

# Transwomen in elite sport: scientific and ethical considerations

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## ABSTRACT

The inclusion of elite transwomen athletes in sport is controversial. The recent International Olympic Committee (IOC) (2015) guidelines allow transwomen to compete in the women's division if (amongst other things) their testosterone is held below 10 nmol/L. This is significantly higher than that of cis-women. Science demonstrates that high testosterone and other male physiology provides a performance advantage in sport suggesting that transwomen retain some of that advantage. To determine whether the advantage is unfair necessitates an ethical analysis of the principles of inclusion and fairness. Particularly important is whether the advantage held by transwomen is a tolerable or intolerable unfairness. We conclude that the advantage to transwomen afforded by the IOC guidelines is an intolerable unfairness. This does not mean transwomen should be excluded from elite sport but that the existing male/female categories in sport should be abandoned in favour of a more nuanced approach satisfying both inclusion and fairness.

The International Olympic Committee (IOC) guidelines<sup>1</sup> that allow male-to-female transgender athletes to compete in the women's category at the elite level has raised significant debate.<sup>2–7</sup> These guidelines specify that transwomen athletes who have demonstrated total testosterone levels below 10 nmol/L for at least 12 months can compete in the women's division. The previous requirement (in the IOC's 2004 guidelines) for gender affirmation surgery has been removed.

A recent New Zealand (NZ) case has polarised opinion about the inclusion of transwomen in women's sport. Laurel Hubbard, a 39-year-old transwoman, competed in the 90 kg+ female category as a weightlifter in the 2018 Commonwealth Games. In 2017, Hubbard won silver medals at the weightlifting world championships—the first NZ weightlifter to win a medal at any world championships. Hubbard previously competed as an adult male and was a junior 105 kg+ NZ record holder. Responses to Hubbard's successes as a female competitor have ranged from support to dismay. Supporters claim she has every right to compete with the women after passing 'straight-forward' hormone regulations, and that 'anyone who says otherwise is prejudiced or jealous'.<sup>8</sup> This fits with an inclusion-first policy that argues 'there is a fundamental human right for everyone to be recognised in the gender in which they identify'.<sup>7</sup> Conversely, one of Hubbard's competitors said, "we all deserve to be on an even playing field. If (the playing field) is not even, why are we doing the sport?".<sup>8</sup> Those who object to the IOC guidelines<sup>1</sup>

argue they are unfair, specifically that transwomen who now meet those criteria have an advantage not available to cis-women, thus creating an uneven playing field<sup>8–9</sup>. These conflicting views highlight the tension between the principles of inclusion and fairness and raise the question as to whether or how transwomen should be included in elite women's sport.<sup>10</sup>

To determine whether the IOC<sup>1</sup> guidelines adequately address the fairness principle requires, among other things, a scientific understanding of whether transwomen have a performance advantage.

Here we provide a thorough examination of the science to show that elite male athletes have a performance advantage over their female counterparts due to physiological differences. By reasonable inference, the science of male physiology suggests the IOC guidelines may allow elite transwomen athletes to have a performance advantage in comparison with cis-women. On its own, this does not show that transwomen should not compete in the women's division. The arguments for inclusion must also be considered. One such argument is that transwomen should be able to compete in the women's division because even though they may have an advantage, the advantage is not unfair. After assessing the scientific and normative arguments, we conclude that the IOC guidelines are poorly drawn and do not adequately address the fairness principle in elite sport. Far from arguing that transwomen be excluded, we are in favour of a radical change to the outdated structure of the gender divisions currently used in elite sport.

## TERMINOLOGY

Before the science is discussed, it is helpful to define terms.

*Sex* refers to a person's physical characteristics, including their reproductive system (ie, whether they have ovaries or testes), hormones, chromosomes (classically male XY and female XX) and external genitalia. Sex is most commonly determined on the basis of external genitalia. *Intersex* people (ie, those with differences of sexual development (DSD)) are born with reproductive anatomy, chromosomes and/or hormones that cannot be straightforwardly categorised as male or female.

The conflation of transgender and intersex people leads to confusion around effective testosterone versus testosterone levels.<sup>3</sup> This article solely discusses transwomen, and therefore our arguments are not complicated by androgen insensitivities in which receptors are not sensitive, or only partially sensitive to testosterone.<sup>3 11–13</sup> This review only requires discussion of testosterone levels and prior male physiology.



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In the scientific literature, the terms ‘male’ and ‘female’ are used to refer to biological sex. Outside of science, ‘male’ and ‘man’ are used interchangeably, as are ‘female’ and ‘woman’. We follow both these conventions, except in cases in which doing so does not read well in everyday English.

*Gender* refers to one’s sense of self as a man or a woman (or something else such as gender-neutral or gender-fluid). *Cis-women* are those women whose sex and gender align—they are born female and identify as such. Equally, a cis-man’s sex and gender are both male. For a minority of people, sex and gender do not align. A person may be of the male sex but identify as a woman, or be of the female sex but identify as a man. These people are *transgender*.<sup>1</sup> A transgender person may or may not undergo transition, including social changes (coming out to friends and family, changing one’s name, personal pronoun, style of dress) and medical intervention (hormone therapy, gender affirmation surgery).

A transwoman who has had full gender affirmation surgery (including testes removal) will have very low testosterone levels below 1 nmol/L.<sup>14</sup> These transwomen will have much less opportunity for a performance advantage in comparison to elite cis-women athletes. Henceforth, unless specifically stated, we use the term ‘transwomen’ to refer to those elite transwomen athletes who have testosterone levels from 6 to 10 nmol/L (primarily in cases in which a transwoman has retained her testes). Equally, we use the term ‘cis-women’ to refer to elite cis-women athletes.

Unless stated otherwise, this article solely concerns elite sport. We use Swann *et al*’s<sup>15</sup> definition of *elite athlete* which includes athletes competing at national, professional or university (in USA) levels, either paid or unpaid<sup>7 15 16</sup>.

Finally, *inclusion* refers to the idea that all athletes should be included.<sup>7</sup> *Fairness* in sport can be used in a broad sense in which inclusion is considered an aspect of fairness.<sup>16</sup> However, to clearly illustrate the conflict between the principles of fairness and inclusion in sport, for the purposes of this article we will not consider inclusion to be an aspect of *fairness*. Instead, we use *fairness* more narrowly to refer to the idea that all athletes must begin from roughly the same starting point.

## DIFFICULTY TALKING ABOUT THIS TOPIC

Discussing transwomen’s inclusion in elite women’s sport is a difficult conversation. Even asking whether transwomen have an unfair performance advantage over cis-women might be offensive to some. Any discussion questioning the inclusion of transwomen may be dismissed as transphobic, prejudiced or coming from a lens of cis-normativity. We recognise the importance of including transpeople in society, including sport, and acknowledge the difficulties faced by many transpeople in establishing safe spaces in everyday life (Bagger<sup>17 18</sup>). However, it is critical that the guidelines attend to both fairness and inclusion to meet the needs of both transwomen and cis-women.

## GUIDELINES

### IOC guidelines

In 2015, the IOC updated its guidelines, declaring that transwomen athletes can compete in the women’s division, if: (A) They have declared, for sporting purposes, their gender to be female for at least 4 years. (B) Their blood testosterone levels are below 10 nmol/L for at least 12 months prior to competition.

(This is a general guideline and cases may be reviewed on an individual basis to determine whether 12 months is sufficient time to minimise advantage.)

The 2015 IOC guidelines are markedly different from the 2004 IOC guidelines which held that transgender people who had transitioned after puberty could participate in future Olympic competitions in line with their gender identity if they had: (A) Fully transitioned, that is, they had taken hormone treatment for a minimum of 2 years and had had genital affirmation surgery (including removal of testes for transwomen). (B) Lived in their experienced gender for a minimum of 2 years. (C) Legal recognition of their gender.

A significant difference from the 2004 to the 2015 policies is that genital affirmation surgery is no longer required, instead relying on hormone therapy to maintain testosterone levels under 10 nmol/L for 1 year.<sup>5</sup> This cap was selected because it is at the lower end of the testosterone level for young (< 40 years old) adult men.<sup>19</sup>

In the remainder of this paper, we ask whether 10 nmol/L is too high because the normal healthy female testosterone range is 0–1.7 nmol/L.<sup>19 ii</sup>

The 2004 IOC position is a heavily restricted inclusion model. The 2015 guidelines have moved along the spectrum to a more inclusive and less invasive approach. At the same time, the IOC maintains that the overriding sporting objective of the Olympics is fair competition.<sup>1</sup> Further restrictions may be implemented if it is ‘necessary and proportionate to the achievement of that objective (fairness)’ and it is possible that transathletes may be further restricted ‘in light of any scientific or medical developments’.<sup>1</sup>

### Canadian Centre for Ethics in Sport

In 2016, the Canadian Centre for Ethics in Sport (CCES) published guidelines pertaining to the inclusion of transpeople. The CCES noted seven principles of sport, two of which are important for our purposes, namely, ‘include everyone’ and ‘fair play’.<sup>7</sup> The CCES considered transpeople’s participation at all levels of sport and concluded that inclusion is the most important principle. However, they recognised that for high performance sport, the ‘fair play’ principle requires greater consideration (c.f. the 2015 IOC guidelines which claim that fair competition is the overriding sporting objective of the Olympics).<sup>7</sup> With this in mind, CCES provides the following policy guidelines.

1. Hormone therapy is not required unless it can be shown that it is a reasonable and bona fide requirement. The burden of proof is on the sporting organisation to demonstrate a need for hormone therapy.
2. Declaration of trans status is not required unless there is a justified reason. Transpeople are not required to disclose personal information beyond that required by cis-gender athletes.
3. Gender affirmation surgery is not required for any reason.<sup>7</sup>

CCES says that for most sports, there is insufficient evidence to require hormone therapy for transathletes. They say that while there is a ‘persistent, ingrained assumption ... that men are generally faster, stronger, and better at sport than women’,<sup>7</sup> there is a lack of scientific evidence to directly and consistently connect endogenous testosterone levels with athletic performance.<sup>7</sup>

<sup>i</sup>An individual’s sexuality (whether they are homosexual, heterosexual or something else) is irrelevant to whether a person is cisgender or transgender.

<sup>ii</sup>As measured by liquid chromatography-mass spectrometry (LCMS).

The CCES base their inclusive policy on the paucity of direct evidence concerning the competitive advantage of transwomen and use the absence of evidence as a green light for including transathletes. They maintain that the benefits of testosterone must be proven to require regulation.<sup>7</sup> In the following section, we show that there is evidence to suggest transwomen have a performance advantage over cis-women. We use the term *suggest* because there have been very few studies on the performance of transwomen athletes at the elite level. (Harper's<sup>20</sup> study does not consider elite athletes, and is limited insofar as it has a very small sample size.) Given the absence of evidence directly related to elite transwomen athletes, and as transwomen were previously biologically male, we extrapolate from evidence based on male physiology.

## SCIENCE

Two fundamental assumptions emerge from the IOC guidelines.

1. High testosterone levels provide an all-purpose benefit in sport.
2. Transwomen with testosterone levels under 10 nmol/L for 1 year have mitigated the performance advantage of their former male physiology.

### Assumption 1: high testosterone levels provide an all-purpose benefit in sport

It is well recognised that testosterone contributes to physiological factors including body composition, skeletal structure, and the cardiovascular and respiratory systems across the life span, with significant influence during the pubertal period.<sup>19</sup> These physiological factors underpin strength, speed and recovery<sup>21</sup> with all three elements required to be competitive in almost all sports. An exception is equestrian, and for this reason, elite equestrian competition is not gender-segregated. As testosterone underpins strength, speed and recovery, it follows that testosterone benefits athletic performance.

A complicating factor arises. The extent to which strength, speed and recovery are advantageous changes depending on the sport in question. For example, lawn bowls requires less strength, speed and recovery than many other sports, and so the advantage that testosterone provides is less pronounced. Similarly, the advantage acquired from an individual having high levels of testosterone will apply to team sport, but will be more pronounced in individual sport.

There is little question that strength, speed and recovery influence athletic performance. When considering performance, the parameters that comprise body composition requiring consideration are the percentage of muscle versus fat, and bone strength. On average, from puberty onwards, men have considerably more muscle and less body fat than women.<sup>22 23</sup> Puberty is associated with increased testosterone production in men, and many studies now show testosterone is a key driver of muscle mass. For example, young men administered testosterone in a dose-dependent manner (8.8–82 nmol/L) showed significant increases in muscle mass and strength.<sup>24</sup> Testosterone administration to men has also been shown to protect against loss of muscle mass and strength by increasing muscle protein synthesis and decreasing protein degradation.<sup>25</sup>

Testosterone also has a strong influence on bone structure and strength. From puberty onwards, men have, on average, 10% more bone providing more surface area.<sup>23 26 27</sup> The larger surface area of bone accommodates more skeletal muscle so, for example, men have broader shoulders allowing more muscle to build. This translates into 44% less upper body strength for

women, providing men an advantage for sports like boxing, weightlifting and skiing.<sup>28–30</sup> In similar fashion, muscle mass differences lead to decreased trunk and lower body strength by 64% and 72%, respectively in women.<sup>22 28 29 31</sup> These differences in body strength can have a significant impact on athletic performance, and largely underwrite the significant differences in world record times and distances set by men and women.<sup>32</sup>

In contrast, the major female hormones, oestrogens, can have effects that disadvantage female athletic performance. For example, women have a wider pelvis changing the hip structure significantly between the sexes. Pelvis shape is established during puberty and is driven by oestrogen.<sup>33</sup> The different angles resulting from the female pelvis leads to decreased joint rotation and muscle recruitment<sup>34–36</sup> ultimately making them slower.<sup>37 38</sup> Oestrogens also affect body composition by influencing fat deposition. Women, on average, have higher percentage body fat, and this holds true even for highly trained healthy athletes (men 5%–10%, women 8%–15%).<sup>39</sup> Fat is needed in women for normal reproduction and fertility, but it is not performance enhancing. This means men with higher muscle mass and less body fat will normally be stronger kilogram for kilogram than women. In short, higher testosterone levels lead to larger and stronger bones as well as more muscle mass providing a body composition-related performance advantage for men for almost all sports. In contrast, higher oestrogen levels lead to changes in skeletal structure and more fat mass that can disadvantage female athletes, in sports in which speed, strength and recovery are important.

Testosterone also influences the cardiovascular and respiratory systems such that men have a more efficient system for delivering oxygen to active skeletal muscle. Three key components required for oxygen delivery include lungs, heart and blood haemoglobin levels. Inherent sex differences in the lung are apparent from early in life and throughout the life span<sup>40</sup> with lung capacity larger in men because of a lower diaphragm placement due to Y-chromosome genetic determinants.<sup>41 42</sup> The greater lung volume is complemented by testosterone-driven enhanced alveolar multiplication rate during the early years of life.<sup>43</sup>

Oxygen exchange takes place between the air we breathe and the bloodstream at the alveoli, so more alveoli allows more oxygen to pass into the bloodstream. Therefore, the greater lung capacity allows more air to be inhaled with each breath. This is coupled with an improved uptake system allowing men to absorb more oxygen. Once in the blood, oxygen is carried by haemoglobin. Haemoglobin concentrations are directly modulated by testosterone<sup>24 44</sup> so men have higher levels and can carry more oxygen than women.<sup>45</sup> Oxygenated blood is pumped to the active skeletal muscle by the heart. The left ventricle chamber of the heart is the reservoir from which blood is pumped to the body. The larger the left ventricle, the more blood it can hold, and therefore, the more blood can be pumped to the body with each heartbeat, a physiological parameter called 'stroke volume'. The female heart size is, on average, 85% that of a male resulting in the stroke volume of women being around 33% less.<sup>46</sup> Putting all of this together, men have a much more efficient cardiovascular and respiratory system, with testosterone being a major driver of enhanced aerobic capacity.

Combining all of this information, testosterone has profound effects on key physiological parameters that underlie athletic performance in men. There is substantial evidence regarding the effects on muscle gain, bone strength, and the cardiovascular and respiratory system, all of which drive enhanced strength, speed and recovery. Together the scientific data point

to testosterone providing an all-purpose benefit across a range of body systems that contribute to athletic performance for almost all sports. This is exemplified best by the male dominance of sporting world records. Therefore, the first assumption underlying the IOC guidelines is true. Transwomen are allowed to compete with testosterone levels just under 10 nmol/L. This is more than five times the upper testosterone level (1.7 nmol/L) of healthy, premenopausal elite cis-women athletes.<sup>19</sup> Given that testosterone (as well as other elements stemming from Y-chromosome-dependent male physiology) provides an all-purpose benefit in sport, suggests that transwomen have a performance advantage.

### Assumption 2: transwomen with testosterone levels under 10 nmol/L for 1 year have mitigated the performance advantage of their former male physiology

We now argue that in addition to higher testosterone levels, transwomen will retain some of the advantages of their former male physiology regardless of 1 year of hormone therapy. Contrary to the second assumption underlying the IOC guidelines, lowering a transwoman's testosterone to under 10 nmol/L does not entirely mitigate the physiology of prior exposure to testosterone and other Y-chromosome genetic determinants. The common hormone therapy for transwomen involves lowering testosterone levels coupled with the administration of the major female hormone, oestradiol. The altered hormonal milieu has pronounced effects on male physiology, including breast development and reduction in body hair. However, there is very little scientific evidence to provide assurance that such hormone therapy will mitigate the advantage transwomen may have in comparison with cis-women athletes. As discussed above, testosterone is central to male physiology and subsequent athletic performance. Lowering testosterone levels to 10 nmol/L could impact on muscle mass and haemoglobin levels because these are positively regulated, in a dose-dependent manner, by testosterone. However, it has been demonstrated that healthy young men did not lose significant muscle mass (or power) when their circulating testosterone levels were reduced to 8.8 nmol/L (lower than the IOC guideline of 10 nmol/L) for 20 weeks.<sup>24</sup> Moreover, retention of muscle mass could be compensated for by training or other ergogenic methods.<sup>47</sup> In addition, the phenomenon of muscle memory means muscle mass and strength can be rebuilt with previous strength exercise making it easier to regain muscle mass later in life even after long intervening periods of inactivity and mass loss.<sup>48–49</sup> Also, indirect effects of testosterone will not be altered by hormone therapy. For example, hormone therapy will not alter bone structure, lung volume or heart size of the transwoman athlete, especially if she transitions postpuberty, so natural advantages including joint articulation, stroke volume and maximal oxygen uptake will be maintained.<sup>50</sup>

While testosterone is the well-recognised stimulator of muscle mass gain, administration of oestradiol has also been shown to activate muscle gain via oestrogen receptor- $\beta$  activation.<sup>51–55</sup> The combination of oestradiol therapy and a baseline testosterone of 10 nmol/L arguably provides transwomen athletes with an added advantage of increased muscle mass, and therefore power. A recent meta-analysis shows that hormone therapy provided to transwomen over 2 years maintains bone density<sup>56</sup> so bone strength is unlikely to fall to levels of cis-women, especially in an elite athlete competing and training at high intensity. Increased bone strength also translates into protection against trauma, helping with recovery and prevention of injury.<sup>57</sup>

Hence, having transwomen compete in the women's division if their testosterone levels are just under 10 nmol/L will not negate all the performance advantages accrued from having a male physiology prior to transition. A transwoman athlete will retain some of the advantages accrued prior to receiving hormone therapy.<sup>58</sup>

In summary, assumption 1 is true—testosterone provides an all-purpose benefit in almost all sports. Assumption 2 is false. A transwoman athlete with testosterone levels under 10 nmol/L for 1 year will retain at least some of the physiological parameters that underpin athletic performance. This, coupled with the fact that transwomen athletes are allowed to compete with more than five times the testosterone level of a cis-woman, suggests transwomen have a performance advantage.

Proponents of inclusion argue because there are no studies on elite transwomen athletes, and our conclusions are extrapolated from studies on male physiology, there is therefore insufficient evidence to show that transwomen have a performance advantage. However, science does show that having both high testosterone levels and prior male physiology means that transwomen will likely have an inherent advantage in almost all sports.

While the science demonstrating a performance advantage is necessary, normative arguments regarding the inclusion of transwomen in the women's division need to be considered.

### ARGUMENTS FOR AND AGAINST INCLUSION

We now present the arguments for inclusion of transwomen in the women's category in elite sport, and each counterargument:

1. Those transwomen athletes who meet the criteria set by the IOC should compete in the women's division.
2. Transwomen identify as women and so should be able to compete in the women's division.
3. The advantage that transwomen have is a tolerable unfairness.
4. As transpeople face discrimination in many spheres of life, they should compete in the gender division in which they identify.
5. The science has been developed using a cis-normative lens.
6. The male/female binary is socially constructed, so athletes ought to be able to switch between men's and women's divisions.

(1) Transwomen athletes who have met accepted IOC criteria should compete in the women's division. These criteria should be followed either because (A) they are fair. Or (B) because they are the established eligibility criteria.

The first point could be countered by showing that the eligibility criteria for the women's category are unfair because, as explained in the science section, transwomen have a significant performance advantage from being able to compete with testosterone levels just under 10 nmol/L and because there has been no thorough exploration of the advantage of having a prior male physiology (for the elite athlete). As Teetzel points out, 'adding a rule or eligibility requirement in a policy or rulebook does not make the rule fair, even if the sports organisation can legally enforce the addition'.<sup>59</sup>

The claim that transwomen have a performance advantage is supported by evidence that testosterone in men is a driving force for the striking dominance of men in elite sport. However, currently women with hyperandrogenic states (having excessive levels of the androgenic hormones including testosterone, such as DSD) compete in the women's division without restrictions. This is despite evidence, although contested, that the high

testosterone levels lead to a performance advantage.<sup>60–62</sup> Both DSD (excess hyperandrogenism) and PCOS (mild hyperandrogenism) are overrepresented among elite women athletes when compared with the wider population.<sup>60 63 64</sup> Recently, based on evidence that hyperandrogenism is associated with performance advantage, the IAAF have lowered the acceptable level of testosterone to 5 nmol/L for some ‘restricted’ events.<sup>65 66</sup> Hence, the eligibility criteria for transwomen may also be unfair to cis-women, and therefore the guidelines need further attention.

Advocates of inclusion could then argue that transwomen athletes who meet the criteria should be able to compete even if the criteria are unfair and afford transwomen a performance advantage because hyperandrogenism already exists in the women’s division. As elite sport has eligibility criteria for transwomen, we agree that until a change is made, transwomen who meet such criteria should compete in the women’s division.

(2) Inclusion is an important principle in society. Transwomen identify as women and as such should be included within the women’s division in elite sport.

The most common counterargument used by the popular press and cis-gender athletes and their coaches is that the inclusion of transwomen is unfair because they have a physiological advantage. As noted above, we take *fairness* to refer to the idea that all athletes must begin from roughly the same starting point. As Simon explains, ‘if one individual has a competitive advantage over another due to differences in initial circumstances that were under the control of neither, the favoured individual can claim no credit for the successes that flow from that undeserved head start’<sup>18 67</sup>; see also Sher 1979, Loland, 1999). For example, it would be unfair to allow a competitive cyclist to use a hidden electric motor, where others do not. The principle of fairness is the reason why there are sporting regulations prohibiting certain technological advancements (swimsuits using sharkskin technology to reduce drag) or standardising equipment for all (fibreglass pole vaults). The purpose of such standardisation is to level the playing field with regards to that particular concern so the most skilful athlete wins.

The principle of fairness relies on acceptance of the ‘skill thesis’ which states that the purpose of competitive sport is to identify who is the most skilful.<sup>3 67</sup> Neither Simon nor Bianchi define *skill* with respect to sport. It is incredibly difficult to pin down the meaning of *skill*. However, we take the most skilful athlete to be the one who maximises natural talent via training).<sup>3</sup> We recognise that this definition is problematic because, as discussed below, some natural talents (advantages) are deemed fair while others are not.

Nor do Simon or Bianchi explain how to determine the most skilful athlete. The most skilful athlete is not always the winner of the competition in question. This is because who wins a competition is also influenced by luck,<sup>67 68</sup> such as the bounce of a ball or gust of wind. The eligibility criteria also have a part to play. For example, if a heavyweight boxer was eligible to compete against a bantamweight fighter, the heavyweight would almost invariably win yet not necessarily be the most skilful. If the eligibility criteria are unfair, the winner may not be the most skilful.<sup>59</sup> As stated above, fairness requires that all athletes begin from roughly the same starting point. If a transwoman has a performance advantage over her cis-women competitors then she may win the competition yet not be the most skilful.

(3) Sport is not a level playing field as there are significant physical and psychological differences between people. Furthermore, economic and social factors give rise to differences in funding

and resources available to athletes. Both these mean that sport is not fair. If sport is not fair, then the advantage transwomen have should be accepted as, to use Devine’s terminology, ‘tolerable unfairness’.<sup>69</sup>

It is often claimed that sport is uneven due to socioeconomic factors; that athletes from a wealthy country will have resources available that provide a competitive advantage.<sup>70</sup> This is considered a tolerable unfairness. In addition, many physical differences between people are due to the genetic lottery. Some women are very short and some very tall, some have shorter limbs and some longer. Some of these differences are examples of tolerable unfairness, such as the advantage that tall people have in basketball and the advantage that short-limbed people have in weightlifting. The Finnish skier Eero Mäntyranta had a genetic mutation that enabled him to carry more oxygen in his blood which is known to be performance enhancing.<sup>71</sup> Mäntyranta was able to compete despite his significant advantage—this was a tolerable unfairness. This suggests ‘prevailing conceptions of fair play seem unconcerned about the effect of the “natural lottery”’.<sup>72</sup> Equally, those with PCOS with higher than average standard testosterone levels for cis-women compete within the women’s division suggesting their advantage is considered a tolerable unfairness. By logical extension, it could be argued that transwomen levels should also be accepted within women’s sport—as a further tolerable unfairness.

It is not entirely clear how to distinguish between a tolerable and an intolerable unfairness. Bianchi uses high testosterone levels as an example of something that may be an unfair advantage (ie, an intolerable unfairness). Bianchi says this advantage may be unfair because cis-women cannot attain the advantages afforded by high testosterone levels via endogenous means.<sup>3</sup> Nor are cis-women permitted to take exogenous testosterone to raise their levels to those of transwomen<sup>73</sup> in the women’s division. This suggests that an advantage is unfair if no member of the category (eg, cis-women) can attain that advantage.<sup>iii</sup>

Another way to distinguish between tolerable and intolerable advantages is to consider whether the property under consideration provides an all-purpose benefit. High testosterone levels are beneficial in almost all sports (an all-purpose benefit) whereas other advantages are beneficial in only some. For example, a short person is highly unlikely to become an elite basketballer but may excel in gymnastics. Individuals of varying height can self-select into sports that suit their physiological make-up, whereas people with average or low testosterone levels cannot. Hence, it is arguable that height is a tolerable unfairness, whereas high testosterone levels (being an all-purpose benefit) is an intolerable unfairness. High testosterone levels and prior male physiology provide an all-purpose benefit, and a substantial advantage. As the IAAF says, “To the best of our knowledge, there is no other genetic or biological trait encountered in female athletics that confers such a huge performance advantage”.<sup>66</sup>

Combined, these three factors (cis-women cannot attain the advantage, all-purpose benefit and magnitude of the advantage) provide a strong argument that transwomen have an intolerable advantage over cis-women. In turn, the impact testosterone has on performance might lead us to reconsider the divisions currently used in competitive sport. In addition, if Mäntyranta’s genetic mutation or coming from a wealthy nation are also examples of an intolerable unfairness, these would need to be

<sup>iii</sup>The phrase ‘intolerable unfairness’ is a philosophical concept, and we do not suggest that gender-variant people are intolerable. Nor do we wish to disregard the discrimination they experience. Thanks to an anonymous reviewer.

accounted for to maintain the skill thesis. Inconsistency may arise if we restrict transwomen from competing in the women's division but allow those from wealthy nations to compete without restriction.<sup>72</sup> This is not to suggest that transwomen (and others such as Mäntyranta or those from wealthy nations) have an easy ride in elite sport. All elite athletes possess a great deal of skill, enhanced by hard work and training. Instead, our point is that some have a head start on their competitors and that the head start ought to be accounted for.

(4) As discussed earlier, transpeople, indeed many groups outside the binary distinctions of male and female, have consistently experienced discrimination and exclusion in all spheres of life. To address these concerns transpeople should compete in the gender division in which they identify.

We fully accept that transpeople have experienced discrimination and transphobia in many aspects of life, and this is unconscionable. While there is a need to ensure there is space for transwomen in elite sport, it does not follow that the space afforded to transwomen should automatically be in women's sport. Cis-women have faced, and still face, difficulties being recognised in top-level sport. The 2020 Olympics will be the first in which all events in all sports will have a women's category.<sup>74</sup> Despite this, some cis-women still struggle for space in elite sport. The first year all 206 Olympic nations sent women to the Olympics was 2012, although many nations do not send women in equal numbers. While there has been dramatic growth in women's sport, 'women of this century (the twentieth century) have occupied only a marginal space in the sports world'.<sup>75</sup> Elite women athletes still face discrimination—they are paid less, receive less media coverage, and when they do, discussion is often about their appearance, rather than athletic ability, and so they contend with 'the ordeal of not being taken seriously as ... athlete[s]'.<sup>74 75</sup> In short, women have not achieved gender equity in most sports<sup>76</sup> so care should be taken with any guidelines that may undermine this.

Gender separation provides a dedicated and safe space in which women can compete<sup>77–79</sup> although not all agree that this is desirable for women's sport.<sup>80–82</sup> Cis-women may also be discouraged from direct competition against transwomen. For example, New Zealand weightlifter Tracey Lambrechts reportedly dropped a weight class to avoid competing against Laurel Hubbard because she perceived that Hubbard had a performance advantage because of Hubbard's previous male physiology.<sup>83</sup> iv Having transwomen compete against cis-women might erode the space painstakingly built for cis-women. Clearly, transwomen have not had an easy ride in engaging in elite sport, and so we need to negotiate a space in which they can compete fairly. However, that place is not the women's category.

It could be argued that the science has been interpreted using a cis-normative lens meaning that it has been carried out by people who have a (perhaps unconscious) bias towards finding that transwomen have a performance advantage, and so are drawn to results that confirm this bias.<sup>84</sup>

As Ritz explains, employing this binary understanding of sex in experimental systems inherently creates a situation in which we seek difference and which thereby plays into and reinstates essentialist and biologically determinist biases. At a fundamental

level, experiments are implicitly (and statistically) geared to seeking difference because difference is mechanistically informative in a way that sameness is not. ... The upshot is that in treating sex as a unitary dichotomous variable and comparing women and men, we are allowing stereotyped thinking about sex and gender to substitute for the mechanistic understanding that is presumably the goal of experimental research, doing a disservice to people of all genders with respect to our understanding of biology and health.<sup>85</sup>

If a cis-normative lens has affected the scientific approach, and if it is found that transwomen do not have a performance advantage, then this would create a counterargument to the fairness claim. However, there may not be a cis-normative lens. Even if there is such a lens, its existence does not necessarily mean that transwomen do not have a performance advantage. That is, science carried out in the absence of a cis-normative lens might also show that transwomen have a performance advantage. Finally, it might be impossible to do science without a lens, be it cis-normative or something else.<sup>86</sup> If so, and if non-cis-normative science shows that transwomen do not have a performance advantage, then it does not straightforwardly follow that the science that shows 'transwomen do have a performance advantage' is wrong. Instead, it means that claims about truth become much more complex. In short, until there is evidence that the cis-normative lens has generated inaccurate findings, it is justifiable to claim there is strong evidence (although some of it is indirect) to suggest that transwomen have a performance advantage over cis-women. This argument requires us to have solid data on elite transwomen athletes, so we do not have to interpret and extrapolate from male data from which a cis-normative bias could emerge.

(5) It might be argued that the categories of man and woman are socially constructed—that is, they are not natural kinds.<sup>87</sup> v Social constructionists might claim that male and female only appear to be natural kinds because the world is interpreted through a cis-normative lens which is entrenched in our everyday lives. If the categories of male and female are socially constructed then this supports an athlete switching from the men's to women's division and vice versa.

There are two possible counterarguments. The first would be to show that the male/female binary does exist in the natural world. This is outside the scope of the paper. The second is to claim that elite athletes should not be able to switch between divisions because the binary is a pragmatic categorisation as it preserves space for women. In other words, the binary might be socially constructed, yet not arbitrary. If the binary serves a pragmatic purpose, then some might claim that it should be retained despite the presence of transgender and intersex people.<sup>88</sup> To reject the binary in sport, it would need to be shown that (A) It is not pragmatic; and/or (B) there are fairer, more respectful ways of categorising athletes.

To summarise the arguments and counterarguments, the issue of whether transwomen should compete in the women's division is particularly difficult because elite sport ought to be both inclusive and fair. The 2015 IOC guidelines allow a transwoman to compete, if, inter alia, her testosterone levels have been under 10 nmol/L for 1 year. The science section showed that the IOC 2015 guidelines allow transwomen to have an advantage over their cis-women competitors. While the IOC 2015 guidelines do not adequately address the principle of fairness, it does not follow that transwomen should not compete in the women's

<sup>iv</sup> See also IAAF's president Sebastian Coe's comments on incentivisation.<sup>65</sup>

<sup>v</sup> *Natural kind* is a term used in the philosophy of science.

division. It could be argued that the advantage that transwomen have is a tolerable unfairness,<sup>69</sup> given the wide range of testosterone levels currently permitted in the woman's division (DSD and to a lesser extent PCOS). We dispute that this is a tolerable unfairness as (A) These high testosterone levels are not available to cis-women (except via doping<sup>3</sup>). (B) Testosterone provides an all-purpose benefit for most sports. (C) Hormone therapy does not mitigate all the benefits from a previous male physiology. Hence, we claim that the IOC guidelines as they stand are poorly drawn. At the same time as being inclusive, the guidelines also need to ensure fairness.

## POSSIBLE SOLUTIONS

There is a range of possible responses that could be taken to resolve this conflict between fairness and inclusion.

1. Exclude transwomen from competing in the women's division. This might go some way to levelling the playing field (as evidenced by the science above) but is inconsistent with the principle of inclusion.
2. Transwomen compete in the gender with which they identify. While consistent with the principle of inclusion, this option does not satisfy the principle of fairness given the scientific evidence of a performance advantage. Having unregulated testosterone levels would be an intolerable unfairness. This remains even if testosterone levels are kept below 10 nmol/L.
3. Further restrict the IOC's eligibility criteria for transwomen, by setting the maximum testosterone to a lower level. This approach is problematic because physical harm may result from requiring a transwoman to reduce her testosterone levels further.<sup>89</sup> Further, it would not account for the performance advantage transwomen retain from earlier male physiology.

These three options suggest that the principles of inclusion and fairness are incompatible if the male/female binary is retained. *The following solutions are more radical, challenging the male/female binary in sport:*

4. Have a single category for all athletes regardless of gender.<sup>80 81</sup> This option is problematic as elite women athletes would rarely win against elite male athletes,<sup>79</sup> and so would not satisfy the principle of fairness. Moreover, it may erode the space carved out for women's sport.<sup>77</sup>
  - a. Have a single category for all athletes regardless of gender and allow exogenous testosterone to be taken to a single safe level.<sup>11</sup> In addition to the problems noted by Foddy and Savulescu,<sup>11</sup> it would not account for the prior male physiology of transwomen.
5. *Change or increase the categories for participation.*
  - a. Create a third division for transwomen and intersex women (who retain their testes).<sup>78</sup>
  - b. Create many more categories, such as cis-man, cis-woman, transwoman, transman, transwoman who has had gender affirmation surgery and so on.

Having multiple categories (in 5a and 5b) is not novel as there are weight divisions in sports such as boxing and weightlifting. Weight divisions provide safety to competitors, as well as give athletes in each category a real chance of winning. Approach 5b can also recognise and account for the disadvantage that transwomen without testes have against cis-women competitors, and the disadvantage that transmen have in comparison with cis-men.

A problem with 5a and 5b is that transgender athletes may not get to compete in the category in which they identify.<sup>38 69</sup> Separating out gender-variant people may be

perceived as stigmatising or as denying the dignity of transgender people.<sup>vi</sup> This problem might be solved by using a system that does not classify athletes on the basis of whether they are cis-gender or transgender, but on their testosterone levels (as suggested in the following potential solution). A further potential problem with 5a and 5b could be the number of athletes is so small in some categories that it may render the competition meaningless.<sup>38</sup>

(A) Calculate a handicap for transwomen based on their testosterone levels, similar to that used in golf. This approach is suggested by Bianchi.<sup>3 79</sup>

While Bianchi's approach accounts for the disadvantage that transwomen without testes and transmen have, there are two problems with her account. It does not account for the performance advantages transwomen have by virtue of their previous male physiology. Second, Bianchi's system might also be considered offensive as it does not account for gender identity.

Our proposed approach is an extension of Bianchi's.

(B) An algorithm that accounts for (a) Social parameters including gender identity and socioeconomic status. (b) Physiological parameters.

Such an algorithm would be analogous to the divisions in the Paralympics, and may also include paralympians. First, there would be multiple divisions rather than simply male and female. Second, based on the results of the algorithm, athletes would be placed into a division which best mitigates unfair physical and social parameters.

The physiological parameters could include

- ▶ Size, for example, height and weight.
- ▶ Haemoglobin levels.
- ▶ Maximal oxygen uptake (VO<sup>2</sup> max).
- ▶ Whether the athlete transitioned before, during or well after puberty.
- ▶ Past and present testosterone levels, and the presence of testes.
- ▶ Previous characteristics of physiology that are not changed via hormone therapy, that is, bone strength or structure, lung capacity and heart size.

The algorithm would need to be tailored to specific sports as a physiological factor will be more advantageous in some sports than others. For example, weight would need to be accounted for in weightlifting, and perhaps wingspan for swimming.

While it would be difficult to generate such an algorithm, a considered response that adapts to evolving scientific evidence is required. Further discussion regarding this algorithm is beyond the scope of this article but is being developed by the authors.

## CONCLUSION

To arrive at conclusion about the adequacy of the IOC (2015) guidelines, both scientific and normative analysis is required. The science section has shown that elite cis-men athletes have a performance advantage in almost all sports due to their higher testosterone levels, and other aspects of male physiology. Extrapolating from this it is plausible that transwomen retain some of that advantage. We acknowledge that these findings rest on extrapolations from male physiology, and encourage further specific scientific investigation regarding elite transwomen athletes. The normative section has shown that while inclusion is an important principle of sport, including elite

<sup>vi</sup>Thanks to an anonymous reviewer.

sport, inclusion does not outweigh the importance of fairness for cis-women athletes—the performance advantage likely held by transwomen is not a ‘tolerable unfairness’. This is not an attempt to exclude transwomen from elite sport. Instead, we conclude that it is important to both extend and celebrate diversity, while maintaining fairness for cis-women in sport. To be simultaneously inclusive and fair at the elite level the male/female binary must be discarded in favour of a more nuanced approach. We conclude that the gender binary in sport has perhaps had its day.

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