-JGZ **ORDER ON MOTION FOR PRELIMINARY INJUNCTION AND FINDINGS OF FACT AND CONCLUSIONS OF LAW**

INTRODUCTION

Plaintiffs filed this action on April 17, 2023, seeking preliminary and permanent injunctive relief related to the implementation of A.R.S. § 15-120.02, the Save Women's Sports Act ("the Act"), which Plaintiffs allege precludes them from playing on girls' sports teams because they are transgender girls. Plaintiffs assert that they have not undergone male puberty and do not have a competitive or physiological advantage over their non-transgender peers on these teams. Plaintiffs ask the Court for declaratory relief that enforcement by Defendants of Ariz. Rev. Stat. § 15-120.02 violates Plaintiffs' rights under the Equal Protection Clause of the Fourteenth Amendment to the United States Constitution, Title IX, 20 U.S.C. § 1681 et seq., the Americans with Disabilities Act, 42 U.S.C. § 12101, et seq., and Section 504 of the Rehabilitation Act, 29 U.S.C. § 794, et seq.

The Arizona legislature adopted A.R.S. § 15-120.02, effective September 24, 2022, as follows: "Each interscholastic or intramural athletic team or sport that is sponsored by a public school or a private school whose students or teams compete against a public school shall be expressly designated as one of the following based on the biological sex of the students who participate on the team or in the sport: 1) 'males,' 'men' or 'boys'; 2) 'females,' 'women' or 'girls,' and 3) 'coed' or 'mixed'." "Athletic teams or sports designated for 'females,' 'women' or 'girls' may not be open to students of the male sex." The statute does not apply to "restrict the eligibility of any student to participate in any . . . athletic team or sport designated as being for males, men or boys or designated as coed or mixed." The statute creates a private cause of action for injunctive relief and damages for any student for a deprivation of an athletic opportunity or who has suffered any direct or indirect harm as a result of a school knowingly violating this section.

The Motion for Preliminary Injunction asks the Court to enjoin enforcement of A.R.S. § 15-120.02 by Defendant Horne and enjoin implementation of and compliance with the Act by Defendants Kyrene Middle School and The Gregory School (TGS) as to Plaintiffs. The Court has granted intervenor status to the legislators who adopted the Act. The Motion for Preliminary Injunction was fully briefed by all parties and the Intervenor Legislators ("Intervenors"). The Court will grant the Motion for Preliminary Injunction pursuant to the Findings of Fact and Conclusions of Law set out below. Defendant Arizona Interscholastic Association, Inc.'s ("AIA") transgender policy, allowing transgender girls to play on teams consistent with their gender identity, complies with the terms of the preliminary injunction.

FINDINGS OF FACT AND CONCLUSIONS OF LAW

On July 10, 2023, the Court heard oral argument and took evidence pertaining to Plaintiffs' Motion for Preliminary Injunction. Having heard oral argument, having examined the proofs[1] offered by the parties, and having heard the arguments of counsel

[1] By stipulation, the parties offer proof by way of expert declarations filed in advance of the hearing and by supplement thereafter. Accordingly, the Court references the evidence herein by CM/ECF document number, not as a trial exhibit.

and being fully advised herein, the Court now finds generally in favor of Plaintiffs and against the Defendants, and hereby makes the following special Findings of Fact and Conclusions of Law pursuant to the Federal Rules of Civil Procedure, Rule 52(a) and (c) which constitutes the decision of the Court herein:

I. <u>Findings of Fact</u>

To the extent these Findings of Fact are also deemed to be Conclusions of Law, they are hereby incorporated into the Conclusions of Law that follow.

A. <u>Gender identity and gender dysphoria</u>.

1. "Gender identity" is the medical term for a person's internal, innate, deeply held sense of their own gender. (Dr. Daniel Shumer ("Shumer Decl.") (Doc. 5) ¶ 18.) Everyone has a gender identity. (*Id.*)

2. "Gender identity" differs from "gender role," which are behaviors, attitudes, and personality traits that a particular society considers masculine or feminine, or associates with male or female social roles. For example, the convention that girls wear pink and have longer hair, or that boys wear blue and have shorter hair, are socially constructed gender roles. Gender identity does not refer to socially contingent behaviors, attitudes, or personality traits; it is an internal and largely biological phenomenon. (Shumer Decl. (Doc. 5) ¶¶ 19-22.)

3. There is a consensus among medical organizations that gender identity is innate and cannot be changed through psychological or medical treatments. (Dr. Stephanie Budge Rebuttal ("Budge Decl. (Rebuttal)") (Doc. 65-1) ¶ 31; Dr. Stephanie Budge ("Budge Decl.") (Doc. 4) ¶ 21; Daniel Shumer Rebuttal ("Shumer Decl. (Rebuttal)") (Doc. 65-2) ¶¶ 54–58; Shumer Decl. (Doc. 5) ¶ 23.)

4. When a child is born, a health care provider identifies the child's sex based on the child's observable anatomy. (Budge Decl. (Doc. 4) ¶ 18; Shumer Decl. (Doc. 5) ¶ 27.) This identification is known as an "assigned sex," and in most cases turns out to be consistent with the person's gender identity. (Budge Decl. (Doc. 4) ¶ 18; Shumer Decl. (Doc. 5) ¶ 27.)

5. The term "biological sex" is not defined in the Act, but the Court finds that as used by Defendants it is synonymous with the term "assigned sex." (*See* Declaration of Dr. James

M. Cantor ("Cantor Decl.") (Doc. 82-2; Doc. 92-2) ¶¶ 105-107; Declaration of Dr. Gregory A. Brown ("Brown Decl.") (Doc. 82-1; 92-1) ¶ 1; Dr. Emma Hilton ("Hilton Decl.") (Doc. 92-8) ¶¶1.8, ¶ 3.1-3.2 (explaining sex is an objective feature determined at the moment of conception; infants are born male or female, ascertainable by chromosomal analysis or visual inspection at birth).)[2]

6. For a transgender person, that initial designation does not match the person's gender identity. (Budge Decl. (Doc. 4) ¶ 18; Shumer Decl. (Doc. 5) ¶ 27.)

7. Gender dysphoria is a serious medical condition characterized by significant and disabling distress due to the incongruence between a person's gender identity and assigned sex. (Budge Decl. (Doc. 4) ¶ 23; Shumer Decl. (Doc. 5) ¶ 28.) Defendant Horne and Intervenors accept that gender dysphoria is a medical condition. (Preliminary Injunction, Oral Argument: July 10, 2023).

8. Gender dysphoria is highly treatable. Every major medical association in the United States agrees that medical treatment for gender dysphoria is necessary, safe, and effective. (Budge Decl. (Doc. 4) ¶ 25; Shumer Decl. (Doc. 5) ¶ 30.)

9. "Transgender individuals may experience 'gender dysphoria,' which is 'characterized by significant and substantial distress as result of their birth-determined sex being different from their gender identity.' 'In order to be diagnosed with gender dysphoria, the incongruence must have persisted for at least six months and be accompanied by clinically significant distress or impairment in social, occupational, or other important areas of functioning.' If left untreated, symptoms of gender dysphoria can include severe anxiety and depression, suicidality, and other serious mental health issues. Attempted suicide rates in the transgender community are over 40%." *Hecox v. Little*, 479 F. Supp. 3d 930, 945-46 (D. Idaho 2020) (cleaned up), *aff'd* No. 20-35813, 2023 WL 1097255 (9th Cir. Jan. 30,

[2] From a medical perspective, the terms "biological sex," "biological male," and "biological female" are imprecise terms because a person's sex encompasses several different biological attributes, including sex chromosomes, certain genes, gonads, sex hormone levels, internal and external genitalia, other secondary sex characteristics, and gender identity, which may or may not be in alignment. (Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶44 (citing Joshua D. Safer, *Care of Transgender Persons*, 381 N. Engl. J. Med. 2451 (2019)).

2023).

10. The major associations of medical and mental health providers in the United States, including the American Medical Association, the American Academy of Pediatrics, the American Psychiatric Association, the American Psychological Association, and the Pediatric Endocrine Society, have endorsed medical standards of care for treating gender dysphoria in adolescents, which were developed by the World Professional Association for Transgender Health ("WPATH") and the Endocrine Society. (Shumer Decl. (Doc. 5) ¶ 31.)

11. The goal of medical treatment for gender dysphoria is to alleviate a transgender patient's distress by allowing them to live consistently with their gender identity. (Budge Decl. (Doc. 4) ¶ 27; Shumer Decl. (Doc. 5) ¶ 30.)

12. Undergoing treatment to alleviate gender dysphoria is commonly referred to as "transition" and includes one or more of the following components: (i) social transition, including adopting a new name, pronouns, appearance, and clothing, and correcting identity documents; (ii) medical transition, including puberty-delaying medication and hormone-replacement therapy; and (iii) for adults, surgeries to alter the appearance and functioning of primary- and secondary-sex characteristics. (Budge Decl. (Doc. 4) ¶¶ 26–27; Shumer Decl. (Doc. 5) ¶ 34.)

13. For social transition to be clinically effective, it must be respected consistently across all aspects of a transgender individual's life. (Budge Decl. (Doc. 4) ¶ 27.)

14. At the onset of puberty, adolescents with gender dysphoria may be prescribed puberty-delaying medications to prevent the distress of developing physical characteristics that conflict with the adolescent's gender identity. (Budge Decl. (Doc. 4) ¶ 28; Shumer Decl. (Doc. 5) ¶ 35.)

15. For older adolescents, doctors may also prescribe hormone therapy to induce the puberty associated with the adolescent's gender identity. (Budge Decl. (Doc. 4) ¶ 28; Shumer Decl. (Doc. 5) ¶ 36.)

16. When transgender adolescents are provided with appropriate medical treatment and have parental and societal support, they can thrive. (Shumer Decl. (Doc. 5) ¶ 29.)

17. Untreated gender dysphoria can cause serious harm, including anxiety, depression, eating disorders, substance abuse, self-harm, and suicide. (Budge Decl. (Doc. 4) ¶ 33; Shumer Decl. (Doc. 5) ¶ 28.)

18. Being denied recognition and support can cause significant harm, exacerbate gender dysphoria, and expose transgender adolescents to the risk of discrimination and harassment. (Budge Decl. (Doc. 4) ¶¶ 33–34; Shumer Decl. (Doc. 5) ¶ 28.)

19. Attempts to "cure" transgender individuals by forcing their gender identity into alignment with their birth sex are harmful and ineffective. Those practices have been denounced as unethical by all major professional associations of medical and mental health professionals, such as the American Medical Association, the American Academy of Pediatrics, the American Psychiatric Association, and the American Psychological Association, among others. (Shumer Decl. (Doc. 5) ¶ 25.)

B. <u>Plaintiffs are transgender girls who have not and will not experience male puberty</u>.

20. Plaintiff Jane Doe is an 11-year-old transgender girl who will attend Kyrene Aprende Middle School beginning on July 19, 2023. (Jane Doe ("J. Doe Decl.") (Doc. 6) ¶ 1; Helen Doe (Second) ("H. Doe 2nd Decl.") (Doc. 78) ¶ 3.)

21. Jane has lived as a girl in all aspects of her life since she was five years old. (J. Doe Decl. (Doc. 6) ¶ 2; Helen Doe ("H. Doe Decl.") (Doc. 7) ¶¶ 3, 5.)

22. Jane was diagnosed with gender dysphoria when she was seven years old. (H. Doe Decl. (Doc. 7) ¶ 7.)

23. Jane has changed her name through a court order to a more traditional female name and has a female gender marker on her passport. (Pls. Exs. 13 (Doc. 90-1), 15 (Doc. 90-3).)

24. Jane has been monitored by her doctor for signs of the onset of puberty as part of her medical treatment for gender dysphoria. (H. Doe Decl. (Doc. 7) ¶ 11.)

25. At an appointment on June 27, 2023, Jane's doctor prescribed a Supprelin implant, which is a puberty-blocking medication. (Helen Doe (Third) ("H. Doe 3rd Decl.")

(Doc. 97-1) ¶ 4.)

26. Jane is in the process of scheduling the implant procedure for as soon as possible. (*Id.*)

27. Accordingly, Jane has not and will not experience any of the physiological changes that increased testosterone levels would cause in a pubescent boy. (Shumer Decl. (Doc. 5) ¶ 45; Budge Decl. (Doc. 4) ¶ 28.)

28. Sports are very important to Jane and her parents. (J. Doe Decl. (Doc. 6) ¶ 5; H. Doe Decl. ¶ 12.)

29. Jane particularly loves playing soccer and has played soccer on girls' club and recreational sports teams for nearly five years. (J. Doe Decl. (Doc. 6) ¶¶ 6–8; H. Doe Decl. (Doc. 7) ¶ 12.)

30. Aside from its physical and emotional health benefits, soccer has helped Jane make new friends and connect with other girls. (J. Doe Decl. (Doc. 6) ¶ 7; H. Doe Decl. (Doc. 7) ¶ 13.)

31. Jane's teachers, coaches, friends, and members of her soccer team have all been supportive of Jane's identity. (H. Doe Decl. (Doc. 7) ¶ 9; Stipulation in Lieu of Answer ("Kyrene/Toenjes Stip.") (Doc. 59) ¶ 1.)

32. When Jane enters Kyrene Aprende Middle School this July, she intends to participate and compete with the cross-country team and try out for the girls' soccer and basketball teams. (J. Doe Decl. (Doc. 6) ¶ 9; H. Doe 2nd Decl. (Doc. 78) ¶ 4.)

33. Both the soccer and basketball teams at Kyrene Aprende Middle School have separate teams for boys and girls. (J. Doe Decl. (Doc. 6) ¶ 9.)

34. The cross-country team trains together, but boys and girls compete separately. (*Id.*)

35. Registration for the cross-country team began on July 1, 2023. (H. Doe 2nd Decl. (Doc. 78) ¶ 6.)

36. The registration occurs online and involves the submission of registration forms and supporting documents, such as a physical report signed by a doctor. (*Id.*)

37. Typically, a student's registration takes at least two to three days to process after it is submitted. (*Id.*)

38. The first practice for cross country is on July 31, 2023, and the first cross-country competitive meet will occur the week of August 14, 2023. (*Id.* ¶ 7.)

39. Jane is excited to participate and compete on the girls' teams with her friends and peers. (J. Doe Decl. (Doc. 6) ¶¶ 8–9.)

40. If not for the Act, the Kyrene School District would permit Jane Doe to play on girls' sports teams. (Kyrene/Toenjes Stip. (Doc. 59) ¶ 1.)

41. However, if the Act is applied to Jane, she will not be able to play on the girls' soccer and basketball teams or compete with the girls' cross-country team. (*Id.*)

42. Plaintiff Megan Roe is a 15-year-old transgender girl who attends TGS. (Megan Roe ("M. Roe Decl.") (Doc. 8) ¶¶ 2, 5.)

43. Megan has always known she is a girl. (Kate Roe ("K. Roe Decl.") (Doc. 9) ¶ 3.)

44. Megan has lived as a girl in all aspects of her life since she was seven years old. (M. Roe Decl. (Doc. 8) ¶ 3; K. Roe Decl. (Doc. 9) ¶¶ 4–5.)

45. Through a court order, Megan has changed her name to a more traditional female name and her gender to female. (Pls.' Ex. 14 (Doc. 90-2).) She also has a female gender marker on her passport. (Pls.' Ex. 16 (Doc. 90-4).)

46. Megan was diagnosed with gender dysphoria when she was ten years old. (K. Roe Decl. (Doc. 9) ¶ 6.)

47. Before starting school at TGS, Megan's parents shared with administrators and teachers at the school that Megan is a transgender girl. (M. Roe Decl. (Doc. 8) ¶ 5.) TGS has been very supportive of Megan and her identity. (*Id.*; Defendant TGS Motion to Dismiss ("TGS Mot. to Dismiss") (Doc. 37) at 3.)

48. Megan has been taking puberty blockers since she was 11 years old as part of her medical treatment for gender dysphoria. (M. Roe Decl. (Doc. 8) ¶ 6; K. Roe Decl. (Doc. 9) ¶ 6.) This prevented Megan from undergoing male puberty. (K. Roe Decl. (Doc. 9) ¶ 6.)

49. Megan began receiving hormone therapy when she was 12 years old. (M. Roe Decl. ¶ 6; K. Roe Decl. (Doc. 9) ¶ 6.)

50. As a result of the puberty blockers and hormone therapy, Megan has not experienced the physiological changes that increased testosterone levels would cause in a pubescent boy. (K. Roe Decl. (Doc. 9) ¶ 6; Shumer Decl. (Doc. 5) ¶ 47; Budge Decl. (Doc. 4) ¶ 29.)

51. The hormone treatment that she has received has caused Megan to develop many of the physiological changes associated with puberty in females. (Shumer Decl. (Doc. 5) ¶ 47; see also Budge Decl. (Doc. 4) ¶ 29.)

52. Sports have always been a part of Megan's life. (M. Roe Decl. (Doc. 8) ¶ 4.)

53. When she was about seven years old, Megan joined a swim team. (K. Roe Decl. (Doc. 9) ¶ 7.)

54. The coach of the swim team was supportive of Megan and her gender identity. (*Id.*)

55. Megan intends to try out for the girls' volleyball team at TGS for this year's fall season. (M. Roe Decl. (Doc. 8) ¶ 7.)

56. Volleyball is an important part of the TGS community and many students attend the games. (M. Roe Decl. (Doc. 8) ¶ 8; K. Roe Decl. (Doc. 9) ¶ 8.)

57. Megan is excited to play on the girls' volleyball team with her friends. (M. Roe Decl. (Doc. 8) ¶ 7; K. Roe Decl. (Doc. 9) ¶ 8.)

58. Megan's teammates, coaches, and school are highly supportive of her and would welcome her participation on the girls' volleyball team. (M. Roe Decl. (Doc. 8) ¶ 5; K. Roe Decl. (Doc. 9) ¶ 5; TGS Mot. to Dismiss (Doc. 37) at 3; Dr. Julie Sherrill ("Sherrill Decl.") (Doc. 37-1) ¶ 5.)

59. If not for the Act, TGS would permit Megan to play on the girls' volleyball team. (Sherrill Decl. (Doc. 37-1) ¶ 5.)

60. If the Act is applied to Megan, she will not be able to compete with the girls' volleyball team. (*Id.*)

C. Prior to enactment of A.R.S. § 15-120.02, Plaintiffs would have been allowed to play on girls' sports teams.

61. Defendant AIA sets rules for governing interscholastic sports, grades 9-12, and cutoff age of 19, for member schools, with membership being voluntary, but compliance with AIA rules being mandatory for all membership schools. (AIA Constitution; Article 2. Membership (Doc. 51-1).)

62. Each school or school district set its own rules on transgender students' participation in intramural sports. (*Id.* ¶¶ 2.5.2–3 (vesting "[f]inal authority and ultimate responsibilities in all matters pertaining to interscholastic activities of each school shall be vested in the school principal," with school administration assuming responsibility for verification of all student eligibility rules).)

63. Prior to the enactment of the Act, A.R.S. § 15-120.02, transgender girls in Arizona were permitted to play on girls' sports teams, under the AIA Constitution, Bylaws, Policies and Procedures § 41.9, as follows: "[A]ll students should have the opportunity to participate in Arizona Interscholastic Association activities in a manner that is consistent with their gender identity, irrespective of the sex listed on a student's eligibility for participation in interscholastic athletics or in a gender that does not match the sex at birth." (AIA Resp., Ex. 1 (Doc. 51-1).)

64. By December 2018, the AIA formalized its policy to permit transgender students to play on teams consistent with their gender identity so long as they had a letter of support from their parent or guardian explaining when they realized they were transgender. (Compl. (Doc. 1) ¶ 21; AIA Answer (Doc. 50) ¶ 21; AIA Transgender Policy § 41.9 (Doc. 51-1).)

65. Under the AIA policy, a student request to play on a team consistent with his or her gender identity is reviewed by a committee of medical and psychiatric experts, and consistent with AIA health and safety policy and if not motivated by an improper purpose, the request is approved or denied. (AIA Resp., Ex. 1 (Doc. 51-1) § 41.9.3; Consideration of Bills: Hearing on S.B. 1165 Before S. Comm. on Judiciary, Jan. 20, 2022, 55th Leg., 2d

Reg. Sess. 50:12–52 (Ariz. 2022).)

66. In the past 10 to 12 years, the AIA fielded approximately 12 requests consistent with their policy and approved seven students to play on a team consistent with their gender identity. Consideration of Bills: Hearing on S.B. 1165 Before S. Comm. on Judiciary, Jan. 20, 2022, 55th Leg., 2d Reg. Sess. 52:10 (Ariz. 2022).

67. The parties do not provide the Court with a breakdown of the gender identity for these seven transgender students but even assuming they were all transgender girls, the Court finds that seven students over 10 to 12 years is not a substantial number, particularly when compared to the "roughly 170,000 students playing sports in Arizona." (Preliminary Injunction, Oral Argument: July 10, 2023).[3]

68. Less than one percent of the population is transgender, with male and female transgender people being roughly the same in number. *Hecox*, 479 F. Supp. 3d at 977–78. "Presumably, this means approximately one half of one percent of the population is made up of transgender females. It is inapposite to compare the potential displacement allowing approximately half of the population (cisgender[[4]] men) to compete with cisgender women, with any potential displacement one half of one percent of the population (transgender women) could cause cisgender women. It appears untenable that allowing transgender women to compete on women's teams would substantially displace female athletes." *Id.* at 977-978.

69. The Arizona Bill Summary for the Act, SB 1165 transmitted to the Governor on May 11, 2022, expressly cites the AIA's "policy allowing transgender students to participate in activities in a manner consistent with their gender identity. (AIA Policies and Procedure, Art. 41 § 9)." (2022 Reg. Sess. S.B. 1165, Bill Summary).

[3] The record is missing the relevant number of participants in girls' sports and in sports generally over this same 10-to-12-year period. Based on its independent research, the Court accepts the 170,000 number as representing the total number of students playing sports per year because in 2018-19, there were 52,817 girls and 68,520 boys playing sports in Arizona. https://www.statista.com/statistics/202219/us-high-school-athletic-participation-in-arizona.

[4] "The term 'cisgender' refers to a person who identifies with the sex that person was determined to have at birth." *Hecox*, 479 F. Supp. 3d at 945 (relying on *Doe v. Boyertown*, 897 F.3d 518, 522 (3rd Cir. 2018)).

70. Despite enactment of the Act, the AIA has not changed its transgender policy. (AIA Resp. (Doc. 51) at 5.) Yet, organizations like the AIA do not have discretion to disregard validly enacted laws of the State of Arizona. (AIA Resp. (Doc. 51) at 4.)

71. The Act prohibits "any licensing or accrediting organization or any athletic association or organization," including the AIA, from "entertain[ing] a complaint, open[ing] an investigation or tak[ing]any other adverse action against a school for maintaining separate interscholastic or intramural athletic teams or sports for students of the female sex." A.R.S. § 15-120.02(D).

72. The Act creates a private cause of action for students or schools to sue schools or organizations like the AIA if the school or organization violates the ban or retaliates in response to the reporting of a violation of the Act. A.R.S. § 15-120.02(F)-(G).

D. A.R.S. § 15-120.02 prevents Plaintiffs from playing on girls' sports teams at their schools.

73. On March 30, 2022, Arizona enacted the Act (S.B. 1165), with an effective date of September 24, 2022. Ariz. Rev. Stat. § 15-120.02.

74. As of the effective date of the Act, School Year 2022-23, first quarter (July-September) sports, including volleyball, were almost over. Second quarter (October-December) girls' sports are softball and soccer. The Third quarter (January-March) sports for girls, includes basketball. The Fourth quarter (March-May) sport is track and field.

75. In School Year 2022-23, Megan was allowed to practice as a member of the team, but not allowed to participate in TGS interscholastic competitions (games). (TGS Mot. to Dismiss (Doc. 37) at 3, n3.)

76. In School Year 2022-23, Jane played soccer but not at her elementary school because it did not have a school team; she will attend Kyrene Middle School for the first time this year. (Preliminary Injunction, Oral Argument: July 10, 2023).

77. The Court finds that the challenged conduct, passage of the Act precluding transgender girls from playing on girls' sports teams, occurred at a time when the Plaintiffs had an opportunity to play on girls' sports teams consistent with their gender identity.

78. Unlike the prior case-by-case basis used to approve a transgender girl's request to play on a team consistent with her gender identity, which considered among other things the age and competitive level relevant to the request, the Act categorically bans all transgender girls' participation by requiring each team that is sponsored by a public school or a private school team that competes against a public-school team to be designated as "male," "female," or "coed," based on the "biological sex of the students who participate." Ariz. Rev. Stat. § 15-120.02(A).

79. The Act applies equally to kindergarten through college teams although the problems identified as being addressed by the Act-- opportunity and safety-- are limited to high school and college sports. *See e.g.* Consideration of Bills: Hearing on S.B. 1165 Before S. Comm. on Judiciary, Jan. 20, 2022, 55th Leg., 2d Reg. Sess., 0:9:56 (Ariz. 2022) (Sharp testimony explaining problem being addressed is AIA policy that allows males in a matter of weeks to dominate a sport, break a girl's record, and cause a girl to lose her championship or scholarship opportunity); same at 1:24:00 (Sen. Burley explanation for vote "yea" to protect integrity of high school sports by preventing victimization of girls that are trying to compete for sports scholarships).[5]

80. "Biological sex" is not defined in the statute. Ariz. Rev. Stat. § 15-120.02. However, the S.B. 1165 Legislative Findings state that for purposes of school sports, a student's sex is determined at "fertilization and revealed at birth, or, increasingly, in utero." S.B. 1165, 55th Leg., 2d Reg. Sess. (Ariz. 2022), § 2.

81. The Act states that "athletic teams or sports designated for 'females', 'women' or 'girls' may not be open to students of the male sex." Ariz. Rev. Stat. § 15-120.02 (B).

82. The Act was adopted for the purpose of excluding transgender girls from playing on girls' sports teams. *See, e.g.* Consideration of Bills: Hearing on S.B. 1165 Before S. Comm. on Judiciary, Jan. 20, 2022, 55th Leg., 2d Reg. Sess., 1:17:32–39 (Ariz. 2022) (statement of Sen. Vince Leach, Member, S. Comm. on Judiciary) (explaining his vote for the bill by stating, "if we allow transgenders to take over female sports, you will not have

[5] http: https://www.azleg.gov/videoplayer/?clientID=6361162879&eventID=2022011057

females participating"); 1:28:28–55 (statement of Sen. Warren Petersen, Chairman, S. Comm. on Judiciary) (questioning whether those opposing the bill would "be opposed to having just a trans league, so that they can all compete in their own league"); (Pls.' Ex. 25, Gov. Douglas Ducey Signing Letter) ("S.B. 1165 creates a statewide policy to ensure biologically female athletes at Arizona public schools, colleges, and universities have a level playing field to compete….This legislation simply ensures that the girls and young women who have dedicated themselves to their sport do not miss out… due to unfair competition.")

83. Precluding transgender girls, who have not experienced male puberty, from playing girls sports, treats transgender boys and transgender girls differently and treats boys' and girls' sports differently, with only girls' teams facing potential challenges, including litigation, related to suspected transgender players. *Compare* Consideration of Bills: Hearing on S.B. 1165 Before S. Comm. On Judiciary, Jan. 20, 2022, 55th Leg., 2d Reg. Sess., 0:18:16 (inviting legislators to come see purported transgender girl on a team and describing need to challenge suspected transgender girls on opposing teams) *with* *Hecox*, 479 F. Supp. 3d at 988 (explaining all biological women are subject, in the event of a challenge, to the statutory verification process in order to play on a team, and this creates a different, more onerous set of rules for women's sports when compared to men's sports).

84. Contrary to the asserted safety goal, the Act does not protect transgender boys—identified by Defendant Horne and Intervenors as "biological girls." In fact, the Act allows "biological girls" to play on boys' sports teams, subjecting them to the alleged risks of that association. This is allowed prepuberty and without regard for whether the transgender boy is receiving testosterone enhancements.

85. The Act's creation of a private cause of action against a school for any student who is deprived of an athletic opportunity or suffers any harm, whether direct or indirect, related to a schools' failure to preclude participation of a transgender girl on a girls' team places an onerous burden on girls' sports programs, not faced by boys' athletic programs.

86. The record does not support a finding that prior to the Act's enactment, there was a problem in Arizona related to transgender girls replacing non-transgender girls on sports teams. Consideration of Bills: Hearing on S.B. 1165 Before S. Comm. on Judiciary, Jan. 20, 2022, 55th Leg., 2d Reg. Sess., 1:15:30–36 (Ariz. 2022) (statement of Sen. Warren Petersen, Chairman, S. Comm. on Judiciary) (acknowledging to another Senator that "we're not aware of a specific instance" where any cisgender girl had lost a place on a team to a transgender girl).

87. The record does not support a finding that during the 10 to 12 years prior to passage of the Act there was a risk of any physical injury to or missed athletic opportunity by any girl as a result of allowing seven transgender girls to play on sports teams consistent with their gender identity.

E. <u>Excluding Plaintiffs from school sports causes very serious injury to Plaintiffs</u>

88. School sports offer social, emotional, physical, and mental health benefits. (Budge Decl. (Doc. 4) ¶¶ 35–38.)

89. The social benefits of school sports include the opportunity to make friends and become part of a supportive community of teammates and peers. (*Id.* ¶ 35.)

90. School sports provide an opportunity for youth to gain confidence and reduce the effects of risk factors that lead to increases in depression. (*Id.* ¶ 36.)

91. Students who play school sports have fewer physical and mental health concerns than those that do not. (*Id.* ¶ 37.)

92. Students who participate in high school sports are more likely to finish college and participation in high school sports has a positive impact on academic achievement. (*Id.* ¶ 38.)

93. It would be psychologically damaging for a transgender girl to be banned from playing school sports on equal terms with other girls. (*Id.* ¶ 39; Budge Decl. (Rebuttal) (Doc. 65-1) ¶ 10.)

94. Transgender girls will internalize the shame and stigma of being excluded for a

personal characteristic (being transgender) over which they have no control and which already subjects them to prejudice and social stigma. (Budge Decl. (Doc. 4) ¶ 40.)

95. For transgender girls who are already playing on girls' teams, a law that requires them to be excluded from continued participation on girls' teams would have a further negative impact on their health and well-being, causing them to feel isolated, rejected, and stigmatized, and thereby putting them at high risk for severe depression and/or anxiety. (*Id.*)

96. For transgender girls, who are gender transitioning to address gender dysphoria, the benefits from playing sports on teams compatible with their gender identity is important because to be clinically effective, gender transitioning must be respected consistently across all aspects of her life.

F. <u>Transgender girls who have not undergone male puberty do not have an athletic advantage over other girls</u>.

97. The Plaintiffs' experts' opinions are based on the scientific consensus that the biological cause of average differences in athletic performance between men and women is caused by the presence of circulating levels of testosterone beginning with male puberty. (Shumer Decl. (Rebuttal) (Doc 65-2) ¶ 8 (citing Brown Decl. ¶¶ 127–30 relying on Handelsman (2018) at 823 ("summarizing evidence makes it highly likely that the sex difference in circulating testosterone of adults explains most, if not all, of the sex differences in sporting performance.")); (Brown Hecox Decl. ¶¶ 20a, 25–28, 77–85).

98. A large part of the record created by the Defendants is not relevant to the question before the Court: whether transgender girls like Plaintiffs, who have not experienced male puberty, have performance advantages that place other girls at a competitive disadvantage or at risk of injury. For example, Defendants submit evidence that girls have more body fat than boys at birth. (Brown Decl. (Doc. 82-1; 92-1) ¶ 79.) Without more, this evidence is not relevant to the question before the Court.

99. Defendant Horne and the Intervenors submit expert declarations, including the declaration by Dr. James Cantor, which in large part are not relevant criticisms of medical

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treatments for gender dysphoria. The appropriateness of medical treatment for gender dysphoria is not at issue in this case. (Pls Ex. (Doc. 88-3) at 39-40 (dated March 30, 2022, describing purpose of Act to ensure a level playing by preventing unfair competition in women's sports).) Protecting transgender girls from any such risk is not a rationale or purpose of the Act.

100. Defendants' expert Dr. Brown admits that many of the specific male physiological advantages he describes are a result of testosterone levels in men post-puberty. This evidence is not relevant because the Plaintiffs have not and never will experience male puberty. The Court is not concerned with Dr. Brown's opinion that such advantages are not reversed by testosterone suppression after puberty or are reduced only modestly, leaving a large advantage over female athletes. Dr. Brown agrees it is well documented that the large increases in physiological and performance advantages for men result from increases in circulating testosterone levels that males experience in puberty, "or generally between the ages of about 12 through 18." (Brown Decl. (Doc. 82-1; 92-1) ¶¶ 163-164.)[6]

101. Defendants rely on school-based fitness testing of boys and girls, comparisons between $10^{th}/50^{th}/90^{th}$ percentile scores for girl and boy students ages 6 through 11 reflecting, for example, that 50% of 6-year-old boys completed more laps in the 20-meter shuttle (14) than girls (12). (Brown Decl. (Doc. 82-1; 92-1) ¶ 84.) Other fitness data reflects differences between 9 through 17-year-old boys and girls, with 9-year-old boys always exceeding girls' running times by various percentages ranging from 11.1-15.2%, *id.* ¶ 89; arm hang fitness scores (7.48 boys, 5.14 girls), *id.* ¶ 92; standing broad jump (128.3 boys, 118.0 girls), *id.* ¶ 99. (*See also* Brown Decl. (Doc. 82-1; 92-1) ¶106 (quoting Thomas 1985 study at 266) ("Boys exceed girls in throwing velocity by 1.5 standard deviation units as early as 4 to 7 years of age . . ." and throwing distance by 1.5 standard deviation units as

[6] A categorical bar to girls and women who are transgender stands in "stark contrast to the policies of elite athletic bodies that regulate sports both nationally and globally—including the National Collegiate Athletic Association ("NCAA") and the International Olympic Committee ("IOC")—which allow transgender women to participate on female sports teams once certain specific criteria are met," primarily specified levels of circulating testosterone. *Hecox*, 479 F. Supp. 3d at 944.

early as 2 to 4 years of age).)[7] (*But see* Shumer Decl. (2nd Rebuttal) (Doc. 65-2) ¶12 (opining clear scientific consensus that athletic ability does not diverge significantly until puberty (citing e.g., David Handelsman, *Sex Differences in Athletic Performance Emerge Coinciding with the Onset of Male Puberty*, 87 Clinical Endocrinology 68, 70–71 (2017) ("The gender divergence in athletic performance begins at the age of 12–13 years"); Ps Motion for PI, Jonathon W. Senefeld et al., *Sex Differences in Youth Elite Swimming*, 14 PLOS ONE 1, 1–2 (2019) (Doc. 88-2) at 42-43 (studying child and youth swimmers and concluding that the data suggests "girls are faster, or at least not slower, than boys prior to the performance-enhancing effects of puberty"); M.J. McKay, *Normative reference values for strength and flexibility of 1000 children and adults* (Doc. 88-3) at 12 (finding no significant ($p<0.05$) differences between the strength measures of boys or girls aged 3-9, except for shoulder internal rotators where boys were stronger).

102. The World Rugby Transgender Women's Guidelines 2020 , which Dr. Brown cites throughout his declaration, allow transgender girls and women to participate in women's rugby if they did not experience endogenous male puberty, stating: "Transgender women who transitioned pre-puberty and have not experienced the biological effects of testosterone during puberty and adolescence can play women's rugby." (Pls.' Ex. 24 (Doc. 88-3); Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶ 35.)

103. The physical fitness data relied on by Defendant Horne and Intervenors merely observes phenomena across a population sample in isolated areas and does not determine a cause for what is observed. There is no basis for these experts to attribute those small

[7] The Court does not know whether Dr. Brown's opinion that hormone and testosterone suppression cannot fully eliminate physiological advantages once an individual experienced male puberty has been revised since the peer review of the Handelsman study. *See Hecox* 479 F. Supp. 3d at 980 (criticizing Brown's opinion because not updated subsequent to peer review and noting some of the studies Dr. Brown relied on "actually held the opposite").This evidence, relating to transgender girls/women who have experienced male puberty, is not directly relevant in this case, except to the extent the Court might extrapolate that if testosterone suppression in transgender females who have experienced male puberty, can bring them into athletic alignment with other girls/women, then preventing transgender girls from experiencing male puberty in the first place would result in even greater equity. The Court does not draw such a conclusion for purposes of deciding the request for preliminary injunction.

differences to physiology or anatomy instead of to other factors such as greater societal encouragement of athleticism in boys, greater opportunities for boys to play sports, or differences in the preferences of the boys and girls surveyed. (Dr. Linda Blade ("Blade Decl.") at 7–9; Hilton Decl. (Doc. 92-8) ¶¶ 7.3–7.5; Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶¶ 21, 46.) The Court finds that transgender girls, who are being raised in conformance with their gender identity, will be subject to the same social/cultural factors that girls face that correlates to lower physical fitness scores.

104. There is no evidence to support Dr. Hilton's opinion that girls have "delicate brain structures" making them prone to injury; brain MRIs reveal no differences based on sex, except for size. (Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶ 40.) Evidence suggests the difference between male and female sports' concussions occurs because girls, post-puberty, have weaker neck muscles than boys. (Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶ 41 (citing Abigail C. Bretzin et al., Association of Sex with Adolescent Soccer Concussion Incidence and Characteristics, 4 JAMA Network Open 4, 6 (2021); Ryan T. Tierney et al., Gender Differences in Head-Neck Segment Dynamic Stabilization During Head Acceleration, 37 Med. & Sci. Sports & Exercise 272, 272 (2005)).

105. The Court rejects Dr. Hilton's idea that "sporty-girls" will be "as well-trained as their male peers" and, therefore, higher win scores at Kyrene Middle School for boys cannot be explained by social cultural factors and must be biological. (Hilton Decl. (Doc. 92-8) (citing Thomas and French, 1985, *Gender differences across age in motor performance a meta-analysis:* Psychol Bull 98(2): 260-282)).

106. Height differences in babies are negligible, with differences disappearing altogether between ages 6 and 8 but reappearing when girls enter puberty and overtake boys in height and weight for a few years until boys experience puberty and grow taller on average than girls/women. (Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶¶ 12-15.)

107. The Plaintiffs do not challenge the existence of separate teams for girls and boys. Defendants do not explain why the minor differences in physical fitness scores for prepuberty boys compared to girls reflect a significant athletic advantage of boys over girls,

prepuberty. There are many other reasons why boys' and girls' sports teams are separated: (1) women historically were deprived of athletic opportunities in favor of men; (2) as a general matter, men had equal athletic opportunities to women; and (3) according to stipulated facts, average physiological differences meant that "males would displace females to a substantial extent" if permitted to play on women's teams. *See Hecox*, 479 F. Supp. 3d at 976 (distinguishing *Clark by and Through Clark v. Arizona Interscholastic Ass'n*, 695 F.2d 1126 (9th Cir. 1982) finding these factors do not apply for transgender women).

108. Defendants ask the Court to rely on evidence they allege supports separating sports teams by sex to conclude that transgender girls, who have not experienced puberty, should not play on girls' teams solely because they are boys, regardless of whether they have experienced puberty.

109. The Court will not make this leap because Plaintiffs present expert evidence that any prepubertal differences between boys and girls in various athletic measurements are minimal or nonexistent. (Shumer Decl. (Rebuttal) (Doc. 65-2) ¶ 5) (citing Alison McManus & Neil Armstrong, *Physiology of elite young female athletes*, 56 Medicine & Science Sports & Exercise 23, 24 (2011) ("Prior to 11 years of age differences in average speed are minimal"); *id.* at 27 ("[S]mall sex difference in fat mass and percent body fat are evident from mid-childhood"); *id.* at 29 ("[B]one characteristics differ little between boys and girls prior to puberty"); *id.* at 32 ("There is little evidence that prior to puberty pulmonary structure or function limits oxygen uptake"); *id.* at 34 ("[N]o sex differences in arterial compliance have been noted in pre- and early- pubertal children")).

110. Based on the evidence, transgender girls' physical characteristics, especially in terms of height, weight, and strength, overlap with those of other girls. In other words, some girls may be taller than average, and some transgender girls may be taller than average. The rationale for excluding transgender girls with above average physical characteristics is equally applicable to excluding taller than average girls, but height, weight, or strength factors are not used at any level of competition to protect girls or women

athletes. (Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶¶ 42-43; *see also Hecox*, 479 F. Supp. 3d at 980 (describing evidence of similar bell curve differences for transgender women, who have gone through male puberty and are using gender affirming interventions, including lowering testosterone as "a transgender woman who performed 80% as well as the best performer among men of that age before transition would also perform at about 80% as well as the best performer among women of that age after transition.")

111. The categorical preclusion of transgender women, especially girls who have not experienced male puberty, appears unrelated to the interests the Act purportedly advances. A "justification must be genuine, not hypothesized." *United States v. Virginia*, 518 U.S. 515, 533 (1996). The proponents of the Act fail to provide persuasive evidence of any genuine, not hypothesized problem. *Hecox*, 479 F. Supp. 3d at 979.

112. Before puberty, there are no significant differences in athletic performance between boys and girls. (Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶ 16; Shumer Decl. (Rebuttal) (Doc. 65-2) ¶¶ 9–13; Shumer Decl. (Doc. 5) ¶ 38; Pls.' Exs. 19–20, 22–23 (Doc. 88-2).)

113. After puberty, adolescent boys begin to produce higher levels of testosterone, which over time causes them to become, on average, stronger and faster than adolescent girls. (Shumer Decl. (Doc. 5) ¶ 39; Pls.' Exs. 18–19 (Doc. 88-2).)

114. The biological driver of average group differences in athletic performance between adolescent boys and girls is the difference in their respective levels of testosterone, which only begin to diverge significantly after the onset of puberty. (Shumer Decl. (Rebuttal) ¶¶ 4, 8; Shumer Decl. (Doc. 5) ¶ 39; Pls.' Exs. 18–19.)

115. Transgender girls who receive puberty-blocking medication do not have an athletic advantage over other girls because they do not undergo male puberty and do not experience the physiological changes caused by the increased production of testosterone associated with male puberty. (Shumer Decl. (Rebuttal) (Doc. 65-2) ¶¶ 15–16; Shumer Decl. (Doc. 5) ¶¶ 35, 38–42.)

116. Transgender girls who receive hormone therapy after receiving puberty-

blocking medication will develop the skeletal structure, fat distribution, and muscle and breast development typical of other girls. (Budge Decl. (Doc. 4) ¶ 29; Shumer Decl. (Rebuttal) (Doc. 65-2) ¶ 22; Shumer Decl. (Doc. 5) ¶¶ 35–36.)

117. A transgender girl who receives hormone therapy will typically have the same levels of circulating estrogen and testosterone as other girls. (Shumer Decl. (Doc. 5) ¶ 36.)

118. Knowing that a girl is transgender, if she has not gone through male puberty, reveals nothing about her athletic ability. (Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶ 31, 48; Shumer Decl. (Rebuttal) (Doc. 65-2) ¶¶ 26–27; Shumer Decl. (Doc. 5) ¶ 42.)

119. Similarly, transgender girls who have not yet undergone male puberty or who have received puberty-blocking medication at the onset of puberty do not present any unique safety risk to other girls. (Shumer Decl. (2nd Rebuttal) (Doc. 113) ¶¶ 25, 36; Shumer Decl. (Rebuttal) ¶ 41.)

120. In short, transgender girls, who have not experienced male puberty, play like girls. There is no logical connection between prohibiting them from playing on girls' sports teams and the goals of preventing unfair competition in girls' sports or protecting girls from being physically injured by boys.

G. Plaintiffs cannot play on boys' sports teams.

121. Jane cannot play on boys' teams or compete with the boys because she is a girl, with athletic capabilities like other girls her age and different from boys her age who are beginning to experience puberty and increased testosterone levels. Jane will not experience male puberty and will experience female puberty. Assuming there are safety issues created if girls compete with boys, Jane would be subjected to such risks by playing on boys' teams.

122. Jane's medical health depends on her ability to live her life fully as a girl, and playing on a boys' sports team and competing against boys would directly contradict her medical treatment for gender dysphoria and jeopardize her health. (H. Doe Decl. (Doc. 7) ¶ 15; Budge Decl. (Doc. 4) ¶¶ 33–34.)

123. "Participating in sports on teams that contradict one's gender identity 'is

equivalent to gender identity conversion efforts, which every major medical association has found to be dangerous and unethical.'" *Hecox*, 479 F. Supp. 3d at 977.

124. Jane would find it humiliating and embarrassing to play on a boys' team because everyone at school knows her as a girl. (J. Doe Decl. (Doc. 6) ¶ 11; H. Doe Decl. (Doc. 7) ¶ 15.)

125. If she is not allowed to play sports on a girls' team, Jane will be very upset. (J. Doe Decl. (Doc. 6) ¶ 10; H. Doe Decl. (Doc. 7) ¶ 16.)

126. Jane will not participate in sports at all if she is forced to be on a boys' team. (J. Doe Decl. (Doc. 6) ¶ 11; H. Doe Decl. (Doc. 7) ¶ 15.) The last thing she wants to do is draw attention to herself by drawing into question her gender identity. She wants to go to school like other girls. (Jane Decl. (Doc. 6) ¶ 11.)

127. Jane will also lose the opportunity to receive the physical, social, and emotional benefits that school sports provide. (H. Doe Decl. (Doc. 7) ¶ 16).

128. Megan cannot play on boys' teams or compete with the boys because she is a girl, with athletic capabilities like other girls her age and different from boys her age, who have experienced puberty and increased testosterone levels. Megan has not experienced male puberty and has experienced female puberty. Assuming there are safety issues created if girls compete with boys, Jane would be subjected to such risks by playing on boys' teams.

129. Playing on a boys' team would directly conflict with Megan's medical treatment for gender dysphoria, and her medical health depends on her ability to live her life fully as a girl. Playing on a boys' team would be emotionally painful and humiliating for her. (M. Roe Decl. (Doc. 8) ¶ 9; K. Roe Decl. (Doc. 9) ¶ 10.)

130. "Participating in sports on teams that contradict one's gender identity 'is equivalent to gender identity conversion efforts, which every major medical association has found to be dangerous and unethical.'" *Hecox*, 479 F. Supp. 3d at 977.

131. If she is not allowed to play on the girls' volleyball team, Megan will not compete on the boys' volleyball team. (M. Roe Decl. (Doc. 8) ¶ 9; K. Roe Decl. (Doc. 9)

¶ 10.)

132. Megan will be distraught if she loses the opportunity to try out for the girls' volleyball team. (K. Roe Decl. (Doc. 9) ¶ 11.)

133. Megan will also lose the opportunity to receive the physical, social, and emotional benefits that school sports provide. (*Id.* ¶ 9.)

II. Conclusions of Law

To the extent these Conclusions of Law are also deemed to be Findings of Fact, they are hereby incorporated into the preceding Findings of Fact.

134. A preliminary injunction is an "extraordinary and drastic remedy" that is "never awarded as of right." *Munaf v. Geren*, 553 U.S. 674, 689-90 (2008) (citations omitted). Instead, in every case, the court must balance competing claims of injury and must consider the effect on each party of granting or withholding relief. *Winter v. Natural Resources Defense Council, Inc.*, 555 U.S. 7 (2008).

135. A preliminary injunction may take one of two forms: 1) a prohibitory injunction prohibits a party from taking action and "preserve[s] the status quo pending a determination of the action on the merits." *Chalk v. United States Dist. Court*, 840 F.2d 701, 704 (9th Cir. 1988). A mandatory injunction goes beyond simply maintaining the status quo and requires a heightened burden of proof and is particularly disfavored. *Marlyn Nutraceuticals, Inc. v. Mucos Pharma GmbH & Co.*, 571 F.3d 873, 879 (9th Cir. 2009) (citing *Anderson v. United States*, 612 F.2d 1112, 1114 (9th Cir. 1980)).

136. "Status quo" for the purpose of an injunction "refers to the legally relevant relationship between the parties before the controversy arose." *Arizona Dream Act Coal. v. Brewer*, 757 F.3d 1053, 1061 (9th Cir. 2014) (emphasis in original); *see also Regents of Univ. of California v. Am. Broad. Companies, Inc.*, 747 F.2d 511, 514 (9th Cir. 1984) (for purposes of injunctive relief, the status quo means "the last uncontested status which preceded the pending controversy") (cleaned up).

137. For the purpose of issuing a preliminary injunction, the Court's findings that both Jane and Megan could have played on girls' sports teams last year prior to passage of

the Act, cannot play on sports teams consistent with their gender identity now, and want to participate in girls' sports programs at Kyrene Middle School and TGS this year, warrant issuance of a mandatory prohibitory injunction to preserve the status quo.

138. The purpose of a preliminary injunction or temporary restraining order is to preserve the status quo if the balance of equities so heavily favors the moving party that justice requires the court to intervene to secure the positions until the merits of the action are ultimately determined. *University of Texas v. Camenisch*, 451 U.S. 390, 395 (1981).

139. A party seeking a preliminary injunction must establish that: (1) they are likely to succeed on the merits of their claims; (2) they are likely to suffer irreparable harm in the absence of preliminary relief; (3) the balance of equities tips in their favor; and (4) an injunction is in the public interest. *Alliance for the Wild Rockies v. Cottrell*, 632 F.3d 1127, 1131 (9th Cir. 2011).

140. When the government is a party, the third and fourth factors merge. *Nken v. Holder*, 556 U.S. 418, 435 (2009); *Porretti v. Dzurenda*, 11 F.4th 1037, 1050 (9th Cir. 2021).

A. Likelihood of success on the merits.

Equal Protection Clause Claim

141. There is a strong presumption that gender classifications are invalid and the burden rests on the state to justify the classification. *Virginia*, 518 U.S. at 533. This burden tracks for purposes of considering the likelihood of the merits of the Plaintiffs' claim. Defendants must show that it is "more likely than not" that the Act is constitutional. *Gonzales v. O Centro Espirita Beneficente Uniao de Vegetal*, 546 U.S. 418, 429–30 (2006) (finding evidentiary equipoise insufficient and issuing a preliminary injunction).

142. The Supreme Court has addressed the Defendants' concern that legislation must be written for the population generally, therefore, "most legislation classifies for one purpose or another, with resulting disadvantage to various groups or persons." *Hecox*, 479 F. Supp. 3d at 972); (Preliminary Injunction, Oral Argument: July 10, 2023). There are

three tiers of judicial scrutiny depending on the characteristics of the disadvantaged group or the rights implicated by the classification. *Hecox*, 479 F. Supp. 3d at 972.

143. When the state restricts an individual's access to a fundamental right, the policy must withstand the strictest of scrutiny. *San Antonio Indep. Sch. District. v. Rodriguez*, 411 U.S. 1, 16-17 (1973). Access to interscholastic sports is not a constitutionally recognized fundamental right. *Walsh v. La High Sch. Athletic Ass'n*, 616 F.2d 152, 159-60 (5th Cir. 1980). Strict scrutiny also applies if a government policy discriminates against a suspect class such as race, alienage, and national origin because government policies that discriminate based on race or national origin typically reflect prejudice. *City of Cleburn v. Cleburn Living Center*, 473 U.S. 432, 440 (1985).

144. The least stringent level of scrutiny is rational basis review, which is applied to laws that impose a difference in treatment between groups but do not infringe upon a fundamental right or target a suspect or quasi-suspect class. *Heller v. Dow*, 509 U.S. 312, 319-321 (1993).

145. Heightened scrutiny is an intermediate scrutiny, a slightly less stringent standard than strict scrutiny, but greater than rational basis review. *Craig v. Boren*, 429 U.S. 190, 197 (1976); *Virginia*, 518 U.S. at 533. Heightened scrutiny applies to statutes that discriminate on the basis of sex, a quasi-suspect classification. "'The purpose of this heightened level of scrutiny is to ensure quasi-suspect classifications do not perpetuate unfounded stereotypes or second-class treatment.'" *Hecox*, 479 F. Supp. 3d at 973 (quoting *Latta v. Otter* (*Latta I*), 19 F. Supp. 3d 1054, 1073 (D. Idaho), *aff'd*, 771 F.3d 456 (9th Cir. 2014) (citing *Virginia*, 518 U.S. at 533)). To withstand heightened scrutiny, a classification by sex "must serve important governmental objectives and must be substantially related to achievement of those objectives." *Craig*, 429 U.S. at 197.

146. Laws that discriminate against transgender people are sex-based classifications and, as such, warrant heightened scrutiny. *See Karnoski v. Trump*, 926 F.3d 1180, 1200–01 (9th Cir. 2019) (analyzing a policy barring transgender people from military service as sex-based discrimination and applying heightened scrutiny); *see also D.T. v. Christ*, 552 F.

Supp. 3d 888, 896 (D. Ariz. 2021) ("Discrimination against transgender people is discrimination based on sex; as such, heightened scrutiny applies.").

147. Defendant Horne's and Intervenors' argument that the Act does not mention transgender girls and, therefore, does not discriminate based on transgender status or gender identity fails. The Act's disparate treatment of transgender girls because they are transgender is clear on the face of the statute and makes it facially discriminatory even if the statute does not expressly employ the term "transgender". *See e.g. Hecox*, 479 F. Supp. 3d at 975 (rejecting defendants' argument that similar Idaho statute "does not ban athletes on the basis of transgender status, but rather on the basis of the innate physiological advantages males generally have over females"); *A.M.*, 617 F. Supp. 3d at 965–66 (holding that a virtually identical Indiana statute discriminated against transgender individuals despite not using the term "transgender"); *B.P.J. v. W. Va. State Bd. of Educ*., 550 F. Supp. 3d 347, 353–54 (S.D. W. Va. 2021) (holding that a virtually identical West Virginia statute "discriminates on the basis of transgender status"), *B. P. J. v. W. Virginia State Bd. Of Educ.,* No. 2:21-CV-00316, 2023 WL 111875, at *6 (S.D.W. Va. Jan. 5, 2023) (cleaned up), *stayed pending appeal B.P.J. v. W. Virginia State Bd. of Educ*., No. 23-1078, 2023 WL 2803113, at *1 (4th Cir. Feb. 22, 2023).

148. The Arizona legislature intentionally created a classification, specifically "biological girls," that necessarily excludes transgender girls, and expressly allowed only that exclusive classification to play girls sports to the exclusion of transgender girls.

149. The legislative history demonstrates that the purpose of the Act is to exclude transgender girls from girls' sports teams. Therefore, the Court applies heightened scrutiny to the Act, does not make a presumption of constitutionality, and does not defer to legislative judgment. *SmithKline Beecham Corp. v. Abbott Laboratories,* 740 F.3d 471, 483 (9th Cir. 2014).

150. Plaintiffs Jane and Megan are transgender girls, members of a quasi-protected class. The Court applies heightened scrutiny in this case, placing the burden on the government to show "an exceedingly persuasive justification" for the alleged

discriminatory treatment, *Virginia*, 518 U.S. at 531, which must not be based on "generalizations" or "stereotypes," *id.* at 549–50, 565. "The justification 'must be genuine, not hypothesized or invented post hoc in response to litigation,' and 'must not rely on overbroad generalizations about the different talents, capacities, or preferences of males and females." *Karnoski*, 926 F.3d at 1200 (quoting *Virginia*, 518 U.S. at 533).

151. In applying heightened scrutiny review, the Court must examine the Act's "'actual purposes and carefully consider any resulting inequality to ensure that our most fundamental institutions neither send nor reinforce messages of stigma or second-class status.'" *Latta II*, 771 F.3d at 468 (quoting *SmithKline*, 740 F.3d at 483).

152. According to Defendants, the Act is to protect girls from physical injury in sports and promote equality and equity in athletic opportunities, which are, in addition to redressing past discrimination against women in athletics, considered legitimate and important governmental interests justifying rules excluding males from participating on female teams. *Clark*, 695 F.2d at 1131.

153. However, the well-established scientific consensus is that, before puberty, there are no significant physiological differences in athletic performance between boys and girls. Instead, there is overlap between the sexes, with some boys being better athletically than some girls and some girls outplaying some boys. There is also no evidence that transgender girls who do not undergo male puberty because they have taken puberty suppressing medication at the onset of male puberty have an athletic advantage over other girls. There are no studies that have documented any such advantage, and there is no medical reason to posit that any such advantage would exist. (*Id.* ¶ 26.)

154. The testimony by Drs. Brown and Hilton that boys have some biological advantages related to physical fitness before puberty does not support a conclusion that Plaintiffs, who have not experienced male puberty, have any athletic advantage over other girls or pose a safety risk to other girls by playing on girls' sports teams.

155. Defendant Horne and Intervenors discuss *Clark*, 695 F.2d at 1131, throughout their briefs but *Clark* strongly supports Plaintiffs. In *Clark*, the Ninth Circuit held that it

was lawful to exclude boys from girls' volleyball teams because: (1) women had historically been deprived of athletic opportunities in favor of men; (2) as a general matter, men had equal athletic opportunities compared to women; and (3) according to the stipulated facts in the case, average physiological differences meant that males would displace females to a substantial extent if permitted to play on women's volleyball teams. *Hecox*, 479 F.Supp. 3d at 1131.

156. None of the *Clark* premises hold true for girls who are transgender: (1) far from being favored in athletics, "women who are transgender have historically been discriminated against;" (2) transgender women—unlike the boys in Clark—would not be able to participate in any school sports; and (3) based on the very small numbers of transgender girls in the population, "transgender women have not and could not 'displace' cisgender women in athletics 'to a substantial extent.'" *Hecox*, 479 F. Supp. 3d at 977 (quoting *Clark*, 695 F.2d at 1131). Hecox's analysis of *Clark* is more compelling here, where Plaintiffs have not experienced male puberty and will experience female puberty. *See Hecox*, 479 F. Supp. 3d at 981 (transgender girls who do not experience male puberty "do not have an ascertainable advantage over cisgender female athletes").

157. Under *Clark*, the legislature need not pick the wisest alternative for addressing a problem, but it must show that the policy is "substantially related to the goals of providing fair and equal playing opportunities for girls and protections to ensure the safety of girls playing sports. *Clark*, 695 F.2d at 1132.

158. The Court finds that Defendant Horne and Intervenors fail to produce persuasive evidence at the preliminary injunction stage to show that the Act is substantially related to the legitimate goals of ensuring equal opportunities for girls to play sports and to prevent safety risks:

- There is no evidence in the record that transgender girls who have not experienced male puberty, have presented an actual problem of unfair competition or created safety risks to other girls.
- There is no empirical evidence in the record that transgender girls who have not experienced puberty, have any physiological advantages over other girls that create unfair competition for positions on girls' sports teams and other athletic opportunities, or pose a safety risk to other girls.

- The Act is overly broad, reaching sports at all grade levels, including grades when athletes are prepuberty; it bans transgender girls, who have not experienced male puberty and who, instead, will or have experienced female puberty. "The Supreme Court has long viewed with suspicion laws that rely on overbroad generalizations about the different talents, capacities, or preferences of males and females." *B. P. J.* 2023 WL 111875, at *6. Laws that discriminate based on sex must be backed by an "exceedingly persuasive justification." *Virginia*, 518 U.S. at 531.

- The Act treats transgender boys and transgender girls and boys' and girls' sports differently. Transgender boys who, according to Defendants' reasoning and classifications are "biological girls", are allowed to play on boys' sports teams, subject to the alleged risks of that association which the Act proports to address. The Act creates a private cause of action that burdens only girls' sports programs with transgender challenges, investigations, and litigation. The Act subjects only female athletes, transgender and otherwise, to gender challenges and investigations. Boys playing on boys' teams do not have to worry about any gender challenge or investigation.

159. Defendant Horne and Intervenors have not established that categorically banning all transgender girls from playing girls' sports is substantially related to an important government interest. *Virginia*, 518 U.S. at 524.

160. Defendant Horne's and Intervenors' argument that the Act is necessary to protect girls' sports by barring transgender girls, who purportedly have an unfair athletic advantage over other girls and/or pose a safety risk to other girls, is based on overbroad generalizations and stereotypes that erroneously equate transgender status with athletic ability. *See Hecox*, 479 F. Supp. 3d at 982 (holding that the asserted advantage between transgender and non-transgender female athletes "is based on overbroad generalizations without factual justification"). Therefore, the Act does not withstand heightened scrutiny. *Karnoski*, 926 F.3d at 1200 (citing *Virginia*, 518 U.S. at 533).

161. Because the Court's findings of fact reflect that the Act's categorical bar against transgender girls' participation on girls' sports teams is not a genuine justification, the Plaintiffs are likely to prevail on the merits. Heightened scrutiny requires more than a hypothesized problem. *Virginia*, 518 U.S. at 533.

162. In fact, the Act fails even under the rational basis test because it is not related to any important government interest. "[I]f the constitutional conception of 'equal protection of the laws' means anything, it must at the very least mean that a bare

congressional desire to harm a politically unpopular group cannot constitute a legitimate governmental interest." *United States Dep't of Agric. v. Moreno*, 413 U.S. 528, 534 (1973).

Title IX Claim

163. Title IX provides, in relevant part, that no person "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).

164. Defendants Kyrene School District (administered and overseen by Defendant Toenjes) and the AIA receive federal financial assistance, and Defendant Horne is a grant recipient of federal funds. All Defendants must comply with Title IX's requirements. (See Compl. ¶¶ 9–13.)[8]

165. Discriminating against an individual on the basis of transgender status is discrimination based on sex. *See Bostock v. Clayton Cnty*., 140 S. Ct. 1731, 1741 (2020) ("[I]t is impossible to discriminate against a person for being . . . transgender without discriminating against that individual based on sex.").

166. The Ninth Circuit has held that discrimination based on transgender status also constitutes impermissible discrimination under Title IX. *See Grabowski v. Ariz. Bd. of Regents*, 69 F.4th 1110, 1116 (9th Cir. 2023) (holding that *Bostock* Title VII case applies to Title IX); *Doe v. Snyder*, 28 F.4th 103, 114 (9th Cir. 2022).

167. The Act discriminates against Plaintiffs based on their status as transgender girls by providing that for purposes of school sports a student's sex is fixed "at birth." S.B. 1165, 55th Leg., 2d Reg. Sess. (Ariz. 2002), § 2.

168. The Act's classification of all transgender girls as male and its prohibition of students who are "male" from playing on girls' teams, Ariz. Stat. § 15-120.02(B), intentionally excludes all transgender girls, including Plaintiffs, from participating on girls' teams.

[8] TGS has filed a motion to dismiss on the basis that it does not receive federal financial assistance and therefore is not required to comply with Title IX requirements. The Court will address this motion by separate order.

169. Exclusion from athletics on the basis of sex is a cognizable harm under Title IX because it deprives Plaintiffs of the benefits of sports programs and activities that their non-transgender classmates enjoy. *See Grabowski*, 69 F.4th 1121–22 (holding that being removed from the team was an adverse action under Title IX); *see also A.M. by E.M. v. Indianapolis Pub. Sch.*, 617 F. Supp. 3d 950 (S.D. Ind. 2022), appeal dismissed sub nom. *A.M. by E.M. v. Indianapolis Pub. Sch. & Superintendent*, No. 22-2332, 2023 WL 371646 (7th Cir. Jan. 19, 2023) (granting a preliminary injunction of a similar Indiana law that banned transgender girls from playing on girls' sports teams based on Title IX).

170. The Court rejects Defendant Horne's and Intervenors' arguments that Plaintiffs' schools offer teams for both boys and girls and, therefore, Plaintiffs are not excluded from participating in sports on teams consistent with their "biological sex." The Court's findings of fact reflect that Plaintiffs, who are transgender girls, cannot play on boys' teams because they are transgender girls who have not and will not go through male puberty and will go through female puberty. Moreover, playing on a boys' team would be shameful and humiliating for Plaintiffs as well as in direct conflict with ongoing treatment for gender dysphoria, a serious medical condition.

B. <u>Plaintiffs Will Suffer Irreparable Harm if Relief Is Not Granted</u>.

171. Plaintiffs face irreparable harm if this Court does not enjoin the Act as to them.

172. Enforcement of the Act in violation of the Equal Protection Clause in and of itself is sufficient to presume irreparable harm to justify a preliminary injunction. *Hernandez v. Sessions*, 872 F.3d 976, 994–95 (9th Cir. 2017) ("It is well established that the deprivation of constitutional rights unquestionably constitutes irreparable injury.") (internal quotation marks and citation omitted); *Hecox*, 479 F. Supp. 3d at 987 (noting this "dispositive presumption").

173. A violation of Title IX also causes irreparable harm. *See Anders v. Cal. State Univ., Fresno*, 2021 WL 1564448, at *18 (E.D. Cal. Apr. 21, 2021) (finding irreparable harm under Title IX given the "presumption of irreparable injury where plaintiff shows violation of a civil rights statute" and in light of "the insult that comes from unequal

treatment"); *Portz v. St. Cloud State Univ*., 196 F. Supp. 3d 963, 973 (D. Minn. 2016) ("Plaintiffs have a fair chance of succeeding on their Title IX claim, and Congress passed Title IX pursuant to its power to enforce the Fourteenth Amendment. Plaintiffs' expectation that they may be treated unequally in violation of Title IX's terms is an irreparable harm.") (cleaned up).

174. Plaintiffs will also suffer severe and irreparable mental, physical, and emotional harm if the Act applies to them because they cannot play on boys' sports teams. Playing on a boys' team would directly contradict Plaintiffs' medical treatment for gender dysphoria and would be painful and humiliating. Plaintiffs' mental health is dependent on living as girls in all aspects of their lives.

175. Enforcing the Act against Plaintiffs will effectively exclude Plaintiffs from school sports and deprive them of the social, educational, physical, and emotional health benefits that both sides acknowledge come from school sports. This exclusion is a cognizable harm. *Grabowski*, 69 F.4th at 1121.

176. Plaintiffs will also suffer the shame and humiliation of being unable to participate in a school activity simply because they are transgender—a personal characteristic over which they have no control. *Grimm v. Gloucester Cnty. Sch. Bd*., 972 F.3d 586, 625 (4th Cir. 2020) (explaining that the stigma of exclusion "publicly brand[s] all transgender students with a scarlet 'T'") (internal quotation marks and citation omitted).

177. In addition, Plaintiffs will suffer the cognizable and irreparable "dignitary wounds" associated with the passage of a law expressly designed to communicate the state's moral disapproval of their identity, wounds that "cannot always be healed with the stroke of a pen." *Obergefell v. Hodges*, 576 U.S. 644, 678 (2015); *Hecox*, 479 F. Supp. 3d at 987 (finding such wounds constitute irreparable harm).

178. Plaintiffs have established that they will suffer irreparable harm if the Act is enforced against them.

C. <u>The Public Interest and Balance of Equities Favor Injunctive Relief.</u>

179. When an injunction is sought against a governmental entity, the public interest

and balance-of-the-hardships factors merge. *Nken*, 556 U.S. at 435–36.

180. As an initial matter, "it is always in the public interest to prevent the violation of a party's constitutional rights." *Melendres v. Arpaio*, 695 F.3d 990, 1002 (9th Cir. 2012).

181. The balance of equities favors Plaintiffs as well. Defendant Horne and Intervenors "cannot suffer harm from an injunction that merely ends an unlawful practice." *Rodriguez v. Robbins*, 715 F.3d 1127, 1145 (9th Cir. 2013). Plaintiffs, however, face serious and ongoing harm if the Act is enforced against them.

182. The alleged harm to Defendants and Intervenors—"that biological girls will be forced to compete against transgender girls who allegedly have an athletic advantage"—is unsupported by the record. *A.M.*, 617 F. Supp. 3d at 968. Moreover, there is no evidence in the record "that allowing [Plaintiffs] to play on the girls' [teams] will make this [purported] harm a reality." *Id.* On the contrary, the record suggests the opposite. Based on the record for the preliminary injunction, the Court has found that Plaintiffs do not have a competitive advantage over other girls, and they do not pose a safety risk.

183. But for the Act, Defendants TGS, Kyrene School District, Superintendent Toenjes, and the AIA would all permit Plaintiffs to play on girls' teams.

184. There is no evidence that any Defendant will be harmed by allowing Plaintiffs to continue playing with their peers as they have done until now. *Hecox*, 479 F. Supp. 3d at 988 ("[A] preliminary injunction would not harm Defendants because it would merely maintain the status quo while Plaintiffs pursue their claims.").

185. Accordingly, the public interest and balance of equities favor a preliminary injunction.

CONCLUSION

The Court's findings of fact support Plaintiffs' assertions that very serious damages will result from a change in the status quo, and as a matter of law and fact, this is not a doubtful case. *See Anderson*, 612 F.2d at 1114 (generally, mandatory injunctions require extreme or very serious damage and not issued in doubtful cases). Because Plaintiffs have satisfied all elements necessary to obtain a preliminary injunction, the Court grants Plaintiffs' motion for a preliminary injunction.

The Court has the discretion to determine whether the moving party is required to post a bond as a condition for the granting of a preliminary injunction. *Diaz v. Brewer*, 656 F.3d 1008, 1015 (9th Cir. 2011) (citing *Johnson v. Couturier*, 572 F.3d 1067, 1086 (9th Cir. 2009)). Here, a bond is not required because "there is no realistic likelihood of harm to the defendant from enjoining his or her conduct." *Jorgensen v. Cassiday*, 320 F.3d 906, 919 (9th Cir. 2003).

Accordingly,

IT IS ORDERED that the Motion for Preliminary Injunction (Doc. 3) is GRANTED.

IT IS FURTHER ORDERED that Defendant Horne is enjoined from enforcing A.R.S. § 15-120.02 as to Plaintiffs.

IT IS FURTHER ORDERED that the Act shall not prevent Plaintiffs from participating in girls' sports and, as agreed by Kyrene School District and Laura Toenjes, in her official capacity, pursuant to the Stipulation in Lieu of an Answer (Doc. 59), and by TGS in open Court at the hearing for the Preliminary Injunction, the Plaintiffs shall be allowed to play girls' sports at their respective schools.

IT IS FURTHER ORDERED that the AIA transgender policy, § 41.9, complies with the terms of this preliminary injunction.

Dated this 20th day of July, 2023.

Honorable Jennifer G. Zipps
United States District Judge

No. 23-16026 c/w No. 23-16030

IN THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

HELEN DOE, parent and next friend of Jane Doe; et al.,

Plaintiffs-Appellees,

v.

THOMAS C. HORNE, in his official capacity as State Superintendent of Public Instruction; et al.,

Defendants-Appellants,

and

WARREN PETERSEN, Senator, President of the Arizona State Senate; BEN TOMA, Representative, Speaker of the Arizona House of Representatives,

Intervenor-Defendants-Appellants.

On Appeal from the United States District Court
for the District of Arizona

EXCERPTS OF RECORD – VOLUME 2

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Exhibit 27

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UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA
TUCSON DIVISION

Jane Doe, by her next friend and parents Helen Doe and James Doe; and Megan Roe, by her next friend and parents, Kate Roe and Robert Roe, Plaintiffs, v. Thomas C. Horne in his official capacity as State Superintendent of Public Instruction; Laura Toenjes, in her official capacity as Superintendent of the Kyrene School District; Kyrene School District; The Gregory School; and Arizona Interscholastic Association Inc., Defendants.	Case No. 4:23-cv-00185-JGZ **SECOND REBUTTAL DECLARATION OF DANIEL SHUMER, M.D., IN FURTHER SUPPORT OF MOTION FOR PRELIMINARY INJUNCTION**

I, Daniel Shumer, declare as follows:

1. I submit this expert declaration based on my personal knowledge.

2. If called to testify, I would testify truthfully based on my expert opinion.

3. In preparing this declaration, I reviewed the expert declarations submitted by Dr. Emma Hilton ("Hilton Decl.") and Dr. Linda Blade ("Blade Decl.") in support of Defendant Horne's Opposition to Plaintiffs' Motion for Preliminary Injunction. I also reviewed the rebuttal declarations by Dr. Gregory Brown ("Brown Rebuttal Decl."), Dr. Chad Carlson ("Carlson Rebuttal Decl."), and Dr. James Cantor ("Cantor Rebuttal Decl.") that the Intervenors submitted in support of their Opposition to Plaintiffs' Motion for Preliminary Injunction. As with my prior expert declaration, I relied on my scientific education and training, my research experience, and my knowledge of the scientific literature in the pertinent fields. The materials I have relied on in preparing this declaration are the same types of materials that experts in my field of study regularly rely on when forming opinions on these subjects. I may wish to supplement these opinions or the bases for them as a result of new scientific research or publications or in response to statements and issues that may arise in my area of expertise.

Dr. Hilton's Declaration

I. There Is No Evidence Linking In Utero Development or Minipuberty to Athletic Performance and No Credible Medical Reason to Posit Any Such Connection.

4. There is no scientific basis for Dr. Hilton's claim that boys gain an athletic advantage over girls based on exposure to testosterone in utero or during minipuberty. (Hilton Decl. ¶¶ 5.3–5.5.)

5. In a male fetus, testosterone production peaks around 11–14 weeks of gestation (in the first trimester of pregnancy), then declines until it is completely suppressed at birth. Testosterone is necessary during this time for normal development of the genitals. *See, e.g.*, Marianne Becker & Volker Hesse, *Minipuberty: Why Does it*

Happen?, 93 Hormone Rsch. Paediatrics 76 (2020).

6. Male babies also experience an elevation of testosterone after birth, with levels peaking between one to two months old, and returning to prepubertal levels before six months of age. As with the in utero elevation of testosterone, a rise in testosterone during minipuberty correlates positively with growth of the male genitals. *Id.* at 78–79.

7. Contrary to Dr. Hilton's testimony, minipuberty does not result in clinically visible physical changes, other than a possible transient increase in testicular volume.

8. In fact, although Dr. Hilton cites Becker & Hesse's article for the proposition that testosterone levels cause an increase in babies' growth velocity and body weight (Hilton Decl. ¶ 5.5), the article describes the opposite. Becker & Hesse found that testosterone and luteinizing hormone (the hormone that stimulates testosterone production) concentrations "during minipuberty correlate *negatively* with body weight and body mass index [BMI] until the age of 6 years." *Id.* at 80 (emphasis added). A negative correlation between testosterone level and body weight or BMI contradicts Dr. Hilton's assertion that minipuberty in males causes competitive athletic advantage later in life. In addition, the article found that "[d]ata on the influence of minipuberty on growth velocity are conflicting." *Id.*

9. No research has linked this brief exposure to elevated testosterone during minipuberty to any lasting physiological impact, much less to an increase in athletic ability. Nor is there any credible medical basis even to hypothesize such an impact.

II. There Also Is No Evidence Linking Gene Expression to Athletic Performance and No Credible Medical Reason to Posit Any Such Connection.

10. There also is no scientific basis for Dr. Hilton's speculation that boys gain an athletic advantage over girls based on sex-specific genetic architecture that results in approximately 6,500 differences in gene expression. (Hilton Decl. ¶ 5.2.) Dr. Hilton fails to cite any research to connect any differences in gene expression between the sexes to the purported athletic advantage of transgender girls who do not undergo male puberty.

11. Contrary to Dr. Hilton's testimony and as I have previously discussed, there is an overwhelming scientific consensus that the biological cause of average differences in athletic performance between men and women is the rise in circulating levels of testosterone beginning in endogenous male puberty. As Handelsman states, "evidence makes it highly likely that the sex difference in circulating testosterone of adults explains most, if not all, of the sex differences in sporting performance." *See* David J. Handelsman et al., *Circulating Testosterone as the Hormonal Basis of Sex Differences in Athletic Performance*, 39 Endocrine Revs. 803, 823 (2018) (summarizing evidence rejecting the hypothesis that physiological characteristics are driven by the Y chromosome).

III. Any Height Differences Among Male and Female Babies Are Negligible and, in Any Event, Largely Disappear Around the Age of Six or Seven.

12. Dr. Hilton's claim that growth charts reveal that "[m]ales are consistently 1-2 cm taller than females between 0-10 years old" (Hilton Decl. ¶ 4.4) is false.

13. Growth charts show that babies' heights are heavily overlapped, with only negligible differences between boys and girls, which differences almost disappear around 6 to 8 years of age, and do not begin diverging again until puberty (see attached full growth charts at **Exhibit A**):

6– 36 months old:

	6 Months		24 Months		36 Months	
Percentile	Boys	Girls	Boys	Girls	Boys	Girls
95th	72 cm	69.5 cm	93 cm	91.5 cm	102.5 cm	101.25 cm
50th	**67 cm**	**65.25 cm**	**87.25 cm**	**86 cm**	**95.75 cm**	**94.75 cm**
5th	63 cm	61 cm	81.5 cm	80 cm	89.75 cm	88.25 cm

7–12 years old:

	7 Years		8 Years		12 Years	
Percentile	Boys	Girls	Boys	Girls	Boys	Girls
95th	130.75 cm	130.75 cm	137.5 cm	137.75 cm	161.5	163 cm
50th	**121.5 cm**	**121.5 cm**	**128 cm**	**128 cm**	**149 cm**	**151 cm**
5th	113 cm	113 cm	118.5 cm	118.25 cm	137 cm	139 cm

14. The numbers begin to diverge again after around 10 years of age, with girls overtaking males in height and weight for a few years because they typically go through the puberty-related growth spurt around two years earlier than males. *See* Charles Brook, *Mechanism of Puberty*, 3 Hormone Rsch. 52, 53 (1999).

15. Moreover, while post-pubertal boys are taller, on average, than post-pubertal girls, the height ranges for boys and girls continue to be overlapping. Ctrs. for Disease Control & Prevention, *Clinical Growth Charts: Children 2 to 20 Years (5th–95th Percentile)*, https://www.cdc.gov/growthcharts/clinical_charts.htm.

IV. There Is No Evidence That Prepubertal Boys Have a Biological Athletic Advantage Over Prepubertal Girls.

16. Contrary to Dr. Hilton's testimony and as I discussed in my prior declarations in this case, there is a well-established scientific consensus that, before puberty, there are no significant differences in athletic performance between boys and girls. *See, e.g.*, Marnee McKay & Joshua Burns, *When it Comes to Sport, Boys "Play Like a Girl"*, The Conversation (Aug. 3, 2017), https://theconversation.com/when-it-comes-to-sport-boys-play-like-a-girl-80328 (discussing results of research published in American Academy of Neurology Journal).

17. While some studies have found small differences between the performance

of boys and girls with respect to some discrete activities, these studies did not control for other factors, particularly age, location, or athletic experience or exposure. *Id.*

18. When research has controlled for those factors by using representative data, researchers have found that "[a]cross all measures of physical performance, there was one consistent finding. There was no statistical difference in the capabilities of girls and boys until high-school age (commonly age 12)." *Id.* These tests included long jump, muscle strength, walking, jumping, and balancing. *Id.*

19. This finding has been replicated in many other studies, and there is a clear scientific consensus that athletic ability does not diverge significantly until puberty. *See, e.g.*, David J. Handelsman, *Sex Differences in Athletic Performance Emerge Coinciding with the Onset of Male Puberty*, 87 Clin. Endocrinol. 68, 70–71 (2017) ("The gender divergence in athletic performance begins at the age of 12-13 years"); Jonathon W. Senefeld et al., *Sex Differences in Youth Elite Swimming*, 14 PLoS ONE 1, 1–2 (2019) (studying child and youth swimmers and concluding that the data suggests "girls are faster, or at least not slower, than boys prior to the performance-enhancing effects of puberty").

20. In support of her contention that boys have at least some biological advantages in athletic performance over girls before puberty, Dr. Hilton relies primarily on data from physical fitness tests or international track and field event records. The data Dr. Hilton relies on in fact shows several areas where pre-pubertal girls outperform pre-pubertal boys. (Hilton Decl. ¶¶ 7.6, 7.9.)

21. Otherwise, the data Dr. Hilton relies on shows that there is a small difference in performance between prepubertal non-transgender boys and prepubertal non-transgender girls.[1] This data merely observes phenomena across a population sample in isolated areas and does not determine a cause for whatever is observed. There is no

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[1] Two of the studies cited by Dr. Hilton are also cited in paragraph 6 of the legislative findings of Arizona's statute. *See* S.B. 1165, 55th Leg., 2d Reg. Sess. (Ariz. 2022), § 6.

reliable basis for Dr. Hilton to attribute those small differences to physiology or anatomy instead of other factors, such as greater societal encouragement of athleticism in boys, greater opportunities for boys to play sports, or different preferences of the boys and girls surveyed. David J. Handelsman, *Sex Differences in Athletic Performance Emerge Coinciding with the Onset of Male Puberty*, 87 Clin. Endocrinol. 68 (2017).

22. Dr. Hilton's statement that the "performance gap in international and national track and field records evident before puberty, somewhat controls for this sociali[z]ation effect, given that one might expect engaged sporty girls to be as well-trained as their male peers" (Hilton Decl. ¶ 7.22) is pure conjecture and lacks any reliable factual basis to support it.

23. Dr. Hilton also discusses the outcomes of two individual middle school track and field competitions held at the Kyrene Aprende Middle School in the last year. (Hilton Decl. ¶¶ 7.17–7.20.) It is my understanding from Plaintiffs' counsel that one of the Plaintiffs in this case will begin attending Kyrene Aprende Middle School this month and that she wishes to participate and compete on the girls' cross-country, soccer, and basketball teams, not the track and field team. Moreover, given the age ranges of the children who attend middle school, this data likely includes some males who have undergone male puberty. It is my understanding from Plaintiffs' counsel that the Plaintiff who will be attending Kyrene Aprende Middle School will not undergo male puberty because she will be taking puberty suppressing medication, which I have discussed in more detail in my prior declarations in this case. Therefore, this data is not relevant to this litigation.

24. In any event, as previously discussed, this data does not determine a cause for the observed differences. Even if this data included only prepubertal boys and girls, there is no reliable basis for Dr. Hilton to attribute the differences observed to physiology or anatomy instead of other factors, such as greater societal encouragement of athleticism in boys, greater opportunities for boys to play sports, or different preferences of the boys

and girls surveyed.

V. Transgender Girls Who Receive Puberty Suppressing Medication at the Onset of Puberty Have No Athletic Advantage Over Other Girls.

25. Dr. Hilton incorrectly asserts that the administration of puberty suppressing medication (also sometimes referred to as puberty blocking medication) to transgender girls does not eliminate the athletic advantage that men and adolescent boys have over women and adolescent girls.[2] (Hilton Decl. ¶ 9.5.)

26. As I have discussed previously, Tanner staging (also called Sexual Maturity Rating) is used to document and track the development and sequence of secondary sex characteristics of children during puberty. Under current standards of care, transgender adolescents are eligible to receive puberty blockers when they reach Tanner Stage 2, at the first onset of puberty, and long before the development of increased muscle mass and strength associated with later stages of male puberty. *See* Wylie C. Hembree et al., *Endocrine Treatment of Gender-Dysphoric/Gender-Incongruent Persons: An Endocrine Society Clinical Practice Guideline*, 102 J. Clinical Endocrinology & Metabolism 3869–903 (2017).

27. Following the administration of puberty blockers, transgender girls will also receive hormone replacement therapy to allow them to go through puberty consistent with their female gender identity. As a result, these transgender girls will develop many of the same physiological and anatomical characteristics of non-transgender girls, including bone size, skeletal structure, and distinctive aspects of the female pelvis geometry that cut against athletic performance. Thus, a transgender girl who received

[2] Dr. Hilton also briefly discusses the medical treatment of transgender girls and states that many children reporting gender dysphoria desist and that puberty blocking medication is harmful and has uncertain outcomes. (Hilton Decl. ¶¶ 9.3-9.4.) These conclusions are contrary to my experience treating over 600 patients with gender dysphoria. Dr. Hilton is not a medical doctor or mental health professional nor does it appear that she has ever treated a transgender patient. Moreover, Dr. Hilton does not explain how any of her criticisms are relevant to the issue of whether transgender girls should be able to participate on female sports teams. In any event, as discussed in detail in my prior declarations in this case, these criticisms are not well-founded.

puberty suppressing medication followed by hormone replacement therapy does not have the same physiology as a prepubertal non-transgender boy.

28. Because such girls do not undergo male puberty, they do not gain the increased muscle mass or strength that accounts for why post-pubertal boys as a group have an advantage over post-pubertal girls as a group.

29. For that reason, studies on transgender women who have undergone testosterone suppression as adults are almost meaningless when assessing the athletic abilities of transgender girls who have received pubertal suppression beginning at the onset of puberty. The women in those studies did not transition until well after puberty and experienced exposure to testosterone over an extended time, allowing their muscles to keep developing. In sharp contrast, transgender girls who receive Gonadotropin-releasing hormone agonist ("GnRHa") do not go through male puberty and are not exposed to the heightened level of testosterone associated with male puberty.

30. Even so, those studies of adult transgender women show that testosterone suppression resulted in significant mitigation of muscle mass and development in adult transgender women.

31. For example, the only study directly examining the effects of hormone therapy on the athletic performance of transgender female athletes is a small study of eight long-distance runners. The study showed that after undergoing medical interventions, which included lowering their testosterone levels, the athletes' performance had reduced so that relative to non-transgender women their performance was now proportionally the same as it had been relative to non-transgender men prior to any medical treatment. In other words, a transgender woman who performed at about 80% as well as the best performer among men of that age before transition would also perform at about 80% as well as the best performer among women of that age after transition. *See* Joanna Harper, *Race Times for Transgender Athletes*, 6 J. Sporting

Cultures & Identities 1 (2015).[3] Given that adolescent transgender girls who receive puberty suppressing medication do not go through male puberty, there is no medical basis to expect that transgender girls receiving such medications would have an athletic advantage.

32. Dr. Hilton cites two studies that she claims show that transgender girls have an athletic advantage over other girls even when they are receiving puberty blocking medication or hormone therapy; however, neither study supports Dr. Hilton's claim.

33. Dr. Hilton cites to Maartje Klaver et al., *Early Hormonal Treatment Affects Body Composition and Body Shape in Young Transgender Adolescents*, 15 J. Sexual Med. 251 (2018). (Hilton Decl. ¶ 11.3.) Contrary to Dr. Hilton's claim, however, the primary finding of the Klaver study is that receiving puberty blockers and hormone therapy bring the body composition of young transgender women much closer to their non-transgender female peers than their non-transgender male peers. Those results are more pronounced the earlier a transgender girl starts puberty blockers. *Id.* at 255 (finding that "compared with adult transgender persons treated with CHT, larger changes in body shape and body composition are seen in transgender persons who start in adolescence"). It should also be noted that the transgender women participants in the Klaver study started GnRHa at an average age of 14.5 years, and none started prior to age 12. This is because the original Dutch protocol did not provide GnRHa prior to age 12 regardless of whether puberty started at a younger age. The participants in the study by definition had much more testosterone exposure than transgender girls treated with modern protocols,

[3] The legislative findings of the Arizona statute incorrectly state that for transgender women who go through male puberty (unlike the plaintiffs here), the benefit conferred by testosterone "is not diminished through the use of testosterone suppression." *See* S.B. 1165, 55th Leg., 2d Reg. Sess. (Ariz. 2022), § 13. While that statement conflicts with available evidence, which shows that hormone therapy significantly reduces muscle mass and strength, it is also irrelevant to the situation of the plaintiffs in this case who have not undergone male puberty and thus are not in the position of having to mitigate the increased muscle mass and strength caused by male puberty. Notably, the legislative findings do not state that transgender girls who receive puberty suppressing medication at the onset of puberty have any conceivable athletic advantage, nor do they cite any evidence that would support that claim.

which initiate GnRHa based on pubertal stage unrelated to age.

34. Dr. Hilton also cites Lloyd J.W. Tack et al., *Proandrogenic and Antiandrogenic Progestins in Transgender Youth: Differential Effects on Body Composition and Bone Metabolism*, 103 J. Clinical Endocrinology & Metabolism 2147 (2018), for the proposition that transgender girls who receive medical treatments purportedly maintain greater grip strength than transgender boys. (Hilton Decl. ¶ 11.3.) But the medication administered in this study is not used in the U.S. and does not have nearly the same impact as puberty blockers and hormone therapy for transgender girls or as testosterone for transgender boys. The medications administered to the study participants did not fully block puberty for either transgender girls or transgender boys. Even with this less effective medication, the study found that transgender girls "showed a significant increase in fat mass and decrease in lean mass, resulting in an increased body fat percentage" and did not experience any increase in grip strength. *Id*. at 2153–54. If anything, this study shows that even with a less effective medication, the physiological impact of medically treating transgender girls in adolescence, rather than when they are adults, is profound.

35. At the beginning of her declaration, Dr. Hilton discusses her involvement with the World Rugby Transgender Guidelines. (Hilton Decl. ¶ 1.13.) However, even these guidelines allow transgender girls and women to participate in women's rugby if they did not experience endogenous puberty, stating: "Transgender women who transitioned pre-puberty and have not experienced the biological effects of testosterone during puberty and adolescence can play women's rugby." World Rugby, *Transgender Women Guidelines* (2019), https://www.world.rugby/the-game/player-welfare/guidelines/transgender/women.

36. In sum, there is no evidence that transgender girls on puberty suppression medication or hormone therapy have an athletic advantage over other girls. There are no studies that have documented any such advantage, and there is no medical reason to posit

that any such advantage would exist.

37. In my clinical practice, I have provided medical care to more than 300 adolescent transgender girls. None of the transgender girls I have treated with the above medical interventions appeared to have any athletic advantage over other girls.

VI. From a Medical Perspective, Menstruation Does Not Provide a Basis to Conclude That Transgender Girls Have an Athletic Advantage Over Other Girls.

38. In her declaration, Dr. Hilton claims that female athletes have an athletic disadvantage because they "must typically deal with the effects of the menstrual cycle," which may affect "training capacity and performance," and that, as a result, transgender girls have an athletic advantage because they do not menstruate. (Hilton Decl. ¶ 6.5.) This conclusion does not have a sound medical or scientific basis because not all adolescent girls menstruate or suffer any athletic disadvantage if they do menstruate.

39. For example, girls with certain medical conditions do not menstruate, and some adolescent girls may take birth control to prevent menstruation or for other medical reasons. In addition, not all adolescent girls who do menstruate suffer any adverse impacts on their training capacity or performance.

VII. Permitting Transgender Girls to Play on Girls' Teams Does Not Pose a Safety Risk to Other Girls.

40. In her declaration, Dr. Hilton testifies that transgender girls who play on girls' teams somehow pose a threat to the safety of other girls because, she asserts, girls have "delicate brain structures" that make them more prone to injury. (Hilton Decl. ¶ 6.6.) While research has found that girls suffer more sports-related concussions than boys, the cause of that differential is unknown, including whether it is cultural or biological or both. *See* William T. Tsushima et al., *Incidence and Risk of Concussions in Youth Athletes: Comparisons of Age, Sex, Concussion History, Sport, and Football Position*, 34 Archives Clinical Neuropsych. 60, 66 (2019). In any event, however, there

is no scientific evidence that girls have more "delicate brain structures" than boys. If a researcher were to view an MRI of a human brain, there would be no way to identify whether it was the brain of a male or a female other than average size. Lise Eliot et al., *Dump the "Dimorphism": Comprehensive Synthesis of Human Brain Studies Reveals Few Male-Female Differences Beyond Size*, 125 Neurosci. & Biobehav. Rev. 667, 668 (2021).

41. Some researchers have theorized that girls may suffer more sports-related concussions because, on average, adolescent girls have weaker neck muscles than post-pubertal adolescent boys. *See* Abigail C. Bretzin et al., *Association of Sex with Adolescent Soccer Concussion Incidence and Characteristics*, 4 JAMA Network Open 4, 6 (2021); Ryan T. Tierney et al., *Gender Differences in Head-Neck Segment Dynamic Stabilization During Head Acceleration*, 37 Med. & Sci. Sports & Exercise 272, 272 (2005). If that accounts for girls' higher rates of concussions (which is unknown), transgender girls on puberty blockers or hormone therapy would be at the same or similar risk for such injury as non-transgender girls. There is no evidence, and no medical reason to believe, that their participation on girls' teams would pose any increased threat of such injuries to other girls.

42. More generally, transgender girls do not present any unique safety risks to other girls. Transgender girls' physical characteristics (in terms of height, weight, and strength) overlap with those of other girls. For example, while some transgender girls may be taller than average, so are some non-transgender girls, and many transgender girls are simply average.

43. There is no more reason to exclude a tall transgender girl for safety reasons than there would be to exclude any other girl for that reason. While some transgender girls may (or may not) have larger skeletons than some non-transgender girls, there is no medical reason to conclude that that physical characteristic poses any elevated safety concerns when not accompanied by high levels of testosterone and corresponding skeletal

muscle. After a transgender adolescent suppresses her level of testosterone, there is no inherent medical reason why her physiological characteristics related to athletic performance should be treated differently from the physiological characteristics of other girls.

Dr. Blade's Declaration

44. Dr. Blade is not a medical doctor, nor does it appear that she has ever treated a transgender patient; in contrast, I have experience treating over 600 hundred patients with gender dysphoria. From a medical perspective, the terms "biological sex," "biological male," and "biological female" are imprecise terms that can cause confusion. A person's sex encompasses several different biological attributes, including sex chromosomes, certain genes, gonads, sex hormone levels, internal and external genitalia, other secondary sex characteristics, and gender identity. Those attributes are not always aligned in the same direction. *See* Joshua D. Safer, *Care of Transgender Persons*, 381 N. Engl. J. Med. 2451 (2019).

45. Contrary to Dr. Blade's testimony and as I have previously discussed, there is an overwhelming scientific consensus that the biological cause of average differences in athletic performance between men and women is the rise in circulating levels of testosterone beginning in endogenous male puberty.

46. Dr. Blade discusses data from physical fitness tests in children to demonstrate that transgender girls have an athletic advantage over other girls before puberty. (Blade Decl. at 7–9.) This data merely observes phenomena across a population sample in isolated areas and does not determine a cause for whatever is observed. As I have discussed previously, there is no reliable basis for Dr. Blade to attribute any small differences between boys and girls to physiology or anatomy instead of other factors, such as greater societal encouragement of athleticism in boys, greater opportunities for boys to play sports, or different preferences of the boys and girls surveyed.

47. Dr. Blade also asserts that because prepubertal boys have a greater lung volume and other enhanced capabilities throughout the oxygen transport system, they do better in endurance tests and the 1500m run. (Blade Decl. at 9.) In fact, any such difference between boys and girls is small and has no documented impact on athletic performance. If this small average difference in lung capacity had a significant causal relationship to athletic advantage, we would see significant differences in the athletic performance of prepubescent boys and girls, but we do not.

48. Dr. Blade posits that transgender girls' participation in girls' sports causes psychosocial risks to other girls. (Blade Decl. at 11–12.) Dr. Blade's assertion is based on a misunderstanding regarding transgender girls. As discussed in my prior declarations in this case, a transgender girl is a girl. Moreover, there is no reason to assume a transgender girl's identity would be discernible to other girls, particularly when a transgender girl transitions socially and medically. Lastly, Dr. Blade supports her assertion with mere anecdotes rather than scientific research on the topic. As discussed above, the scientific research demonstrates there is no athletic advantage between transgender girls who have not undergone male puberty and other girls.

Dr. Brown's Rebuttal Declaration

49. Dr. Brown cites a hodge-podge of studies, but none support his view that prepubertal boys have a significant group-based advantage over prepubertal girls, which is contrary to the overwhelming weight of medical evidence and consensus on this issue.

50. For example, although Dr. Brown claims that Handelman's research supports Dr. Brown's position, Handelman himself disagrees, as Dr. Brown concedes.

51. The studies cited by Dr. Brown do not support his thesis for a variety of reasons. First, several of the studies include post-pubertal as well as pubertal children. (*See*, *e.g.*, Brown Rebuttal Decl. ¶¶ 9–10 (citing data that includes children from the ages of 9 to 16).) Second, some of the studies show small physiological differences between prepubertal boys and girls, but do not purport to establish any causal link between those

small differences and athletic ability or establishing only a speculative or hypothetical link. (*See*, *e.g.*, Brown Rebuttal Decl. ¶ 12 (citing data showing that girls have a slightly higher resting heart rate).) And third, even with respect to those small physiological differences between prepubertal boys and girls, unlike the post-pubertal production of testosterone, those differences exist on an overlapping spectrum. For example, while it is true that there is some evidence that prepubertal boys on average may have slightly less body fat than girls,[4] there are some girls who have less body fat than some boys, and some boys who have more body fat than some girls. In contrast, apart from girls with certain intersex conditions or other health conditions, there are no post-pubertal girls with more testosterone than post-pubertal boys; generally speaking, testosterone levels in post-pubertal boys and girls do not overlap.

52. Notably, Dr. Brown agrees that there is no basis for alleging that minipuberty has any impact on athletic ability. (Brown Rebuttal Decl. ¶ 37 (stating "At no point in my declaration are the male athletic advantages differences ascribed to 'minipuberty' (indeed, the term 'minipuberty' is not found within my expert report.")).

Dr. Carlson's Rebuttal Declaration

53. Dr. Carlson acknowledges that the only studies finding small differences in athletic performance between prepubertal boys and girls are cross-sectional studies that, as such, do not "assign causation to any measured differences, such as biology vs. sociological effect." (Carlson Rebuttal Decl. ¶ 6.) In addition, the small differences found by these studies relate to discrete activities, not to strength or athletic performance across the board, and do not rise anywhere close to the level of the broad, clear, and significant group-based differences caused by exposure over time to the elevated levels of testosterone associated with male puberty.

54. Dr. Carlson attempts to rebut the conclusion of McKay's study that there

[4] As noted in my prior declaration, and as Dr. Brown acknowledges (Brown Rebuttal Decl. ¶ 17), this research is not conclusive; some studies have found no differences and have criticized other studies for failing to consider factors such as age, maturational status and obesity status. (Shumer Rebuttal Decl. ¶ 6)

are no significant differences in athletic ability between prepubertal boys and girls, but his analysis is not persuasive. As Dr. Carlson acknowledges, McKay found no significant differences in strength based on sex in children ages 3 through 9—i.e., in prepubertal children, and found such differences only in post-pubertal children. (Carlson Decl. ¶ 9).

55. Dr. Carlson's suggestion that the two girls who are Plaintiffs in this case would have been grouped with the 10 to 19 year olds (Carlson Rebuttal Decl. ¶¶ 10–11) has no logical relevance to the import of McKay's study: significant athletic differences between boys and girls are linked to puberty. The Plaintiffs in this case are receiving puberty suppressing medication, which prevents them from undergoing male puberty and thus from gaining the potential athletic advantage associated with exposure to post pubertal levels of testosterone.

56. Dr. Carlson acknowledges that the studies he cites "carry with them the limitations of cross-sectional comparisons" (Carlson Rebuttal Decl. ¶ 15), and thus cannot establish any causal link between physiology and athletic performance in prepubertal children for the reasons explained above.

57. Dr. Carlson offers no evidence for his assumption that the enactment of Title IX means that prepubertal boys and girls now receive equal coaching and skill training, nor does any such evidence exist. (Carlson Rebuttal Decl. ¶ 19) To the contrary, as discussed below, research shows that girls receive far less opportunities for participation than boys.

58. Relatedly, Dr. Carlson relies heavily on a single article by Lombardo, which in turn rests upon speculative and subjective hypotheses about how boys and girls are treated in various cultures, including, for example, a presumption that Aboriginal boys and girls are equally encouraged to hunt and that German boys "do not throw much and do not have U.S.-like cultural support or encouragement for throwing." (Carlson Rebuttal Decl. ¶ 19(citing Michael P. Lombardo et al., *On the Evolution of the Sex*

Differences in Throwing: Throwing is a Male Adaptation in Humans, 93 Q.Rev. Biology 91 (2018))). Such speculative research based on broad sociological generalizations about other cultures does not provide a valid evidentiary basis to conclude that the small differences in athletic performance found in some cross-sectional studies of prepubertal boys and girls are based on physiology rather than culture, much less that such small differences have any applicability to individual transgender girls or warrant excluding all transgender girls from playing on girls' teams.

59. Research that is more carefully and objectively designed has found that differences in skills training and practice—not innate gender-based differences—account for many specific sex-based differences in athletic performance. For example, a 2019 study of spatiotemporal coordination in throwing found that sex-based differences "only arose from age 20 years onwards and that in individuals with throwing practice, performance disparities leveled out." Dena Crozier et al., *Gender Differences in Throwing Revisited: Sensorimotor Coordination in a Virtual Ball Aiming Task*, 13 Frontiers Hum. Neurosci. 231 (2019).

60. Given the far greater social encouragement and skills training provided to boys than to girls, it is not surprising, as Dr. Carlson notes (Carlson Rebuttal Decl. ¶ 21), that boys have the highest-ranking performances in USA Track & Field. Contrary to Dr. Carlson's suggestion that our society promotes "equal opportunities for boys and girls to participate," the reality is much different. Across the board, girls have far fewer opportunities to play sports and therefore far less coaching and skill training than boys in every age group. *See* U.S. Dep't Health & Hum. Servs., *The National Youth Sports Strategy*, 35–37 (2019), https://health.gov/sites/default/files/2019-10/National_Youth_Sports_Strategy.pdf; Aspen. Inst. Project Play, *Youth Sports Facts: Participation Rates*, https://www.aspenprojectplay.org/youth-sports/facts/participation-rates. For example, during the 2018–2019 year, fifty-seven percent of high school athletics participation opportunities went to boys, with only forty-three percent going to

girls, translating into over one million more opportunities for boys than girls. Ellen J. Staurowsky et al., Women's Sports Found., *50 Years of Title IX: We're Not Done Yet*, 30 (2022), https://www.womenssportsfoundation.org/wp-content/uploads/2022/05/Title-IX-at-50-Report-FINALC-v2-.pdf.

61. Dr. Carlson acknowledges that even the highly restrictive World Rugby policy permits transgender girls who receive puberty suppressing medication to play. (Carlson Rebuttal Decl. ¶¶ 23–24.) Dr. Carlson contends that this exception is not "grounded in scientific review of relevant data," but there is no data showing that such girls have any athletic advantage over other girls, nor is there any medically reasonable basis for assuming that they do. (Carlson Rebuttal Decl. ¶ 24.)

62. Dr. Carlson's suggestion (Carlson Rebuttal Decl. ¶ 25) that puberty suppressing medication fails to suppress the heightened levels of testosterone associated with male puberty in 25 to 49 percent of cases has no medical basis. The article he cites to support that erroneous claim is about the use of testosterone suppressant by adult transgender women who went through male puberty; it has no bearing on the efficacy of puberty suppression for transgender girls, which is highly effective and prevents transgender girls from producing the elevated levels of testosterone associated with male puberty.

63. The Klaver study does not support Dr. Carlson's claim that transgender girls who received puberty suppressing medication have an athletic advantage over other girls (Carlson Rebuttal Decl. ¶¶ 31–32) for the reasons stated in paragraph 33 above. It is not appropriate to use the Klaver article to presume that transgender girls may have more lean body mass on average than other girls because, as noted above, Klaver participants started GnRHa at much older ages than modern protocols would dictate. The findings of the study are not generalizable across decades and not relevant to the question at hand.

64. For the reasons explained in paragraphs 40 through 43 above, Dr. Carlson's claim that transgender girls "are more likely to cause concussions than other competitors"

(Carlson Rebuttal Decl. ¶ 33) has no medical basis. It is particularly unwarranted for transgender girls, like the Plaintiffs in this case, who receive puberty suppressing medication and thus do not go through male puberty.

Dr. Cantor's Supplemental Declaration

65. Dr. Cantor acknowledges that his views place him at odds with the standards of care and practice guidelines developed by the World Professional Association of Transgender Health ("WPATH") and the Endocrine Society, and which have been endorsed by a long list of major medical professional associations, including the American Medical Association, the American Academy of Pediatrics, the American Psychological Association, and many others.

66. Contrary to Dr. Cantor's unsupported claims, which implausibly cast aspersions on the integrity of our nation's leading professional medical organizations, the standards of care and practice guidelines relied upon by medical and mental health professionals who specialize in the treatment of gender dysphoria in adolescents have a sound evidentiary basis. The evidence-based methodology used to generate these guidelines is described in detail in both the WPATH Standards of Care and the Practice Guidelines promulgated by the Endocrine Society and is comparable to that used to generate similar clinical practice guidelines for other medical conditions.

67. Dr. Cantor's views, which seek to cast doubt on the existence of gender identity as a facet of human identity and to advocate the use of therapeutic techniques to discourage or prevent minors from identifying as transgender, do not have a sound scientific foundation and are distinctly at odds with the overwhelming consensus of medical science, experts, and practitioners in this area.

68. Dr. Cantor does not diagnose or treat gender dysphoria in adolescents or adults and has no training or expertise in transgender mental health care or medicine. As such, his strong disagreement with the consensus of medical experts in this area appears to be based more on his personal opinions than on a scientific foundation.

I declare under criminal penalty under the laws of Arizona that the foregoing is true and correct. Signed on the 6th day of July, 2023, in Ann Arbor, Michigan.

Daniel Shumer, M.D.

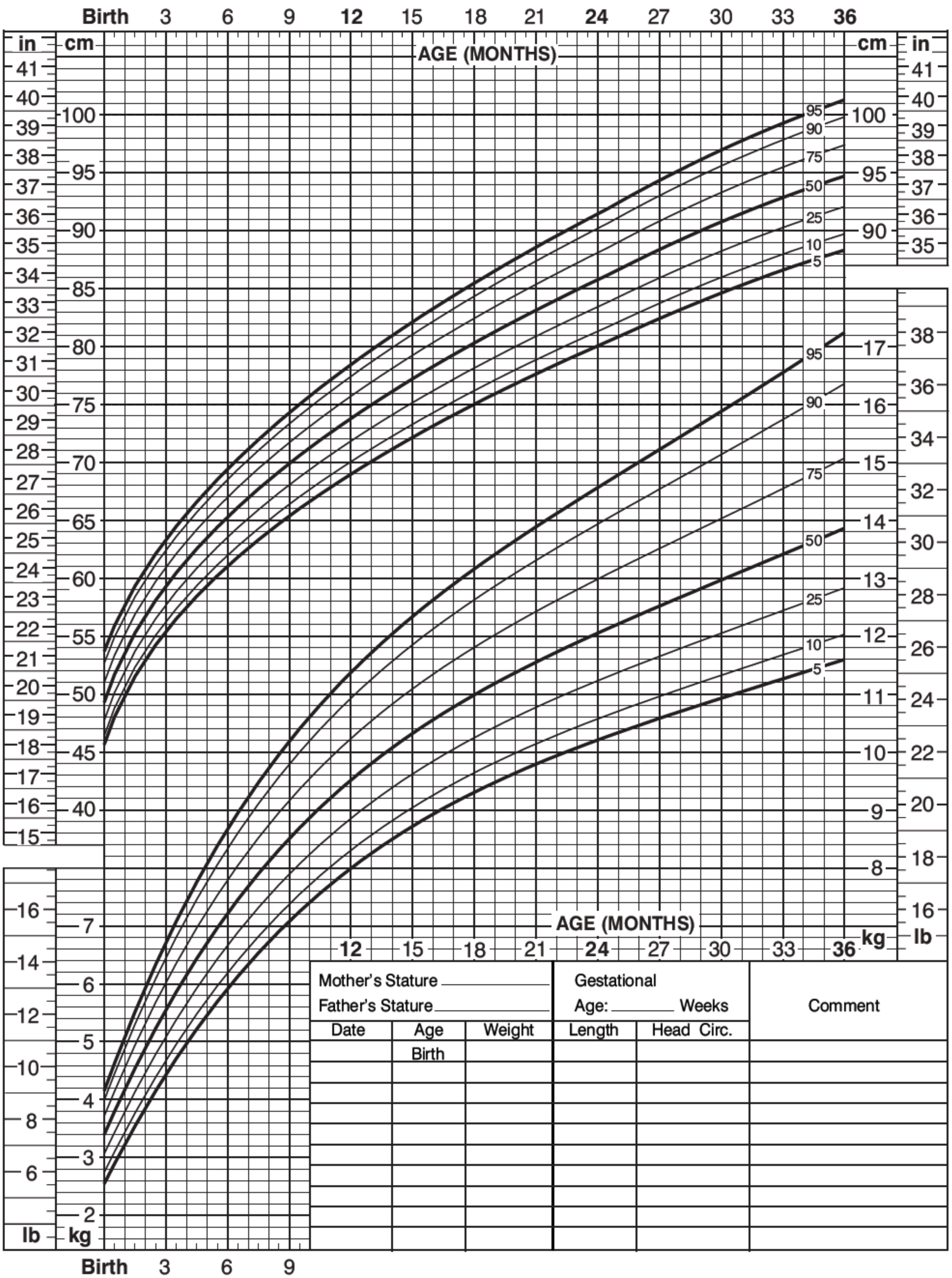
Exhibit A

CDC Growth Charts

Birth to 36 months: Girls
Length-for-age and Weight-for-age percentiles

NAME ____________________

RECORD # __________



Mother's Stature ______			Gestational		Comment
Father's Stature ______			Age: ______ Weeks		
Date	Age	Weight	Length	Head Circ.	
	Birth				

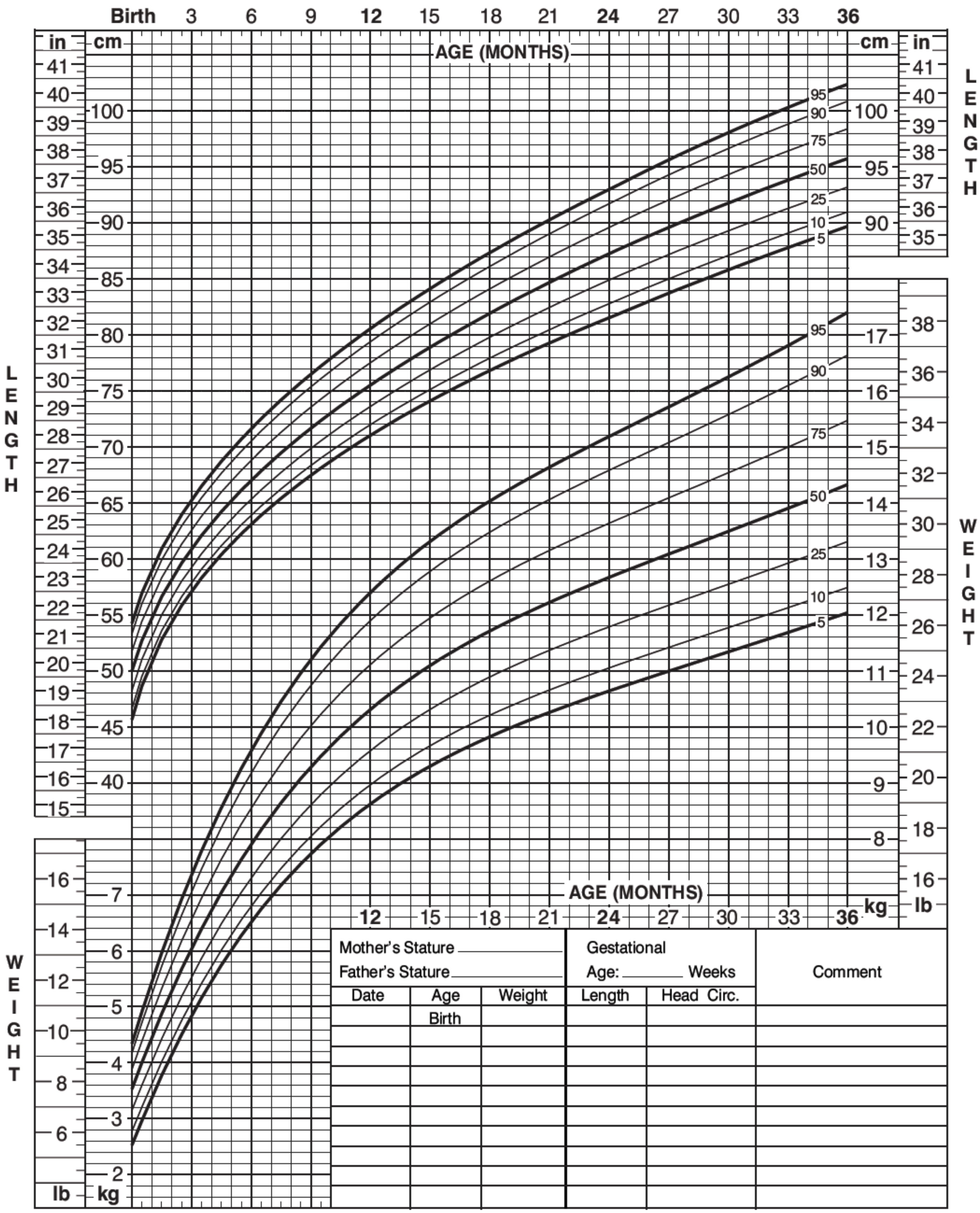
Published May 30, 2000 (modified 4/20/01).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

CDC
SAFER · HEALTHIER · PEOPLE™

Birth to 36 months: Boys
Length-for-age and Weight-for-age percentiles

NAME ________________

RECORD # ________



Mother's Stature ______			Gestational		Comment
Father's Stature ______			Age: ______ Weeks		
Date	Age	Weight	Length	Head Circ.	
	Birth				

Published May 30, 2000 (modified 4/20/01).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

CDC
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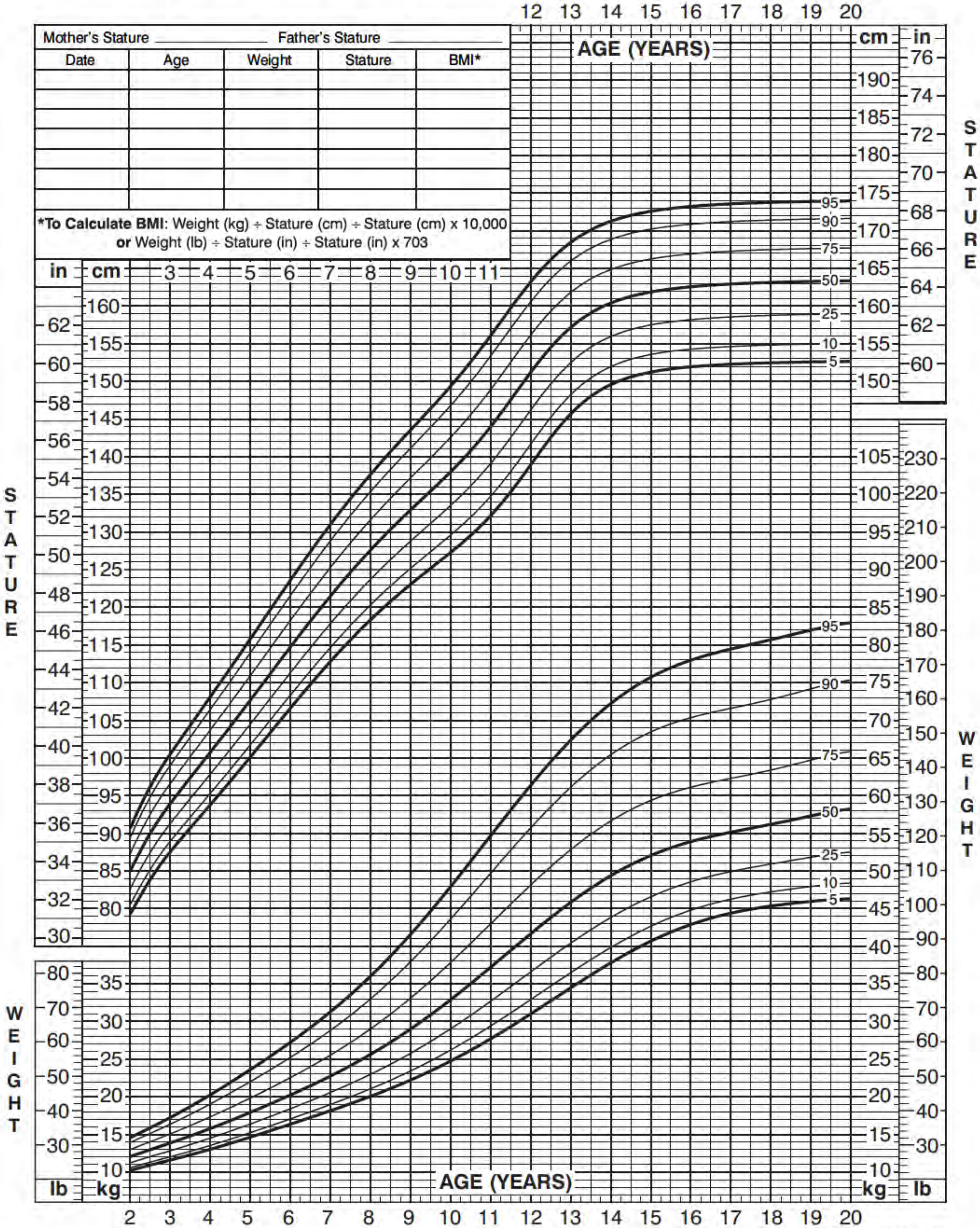
2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME ____________________

RECORD # __________



Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

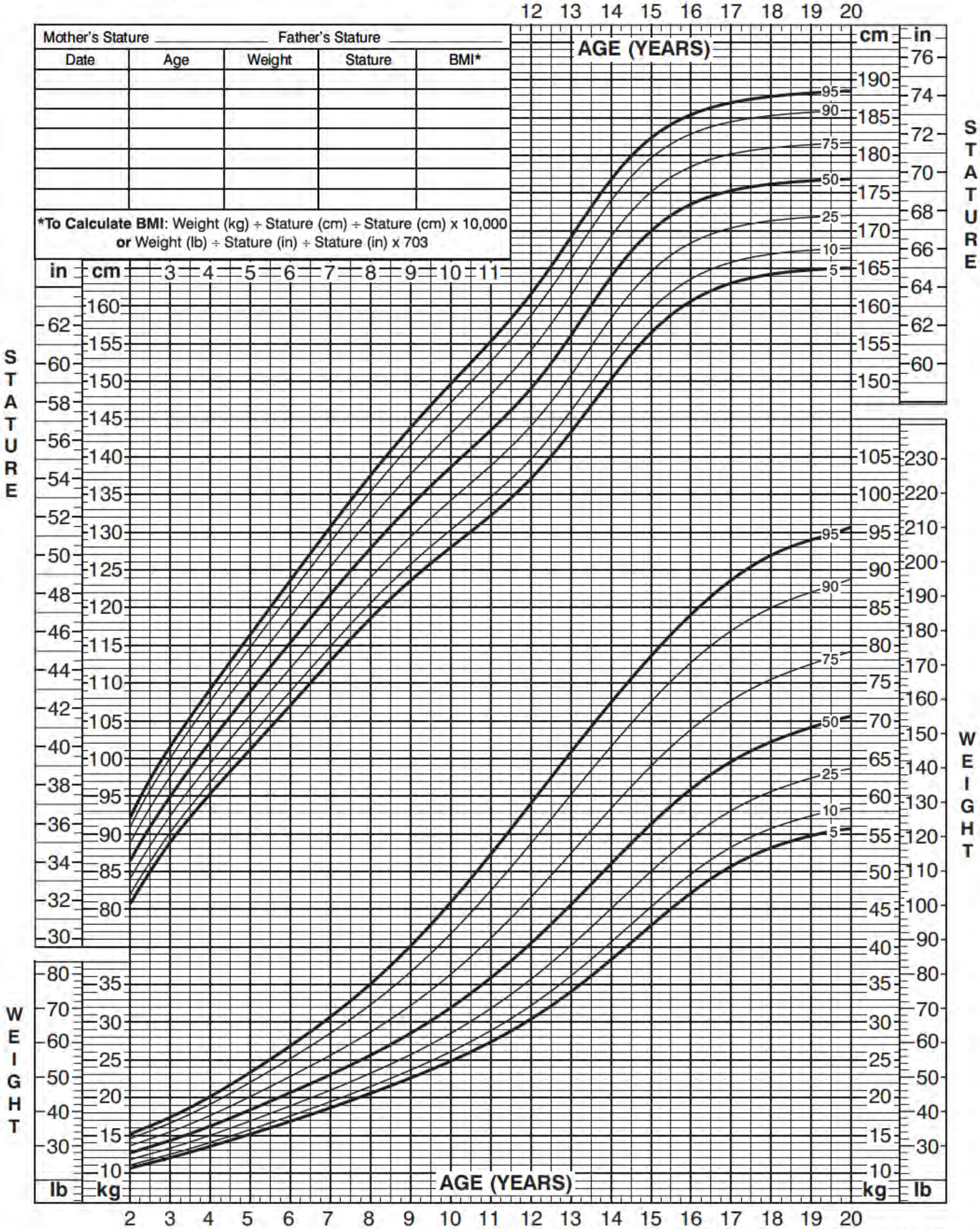
NAME ______________________

RECORD # __________

Mother's Stature ______________ Father's Stature ______________

Date	Age	Weight	Stature	BMI*

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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Exhibit 26

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UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA
TUCSON DIVISION

Jane Doe, by her next friend and parents Helen Doe and James Doe, and Megan Roe, by her next friend and parents, Kate Roe and Robert Roe, Plaintiffs, v. Thomas C. Horne in his official capacity as State Superintendent of Public Instruction; Laura Toenjes, in her official capacity as Superintendent of the Kyrene School District; Kyrene School District; The Gregory School; and Arizona Interscholastic Association Inc., Defendants.	Case No. 4:23-cv-00185-JGZ **THIRD DECLARATION OF HELEN DOE IN SUPPORT OF JANE DOE'S MOTION FOR A PRELIMINARY INJUNCTION**

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Admitted pro hac vice.

I, Helen Doe, declare as follows:

1. I make this declaration of my own personal knowledge, and, if called as a witness, I could and would testify competently to the matters stated here.

2. I am the mother of Jane Doe, one of the plaintiffs in this case. My husband, James Doe, is Jane's father.

3. As I indicated in my first declaration, Jane has been monitored by her doctor for signs of the onset of puberty as part of her medical treatment for gender dysphoria.

4. At an appointment on June 27, 2023, Jane's doctor prescribed a Supprelin implant, which is a puberty-blocking medication, so that Jane does not go through male puberty.

5. After receiving insurance authorization, we will schedule Jane to have the implant procedure as soon as possible.

This declaration was executed this 30th day of June, 2023, in Maricopa County, Arizona.

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

By: Helen Doe

Helen Doe

Exhibit 5

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UNITED STATES DISTRICT COURT
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 Kimberly J. Miller

I, Kimberly J. Miller, declare as follows:

1. I am the President and Chairwoman of USA Women of Action, an Arizona nonprofit corporation that operates under the trade name of "Arizona Women of Action" ("AZWOA"),

2. AZWOA started in October 2020 as a text chain of 8 action-oriented women with a shared love of America and a passion for reviving communities and protecting families. It formally organized a political action committee on March 24, 2021 and then formally incorporated as a domestic nonprofit corporation on November 8, 2021. AZWOA qualifies as tax-exempt under Section 501(c)(4) of the Internal Revenue Code.

3. Attached as **Exhibit A** is a true and correct copy of AZWOA's November 8, 2021 Certificate of Disclosure and Articles of Incorporation filed with the Arizona Corporation Commission under the name of USA Women of Action.

4. Attached as **Exhibit B** is a true and correct copy of the Arizona Secretary of State's online record of the October 12, 2022 registration of Arizona Women of Action as a trade name for USA Women of Action.

5. Since its humble beginnings in October 2020, AZWOA has grown into one of the largest and most effective grassroots organizations in the State of Arizona. AZWOA maintains an active email list with over 2,700 subscribers. Our subscribers are particularly engaged and interested. Recipients of our emails open them 58% of the time, which is almost three times higher than the average 21% open rate for email newsletters.[1] AZWOA also has about 13,700 followers across its social media platforms on Twitter, Instagram, Facebook, and Telegram. Since launching the AZWOA PAC in March 2021, the PAC and the 501(c)(4) have collectively received donations from 645 individuals and entities.

6. Because of the contentious and polarized nature of modern public discourse, many of our donors, subscribers, and followers feel unable to express their views in private discussions, let alone in public debates, because of the risk of online and real-world backlash, including the threat of violence. Therefore, many of our donors, subscribers, and followers view AZWOA as the public voice for their concerns.

7. As an organization that speaks for Arizona women and mothers, AZWOA has a particular focus on improving education and on helping children, and one of its three main purposes is to revive the American dream of thriving kids. AZWOA explains in our promotional materials that our purpose is "reviving the American dream of strong families, safe cities, and thriving kids." Our Mission is "Positive, Effective Action - On Your Schedule." The end goal of AZWOA is to inspire, inform, engage &

[1] MAILCHIMP, *Email Marketing Statistics and Benchmarks by Industry*, (accessed on June 9, 2023), https://tinyurl.com/2tuwyayr.

connect people—men as well as women (we are BY women, FOR Arizona)—to revive freedom and the American dream.

8. AZWOA has been an important and prominent voice in challenging policies it views as harmful to biological girls. For example, on March 21, 2023, I wrote an editorial published on our website criticizing that in Arizona, "girls in schools are stripped of their privacy, dignity and safety in the name of progressive 'inclusion'. A Tucson school board 'wouldn't reconsider their unwritten policy on boys who claim to be transgender — a policy which also doesn't require parents to be notified when males use their daughters' locker rooms and restrooms, and directs girls to use another facility if they're upset that males use female-designated private spaces.'"[2] Additionally, in a recent weekly call to action, we urged our subscribers to contact Mesa Public Schools to voice their concerns that "district leadership [had] quietly developed a Transgender Support Plan for children. This includes choosing which facilities the child wants to use, along with a new name & new pronouns. This plan involves no parental consent or parental notification."[3]

9. AZWOA conducted a survey of its email subscribers from June 1 through June 8 to assess respondents' opinions about Arizona's Save Women's Sports Act, A.R.S. § 15-120.02, and about the participation of biological males in girls' sports. Out of the 272 persons who completed the survey, 91% had children, and 30% had at least some children still under the age of 18. Sixty-five percent of respondents reported having a child who had played or does play sports through school, and 51% reported a daughter who played sports through school. Twelve individuals, or 4% of respondents, reported that their daughters had ever played on a sports team with a biological male, and nine respondents, or 3% of respondents, reported having a daughter forced to compete against a team with a member who was a biological male. When asked, "Have

[2] Kim Miller, *Who Truly Celebrates Women*, AZWOA, (Mar. 21, 2023), https://www.azwomenofaction.com/blog/who-truly-celebrates-women.
[3] AZWOA, *Weekly Call to Action*, (accessed on June 9, 2023), https://www.azwomenofaction.com/weekly-call-to-action.

you considered or would you consider removing your daughter from an all-girls' sports team/league if a biological male participated?", 196 respondents, or 72%, answered "yes." In response to the statement, "Currently, Arizona law prohibits biological males from participating in school sports teams for girls. Do you support this law?", 271 respondents, or 99.6%, answered "yes," and one respondent answered "not sure."

10. The survey also allowed respondents to write additional comments and to express their "thoughts about biological males participating in girls' sports." The following are a representative selection of some of their responses:

- "This will be the downfall of womens sports. Not only is it insanely dangerous, it takes away the girls ability to compete at a collegiate level. We have fought so hard to get the girls to have these opportunities and allowing boys to compete will obliterate these efforts."
- "Girls sports should be for girls (XX) and boys(XY)sports should be for boys."
- "I believe males are created differently than women. Men do not need to compete against women period."
- "Biological males have an unfair advantage. Also, allowing biological males to compete as girls is discriminatory towards girls in terms of competition, scholarships, playing time, and enjoyment of sport."
- "Achieving excellence through competition is foundational to sports. The biological advantages boys have over girls erodes that foundation. Worse, allowing boys to participate in girls' sports reinforces the fallacy that there's nothing unique or special about either gender, and that both are interchangeable. Even worse, pitting boys against girls, even in the seemingly innocent context of sports, counteracts the natural instinct of men to protect and care for women."
- "It's dangerous for the girls and unfair. it should not be allowed. My daughter got a cross country scholarship to college. It wouldn't have happened if boys were also allowed in her sport."

- "Biological males should not be allowed to participate in biological female sports. We need to protect the ability for girls to compete in sports."
- "It is ridiculous. Women have had to work hard for decades to establish rights for girls sports to now having those rights erased. Girls will stop participating in sports entirely if this continues."
- "It's not safe or fair for the biological girls to compete against biological males in sports."
- "It is completely unfair for girl's/women's sports. Biological males are stronger, have more lung capacity, and therefore, more endurance. It would completely wipe out all girl's/women's opportunities to compete. This would set back women's equality several decades!"
- "Biological males should participate in boys sports only. Biological females should participate in girls sports only. Spaces should be kept private and separate."
- "Biological males do NOT and SHOULD NOT be allowed to compete on a women's sports team or league."
- "It's unfair and potentially dangerous. It's a huge liability for districts."
- "I do not believe that there should ever be a situation where a biological male completes in any type of women/girls sports. There are physical differences between men and woman that would create an unfair 'playing field'. I would never support a law promoting this and I will never support any league, professional or amateur, club team or school team that promotes this concept. It is just wrong."
- "I have a transgender young adult. He never had the gender change. He did take female hormones. He never desired to race against female athletes. He knew he physically was built bigger and stronger than a female of his ages growing up. He/She would have been thrilled that the races had a transgender categories."

- "Absolutely NO! Not fair or safe. I would not let my daughter play with a male on a girls only team."
- "I struggle with my daughter competing against biological males."
- "I was in high school when Title 9 was passed. This feels like a huge step backwards in what we gained."
- "It is egregious and will be the end of girls sports. Title 9 enabled me and my daughters to play sports in high school and college. Stop the insanity."
- "As a parent and also public high school teacher, I am against this."
- "Girls already drop out of sports in their early teens at a higher rate than boys. They are recruited to college earlier to keep them going in the sport. I think many girls will be demoralized and drop out instead of continuing if competing against boys. The sport has prepared my daughter for life and the work force so much, by supporting others on a team to performing under stress. One big step backward for women's rights!"
- "I have a 12 year old son who is already as strong if not stronger than me -- and I work out. It won't be much longer before he surpasses me significantly in strength and power. It is not fair competition when boys compete against girls. Period."
- "[T]here is no circumstance where male genitalia should ever be present in a locker room, bathroom/restroom, spa or massage area."
- "There are certain things that should only be for biological females OR biological males....like competitive sports teams and sororities/fraternitis. If you want to play a co-ed intramural sport in college, go for it."
- "Breaks my heart to think my daughter won't be given the same opportunities I was as a biological female to compete and learn from sports with males being allowed to compete."

11. As President of AZWOA, I interact frequently with our donors, subscribers, and social media followers online, and also at in-person events. Based on

my personal experience and observation, the preceding comments are a representative sample of the beliefs and concerns of those whom we represent.

12. AZWOA has always been a vocal supporter of the Save Women's Sports Act. We used our email newsletter and social media platforms to encourage our donors, subscribers, and followers to contact their legislators and ask them to adopt the bill. We also used email and social media to encourage our donors, subscribers, and followers to contact Governor Ducey and ask him to support the bill.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, and that this declaration was issued on June 23, 2021, in Phoenix, Arizona.

KJ Miller
Kimberly J. Miller

Exhibit

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UNITED STATES DISTRICT COURT
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 Amber Zenczak**

I, Amber Zenczak, declare as follows:

1. I am a resident of Maricopa, Arizona.

2. I have three daughters, two of whom are still minors. I am the legal guardian of both of my minor daughters. They both attend the same publicly funded charter school.

3. Kyrene School District has an open enrollment policy that allows students from the City of Maricopa to enroll in the school district. Kyrene School District provides bus service for children who live in Maricopa and are enrolled in the following Kyrene schools: Akimel Middle School, Kyrene de los Lagos, Kyrene del Milenio, and

Kyrene de la Estrella. Attached as Exhibit A is a true and correct copy of the Kyrene School District's "Open Enrollment Bus Stop Information" webpage, which confirms that Kyrene School District provides bus service to the City of Maricopa. Kyrene maintains a bus stop in a subdivision that neighbors my own, and I consistently see children's bikes locked up there during the school day. Kyrene School District covers kindergarten through eighth grade and then feeds students into Tempe Union School District for high school. It is possible that my daughters could go to Kyrene School District or Tempe Union School District for better sports opportunities and improved prospects for college sports scholarship opportunities.

4. My middle daughter is 14 years old and will enter ninth grade this school year. She has played on girls' sports teams in school since she was 11 years old. She plays on her school's teams for soccer and basketball and is also considering adding tennis and track this year.

5. My youngest daughter is 13 years old and will enter eighth grade this school year. She has played on girls' sports teams in school since she was nine years old, starting on intramural elementary school teams and then moving into interscholastic teams. She plays on her school's basketball, softball, and soccer teams and plans to do track and field in high school.

6. My girls are working hard academically and physically to improve their chances of receiving scholarships for an opportunity to attend college.

7. Their school is a member of the Canyon Athletic Association (CAA), an Arizona non-profit that organizes and facilitates interscholastic activities among its members. CAA member schools include charter, public, and private schools, and home school organizations.

8. Participating in girls' team sports has dramatically benefited my daughters' personal and social development. Their experiences have built their self-confidence and allowed them to experience a type of camaraderie and friendship that could not be replicated anywhere else. If their teams also included persons born as

biological males, virtually all those benefits would evaporate. There are three reasons for this.

9. First, biological males have innate physical advantages that start before puberty. We have experienced this firsthand. Last school year, my youngest daughter's girls' basketball team played a game against another school's girls' team that had one player who was transgender—in other words, this player was a biological male. This transgender player played in a style very different from the norm for girls' basketball. The player was more aggressive than the other players and unnecessarily touched the other players all over the court. This player even shoved my daughter with both hands on a pass-in. The referees did not make any calls on this obvious foul, and it was evident to me that the referees decided to ignore this foul because of fear of accusations of discrimination and to avoid retaliation from trans activists. The game was unfair because this player had an obvious inherent advantage—the player ran considerably faster, was noticeably taller, and had a thicker build. All these intrinsic advantages made it hard even for this player's own teammates to keep up. Because of this, the transgender player rarely passed the ball to teammates and scored every point for the team, with hardly any assists. The presence of this player caused noticeable distress and anguish to the biological girls on my daughter's team, and even to the other members of the player's own team. It also caused considerable distress and anguish to me and the other parents at the game.

10. This experience has permanently changed my daughter's outlook and approach to sports. She has a persistent fear that she will one day have to compete against biological males for the limited number of spots on her girls' sports team or for the limited number of college scholarship opportunities for female athletes. She now feels compelled to take every opportunity she can to play in co-ed leagues to improve her skills, and even to compete in other sports like track and field to improve her speed.

11. This experience has profoundly affected my older daughter as well. She has told me she would refuse to ever play against a team with a biological male on it

because of the much greater risk of suffering severe injury that may cause lifelong damage and chronic pain.

12. The threat of having to compete against boys is a very real one for my daughters. CAA recently confirmed that a biological male was cleared to play on a girls' team. However, CAA has attempted to keep that information secret. Thus, making this information more publicly known has been virtually impossible.

13. Because my daughters have competed in team sports from a young age, my daughters and I have had the opportunity to observe the difference in athletic performance between boys and girls. We have observed that even pre-pubescent males have physical advantages over girls in terms of athletic performance. Thus, even allowing pre-pubescent boys to compete on girls' teams would be unfair.

14. Second, allowing biological males to compete on female teams discriminates against biological females. My daughters and I believe that when biological males participate in girls-only sports teams, they have obvious natural advantages that degrade the integrity of the sport and make a fair and level playing field for the biological females impossible. We see this as a fight against discrimination, the same fight women have been fighting since before President Nixon signed Title IX into law in 1972. Allowing biological males who identify as female to compete in girls' and women's sports will reverse more than 50 years' worth of progress. I have extreme compassion for the struggles of trans students. I encourage them to find other opportunities to pursue what they enjoy, without infringing the rights of others.

15. Third, the prospect of having biological males in female-only spaces, such as locker rooms, makes my daughters very uncomfortable. They would feel self-conscious and frustrated by having to change clothes or shower in the presence of a teammate having male genitalia in the locker room.

16. I have been an outspoken public proponent of the Save Women's Sports Act since its inception. For example, I gave a speech to an Arizona Senate committee in favor of the Act. I have talked to many parents of other girls. They feel the same way

but are reluctant to come forward because they are scared of the potential backlash, both online and in the real world, from activists who oppose the law.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, and that this declaration was issued on June 23, 2021, in Maricopa, Arizona.

Amber Zenczak

Exhibit

Open Enrollment Bus Stop Information

Welcome to the Bus Stop Information page for parents with Open Enrollment students, who attend school in the Kyrene School District and live in Maricopa and South Phoenix. Here, you have the ability to look up your student's bus route information. Please follow the instructions below and use the designated link for access to our e-link portal.

For students already placed:

Login with the link below with the following info:
User Name: Your Student's School ID Number
Password: Your Student's Date of Birth (Month 00, Day 00, Year 0000; ex: 01291999)
NOTE: This bus information is for students who have already been placed on a bus by the transportation department. Information for students on the waiting list will be unavailable.

BUS STOP INFORMATION

Please view the brief User Guide on how to use the parent e-link portal.
Disclaimer: Bus route information is subject to change based on the needs of the route. Please be sure to review your student's bus route information a of couple days before August 3rd.

Open Enrollment Transportation Requests:

How It Works

- **NOTE: Students are assigned to a bus based on availability of space *and* on a first come, first served basis. Once a bus is at capacity, the remaining requests will be placed on a wait-list.**
- Open Enrollment transportation is only available to students who live in either Maricopa or South Phoenix, and are enrolled at one of the schools below:
  - Maricopa:
    - **Middle School:** Akimel
    - **Elementary Schools:** Lagos, Milenio & Estrella
  - South Phoenix:
    - **Middle Schools:** CMS & KMS
    - **Elementary Schools:** Lomas, Ninos, Norte & Manitas
- The parent / guardian will be notified once the student is assigned to the requested bus.

Use the link below to request Open Enrollment Transportation for the 2023/24 school year

Open Enrollment Transportation Request Form

NOW AVAILABLE! Get the Versatrans My Stop App. [Learn More]

Last Modified on May 23, 2023

Exhibit

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UNITED STATES DISTRICT COURT
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 Lisa Fink**

I, Lisa Fink, declare as follows:

1. I am a resident of Glendale, Arizona. I have five daughters.

2. My seventeen-year-old daughter attends a publicly funded charter school in Phoenix, Arizona. She is a member of the school's varsity volleyball team. I am the coach of her team.

3. Her school is a member of the Canyon Athletic Association (CAA), which is an Arizona non-profit that organizes and facilitates interscholastic activities among its members. CAA member schools include charter schools, public schools, private schools, and home school organizations.

4. My daughter has played volleyball since she was 11 years old. Her volleyball team has thirteen regularly scheduled games this upcoming school season.

5. Participating in girls' team sports has been a great benefit to my daughter's personal and social development. Her experience on the team has built her self-confidence and allowed her to experience a type of camaraderie and friendship that could not be replicated anywhere else. If her team also included persons who were born as biological males, virtually all of those benefits would evaporate. I have talked to her about this, and there are several reasons why the participation of biological males would be a major concern.

6. First, she would feel self-conscious, uncomfortable, and frustrated by having to change clothes or shower in the presence of a teammate having male genitalia in the locker room. My daughter has told me that her teammates have told her they feel the same way—they would be very uncomfortable having a person with male genitalia in the locker room.

7. Second, because she and I both believe that males—even pre-pubescent males—have an inherent athletic advantage that would make competition unfair if biological males were allowed to participate, even if they had been taking puberty blockers or female hormones. Because my daughter has played volleyball since she was 11 years old, she has been able to closely observe both pre- and post-pubescent biological males playing the sport. I also played sports as a student and have coached my daughters' teams and have been able to observe and compare biological males and females in athletic situations. Our observations are that even pre-pubescent biological males have significant advantages over biological females in terms of height, speed, strength, and power. My daughter and I believe that a biological male on their team would have an unfair advantage to be able to get a starting position on the team and achieve other similar benefits and advantages. This would create an environment on the team of disunity and corrosive rivalry. Furthermore, if biological males were allowed to play on teams my daughter's team was competing against, we believe that those teams

would have an unfair advantage. It would create a strong sense that the competition was not on a level playing field. My daughter's volleyball team has already had to deal with this situation—in 2020, an opposing team had a player who very clearly appeared to be a biological male. The girls on the team came to me as their coach and told me that they were very upset about having to compete against a biological male because they felt that this made the game unfair.

8. Third, my daughter and I believe that biological females have a right to have their own spaces for socialization and collaboration. Adolescence for biological females is a period of significant physical and mental change. These changes can cause significant stress and anxiety for biological females. One of the most important ways that biological girls deal with that stress and anxiety is by supporting each other. A biological male who has been taking puberty blockers or hormones does not go through the exact same process of change and development as a biological female. A biological male on the team would not be able to relate in the same way with the biological females. The presence of a biological male will destroy the value of the team as a female-only space for girls to socialize and support each other. It will eliminate much of the benefit of having girls-only sports teams.

9. In my many years of experience as an athlete myself, as a volleyball coach, and as a parent of girls who play sports, my observations confirm that in athletics, even pre-pubescent boys have a significant competitive advantage over biological girls and that the presence of biological males will destroy most of the positive aspects of girls-only sports.

10. As a mother, I strongly support Arizona's Save Women's Sports Act, A.R.S. § 15-120.02. I believe that it is very important for maintaining the integrity and value of girls' sports in our state. I have talked to many parents of girls at the school, and they feel exactly the same way, but are reluctant to come forward because they are scared of the potential backlash, both online and in the real world, from activists who oppose the law.

11. My support for the Save Women's Sports Act is longstanding. I have advocated for it since the Arizona Legislature first started considering it as a bill. For example, I sought witnesses to testify in support of the bill. I also coordinated support for the bill by, among other things, encouraging members of the community to use the Arizona Legislature's Request to Speak system to submit comments in support of the bill and also to email and call legislators in support of the bill.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, and that this declaration was issued on June 10, 2021, in Glendale, Arizona.

Lisa Fink

Exhibit 2

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UNITED STATES DISTRICT COURT
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 Anna Van oe**

I, Anna an Hoek, declare as follows:

1. I am a resident of Gilbert, Arizona.

2. I have one daughter who is still a minor. She is 13 years old.

3. This school year, my daughter will attend high school in the Chandler Unified School District. Before that, she attended middle school in the Higley Unified School District. My daughter played softball in middle school on a team that participates in the Arizona Interscholastic Association (AIA). My daughter plans to continue playing softball in high school. Her high school also participates in the AIA. She has played on girls' sports teams since she was 9 years old and on school teams

since seventh grade.

4. Participating in girls' team sports has dramatically benefited my daughter's personal and social development. Her experience has built her self-confidence and allowed her to experience a type of camaraderie and friendship that could not be replicated anywhere else. If her team also included persons born as biological males, virtually all those benefits would evaporate. There are three reasons for this.

5. First, the presence of biological boys creates a significant obstacle to girls achieving their best performance. My daughter has experienced this firsthand in co-educational physical education classes. For example, the students in the class had to do PACER fitness testing. The biological girls were embarrassed to perform at their greatest capacity in front of the biological boys because the boys would make fun of them or make comments about their bodies.

6. I also have an 18-year-old daughter who started playing soccer in our local city league at age 3. The league had all-girls teams for players up to age 15. She played on these teams until she turned 16, when her only viable option became joining a co-ed team. On her girls' teams, she had been a star player who scored most of the goals as a center striker. On the co-ed team, she was rarely ever even able to touch the ball because the boys dominated the games. She became so discouraged that she ended up quitting soccer. Before she joined the co-ed team, we had realistic hopes that she would get a college soccer scholarship. Unfortunately, playing with the boys ruined her love for the game and ended her soccer career prematurely.

7. My younger daughter saw what happened to her older sister. Because of those negative experiences, coupled with her own negative experiences participating in athletics with biological boys in physical education class, my younger daughter would give up on softball if she were forced to play on a team with biological boys, or to compete against biological boys.

8. Second, biological boys have an innate athletic advantage that would give

them an unfair advantage in girls' sports. Because of my daughters' longstanding participation in athletics, we have been able to observe and compare the athletic performance of biological girls and boys, and our observation is that boys enjoy an athletic advantage over girls at all ages, including before puberty.

9. Third, the prospect of having biological males in female-only spaces, such as locker rooms, makes my daughter very uncomfortable. She would feel self-conscious and frustrated by having to change clothes or shower in the presence of a teammate having male genitalia in the locker room.

10. I strongly support the Save Women's Sports Act and have spoken out in favor of it since the legislature first started considering it. I know many parents in our community who feel the same way but are reluctant to come forward because they are scared of the potential backlash, both online and in the real world, from activists who oppose the law.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, and that this declaration was issued on June 23, 2021, in Gilbert, Arizona.

A Van Hoek

Anna Van Hoek

EXHIBIT 15

WILENCHIK & BARTNESS
A PROFESSIONAL CORPORATION

Case: 23-16026, 09/05/2023, DktEntry: 12.7, Page 60 of 169

Senate Engrossed

interscholastic; intramural athletics; biological sex

State of Arizona
Senate
Fifty-fifth Legislature
Second Regular Session
2022

SENATE BILL 1165

AN ACT

AMENDING TITLE 15, CHAPTER 1, ARTICLE 1, ARIZONA REVISED STATUTES, BY ADDING SECTION 15-120.02; RELATING TO ATHLETICS.

(TEXT OF BILL BEGINS ON NEXT PAGE)

Be it enacted by the Legislature of the State of Arizona:

Section 1. Title 15, chapter 1, article 1, Arizona Revised Statutes, is amended by adding section 15-120.02, to read:

15-120.02. Interscholastic and intramural athletics; designation of teams; biological sex; cause of action; definition

A. EACH INTERSCHOLASTIC OR INTRAMURAL ATHLETIC TEAM OR SPORT THAT IS SPONSORED BY A PUBLIC SCHOOL OR A PRIVATE SCHOOL WHOSE STUDENTS OR TEAMS COMPETE AGAINST A PUBLIC SCHOOL SHALL BE EXPRESSLY DESIGNATED AS ONE OF THE FOLLOWING BASED ON THE BIOLOGICAL SEX OF THE STUDENTS WHO PARTICIPATE ON THE TEAM OR IN THE SPORT:

1. "MALES", "MEN" OR "BOYS".

2. "FEMALES", "WOMEN" OR "GIRLS".

3. "COED" OR "MIXED".

B. ATHLETIC TEAMS OR SPORTS DESIGNATED FOR "FEMALES", "WOMEN" OR "GIRLS" MAY NOT BE OPEN TO STUDENTS OF THE MALE SEX.

C. THIS SECTION DOES NOT RESTRICT THE ELIGIBILITY OF ANY STUDENT TO PARTICIPATE IN ANY INTERSCHOLASTIC OR INTRAMURAL ATHLETIC TEAM OR SPORT DESIGNATED AS BEING FOR "MALES", "MEN" OR "BOYS" OR DESIGNATED AS "COED" OR "MIXED".

D. A GOVERNMENT ENTITY, ANY LICENSING OR ACCREDITING ORGANIZATION OR ANY ATHLETIC ASSOCIATION OR ORGANIZATION MAY NOT ENTERTAIN A COMPLAINT, OPEN AN INVESTIGATION OR TAKE ANY OTHER ADVERSE ACTION AGAINST A SCHOOL FOR MAINTAINING SEPARATE INTERSCHOLASTIC OR INTRAMURAL ATHLETIC TEAMS OR SPORTS FOR STUDENTS OF THE FEMALE SEX.

E. ANY STUDENT WHO IS DEPRIVED OF AN ATHLETIC OPPORTUNITY OR SUFFERS ANY DIRECT OR INDIRECT HARM AS A RESULT OF A SCHOOL KNOWINGLY VIOLATING THIS SECTION HAS A PRIVATE CAUSE OF ACTION FOR INJUNCTIVE RELIEF, DAMAGES AND ANY OTHER RELIEF AVAILABLE UNDER LAW AGAINST THE SCHOOL.

F. ANY STUDENT WHO IS SUBJECT TO RETALIATION OR ANOTHER ADVERSE ACTION BY A SCHOOL OR AN ATHLETIC ASSOCIATION OR ORGANIZATION AS A RESULT OF REPORTING A VIOLATION OF THIS SECTION TO AN EMPLOYEE OR REPRESENTATIVE OF THE SCHOOL OR THE ATHLETIC ASSOCIATION OR ORGANIZATION, OR TO ANY STATE OR FEDERAL AGENCY WITH OVERSIGHT OF SCHOOLS IN THIS STATE, HAS A PRIVATE CAUSE OF ACTION FOR INJUNCTIVE RELIEF, DAMAGES AND ANY OTHER RELIEF AVAILABLE UNDER LAW AGAINST THE SCHOOL OR THE ATHLETIC ASSOCIATION OR ORGANIZATION.

G. ANY SCHOOL THAT SUFFERS ANY DIRECT OR INDIRECT HARM AS A RESULT OF A VIOLATION OF THIS SECTION HAS A PRIVATE CAUSE OF ACTION FOR INJUNCTIVE RELIEF, DAMAGES AND ANY OTHER RELIEF AVAILABLE UNDER LAW AGAINST THE GOVERNMENT ENTITY, THE LICENSING OR ACCREDITING ORGANIZATION OR THE ATHLETIC ASSOCIATION OR ORGANIZATION.

H. ALL CIVIL ACTIONS MUST BE INITIATED WITHIN TWO YEARS AFTER THE ALLEGED VIOLATION OF THIS SECTION OCCURRED. A PERSON OR ORGANIZATION THAT

PREVAILS ON A CLAIM BROUGHT PURSUANT TO THIS SECTION IS ENTITLED TO MONETARY DAMAGES, INCLUDING DAMAGES FOR ANY PSYCHOLOGICAL, EMOTIONAL OR PHYSICAL HARM SUFFERED, REASONABLE ATTORNEY FEES AND COSTS AND ANY OTHER APPROPRIATE RELIEF.

I. FOR THE PURPOSES OF THIS SECTION, "SCHOOL" MEANS EITHER:

1. A SCHOOL THAT PROVIDES INSTRUCTION IN ANY COMBINATION OF KINDERGARTEN PROGRAMS OR GRADES ONE THROUGH TWELVE.

2. AN INSTITUTION OF HIGHER EDUCATION.

Sec. 2. Legislative findings and purpose

The legislature finds that:

1. "With respect to biological sex, one is either male or female." Arnold De Loof, Only Two Sex Forms but Multiple Gender Variants: How to Explain?, 11(1) COMMUNICATIVE & INTEGRATIVE BIOLOGY (2018), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5824932.

2. A person's "sex is determined at [fertilization] and revealed at birth or, increasingly, *in utero*." Lucy Griffin et al., Sex, gender and gender identity: a re-evaluation of the evidence, 45(5) BJPSYCH BULLETIN 291 (2021), https://www.cambridge.org/core/journals/bjpsych-bulletin/article/sex-gender-and-gender-identity-a-reevaluation-of-the-evidence/76A3DC54F3BD91E8D631B93397698B1A.

3. "[B]iological differences between males and females are determined genetically during embryonic development." Stefanie Eggers & Andrew Sinclair, Mammalian sex determination—insights from humans and mice, 20(1) CHROMOSOME RES. 215 (2012), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3279640.

4. "Secondary sex characteristics that develop during puberty . . . generate anatomical divergence beyond the reproductive system, leading to adult body types that are measurably different between sexes." Emma N. Hilton & Tommy R. Lundberg, Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage, 51 SPORTS MED. 199 (2021), https://doi.org/10.1007/s40279-020-01389-3.

5. There are "'[i]nherent differences' between men and women," and that these differences "remain cause for celebration, but not for denigration of the members of either sex or for artificial constraints on an individual's opportunity." United States v. Virginia, 518 U.S. 515, 533 (1996).

6. In studies of large cohorts of children from six years old, "[b]oys typically scored higher than girls on cardiovascular endurance, muscular strength, muscular endurance, and speed/agility, but lower on flexibility." Konstantinos Tambalis et al., Physical fitness normative values for 6-18-year-old Greek boys and girls, using the empirical distribution and the lambda, mu, and sigma statistical method, 16(6) EUR J. SPORT SCI. 736 (2016), https://pubmed.ncbi.nlm.nih.gov/26402318. See also, Mark J Catley & Grant R Tomkinson, Normative Health-related fitness values for children: analysis of 85347 test results on 9-17 year

old Australians since 1985, 47(2) BRIT. J. SPORTS MED. 98 (2013), https://pubmed.ncbi.nlm.nih.gov/22021354.

7. Physiological differences between males and females relevant to sports performance "include a larger body size with more skeletal-muscle mass, a lower percentage of body fat, and greater maximal delivery of anaerobic and aerobic energy." Øyvind Sandbakk et al., Sex Differences in World-Record Performance: The Influence of Sport Discipline and Competition Duration, 13(1) INT'L J. SPORTS PHYSIOLOGY & PERFORMANCE 2 (2018), https://pubmed.ncbi.nlm.nih.gov/28488921.

8. Men also have higher natural levels of testosterone, which affects traits such as hemoglobin levels, body fat content, the storage and use of carbohydrates, and the development of Type 2 muscle fibers, all of which result in men being able to generate higher speed and power during physical activity. Doriane Lambelet Coleman, Sex in Sport, 80 LAW & CONTEMP. PROBS. 63, 74 (2017) (quoting Gina Kolata, Men, Women and Speed. 2 Words: Got Testosterone?, N.Y. TIMES (Aug. 21, 2008).

9. There is a sports performance gap between males and females, such that "the physiological advantages conferred by biological sex appear, on assessment of performance data, insurmountable." Hilton, *supra* at 200.

10. While classifications based on sex are generally disfavored, the Supreme Court has recognized that "sex classifications may be used to compensate women for particular economic disabilities [they have] suffered, . . . to promote equal employment opportunity, . . . [and] to advance full development of the talent and capacities of our Nation's people." United States v. Virginia, 518 U.S. 515, 533 (1996) (internal citations and quotation marks omitted).

11. One place where sex classifications allow for the "full development of the talent and capacities of our Nation's people" is in the context of sports and athletics.

12. Courts have recognized that the inherent, physiological differences between males and females result in different athletic capabilities. See, e.g., Kleczek v. Rhode Island Interscholastic League, Inc., 612 A.2d 734, 738 (R.I. 1992) ("Because of innate physiological differences, boys and girls are not similarly situated as they enter athletic competition."); Petrie v. Ill. High Sch. Ass'n, 394 N.E.2d 855, 861 (Ill. App. Ct. 1979) (noting that "high school boys [generally possess physiological advantages over] their girl counterparts" and that those advantages give them an unfair lead over girls in some sports like "high school track").

13. The benefits that natural testosterone provides to male athletes is not diminished through the use of testosterone suppression. A recent study on the impact of such treatments found that policies like those of the International Olympic Committee requiring biological males to undergo at least one year of testosterone suppression before competing in

women's sports do not create a level playing field. "[T]he reduction in testosterone levels required by [policies like those of the International Olympic Committee] is insufficient to remove or reduce the male advantage, in terms of muscle mass and strength, by any meaningful degree." The study concluded that "[t]he data presented here demonstrate that superior anthropometric, muscle mass and strength parameters achieved by males at puberty, and underpinning a considerable portion of the male performance advantage over females, are not removed by the current regimen of testosterone suppression" permitted by the International Olympic Committee and other sports organizations. Rather, the study found that male performance advantage over females "remains substantial" and "raises obvious concerns about fair and safe competition." Hilton, *supra* at 207, 209.

14. 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.

Sec. 3. Severability

If a provision of this act or its application to any person or circumstance is held invalid, the invalidity does not affect other provisions or applications of the act that can be given effect without the invalid provision or application, and to this end the provisions of this act are severable.

Sec. 4. Short title

This act may be cited as the "Save Women's Sports Act".

EXHIBIT 5

WILENCHIK & BARTNESS

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Attorneys for Defendant Thomas C. Horne

UNITED STATES DISTRICT COURT

DISTRICT OF ARIZONA

Jane Doe, by her next friends and parents Helen Doe and James Doe; and Megan Roe, by her next friends and parents, Kate Roe and Robert Roe, **Plaintiffs,** **v.** **Thomas C. Horne, in his official capacity as State Superintendent of Public Instruction,** **Defendants.**	**Case No. 4:23-cv-00185-JGZ** **DECLARATION OF DR. LINDA BLADE, Ph.D, IN SUPPORT OF DEFENDANT HORNE'S RESPONSE TO PLAINTIFFS' MOTION FOR PRELIMINARY INJUNCTION**

I, Linda Blade, declare as follows:

I submit this expert declaration based upon my personal knowledge.

If called to testify in this matter, I would testify truthfully based on my expert opinion.

QUALIFICATIONS

As a former Canadian Champion (1986) and a full-scholarship NCAA All American (1984) in Track & Field (heptathlon) out of the University of Maryland (1982-1985), I worked hard to be a top student. Academic honors included being named Provost Scholar and member of Phi Beta Kappa.

Now licensed as a Chartered Professional Coach by the Coaches of Canada Association with a PhD in Kinesiology (earned in 1994), I have worked for over 30 years as a "Sport Performance Professional" coaching hundreds of athletes from 5 to 70 years of age, beginner to elite, from many different sports: track & field, hockey, soccer, volleyball, basketball, rugby, triathlon, sailboat racing, football, tennis, squash, swimming, diving, gymnastics, figure skating, skiing and bobsledding.

In my profession as a coach, I blend concepts in human biology with practical coaching methods acquired through many years of personal learning and mentorship opportunities as both athlete and coach. The unique way that I integrate theory and practice has proven to be highly effective. Many top athletes have sought my assistance at various times along their pathway to excellence. At the elite level, I have worked with National Hockey League (NHL) professional players (Edmonton Oilers dryland training, 2016-2018), mentored a world-leading female triathlete (Paula Findlay, 2009-2010) and helped train Pairs Figure Skaters, Jamie Salé and David Pelletier, to an Olympic Gold Medal (2002, Salt Lake City).

Truthfully, though, my greatest accomplishment as a coach has been working with beginners; young athletes ages 6 to 12 years.

It started during my first summer vacation after my freshman year in university. Needing a summer job that would be near the track where I had to continue training, I decided to offer a community "Run, Jump, Throw" camp for kids. Over 200 showed up and seemed to enjoy my coaching. Hosting that camp as a private enterprise became my summer job for consecutive years of college. I learned how to train children and how to help them improve movement skills that would lay a strong athletic foundation for future success in sports.

Almost a decade after those early years of coaching, my life took an interesting turn. I had finished my PhD in Kinesiology with a subspecialty that focused on measurement of physical growth and development of children (anthropometry), and I was stationed in northern Nigeria (West Africa) at the location that is predominantly Islamic. (This is the same region where the Islamic militant group Boco Haram operates.)

The main university in that region is Bayero University, Kano (BUK). I got my first faculty position there in the Department of Physical Education. Admittedly, it was a bit strange to have a Canadian woman (me) teaching courses, including track and field activity courses, to prospective teachers at one of the top centers of Islamic Studies in Africa.

World Athletics got wind of this situation all the way over in Monaco and suddenly I was recruited (1993) by the CEO of World Athletics' global coaching development, Bjorn Wangemann. His plan was to train and send a world-leading female instructor (me) into Islamic countries to teach women how to coach young girls. There was, of course, a need in religiously segregated places to have female instructors deliver the global coaching certification programs.

This is how I came to be teaching the World Athletics Level 1 (for beginners) coaching curriculum in various countries during the 1990s: in Bahrain, Puerto Rico, Guyana, Kenya, and Sri Lanka.

The highlight of that experience was the course I taught in Iran in July of 1995. I was sent into Tehran to deliver the World Athletics certification course to 30 of the top female coaches selected from across that country. I was the first Western woman since Ayatollah Khomeini's 1979 revolution to travel to Iran for the purpose of engaging women and girls in sport.

For me, personally, that trip to Iran was a wakeup call. I witnessed firsthand what life is like when women & girls are not respected nor given the same rights as men and boys in society. Navigating the "opportunity gaps" in search of training spaces where I could teach the women without male interference was unbelievably challenging. It showed me how vulnerable women's rights can be, including the severely limited access that women can have to their own sporting experiences. I vowed to never again take such things as Title IX and open access to women's opportunities for granted. I could see that what women in the West have achieve in sports is historically unique and politically fragile.

In 1997 a story about my travels as a global coaching instructor appeared in Sports Illustrated.[i]

Once becoming a mother (1998) and I settled down to a life of coaching in Edmonton, Alberta. Almost immediately, I was approached (1999) by a leading authority in Canadian Track & Field with a special request to author a curriculum piece for basic athletics instruction of children ages 5-11. The timing was perfect. I poured every bit of knowledge I had acquired as top athlete, scholar of child growth, academic instructor, and global coaching lecturer into the Athletics Canada "Run, Jump, Throw" (RJT) program (2001).[ii] Eventually, the rights to that RJT program were purchased by the Hershey's Track and Field Youth Program (2007). A video describing the RJT program can be found here: https://www.youtube.com/watch?v=TQMEg2D0TTw.

More recently, I have authored an update to the RJT program for children called the "Mini Legends Program." [iii]

In 2014, after years of developing children's sports programs and coaching hundreds of athletes at all levels of expertise, I became nominated and voted into office as President of the Board at Athletics Alberta - the track and field association for the province of Alberta. It was while attending national meetings as president in 2018 that I became aware of a philosophy that seeks to allow male athletes to self-identify into female competitions. I could see in an instant that this would be a catastrophe for female athletes.

Throughout my professional career, I have always maintained that it is unfair for males to compete with females at any age. I believe it is a clear example of discrimination on the basis of sex.

My argument as to why female children should have their own category will now be explained.

REASONS WHY PRE-PUBESCENT GIRLS DESERVE FEMALE-ONLY SPORTS

A few items require clarification before I delve into my rationale.

A. Terminology - For the sake of clarity in my usage of language I will use biological terminology to reflect sex, which is the key determinant of physical reality and performance. For a male-born child I use the word "boy" and pronouns "he/him" (irrespective of social identity). Likewise, for the female-born child I must use the word "girl" and pronouns "she/her."

B. Age delimitation - Since puberty onset can happen as early as nine years of age in some children (especially in girls, who mature on average two years earlier than boys) any comparison of boys and girls deemed to be strictly "pre-pubertal" must be delimited to data obtained at eight years of age and earlier. Therefore, any references I make to data collection and results for prepubertal school children will focus on the 6- to 8-year-old range.

C. Data artifact – In the age range of 9-11 years, due to the phenomenon I mention above, some of the top girls can appear to be "catching up" to the boys in measures of fitness and sport performance. Charts often show a narrowing of the sex differences during this age range. This narrowing of differences between boys and girls is a temporary outlier that arises from the early maturation of a few girls. It is important to note that this phenomenon does not happen for *all* girls at this age range. Therefore, as a coach I will never assume that just because one of the girls (ages 9-11) outperforms her entire class during a drill that it means I should expect the rest of the girls to be able to perform at the same level.

REASON 1 – Physical

The effect of testosterone on human sexual differentiation is an important factor, albeit not the *only* factor in causing boys to have an advantage over girls in sports. "Sexual dimorphism" (male versus female body design differences) arises from the interaction of testosterone and male genetics encoded by the SRY gene (usually found on the "Y" chromosome). The presence of testosterone in the womb triggers a male baby to begin its journey down the pathway to male morphology. There will be thousands of ways (from the cellular level to the overall anatomy level) in which a male baby diverges in form and physiology from a female baby. Height and weight charts at birth are sex specific, of course.[iv] Key differences in brain circuitry and musculoskeletal features develop before birth and will play a role in providing the male child with advantages related to sport performance. These involve the stitching together of subnetworks in the brain that provide a male child with better movement control, coordination, visual and special awareness, and internal proprioception.[v]

The article cited here mentions that there are differences even in the relative bone lengths of the fingers at birth, with boys having a longer 4th digit (ring finger) relative to the 2nd digit (index finger) and girls having a longer index finger (a larger "D2:D4 ratio"). This seemingly insignificant observation hints at sex-based differentiation in skeleton and joints. As a coach I witness with regularity how little boys have so much more strength in their upper body (upper torso, arms, and shoulders) compared to little girls. This manifests most noticeably when children try to climb or do pull-ups. Indeed, when I look at the data charts included in the *President's Council on Physical Fitness and Sports* (1985)[vi], I see that the sex difference is stark when it comes to such upper-body performance measures as pull-ups and flexed arm hang. Here is a summary of those data:

<u>Average number of pull-ups at ages 6, 7 and 8</u>:

Boys = 1.3, 1.8, 2.3

Girls = 0.7, 0.8, 1.0

<u>Average time (seconds) a child can maintain the flexed arm hang at ages 6, 7 and 8</u>:

Boys = 7.9, 10.6, 12.3

Girls = 7.1, 9.3, 9.7

The task of gripping a bar and pulling up one's own body weight involves a kind of "leveraging" of forces at the shoulder, upper torso, arms, and hands. In my educated opinion, the sex-based differences in this physical test strongly suggest that the bones and muscles of boys develop differently in structure. The shape of the shoulder joint, the angles of pull, the muscular strength, and durability of that entire set of bony and muscular levers, enables the boys to do so much more.

But, of course, there are differences in other measures, too. Data from the same *President's Council* tests include the following items:

- Mile Run (seconds)
- Long Jump (inches)
- 50 Yard Dash (seconds)
- Shuttle Run (seconds)
- 2 Mile Walk (seconds)
- Sit & Reach (inches)
- Sit-ups (number)

Here are the comparisons by age (highlighted scores are the ones where girls are equal or better):

At AGE 6

	BOYS	**GIRLS**
Mile Run	788.57	829.21
Long Jump	44.59	40.60
50 Yard Dash	10.22	10.68
Shuttle Run	13.47	13.88
2 Mile Walk	2038.02	2114.23
Sit & Reach	.64	2.43
Sit-ups	22.56	22.90

At AGE 7

	BOYS	**GIRLS**
Mile Run	726.96	789.73
Long Jump	47.36	43.30
50 Yard Dash	9.82	10.19
Shuttle Run	12.96	13.52
2 Mile Walk	2031.31	2146.35
Sit & Reach	.69	2.23
Sit-ups	27.16	25.37

At AGE 8

	BOYS	**GIRLS**
Mile Run	684.77	763.25
Long Jump	51.83	47.42
50 Yard Dash	9.27	9.71
Shuttle Run	12.39	13.15
2 Mile Walk	1969.93	2078.52
Sit & Reach	.18	2.06
Sit-ups	30.48	28.66

In summary, this testing protocol indicates that boys run faster, have greater endurance, are more agile, jump farther and have greater upper body strength than girls, whereas girls are more flexible (indicated here in the sit and reach test).

This sub-set of results from top finishers at the 2022 AAU National Championship Jr Olympics shows a similar outcome for 8-year-olds[vii]:

	BOYS	**GIRLS**
100m Dash (sec)	13.87	14.41
200m Dash (sec)	28.56	29.64
1500m Run	5:07.14	5:18.44
Long Jump (m)	4.09	3.86
Shot Put	31 ft 1.00 in	23 ft 4.75 in

This chart (above) provides additional evidence that is prototypical. Once again, boys are faster and throw and jump farther than girls. Measurements of lung function in small children - with boys having a higher lung volume[viii], more air passages and other enhanced capacities throughout the oxygen transport system[ix] - explains why they also do better in endurance tests and the 1500m run as reflected in the charts.

I leave it up to other experts like Dr. Gregory Brown and Dr. Emma Hilton, whose reports I have reviewed in preparing my opinion, to provide more such data. The point I wish to make here is that consistently across all data bases and amongst the the hundreds of children I have worked with as a coach, boys are better than girls in all fitness parameters except in flexibility and, possibly, balance.

In the realm of physical education and sports we refer to human movement capacities as "biomotor abilities." Some coaches say there are only five, but I recognize ten biomotor abilities (with the main physical factors that influence them in brackets):

- Strength (nervous system, muscles, bone structure & joints)
- Speed (nervous system, muscles, bone structure & joints)
- Stamina (cardiovascular system – heart, lungs, blood & cellular substructures)
- Power (nervous system, bone structure, muscles & joint durability)
- Speed-Endurance (cardiovascular system, bone structure, muscles, nervous system & cellular substructures)
- Muscular-Endurance (cardiovascular system, bone structure, muscles, nervous system & cellular substructures)
- Coordination (proprioception, nervous system, muscles & joints)
- Agility (proprioception, nervous system, muscles & joints)
- Balance (proprioception, location of center of gravity, nervous system & muscles)
- Flexibility (softness of joints; extensibility of muscles and ligaments)

And possibly an 11th one that only top coaches talk about (& professionals like NFL quarterback Tom Brady)[x]:

- Elasticity or Pliability (the ability of the entire body or parts of the body to "whip" – to bend and snap like an elastic band)

Due to the underlying structural differences in the nervous system, musculo-skeletal system, and cardio-vascular system, boys have the advantage in nine out of the eleven biomotor abilities.

Girls do excel in sports where flexibility is a dominant feature. For example, boys typically don't compete in rhythmic gymnastics. It requires body contortions that most males are simply unable to achieve. On the other hand, having hyper-flexible bodies accompanied by lower muscular strength renders girls are highly prone to impact injury in contact sports.

Since most sports involve a combination of biomotor abilities, the male performance advantage will be amplified. In a sport like volleyball, soccer, and basketball where strength, speed, power, endurance, agility, and coordination all come into play, the performance difference compared to the girls will be more obvious than what might be observed in a singular biomotor skill test.

This concept of "additive advantage" is the reason why changing one variable in a boy (say, testosterone level) will not work to fully diminish his performance advantage over his female counterparts. While hormone therapy might diminish a percentage of his original strength and, possibly, endurance, it will not adequately diminish other factors that add up to giving him an overwhelming advantage. For the sake of argument, if boys are better than girls because they are adding up a set of advantages "A + B + C + D + E + F," they will continue to have an advantage even if factor "D" is removed. The male advantage will then be of the set "A + B + C + E + F." It will *still be* insurmountable for the girls.

In summary, as a coach with extensive education in kinesiology – looking at human form and function - I can confirm without hesitation that prepubescent girls as a class will never be able to overcome the performance edge enjoyed by their male cohorts. While not as overwhelming as the differences encountered post-puberty, the sport performance differences enjoyed by pre-pubescent male children are significant and easily recognized by those of us involved: teachers, coaches, parents, and the children. The important point to be made here is that boys will dominate girls in competition because of prepubescent physical differences.

REASON 2 - Psychosocial

As a coach for almost 30 years observing boys and girls in sports competition, I have regularly observed the psychosocial risks of forcing girls to compete against boys. Most little girls simply do not wish to compete against the boys. Girls recognize the categorical difference in biological sex and, as a coach, I have seen quite often that little girls become intimidated when they are compelled to test themselves relative to boys. On a soccer field, a little girl will often stand back and let the boy take the ball. In games like dodgeball girls will often shy away from the aggressive play of boys. Conversely, when little girls compete with each other their confidence grows and they become far more engaged in the match.

This is the same phenomenon witnessed in girls-only schools. A disadvantage with having to compete with boys is described thus: "In coeducational classrooms, boys tend to monopolise discussion, and take more domineering roles in group work and in practical exercise.“ [xi] And: "…teachers [and coaches] tend to ignore the strong correlation between high motivation and high anxiety in many high-achieving girls. In girls-only environments, girls' needs and preferences come to the fore.“

Based on my observations and interactions with children and families over the course of my 30 years of coaching, I have repeatedly seen that the moment a boy is mixed in with the girls in a highly competitive environment, much of the focus turns to him and his needs at the expense of the girls, who tend to quietly withdraw their assertiveness. Recently, a father told me that his nine-year-old daughter's soccer team had to play against another team that had a male child who "identifies as a girl." He said that the girls on his daughter's team became less energized than usual and did not even try to take the ball away from the boy. Their team ended up losing by many points and the girls left the field asking why they should even be playing. This is the opposite of female empowerment.

Female empowerment takes another huge hit when male children are allowed to share a locker room with the girls. One needs only to hear the testimony of swimmer Riley Gaines to understand the devastation and humiliation involved in dealing with compelled sharing of an intimate space.[xii] It leads to tears and long-lasting psychological distress.

The essence of positive empowerment is what happened when female-only sports exploded in popularity after the passage of Title IX. The numbers don't lie. While there is no data for primary schools, we can see what happened with older female students, as summarized in this chart:[xiii]

TIME	**MALE** participation in high school sports (number of boys)	**FEMALE** participation in high school sports (number of girls)
Before Title IX [School year 1971-1972]	3,666,917 (93%)	294,015 (7%)
After Title IX [School year 2018-2019]	4,534,758 (57%)	3,402,733 (43%)

These data show a 1,057% increase in female participation in school sports over a 45-year period. A similar increase is reflected in the NCAA data and the point is that never in the annals of world history has there been such a drastic change (improvement!) in the enthusiastic engagement and physical play of female persons.

The impact upon America has been unprecedented. Twenty years after the passage of Title IX (in the 1990s) along came the phenomenon of the "soccer mom" – mothers across America who piled their kids into the minivan determined to get their children into sports. A generation of both boys and girls now owe it to those moms for engaging them in sports and other physically active past times. Based on my observations, this volunteerism has had a positive impact on many children and on the sports associations.

One significant impact of granting girls the opportunity to engage in fair competition and to experience achievement has been on the American economy and the business environment. In clear contrast to the pre-1980s, there are now thousands of women across the USA who start their own businesses and lead companies.

What does this have to do with sports? Consider these facts revealed in an article by Forbes[xiv] magazine reporting on a study of working women undertaken by Ernst & Young:

"The study found that 90% of the women surveyed had played sports either at primary and secondary school, or during university or other tertiary education, with this proportion rising to 96% among C-suite women."

Almost all top female CEOs have had a sports background.

There can be no doubt that access to sport engendered by TitleIX has promoted the kind of self-confidence in America's little girls that has inspired them to grow into adult women pursuing high achievement. The benefit to society has been priceless.

CONCLUSION:

In conclusion, I must say that I am deeply concerned about the future of sports for young girls. We often hear the phrase, "Trans rights are human rights." This is true, but by the same token, "Female rights are human rights." Everyone has rights. But for an activity to be considered a "sport," the fundamental ingredient must be "fairness."

In 2021 when the UK Sport Council's Equality Group (SCEG) released its thorough review of transgender inclusion, it arrived at the following conclusion:

"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."[xv]

According to the SCEG report, authorities in sex-affected sports must make a choice: prioritize transgender inclusion or prioritize fairness and safety for the female athlete.

I disagree in one way. I believe that we already have full inclusion in sports. Every human person has a biological sex, even if one wishes to self-identify or express as something different. Therefore, there can be a place for everyone within our sex-based eligibility systems.

Nobody benefits in the long run by mixing sports categories. It is my view that the Save Women's Sports Act preserves fairness in sports for female participants of all identities on the basis of sex, as intended by Title IX.

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

Dated: June 28, 2023 Signed: */s/ Dr. Linda Blade, Ph.D*

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[i] htt t i t 2 t h hi th r d tr i t third r d tri t tr i h i i d b d id r t r ti

[ii] hr xt i id b ib i d htt rth b r d rt i t t d 2 hr r d

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[xiv] htt rb it 2 2 r t t di th ti b t x ti d rt h d b 2

[xv] htt it i rt r d 2 id 2 r 2 r d r 2 i 2 i 2 ti 2 rt 2 2 2 d

EXHIBIT 4

WILENCHIK & BARTNESS
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Jane Doe, by her next friends and parents, Helen Doe and James Doe; and Megan Roe, by her next friends and parents, Kate Roe and Robert Roe

.v.

Thomas C. Horne, in his official capacity as State Superintendent of Public Instruction;
Laura Toenjes, in her official capacity as Superintendent of Kyrene School District;
Kyrene School District;
The Gregory School;
Arizona Interscholastic Association, Inc.

Case 4:23-cv-00185-JGZ

Expert witness statement
Emma Hilton, PhD

1. Qualifications and experience

1.1. I am Emma Hilton. I am a postdoctoral researcher in developmental biology—the study of how embryos grow and how individuals mature—at the University of Manchester, UK, a world top 50 university.[1] My short-form academic curriculum vitae is attached in **Appendix 1**.

1.2. In 1999, I received my Bachelor of Science degree from the University of Warwick, UK, where I studied Biochemistry. My final year dissertation described research to identify a genetic cause of Sotos syndrome, a genetic disorder characterised by, among other features, prenatal and childhood bone overgrowth, leading to unusually-early peak height velocity, increased stature during childhood, and concurrent advanced bone age.[2] In 2004, I received my Doctor of Philosophy degree from the University of Warwick, UK, having identified a gene regulatory mechanism that integrates molecular growth signals to specify the future tissue development of a particular region of the very early "ball-of-cells" stage vertebrate embryo.[3,4]

1.3. Since 2004, I have been employed as a developmental biologist at the University of Manchester, UK. My developmental biology career has focussed on the molecular mechanisms underpinning inherited genetic disorders in humans, including—but not limited to—those that differently affect males and females and those that affect neuromuscular development during embryo development.[5] I am currently employed in a research programme to uncover the molecular development of the skin surface in tadpoles, which is the animal model I have systematically exploited to understand human development and disease.

1.4. I have authored over 20 peer-reviewed publications in developmental biology and genetics journals, and have received over 1300 citations. My h-index is 17.[6] I have contributed a chapter entry to a key medical textbook on genetic disorders.[7] In 2007, I received the honour of being named as an Outstanding Young Investigator by the European Society of Human Genetics for my research on a sex-linked genetic disorder that causes first-trimester death in male fetuses.[8]

1.5. Although not employed in a teaching role, I deliver an annual lecture to undergraduate medical students in genetic disorders, inheritance and the ethics of medical screening. I have previously delivered teaching to ophthalmology Masters students in eye development and genetic disorders of the eye, and to undergraduate dentistry students on craniofacial disorders.

1.6. Developmental biology is not simply the study of specific processes in specific species (for example, as part of my current collaborative research, how a nerve makes a junction with a developing block of muscle to generate a functional movement unit.) The discipline of developmental biology operates on common principles: how regions are zoned; how cells "talk" to each other; how tissues and organs interact in synergistic or exclusive patterns; how such interactions proceed. These common principles apply to

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[1] https://www.manchester.ac.uk/study/experience/reputation/rankings/
[2] https://www.genomicseducation.hee.nhs.uk/genotes/knowledge-hub/sotos-syndrome/
[3] Rex et al., 2002. Multiple interactions between maternally-activated signalling pathways control Xenopus nodal-related genes. Int J Dev Biol 46: 217-226.
[4] Hilton et al., 2003. VegT activation of the early zygotic gene Xnr5 requires lifting of Tcf-mediated repression in the Xenopus blastula. Mech Dev 120(10): 1127-1138.
[5] https://www.research.manchester.ac.uk/portal/emma.hilton.html
[6] https://scholar.google.com/citations?user=A8zl2ggAAAAJ&hl=en
[7] Hilton et al., 2016. "The BCL6 corepressor (BCOR) and oculofaciocardiodental syndrome." In Epstein's Inborn Errors of Development: The Molecular Basis of Clinical Disorders of Morphogenesis. Oxford University Press, Oxford, UK.
[8] https://www.eshg.org/index.php?id=102

multiple events in the global development of all species. A solid understanding of such principles—as I have acquired over my 20-year career—permits any developmental biologist to quickly build a picture of developmental events outside of their specific research programme. The differentiation, development and patterning of the reproductive system and the physical changes induced during maturation are no exception for a trained developmental biologist.

1.7. Over the past six years, I have deepened my academic knowledge of physical sex development in many species, particularly humans. Notably, my active research has always involved extensive sexing and breeding of animals, dissecting reproductive organs like male testes (frogs) and the female uterus (mice), and understanding reproductive issues in my animal colonies (for example, the loss of male sex characteristics with aging in frogs). As part of my previous research in a sex-linked genetic disorder, I have routinely visualised and analysed sex chromosome conformation in mice and humans.[9]

1.8. My expertise in human sex development is increasingly recognised in an academic context. In 2021, I was invited by the editor to publish a letter in the official organ of the Royal Academy of Medicine in Ireland, where I argued that, "*Human sex is an observable, immutable, and important biological classification; it is a fundamental characteristic of our species, foundational to many biology disciplines, and a major differentiator in medical/health outcomes.*"[10] I am the invited lead author of a chapter on human sex development in an academic "primer" textbook to be published in August 2023.[11] Titled "Two sexes", this peer-reviewed chapter describes the evolution trajectory of the two sexes in almost all complex species, the development of sexed anatomy in humans, and common myths regarding the phenomenon of sex. Although not yet published, the chapter text is attached in **Appendix 2**. Since 2022, I have delivered a seminar to undergraduate life sciences students in sex development and the long-term effects of sex hormones on the development of the human body.

1.9. During my school years, I competed in interscholastic and regional competitions in judo, track running, netball, field hockey, cross-country and tennis. As an adult, I have completed two marathons. I currently participate in recreational sports, playing netball in single-sex and mixed-sex leagues, and weightlifting with a personal trainer. I am a sports fan.

1.10. The relevance of developmental biology in sports performance has been typically underestimated, particularly in the context of transgender athletes. A long-standing assumption has been that hormonal intervention is sufficient to secure fairness when transgender women were included in female sports. I and Doctor Tommy Lundberg (Karolinska Institutet, SWE) challenged, for the first time in the academic literature, that assumption. In Hilton and Lundberg (2021),[12] the peer-reviewed academic publication most relevant to this expert statement, we, "*review[ed] how differences in biological characteristics between biological males and females affect sporting performance and assess[ed] whether evidence exists to support the assumption that testosterone suppression in transgender women removes the male performance advantage and thus delivers fair and safe competition.*" We concluded that, *"[T]he muscular advantage*

[9] For example, Hilton et al. 2009. BCOR analysis in patients with OFCD and Lenz microphthalmia syndromes, mental retardation with ocular anomalies, and cardiac laterality defects. Eur J Hum Genet 17: 1325–1335.
[10] Hilton et al., 2021. The reality of sex. Ir J Med Sci 190: 1647.
[11] Hilton and Wright, 2023. "Two sexes." In Sex and Gender: A Contemporary Reader. Routledge, Oxford, UK.
[12] Hilton and Lundberg, 2021. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Medicine 51: 199–214.

enjoyed by transgender women is only minimally reduced when testosterone is suppressed."

1.11. In terms of impact (26th June 2023), we published our review in Sports Medicine, an international leader in sports and exercise medicine research, with a five-year impact factor of 13.671.[13] Our Altmetric score is 5471, and our review is ranked 662 out of 23.9 million academic articles published across all fields.[14] It has already been cited 65 times in the academic literature,[14] and also in scientific media including Nature.[15] Hilton and Lundberg (2021) has been cited in the transgender athlete policies of British Triathlon,[16] British Cycling[17] and World Rugby[18] (which was used to formulate the transgender policies of England Rugby, Scottish Rugby and Welsh Rugby), and cited in the scientific reviews underpinning the policies of Union Cycliste Internationale[19] and World Athletics.[20] It was also cited by the UK Sports Council Equality Group in their influential policy document that highlighted the clash between fairness for female athletes and inclusion of transgender women athletes.[21] In 2022, Hilton and Lundberg (2021) was cited in the US Court of Appeals for the 11th Circuit, by Justice Lagoa in her specially concurring opinion in Adams .v. School Board of St. Johns County, Florida.[22] Also in 2022, we were cited in a literature review on transgender athletes, published by the UK Parliamentary Office of Science and Technology, intended to brief UK Members of Parliament on topical issues.[23] Finally, Hilton and Lundberg (2021) is cited in the findings of the Fifty-fifth Legislature of the State of Arizona in Senate Bill 1165 (SB1165; the legislation relevant to this case).

1.12. In 2021, I was invited to author a policy review by the Canadian Macdonald-Laurier Institute.[24] This policy document is a review of the individual authors' peer-reviewed publications and expert knowledge; it was not itself peer-reviewed by the academic community. In this policy document, we review the importance of sex categories in sport, synthesising knowledge across developmental biology, the physiology of transgender women, and sports philosophy. We conclude that a female category that excludes all males, regardless of gender identity, is philosophically coherent in terms of category definition and necessary to ensure everyone can compete fairly and fully. We argue it is reasonable for female athletes to expect that their rights will be upheld by the institutions and procedures of their sports.

1.13. I have been asked to consult with various UK and international sporting bodies seeking advice on policy formation. Many such meetings have been held under conditions of anonymity. In February 2020, I was invited, alongside world experts in transgender endocrinology, sports science and ethics, by World Rugby to give evidence to the

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[13] https://www.springer.com/journal/40279
[14] https://link.altmetric.com/details/95647691
[15] Photopoulos, 2021. The future of sex in elite sport. Nature 592: S12-15.
[16] https://www.britishtriathlon.org/britain/documents/about/edi/transgender-policy-effective-from-01-jan-2023.pdf
[17] https://www.britishcycling.org.uk/zuvvi/media/Transgender_and_Non-Binary_Policy_-_FAQs.pdf
[18] https://www.world.rugby/the-game/player-welfare/guidelines/transgender/faqs
[19] https://assets.ctfassets.net/761l7gh5x5an/4gHOE5EpVItQux9kf39XYC/5c52616af086bdf2c9731679f213c1cd/The_current_knowledge_on_the_effects_of_gender-affirming_treatment_on_the_markers_of_performance_in_transgender_female_cycli.pdf
[20] Not publicly available.
[21] https://www.uksport.gov.uk/news/2021/09/30/transgender-inclusion-in-domestic-sport; Sports Council Equality Group Guidance for Transgender Inclusion in Domestic Sport, 2021.
[22] https://aboutblaw.com/6fe
[23] https://researchbriefings.files.parliament.uk/documents/POST-PN-0683/POST-PN-0683.pdf
[24] Pike, Hilton and Howe, 2021. Fair Game: Biology, Fairness and Transgender Athletes in Women's Sport. Macdonald-Laurier Institute, Canada.

Transgender Working Group, which was tasked with reviewing their regulations for inclusion of transgender women in female categories in elite international competition.[25] After an extensive, 'mock courtroom/adversarial' consultation process, World Rugby determined that female categories can only be safe and fair if males, regardless of gender identity, are excluded from female categories. During 2021, I was consulted as part of a policy project by the UK Sports Council Equality Group.[26] In July 2022, I was invited to present to the Equality, Diversity and Inclusion Commission of World Triathlon, who subsequently tightened restrictions on transgender women athletes in the female category.[27]

1.14. In December 2021, I participated in an online academic seminar hosted by Sports Resolutions, alongside David Grevemberg, the managing director of the Commonwealth Games Federation.[28] In April 2022, I was invited to speak at the Canadian Academy of Sport and Exercise Medicine 2022 Annual Conference, on the topic of transgender athletes, fairness and eligibility.[29] In November 2022, I was invited to speak at the Royal Academy of Medicine (UK), alongside Richard Budgett, the medical director of the International Olympic Committee.[30] In March 2023, I was invited to speak at the 19th World Congress of the International Academy of Human Reproduction, on the topic of transgender athletes in sports.[31]

1.15. Beyond academic activities, I am a vocal advocate for fairness in female sport, and have presented my research findings and arguments in various formats. In January 2021, I was appointed as a board member of Sex Matters, a UK-based human rights group who lobby for clarity on the protected characteristic of sex in law and in institutions.[32] Examples of my outputs for Sex Matters include formal responses to sports policy consultations.[33] I offer advice and input to other resources produced by employees. I vote on board-level decisions regarding strategy, expenditure, employment decisions and other typical administrative duties. My position with Sex Matters is unpaid and my work is voluntary. I receive compensation for travel, food and accommodation at meetings and events.

1.16. Other examples of advocacy include the first presentation of my research findings and arguments in July 2019 at an event organised by two feminist groups, A Woman's Place UK and FairPlay For Women.[34] In this presentation, I mapped the timeline of policy development by the International Olympic Committee (IOC) with the concurrent scientific data. I was—and remain—strongly critical of the IOC policy development trajectory. In April 2022, I was invited to speak at a private meeting at the UK House of Lords (for which I was compensated for travel costs), and wrote a house-wide briefing pack. I have been invited to consult with athlete groups like the US-based Women's Sports Policy

[25] https://www.world.rugby/news/563437/landmark-world-rugby-transgender-workshop-important-step-towards-appropriate-rugby-specific-policy; World Rugby Transgender Guidelines, 2020.
[26] https://www.uksport.gov.uk/news/2021/09/30/transgender-inclusion-in-domestic-sport; Sports Council Equality Group Guidance for Transgender Inclusion in Domestic Sport, 2021.
[27] https://www.triathlon.org/news/article/transgender_policy_process
[28] https://www.youtube.com/watch?v=TbE9aEo8ypA
[29] https://casem-acmse.org/wp-content/uploads/2020/02/ENG_CASEM-AQMSE-Quebec-2022-CASEM-AQMSE-1.pdf
[30] https://www.mededucare.com/_files/ugd/70d91e_b49fb63fc9574bac9ce9c34bfac298a9.pdf
[31] https://hr2023.humanrepacademy.org/scientific-program/
[32] https://sex-matters.org/about/emma-hilton-phd/
[33] For example: https://sex-matters.org/wp-content/uploads/2021/05/Sex-Matters-British-Cycling-policy-response.pdf
[34] https://www.youtube.com/watch?v=pzg9QtQelR8

Working Group[35] and the Independent Council on Women's Sport (ICONS).[36] For the latter, I presented at their inaugural event in Las Vegas in June 2022, and I am due to present again in Denver in July 2023. I received compensation for travel, food and accommodation at the inaugural ICONS event.

1.17. I have been interviewed in the UK media on several occasions, including on BBC Radio 4 and BBC Radio 5 Live Sport. I have published opinion pieces in the mainstream media, including the Wall Street Journal (on the harms arising from denial of the biological reality of sex).[37] Most recently, I wrote with Professor David Handelsman, an international expert in the pharmacology of androgens and expert witness for World Athletics.[38]

1.18. I have been asked by the legal team for the Arizona Superintendent of Public Instruction to provide my expert scientific opinion on the need for a protected female sports category, and the loss of fairness for female athletes arising from the inclusion of transgender girls and transgender women in competitive school sports. In preparation for this case, I have read Senate Bill 1165 (SB1165). My understanding of SB1165 is that sports teams within public schools (or in schools engaged in competitive sports against public schools) will be designated by sex as male or female, or designated as mixed-sex. Female-designated teams will exclude male athletes. An effect of SB1165 is the exclusion of transgender girls from teams designated as female-only. I understand that transgender girls are free to participate in male-designated and mixed-sex teams.

1.19. I am currently retained to provide expert scientific opinion for the State of Indiana and the State of Utah. There is no conflict of interest to declare.

1.20. The opinions put forward in this statement are my own, grounded in my education and scientific expertise, and do not necessarily reflect those of my employer, the University of Manchester, UK. I will make no personal, social, sporting or academic gains from the opinion I present here.

1.21. I am being compensated for my time researching and preparing this report at a rate of $400 USD per hour. I will be compensated for deposition at a rate of $450 USD per hour. My compensation does not depend on the outcome of this litigation.

[35] https://womenssportspolicy.org/
[36] https://www.iconswomen.com
[37] https://www.wsj.com/articles/the-dangerous-denial-of-sex-11581638089
[38] https://amp.theaustralian.com.au/sport/what-science-tells-us-about-transgender-women-athletes/news-story/cb8b7a30f68745a3fa65442b7ff15694

2. **Summary of expert witness statement**

   2.1. Male development, driven by both genetics and hormones, delivers structural differences (compared with females) from as early as first trimester gestation. Physical differences between males and females that matter for athletic sports are detectable in utero, during childhood, and then cemented during puberty.

   2.2. Male athletic advantage over female peers in adolescence and adulthood is undisputed. In childhood, male athletic advantage over female peers is evident across track and field events from 8 years old onwards Males systematically outperform their female peers from 8 years old at a frequency that is vanishingly unlikely to result by chance.

   2.3. Protected female sports categories are justified to protect fairness (and, discipline-dependent, safety) for female athletes, who, by virtue of typical female development, do not benefit from male development and thus male athletic advantage. This includes protected categories for young female athletes.

   2.4. The suppression of testosterone post-puberty in transgender women does not appear to affect skeletal proportions and reduces acquired muscle mass by only a modest amount. The sparse evidence regarding musculoskeletal metrics in transgender girls who have blocked or partially-blocked puberty reveals metrics like height far exceeding those of typical females.

   2.5. It is my professional opinion that the State of Arizona is justified in protecting fairness for female athletes in interscholastic sports competition by restricting from those female categories transgender girls and transgender women, because those individuals will have acquired male athletic advantage by virtue of biological development, and acquisition of male athletic advantage is not entirely removed by either puberty blockers and/or testosterone suppression post-puberty.

3. Sex and gender identity

3.1. Sex is an evolved system function common to almost all complex life on earth. Across the natural world, the words "male" and "female" pertain to the two specific reproductive functions within a system of sexual reproduction that proceeds via two differently-specialised gamete types. They are words used to describe cells, tissues, organs and/or entire individuals that have a physical role in the contribution of small gametes (like sperm) or large gametes (like ova), respectively, to the next generation. "Male" and "female" describe the biology of reproduction and I use these words as neutral descriptions of reproductive biology.

3.2. In humans (and indeed, in almost all animals and many plants), the two reproductive functions are divided between two classes of individual, with each class possessing a distinct and specialised molecular and anatomical pattern corresponding to one of the two reproductive functions. In humans, there are two sexes.

3.3. During embryonic development in utero, males and females develop sex-specific primary sex characteristics that have evolved to facilitate function during future reproduction. In humans, healthy male anatomy comprises gonads in the form of external testes (also called testicles) that will make sperm, internal genital structures like the vas deferens (that carries sperm from the testicles to penis) and external genitalia in the form of a penis and scrotum. In contrast, healthy female anatomy comprises gonads in the form of internal ovaries that will make eggs, internal genital structures like a uterus and vagina, and external genitalia in the form of a vulva, incorporating the clitoris.

3.4. The various parts of the reproductive anatomy of a healthy baby (gonad type, internal genitalia, external genitalia) develop as a system in a regulated and coordinated sequence of events. The sex of a baby is routinely and reliably learned or observed—not "assigned", which implies an element of choice or arbitrariness—at birth by visual and palpable[39] assessment of external genitalia, which is a highly-sensitive marker for the whole system.

3.5. The above descriptions of primary sex are standard, appearing in dictionaries,[40] key biology textbooks,[41] academic publications[42] and medical consensus statements like that issued by the Endocrine Society in 2021.[43] By these standard descriptions of sex, transgender girls and transgender women are biologically male and not biologically female.

3.6. Transgender girls and transgender women feel deep distress and discomfort with their male sex ("gender dysphoria") and claim a sense of identification with the female sex (via "gender identity"). The assertion that "*everyone has a gender identity*" (Shumer declaration, 18) is contradicted by the personal testimonies of people, including myself, who do not experience a gender identity and the delineation of the concept of 'agender', which describes "*identifying as having no gender*" (quoted from Shumer declaration in Flack et al. .v. Wisconsin Department Of Health Services).[44] It appears incoherent to

[39] "Palpable" means, roughly, "detect by touching". This assessment is typically used to confirm the healthy descent of testes in male babies.
[40] Examples include: Oxford English Dictionary; Merriam-Webster Dictionary.
[41] Examples include: Baresi and Gilbert, 2020. Developmental Biology. Oxford University Press, UK; Wolpert, Tickle and Martinez Arias. Principles of Development. Oxford University Press, UK.
[42] Academic publications defining sex, actively researching sex or incidentally dependent on these understandings of sex are too numerous to consider. For example, a search on the scientific publication database PubMed for only "male [AND] sperm" (that is, not an exhaustive search) retrieves over 100,000 results, including multiple results from Nobel Laureates in Physiology or Medicine, and from a huge array of biology and medical disciplines.
[43] Barghava et al., 2021. Considering Sex as a Biological Variable in Basic and Clinical Studies: An Endocrine Society Scientific Statement. Endocrine Reviews, 42(3): 219-258.
[44] http://files.eqcf.org/wp-content/uploads/2019/04/170-Shumer-Expert-Witness-Report.pdf

argue that everyone has a gender identity while recognising the existence of being 'agender'.

3.7. I am scientifically-neutral to the possibility that "*gender identity has a strong biological basis*" (Shumer declaration, 19 and 22). I do not consider gender identity to be a component of sex, which denotes one's physical reproductive development and reproductive role. Even if it is true that gender identity is in some way biological in basis, gender identity is irrelevant to eligibility for sporting categories based on sex. The premise that, in transgender people, sex "*designation turns out to be inaccurate because it does not reflect the person's gender identity*" (Shumer declaration, 27) creates a contradiction where gender identity is asserted as a feature of sex (Shumer declaration, 26) yet is an identity that exists by reference to one's sex (Shumer declaration, 25, decouples gender identity from "*birth sex*").

3.8. Disorders of sex development (DSDs), where the development of reproductive anatomy is atypical or disrupted,[45] are very rare[46] but frequently used to argue that sex in humans cannot be described as simply male and female. While it is true that, rarely even within DSDs, the sex of some individuals is difficult to classify, this is irrelevant when considering the sex of transgender people, who do not typically have DSDs.

[45] For example: Arboleda et al., 2014. DSDs: genetics, underlying pathologies and psychosexual differentiation. Nature Reviews Endocrinology 10(10): 603-615.

[46] Sax, 2002. How common is Intersex? A response to Anne Fausto-Sterling. Journal of Sex Research 39 (3): 174-178.

4. Sex and somatic growth

4.1. Beyond differences in reproductive anatomy, males and females differ in somatic (non-reproductive) physical characteristics. Somatic differences first emerge in utero, are evident at birth, and are further cemented during puberty.

4.2. Small differences in average body length (measured as head-bottom length) can be detected by ultrasound from the first trimester of pregnancy, when males are already slightly longer than females.[47] Larger average skull diameter in male fetuses at twenty weeks has been reported.[48] Gestational growth charts track not just higher male values for skull diameter but also higher abdominal circumference and estimated fetal weight.[49] Analysis of growth charts[50] for male and female infants reveals that, at birth, males are, on average, slightly longer and heavier than females.

4.3. In a large study of male and female fetuses and newborns, Broer-Brown et al (2016) concluded that, "Sex affects both fetal as well as infant growth. Besides body size, also body proportions differ between males and females with different growth patterns."[51] Although the magnitude of size differences in utero and at birth are small, they are consistently-different between males and females; indeed, sex is considered necessary to clinically assess fetal growth with accuracy.[52]

4.4. Males are consistently 1-2 cm taller than females between 0-10 years old. Boys at 10 years old also have a larger vertebral cross-sectional area (larger spinal columns) than girls.[53] Girls enter puberty earlier than boys, typically around 10 years old, and the growth spurt associated with earlier pubertal onset accounts for taller female height between 10-14 years old. Boys catch up and overtake girls in height at around 14 years old.

4.5. At puberty, both sexes undergo rapid somatic changes as they mature in preparation for reproduction, leading to measurably different adult body shapes ('sexual dimorphism').[54] Many male secondary sex characteristics are rooted in our evolutionary history of male fighting ability, displays of strength and competition for mates[55] and become increasingly evident as puberty progresses.

4.6. When—briefly—considering sexually-dimorphic physical characteristics in males compared with females, adolescent and adult males are typically taller with wider shoulders, longer limbs and longer digits. They have larger and denser muscle mass, reduced fat mass, different distributions of muscle and fat, and stiffer connective tissue.

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[47] Pedersen, 1980. Ultrasound evidence of sexual difference in fetal size in first trimester. British Medical Journal 281(6250): 1253.

[48] Persson et al., 1978. Impact of fetal and maternal factors on the normal growth of the biparietal diameter. Scandinavian Association of Obstetricians and Gynaecologists 78: 21-27.

[49] Schwartzler et al., 2004. Sex-specific antenatal reference growth charts for uncomplicated singleton pregnancies at 15–40 weeks of gestation. Ultrasound in Obstetrics and Gynaecology 23(1): 23-29.

[50] For example: World Health Organisation https://www.who.int/tools/child-growth-standards/standards; Centre for Disease Control https://www.cdc.gov/growthcharts/clinical_charts.htm; Royal College of Paediatrics and Child Health https://www.rcpch.ac.uk/resources/growth-charts

[51] Broere-Brown et al, 2016. Sex-specific differences in fetal and infant growth patterns: a prospective population-based cohort study. Biology of Sex Differences 7: 65.

[52] Galjaard et al., 2019. Sex differences in fetal growth and immediate birth outcomes in a low-risk Caucasian population. Biology of Sex Differences 10: 48.

[53] Gilsanz et al., 1997. Differential Effect of Gender on the Sizes of the Bones in the Axial and Appendicular Skeletons. Journal of Clinical Endocrinology and Metabolism 82(5): 1603-1607.

[54] For example: Darwin, C. *The Descent of Man, and Selection in Relation to Sex*. London: Murray, 1871; Well, 2007. Sexual dimorphism of body composition. Best Practice and Research Clinical Endocrinology and Metabolism 21(3): 415-430.

[55] For example: Morris et al., 2020. Sexual dimorphism in human arm power and force: implications for sexual selection on fighting ability. Journal Of Experimental Biology 223(2): 212365; Puts, 2010. Beauty and the beast: mechanisms of sexual selection in humans. Evolution And Human Behaviour 31(3): 157-175.

They have higher amounts of haemoglobin (the molecule that carries oxygen in blood), and larger hearts and lungs.[56]

4.7. The above is a non-exhaustive list of sexually-dimorphic differences between males and females, which could number into the thousands, and include, for example, the fine architecture of muscle tissue like proportions of cell type (fibre type, stem cell populations), cell morphology (numbers of nuclei, amounts of myoglobin) and some 3000 muscle-specific gene expression differences,[57] to the minutiae of different visual perception, hand-eye coordination and tracking capacity.[58]

[56] Reviewed in: Hilton and Lundberg, 2021. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Medicine 51, 199–214 (and references therein).

[57] Haizlip et al., 2014. Sex-Based Differences in Skeletal Muscle Kinetics and Fiber-Type Composition. Physiology (30)1: 30-39.

[58] For example: Mathew et al., 2020. Sex differences in visuomotor tracking. Scientific Reports 10: 11863.

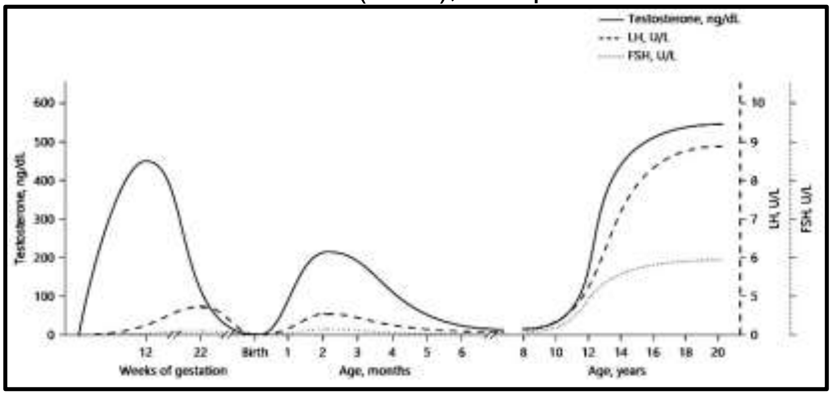
5. Genetics, hormones and development

5.1. Sex differentiation is initiated in utero by the presence or absence of a gene called SRY, typically carried on the Y chromosome, and triggering bipotential gonad development into testes or ovaries in males or females, respectively.[59] The developing gonads, in conjunction with other tissues, establish sex-specific hormonal milieu that, in concert with hormones produced elsewhere, are involved in ongoing male or female physical development.[60]

5.2. It is often assumed that hormones are the driver of all physical sex differences downstream of gonad differentiation.[61] However, analysis of sex-specific genetic architecture in adults reveals some 6500 differences in gene expression, likely to influence development and function outside of hormone effects.[62] Indeed, that "every cell has a sex" dependent on genetics and independent of hormones is recognised and increasingly of scientific interest.[63] REF IOC paper analysis

5.3. A key hormone generating physical differences between males and females is testosterone. Males are exposed to testosterone at three stages of development: 1. in utero; 2. in the post-natal 'minipuberty' period; and, 3. during classic puberty (Figure 1, solid line[64]). Thus, there is an ongoing pattern of differential exposure to testosterone during the development of males and females.

Figure 1. "The three endocrine puberties in boys."
From Becker and Hesse (2020), with permission from S. Karger AG, Basel, CHE



5.4. In utero, testosterone and derived dihydrotestosterone (DHT) are involved in the development of male reproductive anatomy. Testosterone is primarily produced by the male testes.[65] Testosterone promotes the formation of the vas deferens and other male internal genital structures, while DHT is necessary for the development of the penis and prostate gland.[66] The effect of testosterone on somatic development in utero does not appear to be meaningful, and sex differences in fetal size appear unrelated to hormones

[59] Sekido and Lovell-Badge, 2013. Genetic control of testis development. Sexual Development 7:21-32.
[60] Nussey and Whitehead, 2001. Endocrinology: An Integrated Approach. BIOS Scientific Publishers, Oxford, UK.
[61] Lovell-Badge, 1993. Sex determining gene expression during embryogenesis. Philosophical Transactions of The Royal Society (Biological Sciences) 339: 159-164.
[62] Gershoni and Pietrokovski, 2017. The landscape of sex-differential transcriptome and its consequent selection in human adults. BMC Biology 15(1): 7.
[63] For example: Shah et al., 2014. Do you know the sex of your cells? American Journal of Physiology (Cell Physiology) 306(1): C3-C18; Ainsworth, 2017. Sex and the single cell. Nature 550: S6-S8.
[64] Becker and Hesse, 2020. Minipuberty: Why Does it Happen? Hormone Research in Paediatrics 93(2): 76-84.
[65] Richmond and Rogol, 2007. Male pubertal development and the role of androgen therapy. Nature Clinical Practice Endocrinology and Metabolism 3(4): 338-344.
[66] Theakston, 2020. Development of the Reproductive System https://teachmeanatomy.info/the-basics/embryology/reproductive-system

but related rather to the sex-specific genetics of maternal-placental interactions with a male fetus, which affect, for example, nutrient exchange.[67]

5.5 In the post-natal minipuberty period between 1 week to 6 months of age, transient activation of the hypothalamic-pituitary-gonadal axis means males are exposed to a corresponding burst of testosterone.[68] This burst of testosterone supports male penis and testes growth,[69] and is associated with higher growth velocity in the first six months of life,[70] higher weight gain, lower acquisition of body fat and lower body mass index.[71] The transient exposure to testosterone in minipuberty is an excellent candidate to explain the well-established structural differences between males and females in childhood described in **Section 4**.

5.6 At puberty, males experience levels of testosterone up to 20 times greater than in females, driving development during the ensuing teenage years of male secondary sex characteristics.[72] The effects of testosterone on male somatic growth during puberty are well-characterised and hardly require repeating here.[73]

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[67] Buckberry et al., 2014. Integrative transcriptome meta-analysis reveals widespread sex-biased gene expression at the human fetal–maternal interface. Molecular Human Reproduction 20(8): 810-819.
[68] Lanciotti et al., 2018. Up-To-Date Review About Minipuberty and Overview on Hypothalamic-Pituitary-Gonadal Axis Activation in Fetal and Neonatal Life. Frontiers in Endocrinology 9: 410.
[69] Boas et al., 2006. Postnatal penile length and growth rate correlate to serum testosterone levels: a longitudinal study of 1962 normal boys. European Journal of Endocrinology 154(1): 125-129.
[70] Kiviranta et al., 2016. Transient Postnatal Gonadal Activation and Growth Velocity in Infancy. Pediatrics 138(1): e20153561.
[71] Becker et al., 2015. Hormonal 'minipuberty' influences the somatic development of boys but not of girls up to the age of 6 years. Clinical Endocrinology 83: 694-701.
[72] Handelsman et al., 2018. Circulating Testosterone as the Hormonal Basis of Sex Differences in Athletic Performance. Endocrine Reviews 39(5): 803-829.
[73] Reviewed in, for example: Hiort, 2002. Androgens and puberty. Best Practice and Research Clinical Endocrinology and Metabolism 16(1): 31-41; Richmond and Rogol, 2007. Male pubertal development and the role of androgen therapy. Nature Clinical Practice Endocrinology and Metabolism 3(4): 338-344.

6 Sex and sporting advantage in adolescence and adulthood

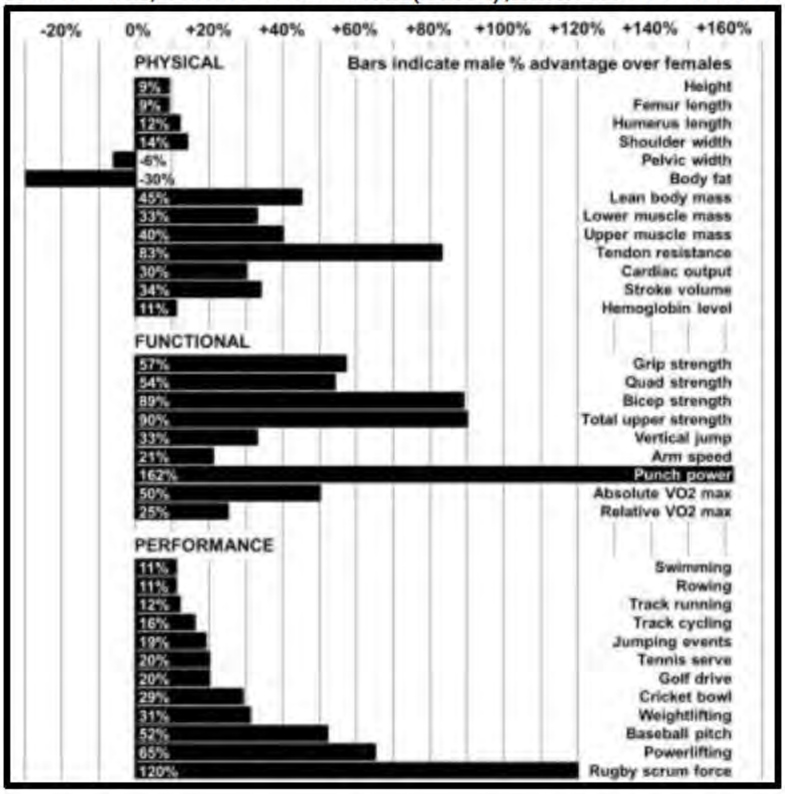
6.1 In most athletic sports—those where outcome is affected by speed, stamina, strength and physique—males have a class-level advantage over females. Male advantage is founded in the physical differences, acquired during male development, that underpin functional differences in muscular strength, skeletal levers and proportions, force application, upper to lower body strength, and cardiovascular and respiratory function. In turn, these functional differences confer superior athleticism.[74]

6.2 Examination of sporting records and performances identifies few athletic sporting disciplines where males do not possess performance advantage over females[75], and competitions are typically separated by sex. Volleyball, basketball, soccer and cross-country running are among those where male development provides competitive advantage, and where competitions are therefore separated by sex.

6.3 The physical, functional and performance advantages in adult males are summarised in Figure 2, using reported record performances across multiple sports and sporting actions. Male strength is disproportionately large in the upper body, and sports and sporting movements that require upper body input typically exhibit larger performance gaps than that where lower body strength is key. Performance differences, emerging from the physical and functional differences between adult males and females, have been described as "insurmountable".[76]

Figure 2. Physical, functional and performance differences between males and females.

From Pike, Hilton and Howe (2021); data from Hilton and Lundberg (2021)



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[74] For example: Tonnessen et al., 2015. Performance development in adolescent track and field athletes according to age, sex and sport discipline. PLOS One 10(6): e0129014.

[75] For example: Olympic performances https://olympics.com/en/olympic-games/olympic-results; track and field performances https://www.worldathletics.org/stats-zone

[76] Thibault et al., 2010. Women and Men in Sport Performance: The Gender Gap has not Evolved since 1983. Journal of Sports Science and Medicine 9(2): 214-223.

6.4 The significance of male puberty is evidenced by the fact that male performances typically exceed those of elite females in mid-puberty; a comparison of elite female records with male junior records[77] is listed in Table 1. Unsurprisingly, in events like the marathon that are associated with greater strategy and maturity, males are older when they surpass elite female records.

Table 1. Elite female records are surpassed by males in mid-puberty.
Abbreviations: m – metres, km – kilometres, s – seconds, m – minutes, h – hours, yrs – years old

Event	Elite female record	Age at which male records surpass elite female records
100 m	10.49 s	15 yrs (10.20 s)
200 m	21.34 s	14 yrs (20.89 s)
400 m	47.60 s	14 yrs (46.96 s)
800 m	1 m:53.28 s	14 yrs (1 m:51.23 s)
1500 m	3 m:50.07 s	14 yrs (3 m:48.37 s)
5km	14 m:06.62 s	15 yrs (14 m:06.51 s)
10km	29 m:01.03 s	16 yrs (28 m:39.04 s)
Marathon	2 h:17 m:01 s	19 yrs (2 h:11 m:34 s)
High jump	209 cm	14 yrs (217 cm)
Pole vault	506 cm	15 yrs (550 cm)
Long jump	752 cm	15 yrs (785 cm)
Triple jump	1574 cm	15 yrs (1663 cm)
Shot put	2263 cm (4 kg shot)	15 yrs (2386 cm; 5 kg shot)
Discus	7680 cm	15 yrs (7768 cm)
Hammer	8298 cm	14 yrs (8517 cm)
Javelin	7228 cm	14 yrs (7642 cm)

6.5 Importantly, male athletic advantage over females is not limited to those physical and functional differences conferred by male morphology, shape and size. Most obviously, female athletes must typically deal with the effects of the menstrual cycle and the cyclical effects of hormones on training capacity and performance. The menstrual cycle is known to affect cardiovascular, respiratory, brain function, response to ergogenic aids, orthopedics, and metabolic parameters,[78] and represents a barrier to athletic capacity not experienced by males. A third of females report their menstrual flow to be "above average" volume.[79] 37 % of female athletes report heavy menstrual flow, and 90 % report menstrual symptoms, affecting their ability to train and compete.[80]

6.6 Further, injury susceptibility differs between males and females, with subsequent impacts on training time. For example, emerging research shows that compared with males, female rugby players appear more susceptible to concussive injuries, with more severe outcomes. This has been attributed to lower impact resistance in their neck

[77] http://age-records.125mb.com; https://worldathletics.org/records/by-category/world-records
[78] Meignie et al., 2021. The Effects of Menstrual Cycle Phase on Elite Athlete Performance: A Critical and Systematic Review. Frontiers in Physiology 12: 654585.
[79] Bitzer et al., 2013. Women's attitudes towards heavy menstrual bleeding, and their impact on quality of life. Open Access Journal of Contraception 4: 21-8.
[80] Bruinvels et al., 2021. Prevalence and frequency of menstrual cycle symptoms are associated with availability to train and compete: a study of 6812 exercising women recruited using the Strava exercise app. British Journal of Sports Medicine 55: 438-443.

muscles and more delicate brain structures.[81] A study of sex differences in cultured nerve cells has shown that, compared with male neurons, female neurons have a smaller cross-section and contain fewer, less-dense structural “fibres”; female neurons are more easily damaged when subject to stretch trauma, and they exhibit higher injury responses post-trauma.[82] Female athletes have a higher incidence of anterior cruciate ligament injury than males and poorer response to injury-prevention programmes, well-studied in soccer and typically attributed to female lower body anatomy (hip width, muscle ratio, joint flexibility).[83]

[81] www.rugbypass.com/news/long-term-brain-damage-could-be-a-significantly-bigger-issue-in-womens-rugby-than-mens-says-lead-concussion-doctor/
[82] Dollé et al., 2018. Newfound sex differences in axonal structure underlie differential outcomes from in vitro traumatic axonal injury. Exp Neurol 300:121-134.
[83] Crossley et al., 2020. Making football safer for women: a systematic review and meta-analysis of injury prevention programmes in 11 773 female football (soccer) players. British Journal of Sports Medicine 54: 1089-1098.

7 Sex and sporting advantage in childhood

7.1 While few deny the athletic sporting differences between males and females in adolescence and adulthood, sporting performance gaps between the sexes before puberty are less well-characterised.

7.2 In **Section 4**, I outlined known physical differences between males and females in utero and during childhood. At the level of function leading to athletic performance, large cohort studies of fitness data in typical schoolchildren reveals differences evident from as young as 6 years old. In these childhood fitness programs, females consistently outperform males in the sit and reach test, a measure of flexibility. However, males can run 9.8 % faster over short sprints, jump 9.5 % further from a standing start, complete 33 % more push ups in 30 seconds, complete 16.6 % more shuttle runs in a given time and have 13. 8 % higher grip strength.[84] Young males of 6-7 years old have higher absolute (+11 %) and relative (+8 %) VO_{2max} than female peers.[85]

7.3 The Presidential Fitness Test was a US fitness testing program conducted in middle school and high schools until 2013. Awards were given to schoolchildren in the top 15th percentile in their cohort. I calculated the % difference between the top 15th percentile in male and female schoolchildren aged 6-16 years old, listed in Table 2.[86]

Table 2. Male advantage (%) at the top 15th percentile in the US Presidential Fitness Test for schoolchildren.
Abbreviations: yrs – years old, n – number, s – seconds, cm - centimetres

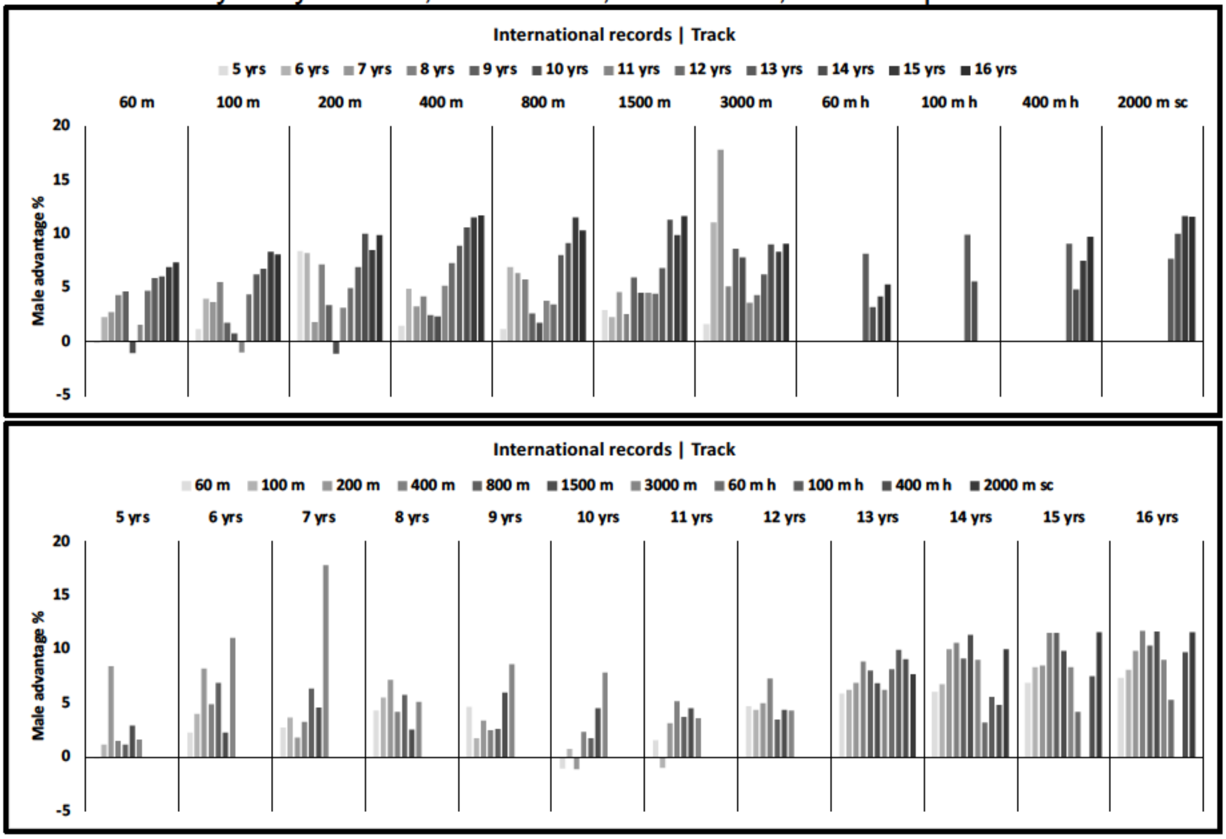
Age	Curl ups n	Shuttle run s	Sit and reach cm	1 mile s	Pull ups n
6 yrs	3.1	2.4	-36.4	9.6	0.0
7 yrs	5.9	5.0	-30.0	11.6	100.0
8 yrs	5.3	5.9	-33.3	12.3	150.0
9 yrs	5.1	1.8	-45.5	10.4	150.0
10 yrs	12.5	4.6	-33.3	14.7	100.0
11 yrs	11.9	4.8	-38.5	16.6	100.0
12 yrs	11.1	5.8	-42.9	14.3	250.0
13 yrs	15.2	6.9	-50.0	16.8	250.0
14 yrs	19.1	9.9	-43.8	19.4	400.0
15 yrs	18.8	10.0	-37.5	22.1	450.0
16 yrs	24.4	13.9	-33.3	26.8	1000.0

7.4 Thus, physical performance differences among schoolchildren are detectable and measurable in school fitness testing programmes. To begin to systematically analyse pre-puberty and early pubertal differences in sports performance between males and females, I interrogated the extensive track and field performance data available in young people. Track and field events comprise the simple "building blocks'—running, jumping and throwing—that are key to athletic performance in many individual and team sports, including volleyball, soccer and basketball. Thus, track and field event performances can be used to understand likely performance differences in more complex sports.

[84] For example: Catley and Tomkinson, 2013. Normative health-related fitness values for children: analysis of 85347 test results on 9–17-year-old Australians since 1985. British Journal of Sports Medicine 47(2): 98–108; Tambalis et al., 2016. Physical fitness normative values for 6–18-year-old Greek boys and girls, using the empirical distribution and the lambda, mu, and sigma statistical method. European Journal of Sport Science 16(6): 736-746.
[85] Eiberg et al., 2005. Maximum oxygen uptake and objectively measured physical activity in Danish children 6–7 years of age: the Copenhagen school child intervention study. British Journal of Sports Medicine 39(10): 725-730.
[86] https://gilmore.gvsd.us/documents/Info/Forms/Teacher%20Forms/Presidentialchallengetest.pdf

7.5 I collected international records in multiple track and field events from both males and females from the ages of 5-16 years old.[87] I then calculated the % difference between the male record and equivalent female record. The male advantages (%) in track, stratified by both event (upper panel) and age (lower panel), are shown in Figure 3. In track events, male advantage is clear in all age groups and for all events.

Figure 3. The male advantage over females in international schoolchildren records in track events, stratified by event (upper panel) and age group (lower panel). Abbreviations: yrs – years old, m – metres, h – hurdles, sc – steeplechase



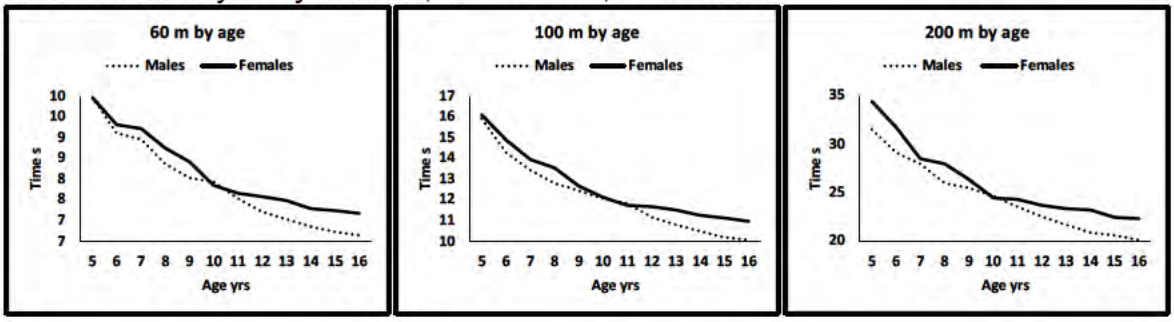
7.6 There are four track events where female schoolchildren appear to outperform their male peers, listed in Table 3. I examined the age progression of these events to seek to understand this apparent female advantage. These data are shown in Figure 4. For 60 m at 5 years old, in the absence of a preceding datapoint, it is impossible to evaluate the female advantage here. For 60 m at 10 years old, the male record appears slightly slower than predicted, with no specific explanation for this beyond typical variation. In this same event, the female record is faster than expected, possibly explained by earlier onset of puberty and associated growth spurt that provides transient ‘catch up’ with male peers. For 100 m at 11 years old and 200 m at 10 years old, again the female records appear faster than expected, again likely underpinned by pubertal growth spurt in these female athletes.

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

Table 3. Female advantage in international schoolchildren track records.
Abbreviations: yrs – years old, m – metres

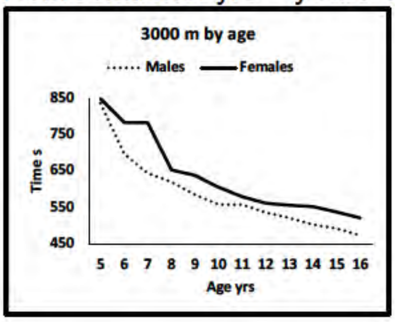
Event	Age group	Female advantage %
60 m	5 yrs	0.1%
	10 yrs	1.0 %
100 m	11 yrs	0.9 %
200 m	10 yrs	1.1 %

Figure 4. Age progression in the 60 m, 100 m and 200 m sprints in international schoolchildren records.
Abbreviations: yrs – years old, m – metres, s – seconds



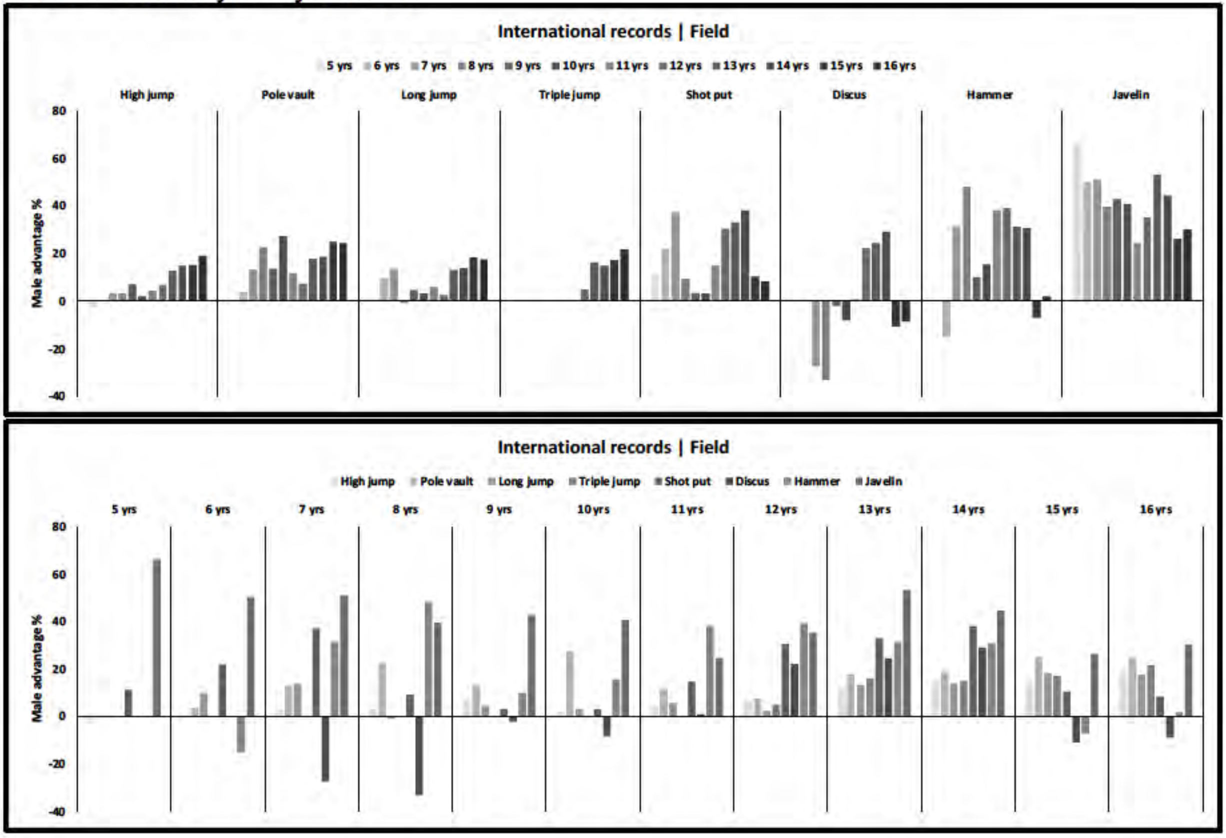
7.7 Also evident in this dataset is an unusually large male advantage for 3000 m at 7 years old. Analysis of the age progression for this event, shown in Figure 5, reveals this is underpinned by an unexpectedly poor female record for 3000 m at 7 years old. Thus, the extent of male advantage here is likely an overestimate of the true performance gap.

Figure 5. Age progression in the 3000 m in international schoolchildren records.
Abbreviations: yrs – years old, s – seconds



7.8 The male advantages (%) in field events, stratified by both event (upper panel) and age (lower panel), are shown in Figure 6. In field events, male advantage is again evident in all age groups and for all events, although this appears less systematic than in track events.

Figure 6. The male advantage over females in international schoolchildren records in field events, stratified by event (upper panel) and age group (lower panel).
Abbreviations: yrs – years old

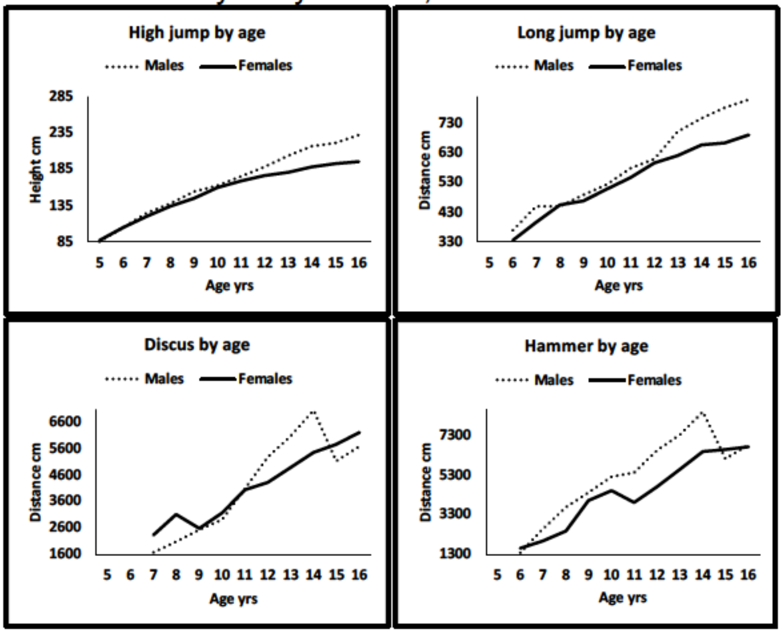


7.9 There are several field events where female schoolchildren appear to outperform their male peers, listed in Table 4. I examined the age progression of these events to seek to understand this apparent female advantage. These data are shown in Figure 7. For the high jump at 5 years old, in the absence of a preceding datapoint, it is impossible to evaluate the female advantage here. For the long jump at 8 years old, the female advantage appears to be explained by the convergence of an unusually poor male record and unusually good female record in this event.

Table 4. Female advantage in international schoolchildren field records.
Abbreviations: yrs – years old, m – metres

Event	Age group	Female advantage %
High jump	5 yrs	2.3 %
Long jump	8 yrs	0.9 %
Discus	7 yrs	27.4 %
	8 yrs	33.1 %
	9 yrs	2.1 %
	10 yrs	8.1 %
	15 yrs	10.8 %
	16 yrs	8.7 %
Hammer	6 yrs	15.1 %
	15 yrs	7.2 %

Figure 7. Age progression in the high jump, long jump discus and hammer in international schoolchildren records.
Abbreviations: yrs – years old, cm – centimetres



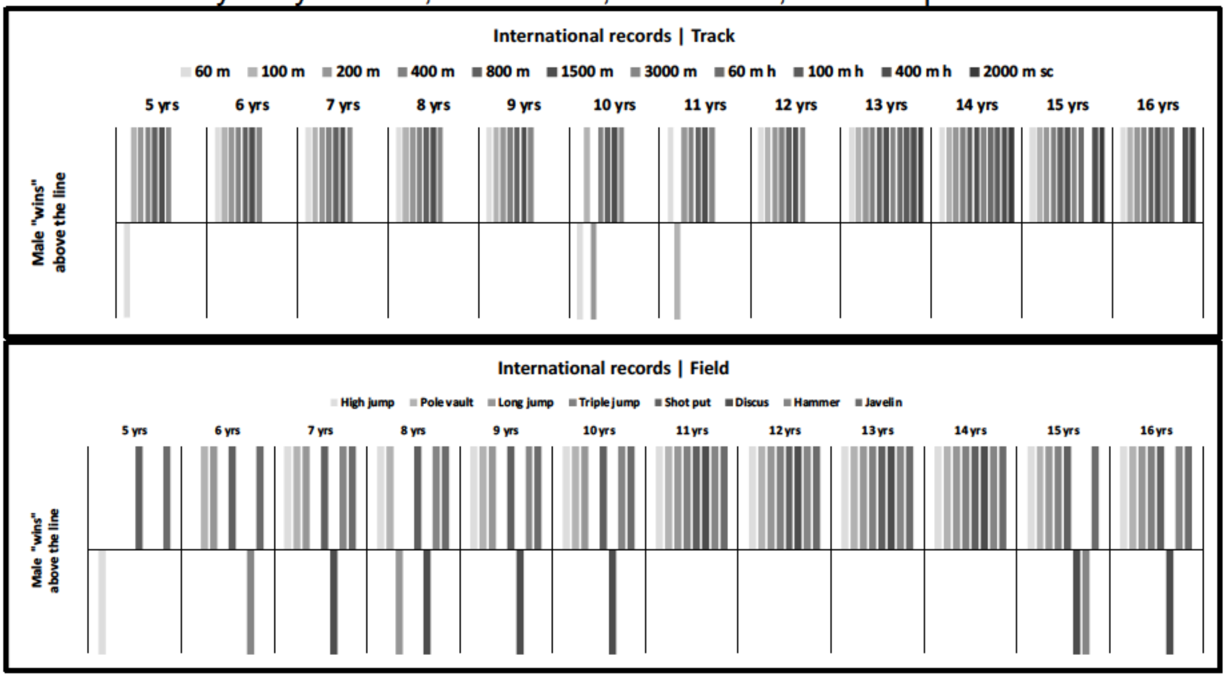
7.10 There are several throw events where female schoolchildren appear to outperform their male peers by a large distance. However, there are important confounding factors in throwing events, given that the weight of throwing implements can differ between male and female athletes at different ages. For the discus, girls at 7-8 years old throw a discus weighing 500 g, compared to boys of the same age using a 750 g discus. I hypothesise that a similar implement weight at 7-8 years old would mitigate or remove the apparent female advantage here. Between 9-14 years old, both sexes use a 1 kg discus. Performance between males and females seems broadly matched until 11 years old, which may be underpinned by earlier female puberty. Males open up the performance gap at 11 years old. At 15 years old, boys switch to a 2 kg discus. I believe it is reasonable, given the increasing male gap to 14 years old with the same implement weight of 1 kg, that a matched implement weight between males and females at 15-16 years old would reverse the apparent female advantage in favour of clear male advantage.

7.11 For the hammer, male and females use a 2 kg implement between the ages of 6-10 years old. At 6 years old, in the absence of a preceding datapoint, it is impossible to evaluate the female advantage here. Male advantage is evident from 7-10 years old; the ‘catch up’ with male peers at ages 9-10 years old may be explained by the physical changes of female puberty. Between the ages of 11-14 years old, both males and females use a 4 kg hammer, and male advantage is consistent through these ages. At 15 years old, males switch to a 7.26 kg hammer. I believe it is reasonable, given the male advantage evident throughout the time period where both sexes use a 4 kg hammer, that a matched implement weight between males and females at 15-16 years old would reverse the apparent female advantage in favour of clear male advantage.

7.12 Interestingly, male advantage is evident in all shot put and javelin events at all ages, despite increases in implement weight at 15-16 years old for males.

7.13 I formulated a null hypothesis: if there are no sex differences in athletic performances in schoolchildren, males and females are equally likely to hold the best record in any event. Therefore the frequency of males with the best record should be approximately equal to the frequency of females with the best record. To interrogate this statistically, I scored all track and field events at all ages as a binary variable of male "wins" versus female "wins" (whichever record was the fastest, longest, etc). I ignored potential confounding explanations in various events; that is, female advantage was scored as a "female win", even if the female advantage is likely an artifact of, for example, earlier puberty or lighter implement weight. Thus, this scoring is deliberately generous to ensure the strength of any findings. Scoring data are visualised in Figure 8, with track events in the upper panel and field events in the lower panel. It is already clear from this analysis that the majority of "wins" go to male schoolchildren.

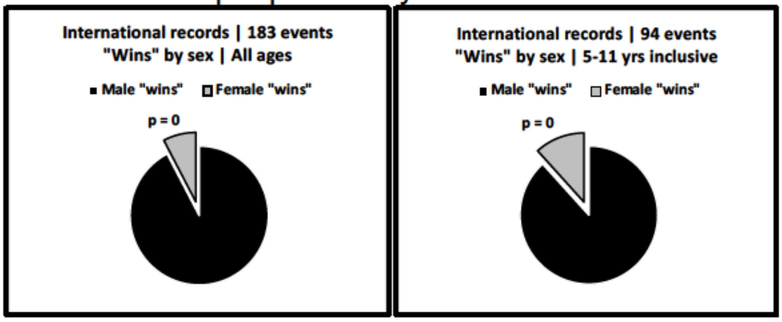
Figure 8. Male versus female "wins" in international schoolchildren records, scored in track events (upper panel) and field events (lower panel).
Abbreviations: yrs – years old, m – metres, h – hurdles, sc – steeplechase



7.14 I counted the frequency of male "wins" versus female "wins" at all ages and in a sub-analysis limited to events in pre-puberty (5-11 years old) age groups. I then calculated the probability that the frequency of male "wins" versus female "wins" would occur by chance.[88] These data are shown in Figure 9. The majority of "wins" go to male schoolchildren, whether across all age groups or limited to pre-puberty age groups. The chances of this frequency of male "wins" occurring by chance in either age grouping is calculated at a probability of effectively zero (p = 0).

[88] https://homepage.divms.uiowa.edu/~mbognar/applets/bin.html

Figure 9. The frequency of male versus female "wins" across pooled events in all age groups (left) and limited to pre-puberty age groups (right).
Abbreviations: p – probability



7.15 Following the same process for international records above, I analysed junior records from 8-16 years old from USA Track and Field (USATF)[89] and the US Amateur Athletics Union (AAU).[90] For brevity here, these datasets are compiled in **Appendix 3** (USATF) and **Appendix 4** (AAU). These national datasets confirm the results obtained from international records. **To summarise the data obtained from international and national schoolchildren records in track and field: 1. male advantage over female peers is evident across track and field events from 8 years old onwards; 2. males systematically outperform their female peers from 8 years old at a frequency that is vanishingly unlikely to result by chance.**

7.16 Again, following the same process for international records above, I analysed Arizona middle school records from 8-16 years old (available to 2014).[91] For brevity here, this dataset is compiled in **Appendix 5**. This dataset confirms that male advantage over female peers is predominant across track and field events from 8 years old. In these state level records, more female "wins" are scored in lower age groups than seen in international and national records. However, the frequency of male "wins" between 8-12 yrs old is still statistically unlikely to result from chance ($p = 0.043$, where $p = 0.05$ is the "significance" threshold).

7.17 I analysed the outcomes of two individual middle-school competitions. The first was the Kyrene District Track and Field Championship, held in April 2023.[92] Middle-schoolers participated in 13 events, and I calculated the male advantage for the winners of each matched event. These data are shown in Figure 10. In this school district championship, male advantage was evident in all events. I pooled all events then plotted the frequency of male versus female "wins" in this group of athletes. Again, I calculated the probability that the male "win" frequency would occur by chance. These data are shown in Figure 11. The probability that males would win all these events by chance is vanishingly low.

89 https://www.usatf.org/resources/statistics/records/championship-meet-records/usatf-national-junior-olympic-track-field-champion
90 https://aautrackandfield.org/Results
91 http://www.usatf.com/assoc/az/records.html
92 https://www.athletic.net/TrackAndField/meet/486419/results/all

Figure 10. The male advantage over females at the Kyrene District Track and Field Championship, held in April 2023.
Abbreviations: m – metres, h – hurdles, SMR – sprint medley relay

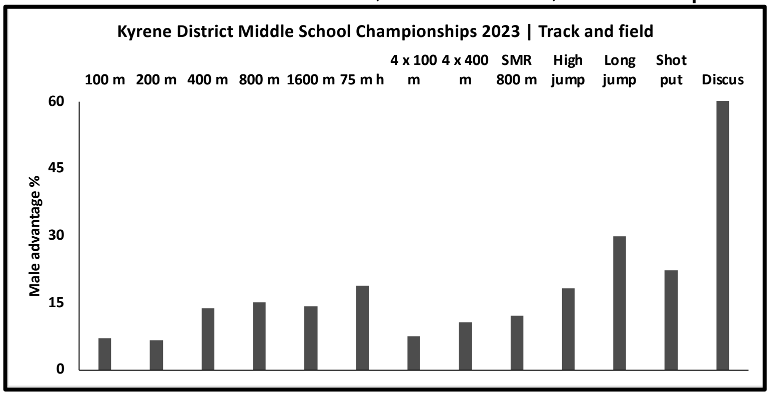
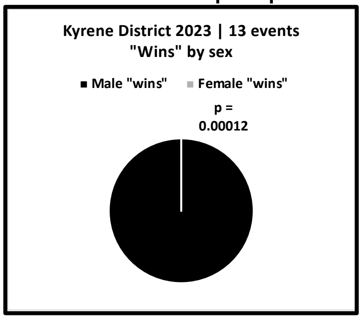
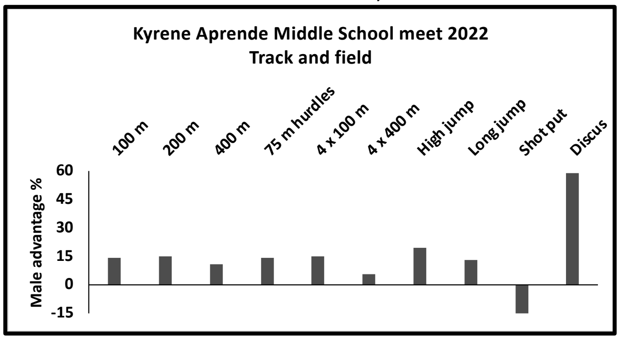


Figure 11. The frequency of male versus female "wins" across the pool of events at the Kyrene District Track and Field Championship, held in April 2023.
Abbreviations: p – probability



7.18 The second middle-school competition I analysed was the Kyrene Aprende Middle School Track and Field meet, held in July 2022.[93] Middle-schoolers participated in 12 events; however, the girls' times for the 800 m and 1600 m were not recorded on the scoresheets so I was unable to include these in my analysis. I calculated the male advantage for the matched winners in the remaining 10 events. These data are shown in Figure 12. In this single school athletics meet, male advantage was evident in all events except the shot put, where the apparent female advantage was an unexpectedly large 14.8 %.

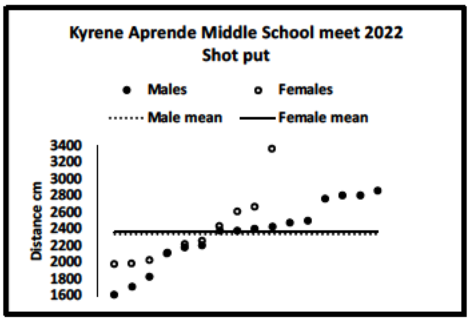
Figure 12. The male advantage over females at the Kyrene Aprende Middle School Track and Field meet, held in July 2022.
Abbreviations: m – metres, h – hurdles



93 https://www.kyrene.org/Page/55102

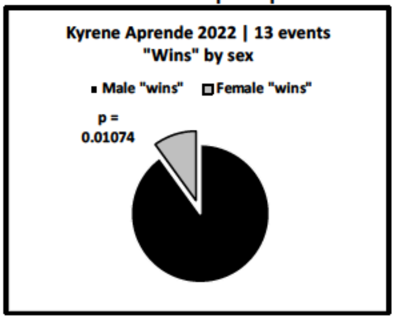
7.19 To understand the source of this female advantage in shot put, I analysed the puts of all the males and females at this middle school meet. These data are shown (with puts in increasing order of distance achieved) in Figure 13. The winner of the female competition putted 3360 cm, well beyond the second placed girl at 2670 cm. This winning female performance is 4.2 standard deviations from the female mean put distance, indicating an extraordinary performance with odds of occurrence of approximately 1 in 15000. A comparison of the mean distance putted by boys and girls shows them to be quite similar; however, the female winner is skewing this mean distance by 110 cm (the male winner only skews the male mean by 35 cm).

Figure 13. Analysis of puts at the Kyrene Aprende Middle School Track and Field meet, held in July 2022.
Abbreviations: cm - centimetres



7.20 I pooled all events then plotted the frequency of male versus female "wins" in this group of athletes. Again, I calculated the probability that the male "win" frequency would occur by chance. These data are shown in Figure 14. The probability that males would win almost all the events by chance is very low (p = 0.05 is the "significance" threshold).

Figure 14. The frequency of male versus female "wins" across the pool of events at the Kyrene Aprende Middle School Track and Field meet, held in July 2022.
Abbreviations: p – probability



7.21 Analyses of international, national and state track and field performances in male and female schoolchildren evidence sex differences in athletic performance, even before puberty. Sex differences in athletic performance are evident in middle school track and field meets. Collectively, these data demonstrate that female children require a female category of sport to win.

7.22 Childhood male athletic advantage over females has been proposed as social in origin. That is, higher engagement in sport and exposure to rougher play may represent 'training advantage' over females who are somewhat socialised to engage in less physical activity.[94] However, despite suggesting that childhood performance gaps are possibly social in origin, Thomas and French (1985) identify an extremely large gap in throwing differences, evident from age 3 years old, that are “unlikely to be completely environmentally caused” and are unlikely, based on biological factors, to be eliminated by training. The performance gap in international and national track and field records, evident even before puberty, somewhat controls for this socialisation effect, given that one might expect engaged, sporty girls to be as well-trained as their male peers.

[94] For example: Thomas and French, 1985. Gender differences across age in motor performance a meta-analysis. Psychol Bull 98(2):260-282.

8 Sports categories and concepts of advantage

8.1 Sports where performance or competitor safety is affected by sex routinely employ a protected female category that excludes males, to secure fairness for (and, discipline-dependent, safety of) female athletes. This separation on the basis of sex in pursuit of fair, safe sports and sporting opportunities for female athletes is permissible under much national equality legislation, including, for example, the UK Equality Act 2010.[95]

8.2 Misunderstandings regarding the nature of categories and advantage are common. Sports categories control for baseline physiological differences in sex, age, and impairment (and occasionally weight) that affect results or outcomes independently of the characteristics sporting competition seeks to reward: talent, strategy, training and dedication. Various initiatives like leagues, which operate alongside categories, exist to permit participation of those with different amounts of talent, strategy, training and dedication.

8.3 Categories are rationalised on biological principles, understanding what effect factors like sex and age have on the human body. They exist to ensure physiological "bonuses" (being male, being young) do not obscure outcomes that should depend on talent, strategy, training, and dedication. It is via categories that fairness is achieved, and we ensure that winning opportunities for the more talented athlete—a fundamental characteristic of sport—are preserved. Protected categories like the female category are a necessary inclusion measure to ensure females have an equal opportunity to compete in sports.

8.4 Advantage exists regardless of magnitude. Indeed, sports bodies have a history of regulating for even very small advantages. For example, inside lane track runners closer to the traditional start gun hear the gun more quickly and more loudly than those in outside lanes, offering them a small kind of advantage unavailable to the whole field. To combat this advantage, worth around 150 milliseconds in a staggered start of a 400m track, runners typically now start races via a loudspeaker at each block.[96] Even if an apparent advantage is small, a category or rule operates to exclude any quantity of it.

8.5 A common argument is to frame 'advantage' as simply a property of results (for example, any person who is faster than any other has 'advantage', while people who are equally fast are said to be fairly-matched), one undermines the very existence of categories. The logical outcome is sports organised not to reward talent but to reward a combination of talent and talent-independent physical properties that together deliver a winning outcome. In such a framework, almost all sports at every competitive level will be dominated by able-bodied males aged around 20-35 years old.

8.6 What has traditionally been described as a "girl's/women's category" is more precisely understood as a category for females that excludes males who have acquired any magnitude of male athletic advantage by virtue of biology, regardless of performance relative to the female field. The ineligibility of those with any male advantage is necessary to maintain the integrity of the female sports category.

8.7 Puberty, where we see a sharp divergence of male and female athletic performance, is typically regarded as the age at which a protected female category becomes necessary. I believe, given the evidence I have presented in **Section 7** that demonstrates male advantage in childhood, that is justified from pre-puberty ages to institute a protected female category that excludes any male advantage, should fairness for young female athletes be a priority for regulators.

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[95] UK Equality Act 2010, Part 14, Section 195.
[96] Holmes, 2008. Olympic start gun gives inside runners an edge. New Scientist, 23rd June 2008.

9 Treatment of transgender girls and transgender women

9.1 Transgender girls and transgender women may take social, pharmaceutical and/or surgical steps to be perceived and treated as if they were female. In adulthood, transgender women may opt for testosterone suppression (for example, via gonadotropin-releasing hormone [GnRH] agonists, spironolactone or cyproterone acetate) then/or surgical removal of the testes; both of these interventions have the effect of lowering testosterone levels to those of females[97] and reducing the functional or visual impact of male physical characteristics. Estrogen supplementation typically promotes feminisation of, for example, breast tissue.[98]

9.2 Early pharmaceutical interventions in transgender girls may involve blocking male puberty via GnRH agonists ("puberty blockers"), administered after the onset of puberty (at least Tanner stage 2; in male children, the appearance of pubic hair, increase in testicular volume and reddening of scrotum skin).[99] This is typically followed by a regime of cross-sex hormones from 16 years old.

9.3 Many children reporting gender dysphoria or incongruent gender identity desist; that is, gender identity issues resolve with puberty.[100] For this reason, puberty blockers are not administered until after the onset of puberty and there is observed demonstrable persistence of gender identity issues. Furthermore, the reported effects and side-effects of puberty blockers are serious, including long-term effects on bone growth, brain development, fertility and sexual function, and short-term effects like headaches, hot flashes, mood swings, and depression and anxiety,[101] necessitating caution with their prescription.

9.4 Considering the potential for medical harm while outcomes remain uncertain, many jurisdictions have cautioned against or restricted the use of puberty blockers in children, including the Swedish National Board of Health and Welfare,[102] the Finnish Health Authority,[103] the French National Academy of Medicine[104] and the Norwegian Healthcare Investigation Board.[105] The UK NHS has recently restricted puberty blockers within clnical research.[106] Pioneers of the original protocol for treatment of childhood dysphoria have advocated re-evaluation considering the rapidly-changing cohort demographics.[107]

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[97] Nishiyama, 2014. Serum testosterone levels after medical or surgical androgen deprivation: a comprehensive review of the literature. Urologic Oncology 32(1): 38.e17-28.
[98] Unger, 2016. Hormone therapy for transgender patients. Translational Andrology and Urology. 5(6): 877-884.
[99] Puberty progression is assessed using "Tanner staging", which describes the typical physical changes in boys and girls using landmarks of external genitalia in males (testicular volume, penis length and skin appearance), quantity and coarseness of pubic hair in both sexes, and breast development in girls. In males, Tanner stage 2 indicates the first signs of puberty, around the age of 11 years old, comprising the appearance of downy pubic hair, an increase in testicular volume and reddening of the scrotum skin. At Tanner stage 3, around the age of 13 years old, the penis begins to grow in length. Testicular volume increase and penis growth continues during later stages, and pubic hair becomes course and curly. For more information, see: https://childgrowthfoundation.org/wp-content/uploads/2020/03/Puberty-and-Tanner-Stages_v2.0.pdf
[100] Wallien and Cohen-Kettanis, 2008. Psychosexual outcome of gender-dysphoric children. Journal of the American Academy of Child and Adolescent Psychiatry 47(12): 1413-1423.
[101] Reported by various healthcare providers, for example: Mayo Clinic, NHS, St. Louis Children's Hospital.
[102] https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/kunskapsstod/2022-3-7799.pdf
[103] https://palveluvalikoima.fi/documents/1237350/22895838/Summary+transgender.pdf/2cc3f053-2e34-39ce-4e21-becd685b3044/Summary+transgender.pdf?t=1592318543000
[104] https://segm.org/sites/default/files/22.2.25-Communique-PCRA-19-Medecine-et-transidentite-genre.pdf
[105] https://www.bmj.com/content/bmj/380/bmj.p697.full.pdf
[106] https://www.england.nhs.uk/wp-content/uploads/2023/06/Interim-service-specification-for-Specialist-Gender-Incongruence-Services-for-Children-and-Young-People.pdf
[107] de Vries, 2020. Challenges in Timing Puberty Suppression for Gender-Nonconforming Adolescents. Pediatrics 146(4): e2020010611.

9.5 When prescribed as above, puberty blockers do not, by definition, block the entirety of male puberty. They do not block any hormone-derived pre-puberty effects on male development. They are unlikely to interfere with genetic effects on male development.

10 Transgender women in sport

10.1 Given the role of testosterone in the development of the male characteristics that matter for sporting performance, and bearing in mind the typical pharmaceutical and medical treatment sought by transgender girls and transgender women, the International Olympic Committee (IOC) and other sporting federations have historically sought to include transgender women in female sports by regulating levels of testosterone prior to inclusion in female competition.[108] More recently, the IOC have suggested that "*testosterone levels could be investigated as a means to mitigate performance*" in transgender women.[109] It is inferred that the IOC believe testosterone suppression may be sufficient to remove the male performance advantage provided by male-typical secondary sex characteristics.

10.2 In 2020, with the IOC equivocating over a review of their testosterone guidelines, Dr Tommy Lundberg and I tested the existing guidelines' promise to protect fair competition, by reviewing peer-reviewed published longitudinal changes in muscular and skeletal metrics in transgender women suppressing testosterone in adulthood for a minimum of 12 months.[110] Having reviewed measures of bone density, lean body mass, muscle mass and strength tests, we identified a unified consensus in original studies covering approximately 800 transgender women that skeletal metrics like height and bone length were unaffected, bone mass was preserved, and muscle mass and strength was decreased by 4% over 12 months of testosterone suppression. Within this dataset, compared with female control cohorts, higher muscle mass/strength values—between +13-41 %—were maintained for at least three years after testosterone suppression (the limit of current longitudinal studies).

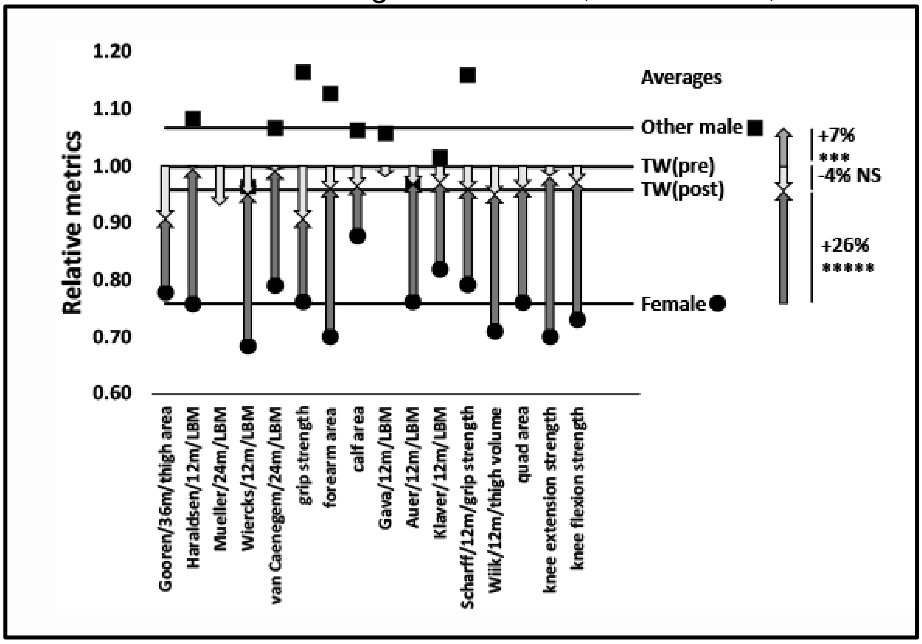
10.3 These observations were subsequently reinforced by a systematic review of the same dataset published by another group later in 2021, which concluded that, in transgender women, "*hormone therapy decreases strength, [lean body mass] and muscle area, yet values remain above that observed in cisgender women, even after 36 months. These findings suggest that strength may be well preserved in transwomen during the first 3 years of hormone therapy.*"[111]

10.4 To gain an overall picture of the baseline metrics and effects on muscle mass and strength in transgender women pre- and post- at least 12 months of testosterone suppression, I compared pre- and post- metrics for transgender women across the Hilton and Lundberg dataset with data from control males and females, shown in Figure 15. Original study metrics were converted to relative percentages, with pre-suppression metrics in transgender women set at 100%. The 4% reduction in muscle mass and strength in transgender women pre- and post- at least 12 months of testosterone suppression was not statistically significant. The difference between transgender women and control males was statistically significant, with transgender women pre- and post- at least 12 months of testosterone suppression deviating from control males by -7% and -11%, respectively. The difference between transgender women and females is also statistically significant; transgender women pre- and post- at least 12 months of

[108] https://stillmed.olympic.org/Documents/Commissions_PDFfiles/Medical_commission/2015-11_ioc_consensus_meeting_on_sex_reassignment_and_hyperandrogenism-en.pdf
[109] Martowicz et al., 2023. Position statement: IOC framework on fairness, inclusion and non-discrimination on the basis of gender identity and sex variations. Br J Sports Med 57:26–32.
[110] Hilton and Lundberg, 2021. Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage. Sports Medicine 51, 199–214. Note: the date disparity of the published paper represents the gap between article submission and publication.
[111] Harper et al., 2021. How does hormone transition in transgender women change body composition, muscle strength and haemoglobin? Systematic review with a focus on the implications for sport participation. Br J Sports Med 55: 865-872.

testosterone suppression deviate from control females by +35% and +30%, respectively. It appears that for metrics of muscle mass and strength, transgender women remain within 'male range'.

Figure 15. Relative metrics in transgender women pre- and post- testosterone suppression, compared with control males and females.
Abbreviations: TW – transgender women, m – months, NS – not significant



10.5 In addition to the longitudinal data captured by the above reviews, there are three significant cross-sectional studies of physical metrics in transgender women suppressing testosterone. The first found that transgender women, after an average of 8 years of suppressed testosterone, had a lean body mass in the 90th percentile for females, and grip strength that remained 25 % higher than the female reference value.[112] The second, in transgender women suppressing testosterone for just over 3 years, showed that those transgender women had a mean lean body mass 18 % higher than the mean in control females.[113] The third found that transgender women suppressing testosterone for over 14 years retained higher cardiopulmonary capacity metrics and higher hand grip strength than female controls.[114]

10.6 In 2015, to assess sports performance in transgender women, an observational cohort study of transgender women runners was performed, studying race times before and after testosterone suppression.[115] Participants were club-level middle-distance runners. After applying an age-grading formula typically reserved for Masters athletes, performance in the female category was judged to be maintained at a level equivalent to pre-suppression performance in the male category. This study had a sample size of eight runners self-reporting times that were unverifiable in 50% of cases and spanning a period of decades. The study could not make any controls for ageing, training, diet,

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112 Lapauw et al., 2008. Body composition, volumetric and areal bone parameters in male-to-female transsexual persons. Bone. 43(6):1016–1021.
113 Bretherton et al., 2021. Insulin resistance in transgender individuals correlates with android fat mass. *Ther Adv* Endocrinol Metab 12:2042018820985681.
114 Alvares et al., 2022. Cardiopulmonary capacity and muscle strength in transgender women on long-term gender-affirming hormone therapy: A cross-sectional study. Br J Sports Med 56: 1292-1298.
115 Harper, 2015. Race times for transgender athletes. Journal of Sporting Cultures and Identities 6:1-9.

injury, running course, or course weather conditions. The overall cohort analysis included times from runners who had experienced chronic injury and loss of fitness, resulting in poorer-than-expected performance within the female field. However, excluded from the overall analysis was a runner who had achieved a far higher ranking competing in female running than in male running. This individual improved ranking significantly, and even recorded a marathon that was faster than previous marathon performance in the male category, but was considered an outlier who had seriously intensified her training after transition into female sport. This individual demonstrates, as argued in Hilton and Lundberg, that training during testosterone suppression can mitigate negative performance effects.

10.7 There have been two studies of athletic performance in military personnel using basic fitness testing data.[116] While not athletes, these individuals do represent a trained population of transgender people. Both studies tracked changes in push-up, sit-up and 1.5 mile run performance during annual fitness testing over 3 or 4 years of testosterone suppression. Such tests are 'work to target': recruits are aware of targets that must be achieved to pass the fitness testing process, minimum performances must be achieved for each test, and a cumulative score threshold must be reached to pass the fitness test. Individual officers have the latitude to "choose" how their scores are allocated, such that a particularly strong runner has a lower need to gain points during the push-up test (for example). The performances cannot thus be assessed as maximal performances, but instead may be considered as paced performances with conscious knowledge of a required standard. The authors of the first study acknowledge that, despite being in a controlled environment of the Air Force, the exercise intentions and training habits of the recruits was unknown, and over a period of three years, changes in training with material implications for muscle and cardiovascular performance cannot be known.

10.8 Significantly, the data from the two studies of athletic performance in military personnel make contradictory findings, presented in Table 5. Roberts et al. (2021) finds that both push-up and sit-up performance are statistically equivalent to female performance after 2 years while advantage in running performance is retained to 2 years. However, Chiccarelli et al. (2022) finds that push-up advantage is retained beyond 4 years, sit-up performance is statistically equivalent to female performance at 4 years and running performance is statistically equivalent to female performance at 2 years.

10.9 This set of performance studies suffer from small numbers of participants, lack of controls for performance times, and issues regarding the validity of performance tests. They cannot be used in isolation to inform sports policy, particularly when the overwhelming body of evidence suggests that the effects of testosterone suppression on important metrics like muscle mass and strength are marginal and that male development, and thus male advantage, cannot be reversed.

[116] Roberts et al., 2021. Effect of gender affirming hormones on athletic performance in transwomen and transmen: Implications for sporting organisations and legislators. Br J Sports Med 55:577-583; Chiccarelli et al., 2022 Fit transitioning: When can transgender airmen fitness test in their affirmed gender? Mil Med 2022;usac320.

Table 5. A comparison of the findings of two studies of athletic performance in military personnel.
Abbreviations: NA – not applicable, * – year at which statistical parity with females is reached

	Roberts et al., 2021 Year group % change (% advantage over female controls)			**Chiccarelli et al., 2022** Year group % change (% advantage over female controls)		
	Push-ups	**Sit-ups**	**Running**	**Push-ups**	**Sit-ups**	**Running**
Pre-transition	NA (+45.5 %)	NA (+17.3 %)	NA (+17.2 %)	NA (66.3 %)	NA (+28.3 %)	NA (+17.8 %)
Year 0-1	-5.7 % (+37.2 %)	+1.1 % (+18.6 %)	-7.1 % (+11.3 %)	-13.0 % (+44.7 %)	-6.1 % (+20.5 %)	-10.4 % (+9.2 %)
Year 1-2	-3.1 % (+32.9 %)	-4.3 % (+13.6 %)	-4.4 % (+7.5 %)	-9.4 % (+31.0 %)	-2.6 % (+17.3 %)	-4.5 % (+5.1 %)*
Year 2-3	-19.9 % (+6.5 %)*	-13.5 % (-1.8 %)*	+3.3 % (+10.5 %)	-2.0 % (+28.3 %)	-5.2 % (+11.2 %)	-0.0 % (+5.1 %)*
Year 3-4				-8.3 % (+17.7 %)	-2.6 % (+8.3 %)*	-5.2 % (+0.2 %)*

11 Transgender girls in sport

11.1 Most sporting federations exempt from testosterone regulations those who have blocked puberty before cross-sex hormone treatment. To my knowledge, there is no published data on muscle mass and strength metrics in a cohort of transgender girls who have blocked puberty from Tanner stage 2.

11.2 Recently available is a study by Boogers et al. (2022) called, "Trans girls grow tall: adult height is unaffected by GnRH analogue and estradiol treatment."[117] In this study, transgender girls who had received puberty blockers from around 13 years of age, then cross-sex hormones at 16 years of age, acquired an average adult height of 180.1-185.3 cm, far larger than the population female average (170.7cm) and around the population male average (183.8cm). The authors conclude that the driver of height acquisition is genetic in origin, and not a result of testosterone during puberty.

11.3 In two studies where male puberty was partially-blocked, lean body mass in young adulthood remains higher than in reference females[118] and grip strength remains higher than in a matched cohort of transgender boys.[119]

11.4 Claims that transgender girls who block puberty do not acquire any male athletic advantage in terms of skeletal structure and/or muscle mass are speculative.

[117] Boogers et al., 2022. Trans girls grow tall: adult height is unaffected by GnRH analogue and estradiol treatment. Journal of Clinical Endocrinology and Metabolism. Epub ahead of print, PMID: 35666195.
[118] Klaver et al., 2018. Early Hormonal Treatment Affects Body Composition and Body Shape in Young Transgender Adolescents. Journal of Sexual Medicine 15(2): 251-260.
[119] Tack et al., 2018. Proandrogenic and Antiandrogenic Progestins in Transgender Youth: Differential Effects on Body Composition and Bone Metabolism. Journal of Clinical Endocrinology and Metabolism 103(6): 2147-2156.

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

Emma Hilton, PhD
27th June 2023

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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 **Supplemental Declaration of Dr. Chad Carlson, M.D., FACSM in Further Support of Intervenor-Defendants' Opposition to Plaintiffs' Motion for a Preliminary Injunction**

I, Chad Carlson, declare as follows:

1. I have submitted an initial declaration to this Court dated May 18, 2023.

2. I now submit this supplemental declaration based on my personal knowledge, and it reflects my expert opinions.

3. In preparing this supplemental declaration, I have reviewed the expert

rebuttal declarations filed by Plaintiffs, submitted by Dr. Shumer and Dr. Budge.

I. There are pre-pubertal differences between boys and girls with respect to physical performance.

4. Pre-pubertal boys and girls differ with respect to physical performance measures. This can in turn contribute to injury risk, as the modeling risk starts to rise when there are differences in strength, speed, and power between two groups. Thus, the performance side of this question is intricately linked to the safety side.

5. As has been pointed out, there are numerous cross-sectional studies from different countries looking at measured performance between the sexes in pre-adolescent children.[1] These studies generally show remarkable consistency, with boys outperforming girls in almost all age categories when looking at measures of speed, power and strength, and girls outperforming boys in flexibility assessments.

6. Plaintiffs' experts seek to dismiss these studies as not providing an accurate assessment of physiologic capacity, and instead reflecting social biases, because they are cross-sectional, meaning that the studies provide categorical comparison of aggregated data without attempting to assign causation to any measured differences, such as biology vs. sociological effect.

7. However, in his counter-argument, Dr. Shumer simply references a blog that in turn references another cross-sectional study to argue (in his words) that there is

[1] *See* Catley M, et al. Normative Health-related Fitness Values for children: analysis of 85347 test results on 9-17 year-old Australians since 1985. 47:98-108 (2013).
DiMiguel-Etayo P., Physical fitness reference standards in European children: The IDEFICS Study. Int J Obes (Lond) 38(2):557-566 (2014).
Kasovic M. et al., Secular trends in health-related physical fitness among 11-14 year old Croatian children and adolescents from 1999 to 2014. Scientific Rep 11:11039 (2021).
Marta C. et al. Physical fitness differences between prepubescent boys and girls. J Strength Cond Res 26(7):1756-66 (2012).
Tambalis K. et al., Physical fitness normative values for 6-18 year old Greek boys and girls. Eur J Sport Sci 16(6):736-46 (2016).
Zhang F et al., Physical fitness reference standards for Chinese children and adolescents. Scientific Reports 11;4991 (2021).

supposedly "a well-established scientific consensus that, before puberty, there are no significant differences in athletic performance between boys and girls." The study linked to in the blog is by McKay, in the Journal of Neurology.[2]

8. Although the McKay study does attempt to analyze data to discern the effect of sex and body size, when you look at the actual study, as opposed to the blog summary, Dr. Shumer's claims cannot be justified.

9. First, the McKay study used a form of statistical analysis that is typically used for comparison of continuous variables, not categorical variables such as sex, so from the beginning, it is not well-suited to make inferences about differences in performance between the sexes.[3] That said, the McKay study looked at children aged 3-9 and found no significant differences in strength measures between the sexes other than shoulder internal rotation strength. (Notably, however, shoulder internal rotation strength is important for throwing or striking a volleyball and probably a factor in early measured differences in throwing capability between boys and girls (see below)).

10. From age 10, the McKay study aggregates data for analysis in a 10-19 year old cohort, and there is a strong effect of sex on performance reported in that group. In the 10-19 year old cohort, boys were statistically stronger than girls in every measured strength category. According to filed statements, plaintiffs went to at least Tanner II before they started puberty suppression (approximately 11 years of age), so for purposes of this study, they would have been aggregated into this group.

11. When Dr. Shumer says that "there was no statistical difference in the capabilities of girls and boys until high-school age (commonly age 12)," what he appears to be doing is repeating the summary conclusion noted on the referenced website, which in turn appears to be using age 12 as a surrogate descriptor for the 10-19 year old group. Unsurprisingly, aggregating ten and eleven year old boys with older male adolescents for

[2] McKay MJ et al. Normative Reference Values for Strength and Flexibility of 1,000 Children and Adults. 88:36-43 (2017)

[3] Pearson Correlation - SPSS Tutorials - LibGuides at Kent State University

purposes of comparison to females does show a strong effect of sex on performance.

12. Thus, noting its previously referenced deficiencies regarding analysis of performance differences between the sexes, the most one could really conclude from this study is that there was no effect of sex on strength (other than shoulder internal rotation) in the 3-9 year old cohort, which is not representative of the Plaintiffs (and which is not what Dr. Shumer claimed anyway when he said “no significant differences”).

13. Returning to the previously referenced cross-sectional studies, the way that these studies vary argues against Dr. Shumer’s interpretation. Measured differences exist between the sexes when children are assessed in countries with varying social norms when it comes to gender. Plaintiffs characterize the differences in these studies as “small,” but in this context, “small” is a subjective term, and is used by Plaintiffs as framing language.

14. As an example, using Catley’s data on Australian children, when one looks at performance at the 50th percentile for ten year old boys and girls, running times are approximately 15% faster in boys in the 1.6 km run; boys complete double the number of shuttle stages in a timed shuttle run, perform a standing long jump 7.5% farther, perform 30% more push-ups and demonstrate 10% greater handgrip strength as a group.[4]

15. Granted, these studies carry with them the limitations of cross-sectional comparisons, but in terms of looking at measured trends across multiple studies, in diverse regions with different social norms, there exists a consistency of outcome that is striking.

16. There is prospective data showing sex-based performance differences between boys and girls. Dohrman looked at throwing and kicking ability of boys and girls both before and after systematic skill coaching, and found that boys outperformed girls both at baseline and after completion of training.[5]

17. Moreover, improvement was similar between the two groups. Differences after training in throwing were nearly categorical.

[4] Catley, 2013.
[5] Dohrmann P. Throwing and kicking ability of 8 year old boys and girls. The Research Quarterly 35(4):464-471 (1964).

18. One important thing to say about this study is that it occurred prior to Title IX, when societal-based differences in sport-related skill sets between boys and girls would be expected to be higher, and yet the rate of improvement between the two groups stayed consistent. In other words, if girls were under-coached, providing them with equivalent access to skill training should have resulted in greater improvement relative to boys; but we don't see that.

19. Lombardo reviewed sex-based differences in throwing in children and found similar consistent findings across all cultures. Boys throw farther in cultures where overhead throwing sports do not predominate, and in cultures where overhead throwing is common. These differences persist in cultures where boys and girls have similar opportunities and would expect to gravitate toward one another in performance if social bias were the primary determinant driving performance change. The following extended quote from Lombardo et al. is instructive:

> "At all ages, males throw faster, on average, than females. The sex differences in throwing velocity emerge during the preschool years before sex differences in sports involvement appear. By ages 4–7, 90% of boys throw faster than the average of same-age girls (Thomas and French 1985) and boys 6 years of age throw faster, on average, than do girls who are 9 years old (Rippee et al. 1990). Practice improves female throwing velocity but, when compared to males with similar throwing experience, the sex difference remains (Thomas and Marzke 1992; Petranek and Barton 2011). By age 12, the fastest throwing girls are comparable to the slowest throwing boys (Thomas and French 1985).
>
> Throwing distance is positively and highly correlated with throwing speed and is influenced by the point in the throw when the projectile is released (Axe et al. 1996, 2014; Zhu et al. 2009). The magnitude of the sex differences

in the development of distance throwing exceeds that of any other motor skill (Espenschade 1960) and manifests itself early; boys 6 years of age throw farther than girls who are 9 years old (Rippee et al. 1990), and only the very best girls throw as far as the least skilled boys at age 17 (Thomas and French 1985). Practice improves throwing distance for both sexes (Zhu et al. 2009), but females do not "catch up" to males (Thomas et al. 1994). The inability of girls to catch up to boys suggests that there may be a biological component that limits the ability of females to improve their throwing with training (Haubenstricker and Seefeldt 1986).

(Before adolescence) there is little sex difference in height, weight, and muscle mass (National Center for Health Statistics 2017), so male superiority in throwing cannot be attributed to sex differences in size or strength. Many scholars of throwing attribute this developmental sex difference in throwing to greater male participation in ball sports and social encouragement of throwing skills by boys (Cratty 1979; Sakurai and Miyashita 1983; Bingham and Souza 2009). However, Butterfield and Loovis (1993) showed that sex differences in the throwing motion and performance remained after age and Tee ball, softball, or baseball participation were statistically controlled during analyses. These results are consistent with our hypothesis that the sex difference in throwing may have a biological component….

Both male and female Australian Aborigines throw during hunting and defense (Clarke 2003) leading Thomas et al. (2010) to predict that there would be few sex differences in throwing in this population. However, contrary to their prediction, boys still outperformed girls and the mean effect sizes were large (Cohen 1992) but smaller than in same-aged populations in the U.S…

Ehl et al. (2005) predicted that sex differences in throwing would be smaller in Germany than in the U.S. where there are more sex differences in throwing experience. They found sex differences in both populations and the relative differences between the sexes were about the same. In terms of effect sizes, and contrary to the authors' expectations, the differences between boys and girls were larger in Germany (d = 5.36) than in the U.S. (d =1.82). The observation that German boys threw much better than girls in the U.S. even though they do not throw much, have U.S.-like cultural support or encouragement for throwing, and throw as well as U.S. boys (Ehl et al. 2005) is consistent with our hypothesis and challenges the hypothesis that sex-biased training significantly contributes to the sex differences in throwing."[6]

20. All of this is noteworthy, because Dr. Shumer specifically states that transgender girls who undergo early transition "do not have greater…throwing speed." Since throwing distance is dependent on both angle of release and initial throwing speed, in light of the above data, including data from the very source cited by Dr. Shumer, his contention cannot be true.

21. In addition to this, there is the question of physiologic ceiling. What is the highest capability of boys and girls at different ages, in comparable competition? If there is really very little difference between boys and girls physiologically, then prior to the effects of testosterone occurring, or the pubertal growth spurt, records should be fairly equally mixed between the sexes, at least in societies that promote more equal opportunities for boys and girls to participate. But that is not what we see. USA Track and Field maintains records by age category in boys' and girls' track. In nine representative events

[6] Lombardo MP et al. On the evolution of the sex differences in throwing: Throwing is a male adaptation in humans. The Quarterly Review of Biology 93(2):91-119 (2018).

in the 8-and-under group,[7] ten events in the 9-10 year old group,[8] and fourteen events in the 11-12 year old group,[9] boys' records exceed those of girls in 33/34 events. In the 11-12 year old long jump category, a girl holds the outright record, at 18' 1.5" compared to 18' 1" for the boys. Even at a preadolescent age, the physiologic ceiling (represented by record performance) is different.

22. All this evidence suggests that there is, in fact, a biological effect of sex on sports performance before puberty, whether or not the cause of that effect has been fully elucidated yet. Available data makes a compelling case, and experience and common sense also testify to these differences.

II. World Rugby and UK Sport.

23. Plaintiffs' experts contend that World Rugby's current policy allows an exception for transgender women who transitioned "pre-puberty." But they misunderstand this point.

24. First, when you look at the referenced research that World Rugby used to come to their decision, it appears to entirely involve an older cohort. So their policy with regards to early transitioners is not grounded in scientific review of relevant data, at least based on what they have made available to the public.

25. Second, this exception is not an unqualified exception. The eligibility rules go on to stipulate that if an early transitioner wishes to participate in the female category, documentation of actual testosterone suppression must be provided. This is important, because many individuals on hormone suppression fail to suppress testosterone. It has been reported that this can occur in between 25% to 49% of treated subjects.[10] If

[7] 100, 200, 400, 800, 1500, 4 x 100, 4 x 400, long jump, shot put.
[8] Same as above with addition of High Jump.
[9] Same as above with addition of 4 x 800, discus and mini-javelin.
[10] Heather AK. Transwomen elite athletes: Their extra percentage relative to female physiology. Int J Environ Res and Pub Health 19 (https://doi.org/10.3390/ijerph19159103) (2022).

testosterone drives major body changes in adolescence, it is certainly relevant whether medical treatments that are purporting to keep boys from entering male adolescence are actually working to achieve this goal in a given individual.

26. Third, national organizing bodies are already moving beyond these recommendations to further tighten controls. The Rugby Football Union in the UK now will not allow any exceptions for transgender females who did not start puberty suppression *before* age 11.[11] Thus, despite World Rugby's recommendations about the preadolescent category, organizing unions under World Rugby are coming to their own conclusions.

27. Dr. Shumer criticizes inclusion of UK Sports' published policy guideline on several points. First, he discounts this document because it "is not a scientific report." This is interesting because he earlier tries to refute any idea of pre-adolescent performance advantage in boys by quoting a website. That said, even a cursory review of the background information that UK Sports reveals that they did, in fact, conduct an independent review of the available research and have made the references that they used to conduct this review publicly available.[12]

28. Unlike World Rugby, this review did consider some criteria involving younger subjects. To Dr. Shumer's point, UK Sports goes on to state that "[c]urrent scientific evidence indicates that the difference between the strength, stamina, and physique between the sexes is *largely* due to the higher testosterone levels of males during their lifetime." (Emphasis added.) This is not a controversial statement, and nobody is disputing it. But again, that does not mean that differences between the sexes before puberty don't exist, or that they aren't relevant to the conversation about public policy when it comes to sports.

III. Dr. Shumer cannot support his assertion that puberty suppression and hormone replacement effectively eliminate the male advantage in sport.

[11] McLarnon M, et al. A Scoping Review of Transgender Policies in the 15 Most Commonly Played UK Professional Sports. Int J Environ Res Public Health. 2023 Feb 17;20(4):3568.

[12] International Research Literature Review (equalityinsport.org).

29. As noted in my prior declaration, there is a dearth of studies directly addressing the question whether puberty suppression and hormone replacement effectively eliminate the male advantage in sports. Thus, we have to look at the evidence that is available and make inferences from that. However, it is important to point out that problems with lack of data cut against Plaintiffs here. Plaintiffs cannot point to any studies establishing that puberty suppression and hormone replacement eliminate the competitive advantage, as they must do to make their case. Policy makers who are trying to determine a way forward on issues pertaining to public safety, and in this case the integrity of sport, have to weigh what we do know. And, as stated above, considerations about pre-adolescent variation between the sexes do matter.

30. Dr. Shumer states that my declaration has "no relevance to transgender girls who transition early," that "transgender girls who receive puberty suppressing medications at the onset of puberty… do not have any advantage over other girls with respect to size, weight, speed or strength," and that I do "not cite to any evidence, nor does any exist, that such girls have an athletic advantage over other girls." This is incorrect. In fact, I do cite studies that support this very conclusion.

31. One study I do cite to that is useful to consider in this regard is the Klaver study.[13] This study looked at transgender girls placed on puberty suppression medication at various times, and tracked lean body mass (among other variables) prospectively. The study has been characterized as showing that biological males who transition end up with a biologically female body type. In fact, what this study does show is that males come into treatment with significantly higher lean body mass than their biological female peers, and that treatment in fact brings their lean body mass to an intermediate point that is still more than biological females are able to achieve. That contradicts the narrative constantly proffered by Dr. Shumer, that "transgender girls who receive puberty suppressing

[13] Klaver M, de Mutsert R, Wiepjes CM, Twisk JWR, den Heijer M, Rotteveel J, Klink DT. Early Hormonal Treatment Affects Body Composition and Body Shape in Young Transgender Adolescents. J Sex Med. 2018 Feb;15(2):251-260. doi: 10.1016/j.jsxm.2017.12.009. PMID: 29425666.

medication at the onset of puberty do not differ from other girls with respect to the factors that" I discuss in my declaration. At another point, Dr. Shumer notes that "a transgender girl who received puberty suppressing medication followed by hormone replacement therapy does not have the same physiology as a pre-pubertal, non-transgender boy." Perhaps, but such an individual is not a physiologic female either. In fact, when you look at the data, the measured ranges for lean body mass in transgender girls fall above the mean for cisgender women, indicating a categorical retained difference.

32. Klaver also tried to look at when individuals started therapy, and was not able to show any differences in terms of anthropometric outcomes in individuals who transitioned in early vs. later Tanner stages. That runs counter to what Dr. Shumer said in his rebuttal declaration. It is also important to point out that these are not athletic subjects, and that the effect of resistance training in an individual taking medication to suppress puberty would be to mitigate the loss and maximize any retained difference between transgender and cisgender girls.

IV. Puberty suppression does not bring concussion risk to parity.

33. Dr. Shumer appears to be missing the point on concussion risk. He states that transgender girls will reduce their neck lean mass towards that of biological females, bringing their risk more in-line with biological females. But the point is not that a transgender girl might be increasing their injury risk by reducing lean body mass through hormonal treatment. The point is that they are being placed into an environment where they are now competing directly against biological girls who do carry higher susceptibility for concussion injury. In other words, regardless of whether transgender girls become more susceptible to concussions themselves, they are more likely to *cause* concussions than other competitors when competing against biological girls.

34. Moreover, if the Klaver data is to be believed, transgender girls are competing with a significant retained advantage in terms of lean body mass. Particularly in a sport like volleyball, where, as we have noted above, boys have documented greater arm strength and throwing speed, the ability to generate more ball force, in combination

with a biologically female population at higher susceptibility for head injury, places opposing female athletes at risk. Dr. Shumer states that "there is no evidence, and no medical reason to believe, that [the] participation [of transgender girls] on girls' teams would pose any increased threat of…injuries to other girls." But in fact, the evidence presents a compelling case that the opposite is true. It certainly is not misguided for policy makers to consider safety for all girls when deciding who should be allowed to compete together.

V. Comments on two of the studies cited by Plaintiffs' experts.

A. *Harper, J. Race Times for Transgender Athletes. J Sporting Cultures and Identities 6(1) (2015).*

35. Were it not for the politically-charged subject matter, this study would never be published in most peer-reviewed journals. The whole point of the study is to compare race times of transgender female runners before and after transition, and assess the athlete's placement relative to, first men, then women. Only eight runners were analyzed, and race times were self-reported and not uniformly verified. The author states in the methods section that "[f]or six of the eight runners, online checking made it possible to verify *approximately half of the submitted times*" (my emphasis). There was no assessment whether training across time remained consistent, or whether other factors than age may have mitigated performance.

36. Dr. Shumer's closing sentence in paragraph 19 of his rebuttal, which deals with this study, has no bearing on the study itself.

B. *Tack LJW et al. Proandrogenic and Antiandrogenic progestins in transgender Youth: Differential Effects on Body Composition and Bone Metabolism. J Clin Endocrinol Metab 103(6):2147-2156.*

37. This study supports the conclusion that grip strength was retained, rather than Dr. Shumer's characterization that subjects "did not experience any increase in grip strength." This is relevant because ultimately the comparison is transwomen to cis-women, not cis-men. Dr. Shumer also notes that the study showed a significant decrease in lean

mass, but in reality, the results are mixed without any significant loss of lean muscle mass in the legs. Again, the lesson here is that treatment does not turn a biological male into a biological female. The natural inference is that there is retained difference.

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

Dated: June 29, 2023

/s/ Chad Carlson, M.D., FACSM
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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 **Rebuttal Declaration of James M. Cantor, Ph.D., in Further Support of Intervenor-Defendants' Opposition to Plaintiffs' Motion for a Preliminary Injunction**

I, James M. Cantor, declare as follows:

1. I have submitted an initial declaration to this Court dated May 18, 2023.

2. I now submit this expert rebuttal declaration based on my personal knowledge, and it reflects my expert opinions.

3. In preparing this rebuttal declaration, I have reviewed the rebuttal

declarations filed by Plaintiffs, submitted by Dr. Shumer and Dr. Budge, and Plaintiffs' Reply Brief. I could not identify in Plaintiffs' Reply any citation of my declaration or challenge to my claims.

I. Response to Dr. Budge.

4. Dr. Budge (Budge Rebuttal ¶6) claimed: "Dr. Cantor asserts that my claims about transgender youth and their medical care are based solely on my clinical experience. (Cantor Decl. ¶ 153.)" Her rebuttal claim is demonstrably untrue. As I made explicit in my declaration, I compared her claims with the research literature only to find she did not cite any of the research literature, so her claims did not come from it. (See Cantor Decl. ¶ 153)

5. Dr. Budge (Budge rebuttal ¶10) claimed: "Dr. Cantor further appears to suggest that excluding transgender girls from playing school sports is not psychologically damaging. (*See* Cantor Decl. ¶159.)" My actual words, however, indicate I said no such thing. Rather, I once again evaluated Dr. Budge's claims using the standard criteria of the scientific method. Not only do I not suggest what is or is not damaging, but rather I am explicit in indicating that the lack of research does not allow anyone to know the answer to that inquiry. (See Cantor Decl. ¶ 159) In other words, when I clearly pointed out that it is not possible for Dr. Budge to know what she claims to know on this point, Dr. Budge interpreted this to mean that I somehow do know the opposite to be true, rather than my observation that no one can know.

6. Similarly, Dr. Budge (Budge rebuttal ¶9) inferred me to say the very opposite of what I did in my ¶ 158. She wrote: "Dr. Cantor appears to suggest that transgender girls can play on boys' teams. (Cantor Decl. ¶ 158.)" My actual words, however, were unambiguous in referring to female-to-male students (whom Dr. Budge would call transgender boys) playing on male-designated teams: "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."

7. Dr. Budge repeated her claims that the WPATH and Endocrine Society (E.S.)

standards are based on high quality reviews of the research. The only sources Dr. Budge cited in support of the claim of high quality were the E.S. and WPATH documents themselves. Dr. Budge did not, however, address the objective evidence: Table 1 of my declaration (Cantor decl pp. 31-32) lists the *entire set of every study* included in E.S. and WPATH reviews. The E.S. included exactly one study. WPATH included a total of four studies, *none* of which was a study of safety.

8. Dr. Budge's contention that "none of the international reports that Dr. Cantor cites is a clinical practice guideline" is frankly illogical: One does not write clinical guidelines for how to perform treatments *that are banned.* Indeed, Dr. Budge does not appreciate that this lack of clinical guidelines demonstrates that I am *correct* to refer to these policies as bans and that she is *incorrect* to represent the European policies as an attempt to increase the availability of medicalized transition. The purpose of the increase in clinics Dr. Budge mentioned, made very clear by NHS England, is to provide *mental health services* to these youth *instead of* easy access to medicalized transition. Dr. Budge did not refer to any of the other health care systems, referring only to English policy, calling it "an example." Dr. Budge did not contest, or even address, any of the statements made by any of the other national health care systems, all of which make incontrovertibly clear the intent of their policies were to ban medicalized transition.

9. Finally, the purpose of a systematic review is to provide the science, not decide the policy: Because my role as expert witness is to provide the science (and to let legislatures and courts decide policy), these reviews are exactly the appropriate documents for me to cite.

10. Dr. Budge's claims about "Dr. Cantor's view that…" (Budge rebuttal, header to her ¶18) and "Dr. Cantor appears to believe that banning…" (Budge rebuttal, ¶18), "Dr. Cantor appears to believe these minor patients…" (Budge rebuttal, ¶18) are objectionable for these same reasons. I never expressed these views, and they represent only more straw man arguments. Moreover, Dr. Budge's use of mental illness as a dismissive epithet reinforces the stigma of mental illness despite the goal of our shared profession to reduce

it.

11. In her original declaration, Dr. Budge (¶¶18–19) gave an invalid definition of "sex," incorrectly including "gender identity" as part of the definition of sex. To point this out, my declaration provided the scientific definition of sex by including the verbatim definitions from several professional associations in the U.S., all defining sex as I did, all excluding gender identity from within the definition of sex, and all contradicting Dr. Budge's inclusion of gender identity within sex. In her rebuttal definition, Dr. Budge claimed I used "outdated, inaccurate, and narrow definitions of sex" (Budge rebuttal ¶28) and that the correct definitions were those provided by: "American Academy of Pediatrics, 2018; American Psychological Association, 2014; American Psychological Association, 2021; American Psychiatric Association, 2017; American Medical Association, 2018" (Budge rebuttal ¶28).

12. The depth of Dr. Budge's misapprehension is difficult to exaggerate: These are largely the very documents I *did* cite, quoted verbatim, all showing they did *not* include "gender identity." For reference, the definition of sex in Dr. Budge's original declaration (¶19, italics added) was: "Every individual's sex is comprised of many distinct biological influences characteristics, including but not limited to chromosomal makeup hormones, internal and external reproductive organs, secondary sex characteristics, *and gender identity*." My initial declaration (Cantor decl ¶¶106, 156) included these direct quotes:[1]

a. Endocrine Society (Bhargava 2021 at 220.): "Sex is dichotomous, with sex determination in the fertilized zygote stemming from unequal expression of sex chromosomal genes."

b. 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."

c. American Psychological Association (APA Answers 2014): "Sex is

[1] For reference, what Dr. Budge cited as AAP, 2018, I cited as Rafferty 2018.

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."

d. 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)."

e. 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."

f. DSM-5-TR: 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.)

13. None of the above definitions includes "gender identity," despite Dr. Budge's now repeated insistence that they do. Dr. Budge included no evidence that any of these documents contains what she claims they say.

14. Dr. Budge cited two documents not already quoted in mine, and they too fail to support her definition of sex. The American Medical Association (2018) document was a press release entitled "Affirming the Medical Spectrum of *Gender*" (italics added). The quote Dr. Budge related was that "sex *and gender* are more complex," not that *sex* is more complex. The press release indicated the need to understand "the scientific nature of a person's sex" and refers to public policy implications following from legal definitions of sex. The press release does not provide or cite any definition of sex of its own, as Dr. Budge misrepresents.

15. Moreover, Dr. Budge's idiosyncratic terminology is not merely in error, and

not merely in conflict with her own cited sources, but it is also logically incoherent: If gender identity were an aspect included *within* the definition of sex, then it would not be possible for gender identity to be in conflict with sex, which is her definition of gender dysphoria. However much it might be Dr. Budge's opinion that gender identity *should be* included, her own citations show it is not.

16. Where Dr. Budge claimed I said "sex can *only* be determined either by 'visual inspection' or 'chromosome'" (Budge rebuttal declaration ¶28, italics added), I actually wrote "Sex is an objective feature: It can be ascertained regardless of any declaration by a person, *such as* by chromosomal analysis or visual inspection" (Cantor declaration ¶105, italics added). Whereas I am explicit in providing examples, Dr. Budge misrepresents it as an exhaustive list, ignoring entirely the key feature being their objectivity, not the examples of some objective features.

17. My initial declaration relayed the topics that WPATH and the Endocrine Society did and did not include in their research reviews, quoting directly those documents' reports of their own contents (Cantor decl ¶90 for Endocrine Society, ¶95 for WPATH). The Endocrine Society reviewed cross-sex hormones, but did not review puberty-blockers, and WPATH (published as Baker et al., 2021) did not review any safety studies, either of puberty-blockers or cross-sex hormones. WPATH's review consisted of three studies (none of safety), and Endocrine Society's, one. My declaration listed *every* study identified by WPATH and the Endocrine Society reviews (Cantor decl, Table 1, page 30): Neither Dr. Budge nor Dr. Shumer identified any study to be missing. Dr. Budge responded, not by citing any evidence for WPATH's claims of safety or effectiveness, but by simply reiterating them (Budge rebuttal ¶36.) Dr. Budge claimed that these associations' guidelines were based on "comprehensive review of all existing data" (Budge rebuttal ¶ 36), and Dr. Shumer repeated that these associations' guidelines are reliable "due to the rigorous nature of their review" (Shumer rebuttal ¶48), that they were "created based on rigorous reviews" (Shumer rebuttal ¶49), and "were developed through rigorous scientific processes" (Shumer rebuttal ¶49). Despite their liberal uses of these adjectives, neither Dr.

Budge nor Dr. Shumer presented any of the evidence that WPATH included to support such claims.

18. Dr. Budge's rebuttal (¶37) and Dr. Shumer's rebuttal (¶50) erroneously claimed it would not be ethical to conduct a Randomized Controlled Trial (RCT) to test the effects of medicalized transition on minors. As already noted in my initial declaration (section III.C.2.), when an experimental treatment cannot be compared with an *inactive* treatment (a placebo), it can instead be compared with another *active* treatment (such as psychotherapy), which is exactly what has been recommended by the England's National Health Service following its systematic review of effectiveness (Cantor decl ¶50). Neither Drs. Budge nor Shumer contested or mentioned these facts.

19. Dr. Budge makes explicit that her belief that RCTs cannot be conducted is because of the principle of "equipoise," which she defined as "true scientific uncertainty about whether an intervention will help the individual." (Budge rebuttal ¶37.) The idea is that there must exist uncertainty in order to justify not providing the otherwise untested treatment. Dr. Budge omitted an important part of the equipoise principle, however, failing to spell out: uncertainty *among whom?* According to bioethicist Benjamin Freedman, the originator of the concept of clinical equipoise, "The requirement is satisfied if there is genuine uncertainty within *the expert medical community*—not necessarily on the part of the individual investigator—about the preferred treatment." (Freedman 1987[2].) That is, it does not matter if Dr. Budge herself feels certain. The international expert medical community is indeed highly *un*certain, as already documented in my initial report (Section II.F. *'No Debate'*) and to which neither Dr. Budge nor Dr. Shumer had a response. The peer reviewed studies that have attempted to do so have been unable to demonstrate differences in efficacy between medicalized and psychotherapeutic treatment of gender dysphoria in minors. (See Section XIII. *Cohort Studies of Puberty Blockers and Cross-Sex Hormones.*) That Dr. Budge and Dr. Shumer neglect to include disconfirming reports and

[2] Freedman, B. (1987). Equipoise and the ethics of clinical research. *New England Journal of Medicine, 317,* 141–145.

decline to acknowledge dissenting experts does not deny the widely documented existence of both. Indeed, the professional uncertainty is itself a topic covered by the international medical press, including the *British Medical Journal's* recent article: *Gender Dysphoria in young people is rising and so is professional disagreement.* (Block 2023[3].)

20. In her initial declaration, Dr. Budge asserted a long series of claims, none with any basis in science. She included no peer reviewed (or other) research at all to support any of these claims, as I indicated in my initial report. In her rebuttal declaration, Dr. Budge simply repeated her claim, "Studies have repeatedly documented that puberty blocking medication and hormone therapy are associated with mental health benefits for transgender people in both the short and long term, including a dramatically reduced rate of suicidality," this time including a footnote listing seven studies. (Budge rebuttal ¶38.) The Budge rebuttal included no summary, evaluation, or other indication of the contents of those studies.

21. For reference, the seven studies were: Tordoff 2022; Green 2021; Turban 2020; Achille 2020; Kuper 2020; van der Miesen 2020; and Costa 2015. Of these seven, five are already detailed in my initial declaration, including the reasons they do not provide reliable evidence of benefit of medical transition (Cantor decl., section XIII.B. and XIII.C.), explicating either how they found medicalized transition *not* to be superior to psychotherapy (Costa 2015; Achille 2020; Tordoff 2022) or how they confounded medical transition with psychotherapy and so could not distinguish the source of any improvements (van der Miesen 2020; Kuper 2020). Dr. Budge did not contest any statement about these studies in my declaration, including no contest to my demonstration that these studies are scientifically unable to support the conclusions to which Dr. Budge puts them.

22. The remaining two of these seven studies are similarly unable to support Dr. Budge's conclusion. Both Green et al. (2021) and Turban et al. (2020) are surveys yielding correlational data. (Indeed, they are both from the same survey.) They do not demonstrate

[3] Block, J. (2023). Gender dysphoria in young people is rising—and so is professional disagreement. *British Medical Journal, 380,* p. 382.

that transition *caused* an improvement in mental health—They equally reflect that youth with better mental health are the ones who receive permission to transition in the first place. Dr. Budge did not contest my reminder that it is a scientific error to infer causation from correlation. Yet she repeatedly engaged in that error.

23. Left off of Dr. Budge's list of studies were the still other studies that attempted to find improvement in transitioned groups but did not find such improvement. (Cantor declaration, section XIII.A.) Dr. Budge's rebuttal represents demonstrable cherry-picking—citing only the studies that (seem to) suggest improvement while neglecting to mention the others showing how unreliable the finding is. This is the very misrepresentation of science that the systematic review process was designed to prevent.

24. Dr. Budge's analysis of suicide and suicidality defy the scientific method. As included in my initial declaration, "correlation does not imply causation." Although Dr. Budge did not contest that, her analysis of the suicide and suicidality data violated that principle. Indeed, the Budge declaration makes explicit what her analysis was based on (Budge rebuttal ¶45), and that basis is an explicit admission of doing exactly the opposite. Dr. Budge's exact words: "Suicide attempts and suicide are interrelated, a treatment that reduces the former reduces the latter." That mistaken belief is mistaken because it means to infer causation from correlation.

II. Response to Dr. Shumer.

25. Dr. Shumer claimed my initial declaration "does not offer a single expert opinion that directly relates to Arizona's law" (Shumer rebuttal ¶42). Although the purpose of my declaration is to assist the court rather than Dr. Shumer, the relevance of this material is straight-forward: The perceived need to play on other-sex teams is to facilitate and participate in the child's social transition, which the evidence suggests greatly increases the probability of medical transition. Thus, making an informed decision about beginning that process requires the objective science for assessing claims about the outcomes of that process.

26. Dr. Shumer's initial declaration did not provide evidence-based opinions,

citing in total exactly one article, as I indicated in my initial declaration. In his rebuttal declaration, Dr. Shumer re-asserted his central claim, "Studies have repeatedly documented that pubertal suppression and hormone therapy are safe and effective treatments for transgender adolescents with gender dysphoria" (Shumer rebuttal ¶47), this time including a footnote listing eight studies. The list of eight is identical (and was even cited in the same order as) presented by Dr. Budge, with the exception of de Vries 2014 added to the end. That study was also discussed in my initial declaration, noting it was one of the studies to have confounded psychotherapy with medical transition.

27. Like Dr. Budge's, Dr. Shumer's rebuttal included no summary, evaluation, or other indication of evaluating the contents of those studies. Also like Dr. Budge, Dr. Shumer provided no indication that any of my descriptions of the contents of those studies was incorrect.

28. Dr. Shumer added that "These [eight] articles represent a small percentage of the full body of literature that was utilized to create evidence-based clinical practice guidelines for the treatment of gender dysphoria in children, adolescents, and adults" (Shumer rebuttal ¶47). First, Dr. Shumer's addition of *"and adults"* hides from the reader just how little of the published evidence actually pertains to children and adolescents. The so-called "full body of literature" consists almost entirely of adults. Second, the set of studies included in my report is exhaustive—It includes all existing cohort studies reporting on the outcomes of these children. No study is left out, and Dr. Shumer cites no such study that I left out. The systematic reviews conducted by the multiple national public health care systems identified the same set of studies as appear in my report (with the exceptions of the most recent such studies, published afterwards). Dr. Shumer insinuates the existence of studies that do not, in fact, exist. Third, Dr. Shumer's claim included that the "clinical practice guidelines" were based on "the full body of literature." That claim also is untrue: Table 1 in my report (page 31) listed *every* study that was included in the systematic reviews from WPATH (e.g., Baker et al., 2021) and the Endocrine Society (Hembree et al., 2017). The Endocrine Society review included exactly *one* study about minors, and the

WPATH review included *zero* studies about safety. Studies cited outside the systematic review process are subject to cherry-picking and other biases. There is no objective basis justifying Dr. Shumer's claims.

29. My initial declaration presented the standard *Pyramid of Evidence* in science (section III.A.) which illustrates the highest level of evidence being the systematic reviews (section III.B.) and points out that randomized-controlled trials (RCTs) are the level capable of distinguishing correlations (which provide only ambiguous conclusions) from cause (section III.C.). In his rebuttal declaration, Dr. Shumer contradicts both himself and the scientific method itself (Shumer rebuttal ¶50), writing: "Dr. Cantor also spends more than 10 pages of his declaration discussing the 'Pyramid of Standards of Evidence' to support his claim that the evidence supporting puberty suppression and hormone therapy is not based on randomized controlled trials and is therefore not reliable. (Cantor Decl. ¶¶ 38–66.) While I agree with Dr. Cantor that randomized control trials are an excellent study design in many contexts, such trials are not ethically permissible for treatments that are already known to provide a benefit to patients, which includes the use of GnRHa and hormone therapy to treat gender dysphoria in adolescents."

30. First, Dr. Shumer's argument engages in a profound bait-and-switch: My declaration (¶¶71–104) very clearly and consistently emphasized that it is the lack of *systematic reviews* (the highest level) that are misguiding many policies. As explicated in my declaration, the national health care systems of several countries have conducted systematic reviews (Cantor initial declaration, section VI.), but the U.S.-based clinical groups have not (section, VII.).

31. Regarding the ethics of conducting RCTs, Dr. Shumer's bait-and-switch is with *placebo-controlled* RCTs with *active-comparator* RCTs. As already noted (¶14 herein, regarding Dr. Budge's same error), an RCT with an active-comparator is the medical standard and is recommended by England's National Health Service. Dr. Shumer did not contest or mention these facts.

32. Third, Dr. Shumer is quite circular in his logic. He claims RCTs of transition

cannot be conducted because transition is "already known" to be beneficial; however, the only way to know what is beneficial is to conduct an RCT. As already noted in my initial report, it is not possible to infer causation from correlation (Cantor decl ¶56)—Dr. Shumer does not contest (or mention) this, but repeats exactly that error in claiming transition causes benefits on the basis of correlations only (i.e., evidence below the RCT-level on the *Pyramid of Evidence*). Rather than acknowledge current evidence to be limited and therefore able to justify only a cautious approach, Dr. Shumer is instead excusing the lack of strong evidence and advocating clinicians to proceed as if the evidence were definitive and unambiguous anyway.

33. Dr. Shumer did not contest, respond to, or mention my noting or the systematic reviews' noting that, because none of the subset of studies suggesting possible improvement were RCTs, it cannot be known whether differences in mental health level were actually due to the psychotherapy the study participants were receiving at the same time, to placebo effects, to survivorship bias (regretful patients dropped out), selection bias (only healthier patients being permitted to transition in the first place), or other issues that require an RCT to be ruled out.

34. In his initial declaration, Dr. Shumer repeatedly claimed gender identity was *internal*—an *internal* sense (Shumer decl ¶23) and an *internal* phenomenon (Shumer decl ¶23). After the reminder in my declaration that science requires claims be objective, testable, and falsifiable (Cantor decl., IV.A.), Dr. Shumer's rebuttal now claims instead that gender identity is "ascertained through *observation*" (Shumer rebuttal ¶59). Dr. Shumer is either attempting to have it both ways or does not know what these terms mean. If a feature is internal, it cannot be observed. If it can be observed, it is not internal.

35. There is little that can be said to Dr. Shumer's profoundly anti-scientific belief that a concept being internal and ascertainable only by conversation "makes it not less valid or 'scientific'" (Shumer rebuttal ¶59). In point of fact: Yes, it does. If being internal and ascertainable only by what someone says met the bar for "scientific," then one's telling of one's internal religious experiences would represent scientific evidence for

the existence of divinity.

36. Dr. Shumer's comments regarding attempts to "change" gender identity are another bait-and-switch. The issue is not using psychotherapy to "change" gender identity, but to help identity when and if a minor is mistaking their experiences to represent gender dysphoria when it instead represents a different issue—one can be helped without the risks posed by medicalized transition.

37. Dr. Shumer's difficulties in accessing non-English research articles do not change the international consensus of scientists. Moreover, Dr. Shumer is in error in asserting that the Sweden research is unavailable in English: It is, in fact, published as a peer-reviewed study in English (Ludvigsson, J. F., Adolfsson, J., Höistad, M., Rydelius, P.-A., Kriström, B., & Landén, M. (2023). A systematic review of hormone treatment for children with gender dysphoria and recommendations for research. *Acta Paediatrica*. doi: 10.1111/apa.16791).

38. Dr. Shumer has no basis for dismissing a claim I made because it was sourced to a press release. My claim was about the status of the French public health care system, and the press release was from that very ministry—it is a perfectly legitimate source for that information. Dr. Shumer's objection would be appropriate if it were the source for a scientific fact, which, in my report, it was not.

39. In my initial report, I summarized the public health care systems of multiple countries increasingly banning medicalized transition of minors, quoting their conclusions directly. Dr. Shumer contested my use of the term "ban" as some of these policies permit exceptions. Dr. Shumer's analysis is in error: A "ban" in public health care is not the same as a "ban" in the U.S. In a national, public health care system, it is possible to entertain exceptions: All medical cases are known to the government, because all medical cases are funded by the government. It is possible to know when only exceptional cases are being treated as exceptions. The U.S. has no such centralized tracking system, supervision system, or enforcement system. It is possible in these countries to detect when flexibility is being abused, deeming nearly all transition-seekers to be "exceptions." Because the U.S.

system has no such supervision or enforcement system, it includes the danger, arguably even the history, of engaging in exactly such abuse.

40. Dr. Shumer is in error to cite Haldeman (2022) as evidence regarding "conversion therapy" for gender identity. First, Haldeman (2022) is a collection of others' writings, none of which is a peer-reviewed document. Second, Shumer engages in another bait-and-switch, this time with sexual orientation with gender identity. The text below is the overview published in Haldeman (2022). The overview includes both *sexual orientation* change efforts (SOCE) and *gender identity* change efforts (GICE), and it associates the ineffectiveness and only with SOCE, not GICE. Dr. Shumer, however, applies it to GICE.

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

Dated: June 29, 2023 *<u>/s/ Dr. James M. Cantor, Ph.D.</u>*

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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 **Rebuttal Declaration of Dr. Gregory A. Brown, Ph.D., FACSM, in Further Support of Intervenor-Defendants' Opposition to Plaintiffs' Motion for a Preliminary Injunction**

I, Gregory A. Brown, declare as follows:

1. I have submitted an initial declaration to this Court dated May 18, 2023.

2. I now submit this expert rebuttal declaration based on my personal knowledge, and it reflects my expert opinions.

3. In preparing this rebuttal declaration, I have reviewed the expert declarations

filed by Plaintiffs, submitted by Dr. Shumer and Dr. Budge.

4. In Dr. Shumer's rebuttal to my expert declaration, at paragraph 4, he states "the studies and findings discussed throughout Dr. Brown's declaration support the scientific consensus that the biological cause of average group differences in athletic performance between males and females is the rise in circulating levels of testosterone beginning in endogenous male puberty." This statement seems to completely ignore paragraphs 77-115 of my declaration and the data tables contained therein along with the data tables included in the appendix (pages 99-107), all of which are drawn from 16 separate sources, which document numerous differences in physical fitness and athletic performance between boys and girls before the onset of puberty.

5. In Dr. Shumer's rebuttal to my expert declaration, at paragraph 5, he states that I have misrepresented the writing of McManus and Armstrong (2011) when I wrote (in paragraph 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)." Dr. Shumer faults me for not noting that the McManus paper found no difference between the sexes in measures of *some other physical characteristics*. But I never claimed that prepubertal boys and girls are physically different in *every* respect. What I claimed—and what the McManus citation supports—is that prepubertal boys and girls are different in *some* areas that contribute to athletic performance. McManus found measurable differences between prepubertal boys and girls in body fat mass, percent body fat, lean

body mass, peak oxygen uptake, maximal pulmonary ventilation, blood volume, cardiac function.

6. I would therefore like to provide the following further quotations from McManus and Armstrong supporting my reading of the paper that boys enjoy a significant athletic advantage over girls before puberty.

7. "Small sex differences in fat mass and percent body fat are evident from mid-childhood…" (at 27) – Mid childhood is considered to be ages 6-12. This statement is used by Dr. Shumer in an endeavor to discredit my expert report, when indeed it supports my report. "Small differences" is an ambiguous term, yet athletic advantages are often the sum of many small differences (as pointed out in my declaration, differences of 3-5% are often more than the difference between a gold medal and no medal, see paragraphs 111-112). Furthermore, the magnitude of an advantage is not a deciding factor in whether that advantage is or is not allowed in sports. Anabolic-Androgenic steroids provide a 5-20% advantage in muscle *strength* (Hartgens and Kuipers, 2004) and are almost universally banned as *performance* enhancing substances. Androstenedione was sold as a testosterone enhancing nutritional supplement in the late 1990s and early 2000s and was banned as a performance enhancing substance even though research shows that androstenedione intake does not enhance the adaptations to resistance training (King et al. 1997, Brown et al. 2000). Fastskin swimming suits provide a 3.2 ± 2.4% performance benefit in swimming (Chatard and Wilson, 2008), and are banned from use by FINA.

8. "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." (at 28)

9. "In comparison to boys, girls are characterised with a smaller absolute peak VO_2. Predicted values range from 1.5 to 2.2 litres•min^{-1} in 10- to 16-year-old girls and are lower than boys by 11, 19, 23 and 27% at ages 10, 12, 14 and 16 years of age, respectively." (at 30) Peak VO_2 is an estimation of maximal oxygen consumption (called VO_2max), which accounts for 30-40% of performance in endurance exercise. Puberty is not typically

experienced by boys or girls by 10 years of age.

10. “In children, like adults, exercise pulmonary gas exchange depends on pulmonary ventilation (VE) and at maximal work rates high rates of ventilation are usual. Maximal values of 49– 95 litres•min^{-1} have been recorded for girls between the ages of 9 and 16 years [] and there is a consistent sex difference with values somewhat higher in boys (58– 105 litres • min^{-1}) for the same age span.” “Maximum ventilation remains higher in boys, whether controlled for body size using a ratio standard or allometric adjustment with either stature and/or body mass []. Thus, the higher peak VO_2 in boys is indeed supported by a higher VE.” (at 31)

11. When describing differences in blood volume per unit of body mass: “When normalised using a ratio standard with body mass, differences between girls and boys were apparent from about 6 years of age, with values lower in the girls.” (at 32)

12. “There are clear differences in cardiac function at rest and during exercise between girls and boys, with differences apparent even prior to puberty. The electrical conduction system is influenced by sex steroid hormones, with girls normally having higher resting heart rates than boys – somewhere in the magnitude of 90 beats per minute at around 10-12 years of age []. This is thought to relate to intrinsic differences in the sinus node pacemaker [], a difference notable at birth with newborn boys displaying lower baseline heart rates than girls []. The higher resting heart rate in girls is often explained as an artefact of differences in cardiac dimensions, and indeed the ratio of heart mass to body mass has been found to be higher in boys than girls at birth, remaining so through adolescence []. Heart volume has also been found to be greater in boys with values of 342 and 403 ml for pre-pubertal girls and boys, respectively…” (at 32)

13. “Data recently published from a thoracic impedance measure of peak C[ardiac]I[ndex] and MRI markers of cardiac size [] demonstrated that pre- pubertal boys had a 16.7% higher (a- v O_2) difference than girls.” (at 34) – Cardiac index is an assessment of the cardiac output value based on the patient’s size. Cardiac output is the volume of blood the heart pumps per minute. (a-v O_2) difference is the arterio-venous oxygen

difference, and measures how well the tissues extract oxygen from the blood stream. (a-v O_2) difference accounts for roughly 40-50% of maximal oxygen consumption.

14. "Results showed phase II pVO_2 kinetics were approximately 20% slower in pre- pubertal girls compared to boys … This is suggestive of a lower tolerance of fatigue in the girls" (at 35) – pVO_2 stand for Pulmonary Oxygen Uptake, and pVO_2 kinetics provides an insight into the integrated capacity of an organism to transport and utilize oxygen to support an increased rate of energy turnover in contracting muscle cells.

15. "To summarise, there are differences between boys and girls in the aerobic responses to exercise which cannot be accounted for solely by size." (at 35)

16. Dr. Shumer states (at paragraph 5) that the article by McManus and Armstrong is published in the journal *Medicine and Science in Sports and Exercise* (which is the flagship journal for the American College of Sports Medicine). The referenced article by McManus & Armstrong is actually published in *Medicine and Sport Science*, which is a book series (not a journal) and is not in any way affiliated with the American College of Sports Medicine.

17. At paragraph 6, Dr. Shumer states "Dr. Brown gives the false impression that all 22 of the peer-reviewed publications demonstrated differences on total body fat. Instead, Staiano and Katzmarzyk expressly note that 'not all studies demonstrate sex differences in T[otal]B[ody]F[at] before puberty.'" Dr. Shumer contends that my report is deceptive because Staiano's conclusion—that prepubertal girls tend to have more body fat (which is exactly what the article says: "In prepubertal children, girls typically have more T[otal] B[ody] F[at] than boys.")—was not based on unanimous evidence, but rather on the weight of the evidence. Staiano noted that, of the 22 studies reviewed, four of them found similar body fat between boys and girls. Staiano suggested that these studies were influenced by a failure to control for "other influences like age, maturational status and obesity status." In any event, I did not claim that the evidence was unanimous; I simply cited the peer-reviewed conclusion reached by Staiano based on 18 of the 22 studies Staiano reviewed. That isn't deceptive. And experts do not need unanimity to reach a reliable conclusion;

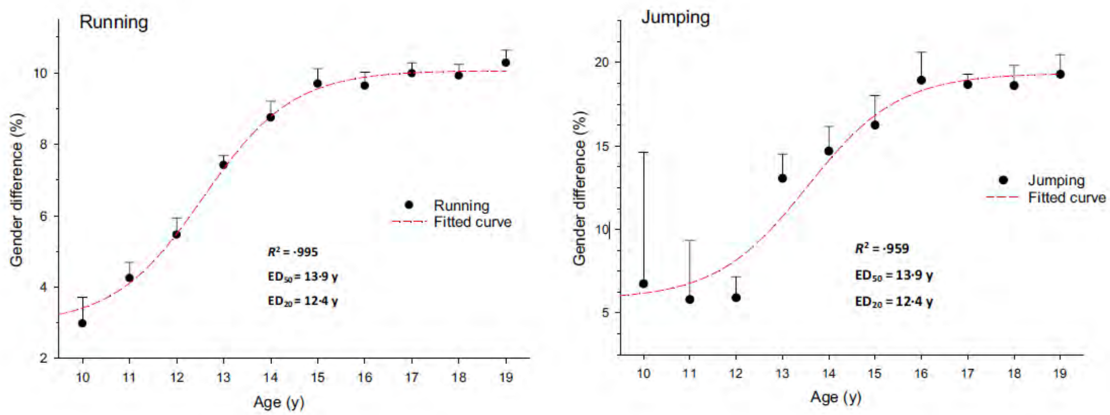
rather, they are to look to the great weight of the evidence, which is exactly what I did.

18. In paragraphs 7 and 8, Dr. Shumer criticizes my partial use of a statement from Handelsman: "Dr. Brown further misrepresents Handelsman (2018)'s findings, notably omitting key portions from the study he cites. Dr. Brown writes, '[t]here 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.' (Brown Decl. ¶ 59; Brown Hecox Decl. ¶ 88.) But Dr. Brown omits the following sentence from Handelsman which explains that '[t]he basis for the sex difference in muscle mass and strength is the sex difference in circulating testosterone.' David Handelsman, et al. Circulating Testosterone as the Hormonal Basis of Sex Differences in Athletic Performance, 39 Endocrine Revs. 803, 816 (2018) (emphasis added)." The second half of that sentence is purposefully omitted as I do not agree with the proposition that testosterone is the only factor responsible for sex-based differences in athletic performance. Indeed, I dedicate many pages of my expert report to demonstrating that there are sex-based differences in athletic performance before puberty citing numerous sources and providing many tables of data. In many places within my report, I acknowledge that puberty driven increases in testosterone in males causes large increases in the differences in athletic performance between males and females (for example, see paragraphs 126-130), so to omit a partial sentence from a single source is hardly misleading.

19. I would like to point out that after paragraph 127, I include the lower panel of figure 2 from Handelsman (2017) which shows "Fitted sigmoidal curve plot of gender differences in performance (in percentage) according to age (in years) in running, jumping and swimming events as well as serum testosterone. Data shown as mean and standard error of the mean of the pooled gender differences by age."

20. I would like to add the upper panel to figure 2 from Handelsman (2017) (see below), which shows Gender differences in performance (in percentage) according to age (in years) in running events including 50 m, 60 m, 100 m, 200 m, 300 m, 400 m, 500 m,

600 m, 800 m, 1000 m, 1500 m, 1 mile, 2000 m, 3000 m and 2 miles (upper left panel) and in jumping events including high jump, pole vault, triple jump, long jump and standing long jump (upper right panel). This figure demonstrates an average male performance advantage of ~3% in running at age 10, ~4% at age 11, and ~5% at age 12, and this figure also demonstrates an ~6% male advantage in jumping at age 10, and ~5% at ages 11 and 12. Extrapolating the error bars in these graphs (which represent the standard deviation, it is very reasonable to expect that a majority of boys at ages 10, 11, and 12 will outperform girls of the same age.



21. In paragraphs 9-12, Dr. Shumer refers to an article written for "The Conversation" (a network of not-for-profit media outlets publishing news stories and research reports online, with accompanying expert opinion and analysis written by academics and researchers) summarizing "research published in American Academy of Neurology Journal." It is important to note that the research published in the journal *Neurology*, published by the American Academy of Neurology, referenced by Dr. Shumer evaluated "Twelve functional outcome measures were collected from 1,000 healthy individuals aged 3-101 years", and did not specifically focus on children or adolescents. In The Conversation, it is explained that "As part of wider research to assess people's physical capabilities across the lifespan, we tested 300 children and adolescents between the ages of 3 and 19."[1]

[1] https://theconversation.com/when-it-comes-to-sport-boys-play-like-a-girl-80328

22. In contrast to the above citation by Dr. Shumer to a single study with "300 children and adolescents between the ages of 3 and 19," my report cited peer-reviewed research publications of a range of sample sizes focusing on children, not children as "part of wider research to assess people's physical capabilities across the lifespan."

23. Here are some of the studies I cited:

a. In a test of reaction time in Spanish Preschool children (1,845 girls and 1,896 boys with a mean age of 55.93 ± 11.14 months) boys performed better than girls (paragraphs 43 and 114 referencing Latorre-Roman et al. 2018)

b. A summary of data from "a national sample of Canadian children and youth" ages 7-17 years demonstrating that boys have higher aerobic power than girls of the same age (Paragraph 80, Citing Malina et al. 2004, and Gauthier et al. 1983).

c. In an evaluation "of 703 male and female elite young German athletes aged 8-18" (1) "fitness development precedes sports specialization" (2) and "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." (Paragraph 81 Citing Lesinski et al. 2020).

d. A total of 424,328 Greek boys and girls aged 6-18 years 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. For each of the fitness tests, performance was better in boys compared with girls, except for the sit and reach test. (Paragraphs 82 -84, 100, Citing Tambalis 2016).

e. USA Presidential Fitness Testing data for 85th and 50th percentile demonstrating that boys perform better on tests of muscle strength and running endurance (Paragraph 85-86).

f. An evaluation of 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. (Paragraphs 88-89, citing Catley & Tomkinson, 2013).

g. Evaluation of the "Eurofit" test battery on children from 30 European countries and 2,779,165 test performances in 9-17 year old boys and girls showed that boys performed better than similarly aged girls at each age on tests of muscular strength, muscular endurance, and aerobic fitness (Paragraphs 90-93, citing Tomkinson 2018).

h. An evaluation of 20m shuttle run performance in 1,142,026 children aged 9-17 in 50 countries showing that boys performed better than girls of the same age (paragraphs 94-95, citing Tomkinson et al., 2017).

i. An evaluation 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 demonstrating that boys performed better than girls in speed, lower- and upper-limb strength and cardiorespiratory fitness. (Paragraphs 97-99, citing De Miguel-Etayo et al. 2014).

j. An evaluation of 18 studies for males (N=5676 in total) and 17 studies for females (N=5489 in total) in the United States and Canada demonstrating 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 (Paragraph 101, citing Silverman 2011).

k. An analysis of vertical jump measurements of 7,614 healthy Colombian schoolchildren aged 9 -17.9 years of age, showing that boys jump higher than girls of the same age (Paragraph 103, citing Ramírez-Vélez et al, 2017).

l. An analysis of vertical jump measurements of 1,845 children aged 10-15 years in primary and secondary schools in the East of England, showing that boys jump higher than girls of the same age (Paragraph 104, citing Taylor 2010).

m. Data from USA Track & Field (Paragraphs 107, 108).

n. Data from Athletic.net for the USA (Paragraph 109, 110).

o. Data from 366 Danish boys and 332 Danish girls between the ages of 6 and 7 years old showing that boys have higher measurements of aerobic fitness, even if the boys and girls engage in the same amount of physical activity (Paragraph 113, citing Eiberg 2005).

24. In Paragraph 10, Dr. Shumer contends that age, location, or socioeconomic factors have not been controlled for in the above-referenced studies. This is quite simply not so, as the vast majority of these papers compared the performance of children of the same age (as demonstrated in the normative data presented in paragraphs 77-115 and the appendix of my declaration), and, as explained above, the male advantages have been documented in a wide range of countries.

25. To further demonstrate that prepubertal boys exhibit advantages in measure of physical fitness and motor control which give them advantages in sports compared to girls of the same age, here are even more papers:

a. A Systematic Review and Meta-Analysis of 38 articles studies were carried out in 19 different countries (Australia, Belgium, Brazil, Britain, China, Croatia, Germany, Iran, Indonesia, Ireland, Japan, Korea, Myanmar, Poland, Portugal, Puerto Rico, Singapore, South Africa, and the USA representing data for 8394 children ages 3-6 years old who were assessed for object control skills. Significant differences were found, favoring boys vs. girls at ages 3, 4, 5, and 6 with at least some of the differences attributable to biology (Zheng et al, 2022).

b. 1,682 children and adolescent aged 6-17 years from central Spain, divided into prepubertal and pubertal groups based on Tanner stages demonstrating that pre-pubertal boys had more muscle mass, less fat mass, and performed better girls on tests of countermovement jump, handgrip strength, and 20 m shuttle run (Manzano-Carrasco et al. 2022).

c. 3,179 preschool children (1678 boys) ages 2.8-6.4 years from 10 different cities and towns in Spain and found boys outperformed girls in the 20 m shuttle run, handgrip strength, standing long jump, and 4X 10 m shuttle run (Cadenas-Sanchez, 2019).

d. 31,484 children (16,023 boys and 15,461 girls) ages 6-11 years old from a representative sample of the French population with boys performing better on tests of Cardiorespiratory fitness, muscular endurance, and speed (Vanhelst et al. 2020).

e. 341 young Nigerian children (ages 3 to 5) At each age level the boys consistently performed better than the girls tests of catching, standing long jump, tennis ball throw and speed run (Toriola and Ingokwe, 1986).

f. 434 low-income preschool children from Santiago Chile (246 boys; 5.48 ± 0.31 years) showing that boys were heavier and taller thang girls, with boys performing better on handgrip strength test, standing long jump. and 20 m sprint (Cadenas-Sanchez, 2015).

26. It is also important to note that sports do not take into account socioeconomic factors or location. For example, at a youth wrestling tournament the athletes may be categorized based on sex, age, and body weight, but not socioeconomic status or location. In a youth soccer tournament, the athletes may be categorized based on sex, age, or possibly the team skill rating, but not socioeconomic status or location.

27. In Paragraph 12, Dr. Shumer claims that there has been wide replication of the lack of difference in sporting performance between prepubertal boys and girls and states that there is a general consensus that there are no sex-based differences in athletic performance before puberty, and yet cites only two sources. Neither of these sources professes to present a scientific consensus statement on the presence or lack of sex-based difference in performance before puberty.

28. In reading Senefeld et al., Sex Differences in Youth Elite Swimming, 14 PLOS ONE 1, 1–2 (2019), these authors cite only two sources regarding the sex-based differences in sporting performance in 10 to 12-year-olds, one of which is the Handelsman (2018) paper and the other is a paper by Tonnessen et al. (Performance development in

adolescent track and field athletes according to age, sex and sport discipline. PloS one. 2015;10(6):e0129014). Indeed, Senefeld et al. state "However, the sex-based differences in performance prior to age 10 are unknown …" (at page 2) and "However it is clear that these data provide one of the only examples of faster (or at least not slower) sports performance for girls than boys." (at page 8)

29. In paragraph 13, Dr. Shumer describes these data as "Demographic Data", which is incorrect. Demographic data are used to help understand the statistical characteristics of human populations. Demographic data can contain specific information about the characteristics of a given population, such as the following: age range, race and ethnicity, sex, gender, level of education, income, employment status, occupation, homeownership, birth rates, death rates, marriage rates, religious affiliation, political affiliation, spoken language, geographic location, or hobbies and interests. Many of the studies which Dr. Shumer calls demographic data are normative data, which are information from a population of interest that establishes a baseline distribution of results for that particular population (Lee & Schuele, Abdi & Williams, Encyclopedia of Research Design, Sage Publications, 2010).

30. The competition data presented in my report represent the under-8 and 9 to 10-year-old records from USA Track & Field, and annual performance data gleaned from Athletic.net for the State of Arizona in 2022, and for the entire United States in 2021.

31. I recently (June 2, 2023) presented research at the 2023 annual meeting of the American College of Sports Medicine using nationwide results from Athletic.net demonstrating that over the years 2017-2021, the top 10 boys ages 7-8 and 9-10 ran faster than girls of the same ages and jumped higher and father in 100m, 200m, 400m, 800m, 600m, high jump and long jump by 3-10% than the girls in every event every year (Brown GA, Brown CJ, Shaw I, Shaw B. Boy and Girls Differ in Track and Field Event Performance Before Puberty. 70th Annual Meeting of the American College of Sports Medicine. Denver CO. Presentation 2577. May 30 – June 2, 2023). There was another presentation in the same session in which the authors used data from Athletic.net for the

top 10 male and female athletes for the years 2019, 2020, and 2021 for ages 7-18 years, and observed that prepubertal males outperformed females of the same age by 3-10% in the 100m, 200m, 400m, 800, high jump and long jump every year and overall (Atkinson MA, Linde JJ, Hunter SK. Sex Differences in Performance of Elite Youth Track and Field Athletes. 70th Annual Meeting of the American College of Sports Medicine. Denver CO. Presentation 2572. May 30 – June 2, 2023). This demonstrates that (1) data from Athletic.net are considered sufficiently reliable for scholarly endeavors, and (2) prepubertal male advantages in running and jumping are consistently demonstrated in elite youth.

32. Additionally, The Motivational Times, from USA Swimming, show under 10-year-old boys consistently swimming faster than under 10-year-old girls.[2]

33. In paragraphs 14-27, Dr. Shumer contends that "Transgender girls who receive puberty suppressing medication at the onset of puberty have no athletic advantage over other girls." While Dr. Shumer is correct to state that there is no research showing puberty suppression and or cross sex hormones does not eliminate male athletic advantages, similarly there is no research showing it does. Dr. Shumer does not cite any studies showing that puberty suppression results in transgender girls exhibiting athletic performance that is the same as equally aged, gifted, and trained females. Dr. Shumer attempts to deflect the research showing the males who take puberty blockers and/or cross sex hormones retain male pattern advantages in lean body mass, muscle strength, body height, and so forth, by stating that this research does not demonstrate athletic advantages. In this he ignores the commonly held tenet in the professions of exercise physiology and strength & conditioning that lean body mass is one the major factors driving athletic performance overall, and driving the sex-based differences in athletic performance (see my declaration, paragraphs 61 and 81 for explanation of this tenet).

34. Overall, athletes spend an inordinate amount of time in the weight room, on the track, in the pool, etc. trying to improve their physical fitness, because improved

[2] https://swimswam.com/usa-swimming-releases-age-group-motivational-times-for-2021-2024/

physical fitness translates to improved athletic performance. Whether it is measured as a higher VO_2max in an endurance athlete, a higher 1-repetion maximum for a thrower or wrestler, or a larger amount of lean body mass in almost any athlete, these measures of improved physical fitness are indicators of a greater potential for successful athletic performance. The differences in physical fitness between males and females before and after puberty predispose males to a winning performance if they were to compete against females of the same age who have the same training and sports background.

35. Lean body mass is a significant determinant of muscle strength and sports performance. As demonstrated by Almiray-Stot et al. (2022), in healthy children ages 5 to 19-years-old, lean body mass is significantly correlated to muscle strength in both boys and girls "Highly positive correlations of muscle strength with lean mass in upper limbs were found r-values 0.87-0.92 for boys and r = 0.80-0.86 for girls. High and moderate positive correlations for lower limbs were also noted for upper limbs: r = 0.74-0.86 for boys and r = 0.67-0.82 for girls." (at 597). And, as observed by Zaras et al. (2020) in well trained adult female weightlifters: "Very large to nearly perfect correlations were found between snatch and clean and jerk for trunk lean body mass (r = 0.959 and 0.929) (at 1)." The connection between lean body mass and muscle strength is quite clear, and the muscle strength is very important to sports performance as stated by Comfort et al. (2023) in the *National Strength and Conditioning Association Position Statement on Weightlifting for Sports Performance*, "strength underpins performance in athletic tasks." (at 1165)

36. In paragraph 19, Dr. Shumer cites the paper by Harper on Race Times for Transgender Athletes as evidence that testosterone suppression and/or cross sex hormones eliminates male advantages. Please see my report, paragraphs 155-159, for an explanation of some of the numerous problems with the data from Harper. Also see my report paragraphs 151-152 for analysis of the papers by Roberts et al. and Chicarelli et al. regarding running times in transgender air force personnel, in which there is at least objective evaluation of endurance performance in transwomen. Also see paragraph 169 for an explanation of the work by Alvares on VO_2max in transwomen.

37. In paragraphs 28-31, Dr. Shumer claims that the pre-pubertal male athletic advantages are not due to "minipuberty". At no point in my declaration are the male athletic advantages differences ascribed to "minipuberty" (indeed, the term "minipuberty" is not found within my expert report).

38. It is important to note that in their initial declarations, and in their rebuttal statements, neither Dr. Stephanie Budge nor Dr. Daniel Shumer cited any peer reviewed publications or presented any data demonstrating that the use of gonadotropin-releasing hormone (GnRH) analogues (aka puberty blockers) prevent juvenile males from developing male sex-based advantages in sports performance. Specifically, neither Dr. Budge nor Dr. Shumer showed that the administration of puberty blockers causes males to cease developing sex-based differences in lean body mass, body height, muscle strength, muscle endurance, aerobic fitness, or any measure of sports-specific performance that gives males large athletic advantages over comparably aged, gifted and trained females before and after puberty.

39. In contrast, I presented considerable data and cited numerous peer reviewed publications demonstrating that males have advantages in physical fitness and sports performance before (see paragraphs 77-115, and the appendix, and the additional information in my rebuttal to Dr. Shumer) and after puberty (see paragraphs 7-73). I also cited and briefly summarized peer-reviewed publications demonstrating that administering puberty blockers does not erase male sex-based advantages in lean body mass (see my declaration paragraphs 117-121) and body height (see my declaration paragraphs 124 & 125).

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

Dated: June 29, 2023 *<u>/s/ Dr. Gregory A. Brown, Ph.D., FACSM</u>*

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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.

[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.

[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

[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.

[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

[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.

[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

[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

[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

[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

[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.

[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

[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,

[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

[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

[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.

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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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IN T E UNITED STATES DISTRICT COURT
FOR T E 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 Jame M. Cantor h.D. in S ort of Inter enor ro o ed O o ition to laintiff Motion for a reliminary In nction**

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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.

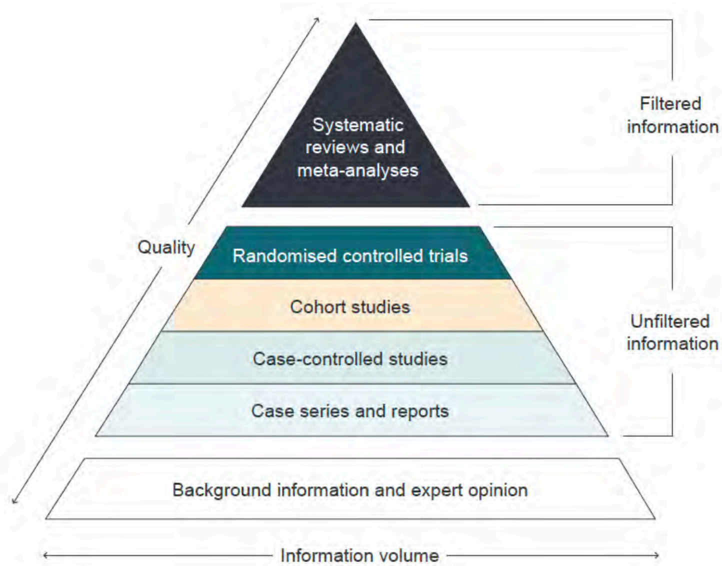
III. Clinical research has a standard *Pyramid of Evidence* that summarizes the relative strength of potential sources of information.

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 ries et al, 2011	Costa et al, 2015 de ries et al, 2011	Becker-Hebly et al, 2020 Carmichael et al, 2021 Costa et al, 2015 Hisle-Gorman et al, 2021			de ries et al, 2011
Effectiveness Sex Hormones	de ries 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 ries et al, 2014			Achille et al, 2020 de ries et al, 2014 L pez de Lara et al, 2020
Safety (Bones) GnRHa		Brik et al, 2020 Joseph et al, 2019 Khatchadourian et al, 2014 Klink et al, 2015 lot et al, 2017	Joseph et al, 2019 Klink et al, 2015 Navabi et al, 2021 Schagen et al, 2020 Stoffers et al, 2019 lot 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 lot 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, (2020), Allen, (2019), de ries, (2011), and L pez de Lara, (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

[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

[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: *<u>/s/ Dr. James M. Cantor, Ph.D.</u>*

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