Questioning Representations of Athletes with Elevated Testosterone Levels in Elite Women's Sports: A Critical Policy Analysis

Journal:	*International Journal of Sport Policy and Politics*
Manuscript ID	RISP-2020-0026.R3
Manuscript Type:	Research Article
Keywords:	biomedical ethics, intersex, critical policy analysis, sex/gender, women's sport, testosterone

Questioning Representations of Athletes with Elevated Testosterone Levels in Elite Women's Sports: A Critical Policy Analysis

Annette Brömdal[1]; Rebecca Olive[2]; Brooke Walker[3]

1. School of Education, Faculty of Business, Education, Law and Arts, Centre for Health Research, Institute for Resilient Regions, University of Southern Queensland, Toowoomba, Queensland, Australia

2. School Human Movement and Nutrition Sciences, Faculty of Health and Behavioural Sciences, The University of Queensland, St Lucia, Queensland, Australia

3. Elite athlete and independent researcher, Queensland Australia

Corresponding Author: Annette Brömdal, School of Education, Faculty of Business, Education, Law and Arts, Centre for Health Research, Institute for Resilient Regions, University of Southern Queensland, Toowoomba, Queensland, 4350 Australia
Annette.Bromdal@usq.edu.au

Questioning Representations of Athletes with Elevated Testosterone Levels in Elite Women's Sports: A Critical Policy Analysis

Sport sociologists are often required to interpret, question and respond to the ways in which fairness and eligibility concerns in elite sports are represented in policy frameworks produced by sports governing bodies. Drawing on Carol Bacchi's critical policy analysis framework, 'what is the problem represented to be?', this paper explores the importance in developing a critical eye and reading about representations of women athletes with particular differences of sex development (DSD) with elevated testosterone levels and the idea of regulating their testosterone levels in the female classification. Through using the above critical policy analysis line of questioning, this analysis aims to consider what the problem of women athletes with relevant DSDs with elevated testosterone levels in female elite sports is represented to be; what the assumptions underlying these representations of the problem are; how these representations of the problem have come about; what is left unproblematic in this problem representation; what the lived effects produced by these representations of the problem are; and how these representations of the problem have been produced, disseminated, defended, questioned, disrupted and even could be replaced. The critical policy analysis argues that the continuing persistence of policies marking particular women with DSDs as a problem, is related in part to societal views defining particular bodies and athletic abilities in the female classification as either 'right' or 'wrong' and in need of fixing. In moving forward and redressing the problem, it requires the embodiment of biomedical ethics and human rights advocacy work by sports governing bodies.

Keywords: biomedical ethics; intersex; critical policy analysis; sex/gender; women's sport; testosterone

Introduction

On 8 September, 2020, World Champion middle-distance runner, Caster Semenya, lost her Swiss Federal Supreme Court appeal against World Athletics (former IAAF)[1], supported by the Court of Arbitration for Sport (CAS) (Swiss Federal Supreme Court 2020). This appeal challenged new eligibility regulations for women runners born with particular "differences of sex development [DSD]" (also referred to as intersex variations)[2]. Specifically, the regulation excludes women born with 46 XY and testosterone levels in serum above 5 nmol/L or above and for whom the testosterone has "a material androgenising effect" (WA 2019, 4). That is, Semenya was appealing policy that created an endocrinological definition of 'female'. The loss of this appeal means that Semenya and others are required to undergo hormone therapy to reduce their naturally occurring elevated levels of testosterone to compete in a number of "restricted events" ranging from 400m to one-mile races and track events in the women's category. Alternatively, excluded women athletes can compete in the male classification, in which competitors are not required to prove they adhere to sex-specific physiological definitions, or in an as yet non-existent intersex category (WA 2019).

While the CAS three-judge-panel voted 2-1 against Semenya (and "dismissed both requests for arbitration" from the IAAF and Semenya), they also declared the IAAF/WA "Regulations are discriminatory" (CAS, 2019b). The verdict ruled that

> on the basis of the evidence submitted by the parties, such discrimination is a necessary, reasonable and proportionate means of achieving the legitimate objective of ensuring fair

1 Following a Congress decision in June 2019, the International Association of Athletics Federation (IAAF) changed its official name to World Athletics (WA). As this research deals with time periods prior to and post the name change, we adopt the acronym IAAF/WA when referring to the organisation throughout this analysis.

2 This analysis will make us of the following terminologies when referring to the same cohort of people: 'intersex', 'differences of sex development' (DSD), and 'disorders of sex development'.

> competition in female athletics in certain events and protecting the 'protected class' of female athletes in those events (CAS, 2019b, 1).

This ruling entrenches sex-based discrimination and is "the latest in a series of regulations that have governed women's eligibility in sport" in order to maintain a binary-based "level playing field" in elite sport (Karkazis and Carpenter 2018, 579).

Arguments that sex and gender are social and cultural categorisations of physiology are not new (Butler 2004, de Beauvoir 2014 [1949]), and outside of the IAAF/WA policies, "sex" "and, by extension, intersex" (Holmes 2011, 394) are understood to be a combination of social and medical constructions (Davis 2015). Intersex people "are born with physical sex characteristics that don't fit medical and social norms for female or male bodies" (Intersex Human Rights Australia 2013). Intersex includes more than 40 variations, can apply to one in 60 individuals (1.7%). Given this diversity, it is not surprising that intersex is "a term whose meaning is contested" and is variously described in terms of "disorders of sex development" in medical milieus and erroneously still referred to as "hermaphroditism" within the general public (Davis 2015, 2). That is, it is still pathologised and understood in relation to female/male sexual binaries. Intersex Human Rights Australia (IHRA), also suggest that intersex variations present in visible "physical differences in secondary sexual characteristics such as muscle mass, hair distribution, breast development and stature" (2013). We recognise that while the current sex-based sporting classifications remain, solutions to the issues outlined here are very limited. However, as intersex health and rights scholars, we offer our critical analysis of discriminatory policies in women's sport as an example of where and how the discrimination, regulation and limitation of women and intersex people in sport is produced and maintained by various elite sport policies.

With bodies that challenge wide-held binary understanding of sex/gender, intersex people are commonly targets of discrimination, such as in the current IAAF/WA policy.

Understanding how policy "problems" are represented "carries all sorts of implications for how the issue is thought about and how the people involved are treated, and are evoked to think about themselves" (Bacchi 2009, 1). That is, how the IAAF/WA is able to set endocrinological, as well as gonadal and chromosomal parameters for what they consider a 'woman' in the female classification. In recent years, a considerable amount of academic work and research have explored and challenged the ways in which women with intersex variations have had their bodies and athletic performances marked, regulated and disciplined in degrading, sexist and unfair ways through sex tests/femininity testing/gender verifications/ hyperandrogenism/DSD regulations and testing technologies in women's sport (such as Brömdal 2013, Bavington 2018, Carlson 1991, Cooky, Dycus, and Dworkin 2013, Erikainen 2019, Healy et al. 2014, Heggie 2010, 2020, Karkazis and Carpenter 2018, Karkazis et al. 2012, Karkazis and Jordan-Young 2018, Larned 1976, Montañola and Olivesi 2016, Pieper 2016, Ritchie 2003, Shani and Barilan 2012, Schultz 2011, 2019b, Pielke 2017, Pielke, Tucker, and Boye 2019b, Sullivan 2011, Sönksen et al. 2015, Sönksen et al. 2018, Xavier and McGill 2012). Several of the aforementioned publications have also explored the historical evolution of these testing technologies from a post-modern critical feminist lens; what the lived experiences and implications have been for affected intersex women; and highlighted flaws and contradictions in the ways in which the policies and testing technologies have been rationalised and revised over time but nevertheless targeted the same minority few.

Building on this work, in this paper we draw on Carol Bacchi's (2009) critical policy analysis framework, "What is the Problem Represented to be?" to explore the history, development and implications of the current policy on women. In particular, we focus on how the most recent IAAF/WA policy has been produced to solve a "problem". Through Bacchi's framework we highlight the importance of developing a comprehensive critical reading regarding representations of the challenge of managing women's sport in a way that

maintains the established sex-binary model of elite sport; there are no policies regulating or policing men born with various intersex variations in the male classification. As such, we develop a critical analysis about the rationales and socio-political agendas of regulating athletes with 46 XY DSD in the female classification, the implications this series of governing have had on the athletes in question, and how the representation of athletes with relevant DSD in the women's events as a 'problem' can be interrogated, disturbed or abolished all together. Bacchi's WRP framework (2009) encourages and equips sport sociologists to critically analyse this representations in a historically, holistically and politically nuanced fashion "interrogating the ways in which [policy] proposals for change *represent* 'problems'" (Bacchi 2009, vii). To this end, this critical policy analysis is framed and structured by six research questions exploring:

(1) What is the problem of women athletes with relevant DSDs with elevated testosterone levels in female elite sports represented to be?
(2) What assumptions underlie this representation of the problem of women athletes with relevant DSDs with elevated testosterone levels in female elite sports?
(3) How has this representation of the problem come about; what are the origins and history of women athletes with relevant DSDs with elevated testosterone levels in female elite sports?
(4) What is left unproblematic in this problem representation? What are the gaps and silences?
(5) What effects are produced by this representation of the problem, such as on women born with DSDs?
(6) How and where have these representations been produced, disseminated, and defended? How could they be questioned, disrupted, and replaced?

Taking this approach, we unpack the continuing persistence of policies marking particular intersex women as a 'problem', and how these relate to societal views defining particular bodies and athletic abilities in the female classification as either 'right' or 'wrong' and in need of regulation (Brömdal 2013, Healy et al. 2014, Karkazis et al. 2012, Pape 2019, Pielke 2017, Schultz 2011, 2012b). Employing Bacchi's WRP framework (2009), and through a Foucauldian lens we bring to light *who* are the voices setting this political agenda of problematisation; *who* are the voices producing and circulating physiological truths and knowledges (Foucault 1980) arguing that a particular cohort of intersex women elite athletes 'disturb' ideal understandings of 'femininity' in terms of their sex, gender, body, embodiment and athletic performance; and *who* have been the beneficiaries of these polices versus *whose* voices have been overlooked, marginalised, and silenced? In framing particular intersex women athletes as the 'problem', these questions are significant to better understand how they have been historically framed as a threat to the 'level playing field' in women's elite sports by the IAAF/WA, the International Olympic Committee (IOC), and their allies, but also how these framings can be challenged, dislocated, replaced, and even abolished.

Methodology and analytical framework

This critical policy analysis examines official IOC, IAAF/WA, and other national bodies of athletics' policy frameworks between 1938 and 2018, including policy informing material. More specifically, it considers the official and mandatory rules for competitions for women and sex/femininity/gender verification policies in the female classification by the IOC, the IAAF/WA and other national bodies of athletics between 1938 and 1998, which enforce variations of clinical examinations prior to competing, and depict women athletes with intersex variations as 'problematic'. These policy documents were all accessed and retrieved from the Historical Archives at the Olympic Museum in Lausanne, Switzerland in 2010 and

2017. Case-by-case inspired IAAF/WA and IOC policies on gender verifications, regulations on females with hyperandrogenism, and regulations for the female classification for athletes with DSDs, released between 2000 and 2018, were all accessible online. Over 20 policies and numerous archival policies informing and illuminating documents were gathered and analysed.

Along with Bacchi's framework, to question representations of athletes with relevant DSD in female elite sports as 'problematic', we have adopted a Foucauldian theoretical approach that examines the construction of knowledges, truths and power relations (Bacchi 2009, Foucault 1979, 1980, 1988). In relation to the perceived 'fairness' problem in female elite sport we agree with Foucault, who suggests that what seems to be an obvious truth to us today has had a history and has been shaped to become the truth we know of today primarily by "those who are charged with saying what counts as true" (1980, 131). That is, with those who held authority at the time. Through a Foucauldian lens, Bacchi (2009) encourages us to understand contemporary problems by establishing a "history of the present" (Foucault 1979, 31), that results in establishing some ideas and ideals as 'normal' (Cryle and Stephens 2017). Our analysis views policy *as* normalising discourse (Bacchi 2009, Foucault 1972, Goodwin 2011) and sees policy-based representations of athletes with relevant DSDs as a socially constructed 'problem' embedded in historical and cultural practices. A policy *as* discourse approach "captures the political ways in which policy shapes the world through the framing of social 'problems' and government 'solutions' and the construction of concepts, categories, distinctions and subject positions" and shifts focus onto "the role of policy in 'making' social problems" (Goodwin 2011, 170). Consequently, the practice of problematisation is at the heart of policy analysis (Bacchi 2009, Goodwin 2011).

As we consider how and why representations of athletes with relevant DSDs in female elite sports and policy frameworks have come to be represented as a 'problem',

Bacchi (2009) and Foucault remind us that the "rationality" behind their making "can be unmade, as long as we know how it was that they were made" (Foucault 1988, 37). Following Foucault, Bacchi's framework recognises that 'problems' are inherently political (2009), and the aim of the critical policy analysis approach is "to challenge problem representations" (Bacchi 2009, 44) that have harmful effects. In the rest of this discussion, we will use Bacchi's WRP framework to examine the assumptions and politics embedded in the current IAAF/WA policy, as well as the impacts these have on athletes' lives. Bacchi's WRP framework disrupts assumptions that the 'problems' themselves "are fixed and uncontroversial starting points for policy development" and "reminds us that the banal and vague notion of 'the problem' and its partner 'the solution' are heavily laden with meaning" (Bacchi 2012, 23). In this case, our critical policy analysis aims to interrogate the politics embedded in representations of regulating intersex women with elevated and functional levels of testosterone, including particular chromosomal, gonadal and/or anatomic sex, which not only has implications for women with targeted intersex variations but on broader biomedical ethics and fairness debates in elite sports.

What is the problem of women athletes with relevant DSDs with elevated testosterone levels in female elite sports represented to be?

The IAAF/WA's November 2019 policy, *Eligibility Regulations for the Female Classification (Athletes with Differences of Sex Development [DSD]*), introduced and defined regulations governing the eligibility of particular intersex women with elevated levels of functional testosterone, which the policy refers to as "relevant athletes" (2019). Specifically, the IAAF/WA make use of a funnelled criteria approach where they first name seven

identified categories of 46 XY DSDs [3], all which also challenge binary understandings of around chromosomal, gonadal and/or anatomic sex. People associated with these categories become of interest if they have 5 nmol/L or more circulating testosterone in blood but become "relevant" if that testosterone translates into a "material androgenising effects". Hence, only intersex women who meet all three criteria are problematised by the policy.

Specifically, the IAAF/WA (2019, 21) stipulates that "the normal female range" of testosterone circulating in the blood is anywhere from 0.06 to 1.68 nmol/L in blood post puberty, while the "normal male range" is considerably higher ranging from 7.7 to 29.4 nmol/L. The IAAF/WA defend their targeted policy by stipulating that "women (including female athletes) with DSDs covered by these Regulations can have serum levels of testosterone above 5 nmol/L and well into (or even above) the normal male range." (2019, 20). The IAAF/WA (2019, 3) cites "broad medical and scientific consensus" on these claims, and that rigorous review of the data has established validity of the idea that a range of 5 and 10 nmol/L "can significantly enhance their sporting performance." From this position, the policy identifies relevant intersex women athletes as posing a 'problem' for the IAAF/WA's political priority of protecting and guaranteeing "a level playing-field" in the female classification by eliminating the risk of any "unfair competition conditions that deny athletes a fair opportunity to succeed" (2019, 2), through regulatory means.

In addition to the fairness and meaningful competition debate, the IAAF/WA also identifies and presents a secondary 'problem' where there are potential health implications for women athletes with "relevant" DSDs if their "condition" is undiagnosed and/or untreated (2019, 21). Here, the IAAF/WA argue that they are 'detecting' and 'solving' potential future

3 These particular DSDs are a) 5α-reductase type 2 deficiency; b) partial androgen insensitivity syndrome (PAIS); c) 17β-hydroxysteroid dehydrogenase type 3 (17β- HSD3) deficiency; d) congenital adrenal hyperplasia; e) 3β-hydroxysteroid dehydrogenase deficiency; f) ovotesticular DSD; or g) any other genetic disorder involving disordered gonadal steroidogenesis.

health problems in the best interests of the athlete (2011, 2019). This secondary health problem, can as a result of this policy and its main problem formulation, also be 'solved'.

In order to guarantee fairness and to allow "relevant" intersex women the opportunity for "meaningful competition" in the "restricted [women's] events", the IAAF/WA regulations stipulate that all women athletes wanting to compete at an international competition or to set a world record must meet three "eligibility conditions" (2019, 4-5). More specifically, the person must be legally recognised as either "female or as intersex"; reduce their blood testosterone level to below 5 nmol/L through the use of hormonal contraceptives for at least six months; and maintain their blood testosterone level below 5 nmol/L for as long as they want to stay eligible to compete at an international level or set a world record in a "restricted event" (2019, 4-5).

To evidence their claims that sports performance is ultimately linked to functional levels of testosterone, the IAAF/WA (2019, 20) draws on research and interventions from the Director of the IAAF/WA Health and Science Department (Bermon 2017, Bermon and Garnier 2017, Bermon et al. 2018, Handelsman, Hirschberg, and Bermon 2018). This research uses the example of three intersex women athletes whose performance declined by an average of 5.7% after engaging in hormonal contraceptives reducing their circulating testosterone levels from 21-25 nmol/L to 2 nmol/L. As Bermon (2017), Bermon and Garnier (2017), Bermon et al. (2018) have 1) "shown exploratory evidence that female athletes with the highest T concentration have a significant competitive advantage over those with lower T concentration, in 400 m, 400 m hurdles, 800 m and hammer throw", and 2) showcased "that there is a very strong correlation between testosterone levels and best results obtained in the World Championships in those events" (Bermon et al. 2018, 2). The significance of this example, and the analysis around it, is that it legitimises and justifies the policy and the need to police and regulate intersex women athletes' functional testosterone levels. From a WRP

perspective, this research continues to frame this cohort of athletes with DSD as the 'problem' to fairness and meaningful competition in the female classification.

To better appreciate the "deep-seated cultural values" (Bacchi 2009, 5) and the "conceptual logics" underpinning how women athletes with relevant DSDs are represented as 'problematic', our next question examines the assumptions that underlie this problem representation.

What assumptions underlie this representation of the problem of women athletes with relevant DSDs with elevated testosterone levels in female elite sports?

In the next step of the WRP framework, Bacchi (2009, 5) prompts us to uncover the "assumed", "taken-for-granted" and "rel[ied] upon" knowledges within this problem representation "to be accorded intelligibility". In this section, we unpack how "meaning is created" within governing policy frameworks by "identifying and interrogating binaries, key concepts and categories operating within" them (Bacchi 2009, 7). That is, we highlight two key assumptions, that women are not as athletic as men, and that testosterone is a male hormone, excesses of which in women leads to an unfair advantage in women's sport.

Particular physiological assumptions have underpinned a hierarchical correlation between circulating testosterone concentration and athletic excellence (Bermon 2017, Borgen 2020, Karkazis and Jordan-Young 2018, Schultz 2019b, Sudai 2017). As we saw in the 2020 Swiss Federal Supreme Court and the 2019 CAS rulings, endocrinologically compliant women – the majority of women athletes – are positioned as in need of protection against a minority cohort of women, who are deemed to have "unfair competitive advantages that violate fair play" (Handelsman, Hirschberg, and Bermon 2018, 803). This idea has been previously entrenched in IAAF/WA policy. For example, the IAAF/WA *Regulations Governing Eligibility of Females with Hyperandrogenism to Compete in Women's Competition* (2011) articulated sex/gender binary-based hierarchies by stressing that male

and female Athletics have been divided into separate categories because they have very different and "specific physical aptitude and performance", and that the classification division is "predominantly due to higher levels of androgen hormones in males resulting in increased strength and muscle development" (2011, 1). The IAAF/WA explicitly uses gender to build their argument "that there are rare cases of young females…who are affected by hyperandrogenism…[who] often display masculine traits and have uncommon athletic capacity in relation to their fellow female competitors" (2011, 1). As Schultz reminds us "the values we associate with masculinity – strength, speed, stamina, muscularity – are the same we associate with athleticism, so when women are charged with looking or performing in an ostensibly gender-incongruent way, the underlying logic is that they are not supposed to be that good in sport" (2012b, 32).

Historically, women athletes have been scrutinised based on underlying sex/gender binary assumptions related to hormone production, internal and external genitalia and chromosome composition as defining female classification. These assumptions have been translated into policy frameworks and actions governing participation in elite women's sport (Brömdal 2013, Pape 2019). In 2011 the lead author conducted an interview with the former Medical and Scientific Director of the IOC, Dr Patrick Schamasch, and asked why women with hyperandrogenism/elevated levels of functional testosterone seem to threaten the 'level-playing field' more than any other biological and innate ingredient in women's sports (Brömdal 2013). Schamasch's response was heavily gendered, highlighting the lack of reflection on the role of socio-cultural norms in how we think about women and particular intersex athletes:

> As you know if these females, or ladies, have functional hyperandrogenism with active receptors, [it] means that they then have testosterone in the male range. And we have defined what is potentially the male range. This means that they will have an advantage because…, testosterone is the hormone which boosts the muscles, so if they have more

> testosterone than a normal lady, they will potentially have more muscles which could lead to a better performance because muscles are directly linked with performance. That is why we think that it could be abnormal and not totally fair to allow these ladies to compete with ladies who have lower testosterone or within the female range. (Schamasch in Brömdal 2013, 129-130)

Schamasch is emphatic in conveying as established fact, the idea that testosterone is the hormone that boosts muscles and that functional androgen levels are directly linked with competitive advantages. The assumption behind Schamasch's rhetoric suggests that this singular biological parameter outranks the influence on performance compared to any other factor and consequently disrupts the level playing field in the female classifications. In expressing his message, Schamasch explicitly recognises that the IOC "have defined what is potentially the male range" and, thus, the female range of testosterone in the body; equally suggesting that it can be 'redefined'.

As we illustrated in the last section, since the hyperandrogenism policy in 2011, the IAAF/WA has made use of, and commissioned, several studies to support this line of argument (WA 2019). Yet, despite the role that testosterone plays in conferring an unfair advantage, limitations are not placed on male athletic classifications. Lisa Bavington (2016) interviewed an IAAF/WA official about why regulations related to testosterone have not been put in place in men's athletics. The official responded that there is no direct relationship between physical performance and testosterone levels in the upper male range and that a 10nmol/L increase in this range will not have a noticeable effect on performance. However, the respondent was very clear about the 'effect' that can be seen in women (Bavington 2016).

Fast-forwarding this to 2020, this sex-based correlation and rhetoric has become increasingly entrenched, such as when the CAS panel endorsed the current regulations by arguing that "discrimination is a necessary, reasonable and proportionate means of achieving the IAAF/WA's aims of preserving the integrity of female athletes in the Restricted Events"

(CAS, 2019a) and when the Swiss Federal Supreme Court supported this ruling (2020). The assumptions underlying the representation of the problem are constructed and can therefore also be undone (Sudai 2017). In order to do so we need to learn how these assumptions about the 'problem' of women athletes with DSD have arisen.

How has this representation of the problem come about; what are the origins and history of women athletes with relevant DSD with elevated testosterone levels in female elite sports?

Inspired by Foucault's use of genealogy, Bacchi (2009) suggests the next step in the WRP framework is to "highlight the conditions that allow" the representation of women athletes with particular DSDs in specific women's sporting events as 'problematic' and to then "assume dominance" (11). This step in Bacchi's framework shows the genealogy of the developments in sex testing/femininity testing/gender verification/hyperandrogenism/DSD regulations in women's sport through various testing technologies and nomenclatures from the 1930s till current time. It provides an important context to the current IAAF/WA policy.

There are comprehensive histories critically analysing the development of sex-gender testing and regulations in women's athletics (Bavington 2018, Brömdal 2013, Erikainen 2019, Heggie 2010, 2020, Pieper 2016, Rogol and Pieper 2018, Schultz 2012a). Collectively, these histories illustrate the united voices of medical representatives proposing the need for policies to "protect" athletes in women's competition from "unfair competition" since the 1930s. The target group of such policies has consistently been women with intersex variations, however which intersex variations, and the language used to refer to the 'undesirable' athletes, have shifted numerous times. When tracing the history and the justifications for introducing the sex tests, they were linked to anxieties around female 'authenticity' in response to fears and rumours that "hermaphrodites" , "hybrid beings", "intersexuals', or men disguised as women were participating in women's events (Brundage

1936, 1, Hay 1974, 20, Thiébault 1968, 2, 5). Although these angsts became a concern as early as 1928 the 1936 Olympic Games in Berlin seems to be the first time a woman, the American 100m sprinter Helen Stephens, was sex tested due to her "muscular" appearance (Time Magazine 1936b, 60). Following this case and that of an English athlete who had gone through gender affirming procedures Avery Brundage (1936), the chairman of the US Olympic Committee, proposed that women athletes should undergo physical examinations to ensure that they were 100% female and for individual sport federations to implement the matter (Time Magazine 1936a, 40 & 42). Two years later, this resulted in the requirement by the American Amateur Athletics Association (AAU) of external examinations by medical professionals and the provision of medical certificates "certifying her fitness for competition" (AAU 1938, 86). This practice was taken up by organisations including the IAAF/WA in 1946 who imposed it on women competing in "athletics" at the 1964 Tokyo Summer Olympic Games (Organizing Committee of the XVIII Olympiad 1964, 89-104, 170). Men were not required to provide such certificates.

In the 1950s and early 1960s a number of "stunning performance marks achieved by women athletes" continued to raise "concerns about the 'femaleness' of certain female participants in women's events" (Ljungqvist et al. 2006, 227). This influenced the move towards standardising sex tests on an international level in the mid-1960s (Brundage 1966, Westerhoff 1966), where event organisers for the 1966 European Athletics Championship in Budapest required that all 243 female athletes underwent "on-site inspections", where they "paraded in the nude before a panel of gynaecologists" (Larned 1976, 10). The IOC quickly replaced these humiliating protocols creating "an unpleasant atmosphere" (Reczek 1967) with laboratory-based chromosomal tests in 1968 after women complained the on-site inspections were both "crude and degrading" as they also included gynaecological examinations (Turnbull 1988, 61). These chromosomal tests became the first rigorous and

mandatory policy on sex verification and were used between 1968-1992 dictating whether a woman met the sex-based criteria to compete in women's events (Brömdal 2013, 88-89).

In 1992 the IAAF/WA agreed to abandon the tests on a mandatory basis, due to scientific inaccuracy and it being unethical. Despite this, the IAAF/WA still allowed for the medical representative at an event to organise a physical examination of an athlete in combination with hormonal tests if deemed necessary (IOC 1992, 21), while the IOC continued to perform mandatory DNA-based chromosomal tests up until the 2000 Sydney Olympic Games (IOC 1999, 80). Although mandatory testing ceased by 2004, sporting governing bodies nevertheless reserved the right to "gender verify" athletes on a 'case-by-case' basis if particular athletes in the female classification raised 'suspicion' by officials, competitors or alike (Ljungqvist et al. 2006). Until 2009, 'suspicion-based' medical examinations and genetic tests were performed on women whose appearance and gender expression deviated from White, Western, cisgendered heterosexual norms of femininity, equating the tests with a "gender verification" inspired by cultural privilege (Brömdal 2013, Karkazis et al. 2012). The case-by-case motivated "gender verification" (IAAF 2006) resulted in scrutiny of South African sprinter Caster Semenya at the IAAF/WA World Championship in Berlin 2009 (Montañola and Olivesi 2016, Schultz 2011) which, yet again, resulted in the development of a new policy centred around "disorders of sex development" and "hyperandrogenism" (IOC 2010). This marked a new era, where women pathologised with hyperandrogenism were bound by regulations and eligibility conditions to compete (IAAF 2011). This reformulated the enduring 'problem' of maintaining authenticity, 'fairness' and 'meaningful competition' in female sporting classifications, in terms of limitations on levels of functional testosterone (Brömdal 2013, Karkazis et al. 2012). In this way, "hyperandrogenism" took precedence over "gender verification", as the incoming way

of maintaining the stability of the sex and gender binary divide and logic in elite sports, which was yet again reframed in 2018 to the current policy.

To tie it all together, this discussion illustrates the inconsistencies in testing practices and language over 80-odd years as governing bodies have tried to establish the physiological characteristics that define a woman. The governing testing technologies have been referred to as rules for "competitions for women" where women had to provide medical certificates including thorough medical examinations and shown fit or feminine enough to compete in women's sports (1938-1964); to sex verification/control/checks (1966-1976); to femininity tests/testing/controls (1976-1984); to gender verifications/controls/tests/testing (1984-2011); to testing the eligibility of women with hyperandrogenism; to now testing the eligibility of women athletes with relevant DSDs in the female classification. The slipperiness of the language, and the use of femininity and gender in anyway, underlines the struggle sporting organisations were facing in defining what the problem was in maintaining sex-based authenticity and fairness in women's sports.

Similarly, the terms the IOC/IAAF/WA have used, when referring to the 'problem', have equally shifted six times from "hybrids" to "hermaphrodites", to "intersexuals", to women with "Disorders of Sex Development" to women with "hyperandrogenism", to for now, women with particular "Differences of Sex Development" in particular events. Even though the 'scientific' knowledges have changed between the 1930s and today, the IOC/IAAF/WA have not been clear nor consistent about what the 'problem' has been and thus, have been unable to present convincing evidence for the 'problem'. In particular, testosterone is at the heart of the new 'problem', in the face of an ongoing fight to maintain the female authenticity of women athletes. The shifts in testing technology (alluding to solve the problem) and who these women representing the problem are, show the IOC/IAAF/WA failure in defining the problem and producing 'convincing' scientific evidence for the

'problem'. This evidences how they have constantly manipulated truths and knowledges about the best or ideal testing technology in meeting their aims as the testing technologies have driven the definition of the 'problem'. This genesis, continuity and discontinuity therefore strongly highlight how the conditions "that allowed [the] particular problem representation" of women athletes with relevant DSDs in the female classification "to take shape and to assume dominance" (Bacchi 2009, 11).

What is left unproblematic in this problem representation? What are the gaps and silences?

While the current policy claims to be maintaining "fairness" in women's athletics (WA 2019) representing women athletes' testosterone levels as both the 'problem' and the 'solution' to the fairness debate leaves several gaps and silences (Bacchi 2009), especially within the space of science and bioethics.

The first silence in the policy is the contested nature of the science on which these policies are based (Bermon and Garnier 2017, Eklund et al. 2017). While the "IAAF claims there is a medical and scientific consensus that female athletes with naturally high testosterone have an advantage over their peers, not unlike the advantage men typically have over women" (Karkazis and Carpenter 2018, 580), a number of researchers highlight flaws in the IAAF/WA-funded research on which the IAAF/WA policy is based (Borgen 2020, Pielke, Tucker, and Boye 2019a, b, Sönksen et al. 2018). Taking different lines of critique, all articles agree that the research "substantiating the IAAF's regulation fail to prove that elevated levels of natural testosterone are causally linked to better sporting performance" (Borgen 2020, 750). For example, Borgen's (2020, 750) critiques are two-fold: the isolation of testosterone from its effects (e.g. on VO2max) means that there is no evidence "that these elite athletes have better athletic performance *because* of high testosterone level". Borgen (2020, 751) also argues that to "identify the competitive advantage [of higher testosterone],

we would have to compare elite athletes with different levels of testosterone but who are otherwise equal". Sönksen et al., (2018) critique the focus on correlation found by Bermon and Garnier (2017), whose methodology and findings they find to be "statistically inappropriate and the lack of adjustment for multiple comparisons a major flaw of the analysis" (1481). They compare Bermon and Garnier's work to Eklund and colleagues' (2017), who "found no correlation between serum T and physical performance" in women Olympic athletes (Eklund et al. 2017, 1306).[4] Sönksen et al. (2018, 1481) argue that neither study "come[s] close to addressing the issue of causality" in their findings, and thus the IAAF/WA has not addressed the CAS task of "providing sufficient evidence that female athletes with androgen levels in the so-called male range have a competitive advantage over their peers, *comparable to that men have over women, previously identified as 10%-12%*" (emphasis original).

Finally, Pielke and colleagues (2019a, b), call into question the methodology, the lack of transparency in the data used, and the "flawed and unreliable results" (2019b, 20) by (Bermon and Garnier 2017, Bermon et al. 2018) in their claims that testosterone levels are positively correlated with athletic performance and competition results in elite athletes. They are troubled that these studies are funded and conducted by the IAAF, and that the data itself has not been peer-reviewed as the "IAAF has refused to release the performance data associated with the study to other researchers or even to the journal which published" the work (Pielke, Tucker, and Boye 2019b, 20). In their strongly worded conclusion, Pielke and colleagues (2019b, 25-26) argue that "Sport regulation should be held to the same high standards that we expect of researchers in other settings where science informs regulation and

[4] While Bermon and Garnier's study (2017) is specifically on IAAF/WA athletes, Eklund *et al.,* (2017, p. 1302) examine "Swedish women athletes participating in the summer (London 2012, n=81) OR winter Olympic Games (Sochi 2014, n=45)".

policy". In particular, the IAAF/WA should "provide research funding to an independent body which could request proposals from researchers unaffiliated with the IAAF/WA to address the scientific questions at issue" (Pielke, Tucker, and Boye 2019b, 25). In this way, Pielke and colleagues highlight genuine silences in the research ethics and transparency of the data used to justify the IAAF/WA policies.

The second issue is the inconsistencies, silences and "limits in the underlying problem representation" (Bacchi 2009, 12) also appear when we consider the regulation of testosterone in terms of maintaining 'fairness'. Schultz (2018) argues that "without explanation, the new guidelines omit both the pole vault and hammer throw, where high-testosterone women ostensibly enjoy the greatest advantage, and add the women's 1500-metre race, even though it was not one of the events in which testosterone seemed to matter. The hormone, the study concluded, does not affect men in 'any of the male athletic events'". In pointing out this inconsistency, Silvia Camporesi (2016) brings our attention to two key issues left unproblematic in the current policy. First, is that "setting a limit on hyperandrogenism and singling it out from other biological variations that may confer an advantage is – at best – an inconsistent policy" (Camporesi 2016). As Camporesi (2016) outlines, there are more than 200 identified genetic variations that can provide an athletic advantage in elite sport. These can "affect a variety of functions including blood flow to muscles, muscle structure, oxygen transport, lactate turnover, and energy production", yet are not consistently considered unfair for competition by the IAAF/WA or governing bodies in other sports (Camporesi 2016). The second is that the policy is only applied to women's events, which follows the previously outlined assumptions about 'normal' testosterone levels in women's and men's bodies (Camporesi 2016, Schultz 2018). Men competing in the male classification are both assumed and allowed to have higher levels than women (IAAF, 2011, WA 2019). Indeed, men who have been diagnosed with low testosterone (such as being

diagnosed with the intersex variation Klinefelter's syndrome) are allowed to take synthetic testosterone for health reasons in line with the World Anti-Doping Agency's (WADA) Therapeutic Use Exemptions (TUE) Guidelines (WADA, 2018) which raise noteworthy contradictions. More specifically this waiver seems to suggests that it is every man's right to compete in elite sports with healthy and high levels of testosterone while athletes in the female classification with an intersex variation generating too high levels of functional testosterone, are subjected to penalties and exclusion (Brömdal 2013, Brömdal and Davis 2020) if not conforming to these hierarchy implied and constructed binary norms.

As critiques of both the science and the ethics of focusing on the role of testosterone in establishing 'fairness' in women's sport argue, given the biological and genetic diversity of human bodies there can be no fairness in sport, and any attempt to create one can only ever be inconsistent and discriminatory. Indeed, elite sport *relies* on variations in individual physiologies, abilities and psychologies within its categories – age, sex/gender, weight – in order to create exciting competition and growth in performance outcomes.

What effects are produced by this representation of the problem, such as on women born with DSDs?

Bacchi (2009, 15) next encourages one to assume that "some problem representations create difficulties (forms of harm) for members of some social groups more so than for members of other groups". Hence, in using contested science to protect the idea of a fair or a level-playing field for women's athletics, IAAF/WA policies further normalise historical, social and cultural assumptions and knowledges that: a) women are defined by bounded endocrinological terms, thus pathologising intersex variations and women's bodies; b) women are less physically capable than men, and; c) women's sport must be protected and thus sex/gender must remain a fundamental and necessary classification in how we play sport. Collectively, these assumptions lead to the normalisation of men's sport as superior,

with women's sporting classification still fighting for recognition and resources. The continuing lack of resources for women's participation in sport remains a significant barrier to their development as athletes in comparison to boys/men, as do many of the cultural limitations placed on girls/women in many societies (Benn and Dagkas 2013, McLachlan 2019).

These are broader social effects, however there are also more personal and harmful impacts (Bacchi 2009) on the athletes whose bodies come under suspicion or are accused of being a DSD 'relevant' athlete. The most obvious is the invasion of athletes' privacy both through the patronising of their bodies through medical procedures, and then by international audiences, with private information about women athletes' bodies made public without their permission. Semenya herself has spoken about this issue, linking it to issues of human rights:

> Since my victory in the female 800 meter event at the Berlin World Championships in August last year, I have been subjected to unwarranted and invasive scrutiny of the most intimate and private details of my being. Some of the occurrences leading up to and immediately following the Berlin World Championships have infringed on not only my rights as an athlete but also my fundamental and human rights including my rights to dignity and privacy (The Guardian 2010).

Sexuality and sex/gender can be fraught issues in diverse national, cultural and religious communities, so the public release of private information about athletes' health and bodies might have additional, isolating effects for athletes in their sports, families and communities. For example, after a gender verification following her silver-medal-win at the 2006 Asian Games in Doha, Indian middle-distance runner, Santhi Soundarajan, was stripped of her medal and banned from further competing (Mitra 2014, Soundarajan 2012). In addition to these impacts, she was confused as to why she was required to undergo testing:

> I do not know, who has told them that I am not a woman. I have told them that I am a woman… Nobody has [ever] questioned me. All the other athletes treated me as a female

> and as a friend… I did not think otherwise. I felt like a girl, like a woman only. I want to live like a woman and stay a woman only (Soundarajan 2012).

Soundarajan came to know about the verdict after seeing it reported on the news. She felt discriminated against by the Indian Olympic Association officials as they did not take an interest in supporting her investigation into the gender allegations, nor did they trust her identification as a woman – pushing her to attempt suicide (Soundarajan 2012). What may further explain the poor treatment of Soundarajan, besides the fact that she was interrupting normative sex/gender/body/embodiment idea(l)s is that she belongs to the lowest caste of Indian society – the Dalits (Shapiro 2012). Even though the caste system has been legally banned, it still has a strong influence on how persons from different castes are treated socio-politically in India (Rao 2010).

These cases highlight how the recent IAAF/WA policies privileges White, Western women in women's sport, and is having disproportionate effects on Black, Indigenous and women athletes of colour, whose bodies are targeted as "suspicious" (Karkazis et al. 2012, Karkazis and Jordan-Young 2018, 26). Even White, women athletes competing against Semenya have attacked her publicly. In 2009, the New York Times reported that, "Some of Semenya's competitors in the 800 meters considered the issue straightforward after Semenya romped to a commanding victory at the world championships Wednesday. 'Just look at her,' said Mariya Savinova of Russia, who finished fifth" (Clarey and Kolata 2009). Similarly, the Italian competitor Elisa Cusma, "who was sixth, told Italian journalists: 'These kind of people should not run with us. For me, she's not a woman. She's a man'" (Clarey and Kolata 2009).

Retired athlete, Madeleine Pape competed as an 800-metre runner at the same 2009 events as Semenya and admits to being part of these attacks. She changed her perspective during her PhD studies in Sociology, which led her to question the assumptions underpinning

her thinking about the role of testosterone in women's sport. Pape wrote about her change of mind in 2016, where she highlighted the racialised aspects of the issue and the IAAF/WA policy:

> Semenya is a black, queer, tomboy from South Africa, making her a marginal character in a sport that is predominantly straight, historically dominated by White Europeans, organised around strict gender segregation and objectification of women's bodies, and where women are often fairly feminine in their self-presentation. I do not think these details are peripheral to the story, I think they are at the heart of it (Pape 2016).

Further to this Pape suggests "Perhaps the worst part is that we – female athletes – police ourselves by policing Semenya and others who we presume to have intersex characteristics. We are scared to see in Semenya a champion worth celebrating" (Pape 2016).

Pape's comments reflect racialised assumptions about authentic forms of femininity that are embedded in IAAF/WA policies and practices related to relevant DSD characteristics as a measure of sex/gender verification. White, women athletes are seldom scrutinised as they, arguably, visually conform to Western imagined ideals about femininity and female-ness (Camporesi in Kessel 2018). While women from eastern European countries were previously in focus, in the recent past Black women and women of colour have had a disproportionately high rate of investigation (e.g. Semenya, Soundarajan, the Simpore sisters, Chand) (Bavington 2016, Brömdal 2013). Karkazis and Jordan-Young (2018) highlight that the policy of suspicion-targeted testing is based on appearance and success; the default femininity in global sport remains that of cisgendered, White women. Hence, by embedding policy that regulates women with particular DSDs as ensuring 'fairness' for all, sports organisations embed (endo)sexist, racist ideas about the women who participate in sport.

How and where have these representations been produced, disseminated, and defended? How could they be questioned, disrupted, and replaced?

The last question within the WRP approach extends Question Three, and "directs attention to…the possibility of challenging [these] problem representations that are judged to be harmful" (Bacchi 2009, 19) and explore how one can reframe the issue at stake. As we have seen, the problem of regulating sex/gender in elite women's sport is linked to historical and contemporary assumptions about women in sport and society. In the context of elite athletics, the IAAF/WA have been the key institution in producing, disseminating and defending current iterations of this problem, including how women are able to be 'defined', along with some sport science researchers and media sources. Questions and disruptions also come from researchers and media sources but are driven by the activism of impacted athletes and human rights groups.

Much scientific research about sport normalises ideas about men as athletes, as well as pathologising women athletes' bodies, especially intersex bodies. The discrimination flows from the assumptions and methodologies used to produce knowledge which stems from the scientists and policymakers themselves. Driving this is 1) the continued dominance of men and patriarchal structures in leadership and policy-making roles across sporting organisations; and 2) the influence of these men in actively leading research projects and 'producing' data to support IAAF/WA's political agenda of policing women's sporting classifications, particular for intersex women. Men in positions of organisational power, are able to make decisions about female and intersex athlete's bodies – about what is normal and correct – while framing these decisions in terms of fairness and protected by misplaced narrative of care for women's health. More specifically, the majority of medical experts named in the 2011 and the current IAAF/WA policy include mainly men and a few women in Western research and medical institutions who have long-standing relationships with the

IAAF/WA/IOC/national sporting organisations, and have produced research informing and justifying the IAAF'/WAs past and present political agenda governing particular intersex women elite athletes (Bermon et al. 2013, Bermon et al. 2015, Elsas et al. 2000, Ljungqvist and Simpson 1992, Bermon and Garnier 2017, Bermon et al. 2018, Handelsman, Hirschberg, and Bermon 2018).

For example, Angelica Lindén Hirschberg, Stéphane Bermon, and colleagues (Hirschberg 2020, Hirschberg et al. 2020) have also had research funded by the International Athletics Foundation tasked with informing and legitimising the current eligibility policy. During 2017-2018 the authors conducted a trial study with physically active and healthy women aged 18-35 years, and randomly gave them a daily 10mg testosterone cream or a placebo cream for 10 weeks. Based on the authors' findings "that exogenous testosterone elevates the muscle mass and improves the physical performance of young, physically active women" it is "unfair to allow female athletes with endogenous testosterone levels in the male range… to compete against those with normal female androgen levels" (Hirschberg 2020, R81 & R87). While their claims are confident, their results are unconvincing; the project rests on assumptions about testosterone as a defining physiological characteristic for regulating participation in elite women's sport and standardising the normal range of testosterone levels for all women. Here we must remember that men have no endocrinological definitions that limit their participation, instead, as suggested earlier, they are allowed to take testosterone supplements to elevate their levels for health reasons. The associations of these research projects, reproducing and defending IAAF/WA's existing agenda, raises many questions about research ethics/integrity, methodologies, conflicts of interests, and research funding distributions.

Other researchers have also been important in challenging IAAF/WA's policies. While this includes biomedical researchers, it has been scholars in the humanities and social

sciences who have been vocal in their critiques of the IAAF/WA policies. The scope of this work runs throughout our discussion and includes scholars from fields as diverse as sociology, history, bioethics, and political science.

Although the IAAF/WA argue that they are 'detecting' and 'solving' potential future health problems in the best interests of the athlete (2011, 2019), the lack of care for athletes' health and wellbeing in the pursuit of "fairness" extends to the lack of consideration of the consequences of medical interventions into bodily and hormone modification for intersex athletes specifically. This is one area medical professions have been active in challenging the IAAF/WA's policies and narratives about the effects of testosterone and hyperandrogenism on women's sport. In April 2019, prior to the CAS ruling, the World Medical Association (WMA) issued a statement that "called on physicians around the world to take no part in implementing new eligibility regulations for classifying female athletes" (2019b). At their Council meeting, "the WMA demanded the immediate withdrawal of the regulations" and argued the new policy regulations "constitute a flagrant discrimination based on the genetic variation of female athletes and are contrary to international medical ethics and human rights standards" (2019b). Their position was based on ethical concerns related to athletes' health, including the IAAF/WA encouraging athletes to take "unjustified" medical products and engage in unwarranted medical procedures (WMA 2019b). The WMA also raised concerns about the validity of the science that supports the IAAF/WA policy, which they argue is "based on weak evidence from a single study, which is currently being widely debated by the scientific community" (2019b).

Conclusion

The IAAF/WA's representations of intersex women's testosterone levels in female elite sports as a problem that requires governing solutions to ensure competitive fairness draws on

narrow, binary and normative assumptions about what constitutes being a woman in elite sports. The IAAF/WA policy strongly suggests that "the broad class of female athletes" are in need of and will "benefit" from 'protection' against a particular cohort of women who challenge IAAF/WA's political mission to "ensure fair and meaningful competition within the female classification" (2019, 3). These representations also legitimately label these athletes as a group of women who in a utilitarian fashion 'needs' to be "discriminated" against to achieve IAAF/WA's mission of "preserving the integrity of female athletics" (Schultz 2019a, CAS, 2019a). Challenging these binary, endosexist and normative assumptions about who is allowed to compete in elite sports, requires ongoing bioethical and human rights advocacy work.

In line with WMA, we strongly agree that "it is the ethical duty of physicians to respect the dignity and integrity of people" aside from what their gender identity or biological sex configuration may be and "medical treatment for the sole purpose of altering the performance in sport is not permissible" (2019a). Considering the current political landscape in track and field, athletes are currently positioned to pick between "an impossible set of choices" (Karkazis and Carpenter 2018, 586). As such, we hope that that the days when doctors, physicians, sporting bodies, and their allies can "through humiliation, stigmatization, and fear" (Karkazis and Carpenter 2018, 586) govern, institutionalise and standardise bodies of women athletes with 46 XY DSD with elevated testosterone levels to eligibly compete in the female classification, *should* hopefully soon be over.

References

Amateur Athletic Union of the United States. 1938. Amateur Athletic Union Official Handbook: Athletic Rules: Track and Field. In *AAU Sports Track and Field: 1931, 1936, 1938, 1945-50 Folder on Avery Brundage Hard Disk*. Lausanne: IOC Historical Archives.

Bacchi, Carol. 2009. *Analysing policy: What's the problem represented to be?* French Forest, NSW: Pearson.

Bacchi, Carol. 2012. "Introducing the 'What's the Problem Represented to be?' approach." In *Engaging with Carol Bacchi: Strategic Interventions & Exchanges*, edited by Angelique Bletsas and Chris Beasley. Adelaide: University of Adelaide Press.

Bavington, Dawn Lisa. 2016. "Regulating Hyperandrogenism in Elite Female Athletes: The History and Current Politics of Sex-Control in Women's Sport " Doctor of Philosophy, University of Otago.

Bavington, Dawn Lisa. 2018. "Sex control in women's sport: a history of the present regulations on hyperandrogenism in female athletes." In *Sex, Gender, and Sexuality in Sport: Queer Inquiries*, edited by Vikki Krane, 181-200. New York: Routledge.

Benn, Tansin, and Symeon Dagkas. 2013. "The Olympic Movement and Islamic culture: conflict or compromise for Muslim women?" *International Journal of Sport Policy and Politics* 5 (2):281-294. doi: 10.1080/19406940.2012.656677.

Bermon, Stéphane. 2017. "Androgens and athletic performace of elite female athletes." *Current Opinion in Edocrinology, Diabetes and Obesity* 24 (3):246-251. doi: 10.1097/MED.0000000000000335.

Bermon, Stéphane, and Pierre-Yves Garnier. 2017. "Serum androgen levels and their relation to performance in track and field: mass spectrometry results from 2127 observations in male and female elite athletes." *British Journal of Sports Medicine* 51 (17):1309-1314. doi: 10.1136/bjsports-2017-097792.

Bermon, Stéphane, Angelica Lindén Hirschberg, Jan Kowalski, and Emma Eklund. 2018. "Serum androgen levels are positively correlated with athletic performance and competition results in elite female athletes." *British Journal of Sports Medicine* 52 (23):1531-1532. doi: 10.1136/bjsports-2018-099700.

Bermon, Stéphane, Martin Ritzén, Angelica Lindén Hirschberg, and Thomas H. Murray. 2013. "Are the New Policies on Hyperandrogenism in Elite Female Athletes Really Out of Bounds? Response to "Out of Bounds? A Critique of the New Policies on Hyperandrogenism in Elite Female Athletes"." *The American Journal of Bioethics* 13 (5):63-65. doi: 10.1080/15265161.2013.776129.

Bermon, Stéphane, Eric Vilain, Patrick Fénichel, and Martin Ritzén. 2015. "Women With Hyperandrogenism in Elite Sports: Scientific and Ethical Rationales for Regulating." *The Journal of Clinical Endocrinology & Metabolism* 100 (3):828-830. doi: 10.1210/jc.2014-3603.

Borgen, Nicolai Topstad. 2020. "Collider bias (aka sample selection bias) in observational studies: why the effects of hyperandrogenism in elite women's sport are likely underestimated." *British Journal of Sports Medicine* 54 (12):750-752. doi: 10.1136/bjsports-2018-100054.

Brömdal, Annette. 2013. "The Phantom Category of 'Intersex' in Elite Sports: Knowledge about 'Disturbing' Female Bodies and Athletic Performances." PhD, Monash University.

Brömdal, Annette, and Ian Davis. 2020. "The Pedagogical Possibilities of Critically Examining Gender and Sexuality in Initial Teacher Education Through the Lens of

Intersex." In *Inclusive Theory and Practice in Special Education*, edited by Henriette van Rensburg and Shirley O'Neill, 99-123. Hershey, PA: IGI Global.

Brundage, Avery. 1936. Dear Count Baillet-Latour. In *F-A02-PS-FEMSP/011_Women and Sport_Correspondance about the women's federations_1925-1938*. Lausanne, Switzerland: IOC Historical Archives.

Brundage, Avery. 1966. Dear Arthur. In *SP Medical Commission IOC, 1966-1969 Folder on Avery Brundage Hard Disk*. Lausanne, Switzersland: IOC Historical Archives.

Butler, Judith. 2004. *Undoing gender*. New York: Routledge.

Camporesi, Silvia. 2016. "Why Caster Semenya and Dutee Chand deserve to compete (and win) at Rio 2016." accessed 8 May 2019. https://theconversation.com/why-caster-semenya-and-dutee-chand-deserve-to-compete-and-win-at-rio-2016-63727.

Carlson, Alison. 1991. "When is a woman not a woman." *Women's Sport & Fitness*:24-29.

Clarey, Christopher, and Gina Kolata. 2009. "Gold Awarded Amid Dispute over Runner's Sex." *The New York Times*. https://www.nytimes.com/2009/08/21/sports/21runner.html.

Cooky, Cheryl, Ranissa Dycus, and Shari L. Dworkin. 2013. "'"What Makes a Woman a Woman?" Versus "Our First Lady of Sport":A Comparative Analysis of the United States and the South African Media Coverage of Caster Semenya." *Journal of Sport and Social Issues* 37 (1):31-56. doi: 10.1177/0193723512447940.

Court of Arbitration for Sport. 2019a. "Athletics - CAS Arbitration: Caster Semenya, Athletics South Africa (ASA) and International Association of Athletics Federation (IAAF): Decision." Court of Arbitration for Sport, accessed 1 May. https://www.tas-cas.org/fileadmin/user_upload/Media_Release_Semenya_ASA_IAAF_decision.pdf.

Court of Arbitration for Sport. 2019b. "Semenay, ASA and IAAF: Exexutive Summary." https://www.tas-cas.org/fileadmin/user_upload/CAS_Executive_Summary__5794_.pdf.

Cryle, Peter, and Elizabeth Stephens. 2017. *Normality: A Critical Genealogy*. Chicagoe: The University of Chicago Press.

Davis, Georgiann. 2015. *Contesting intersex: The dubious diagnosis*: NYU Press.

de Beauvoir, Simone. 2014 [1949]. *The Second Sex* Translated by Constance Borde and Sheila Malovany-Chevallier. London: Vintage Books.

Eklund, E., B. Berglund, F. Labrie, K. Carlstrom, L. Ekstrom, and A. L. Hirschberg. 2017. "Serum androgen profile and physical performance in women Olympic athletes." *British Journal of Sports Medicine* 51 (17):1301-1308. doi: 10.1136/bjsports-2017-097582.

Elsas, Louis J, Arne Ljungqvist, Malcolm A Ferguson-Smith, Joe Leigh Simpson, Myron Genel, Alison S Carlson, Elizabeth Ferris, Albert De La Chapelle, and Anke A Ehrhardt. 2000. "Gender verification of female athletes." *Genetics in Medicine* 2 (4):249-254.

Erikainen, Sonja. 2019. *Gender Verification and the Making of the Female Body in Sport: A History of the Present*. London: Routledge.

Foucault, Michel. 1972. *The archaeology of knowledge and the discourse on language*. New York: Pantheon Books.

Foucault, Michel. 1979. *Discipline and Punish : The Birth of the Prison*. Harmondsworth: Penguin Books.

Foucault, Michel. 1980. "Two lectures." In *Power/knowledge: Selected interviews and other writings, 1972-1977 by Michel Foucautl*, edited by Colin Gordon, 78-108. Brighton, Sussex: The Harvester Press.

Foucault, Michel. 1988. "Critical theory/intellectual history." In *Politics, philosophy, culture: Interviews and other writings 1977-1984*, edited by Lawrence D Kritzman, 17-46. New York: Routledge, Chapman & Hall, Inc.

Goodwin, Susan. 2011. "Analysing Policy as Discourse: Methodological Advances in Policy Analysis." In *Methodological Choice and Design: Sholarship, Policy and Practice in Social and Educatinal Reserach*, edited by Lina Markauskaite, Peter Freebody and Jude Irwin, 167-180. London: Springer.

Handelsman, David J, Angelica L Hirschberg, and Stephane Bermon. 2018. "Circulating testosterone as the hormonal basis of sex differences in athletic performance." *Endocrine reviews* 39 (5):803-829. doi: 10.1210/er.2018-00020.

Hay, Eduardo. 1974. "Femininity tests and the Olympic Games." *Olympic Review* 76-77:119-123.

Healy, Marie-Louise, James Gibney, Claire Pentecost, Mike J Wheeler, and PH Sönksen. 2014. "Endocrine profiles in 693 elite athletes in the postcompetition setting." *Clinical endocrinology* 81 (2):294-305. doi: 10.1111/cen.12445.

Heggie, Vanessa. 2010. "Testing sex and gender in sports; reinventing, reimagining and reconstructing histories." *Endeavour* 34 (4):157-163.

Heggie, Vanessa. 2020. "Health, gender and inequality in sport." In *EveryBody Tells A Story : Zur Geschichte von Sport-, Körper- und Bewegungskulturen*, edited by Sandra Günter, 31-51. Wiesbaden: Springer Fachmedien Wiesbaden.

Hirschberg, Angelica Linden. 2020. "Female hyperandrogenism and elite sport." *Endocrine connections* 9 (4):R81-R92. doi: 10.1530/EC-19-0537.

Hirschberg, Angelica Lindén, Jona Elings Knutsson, Torbjörn Helge, Manne Godhe, Maria Ekblom, Stephane Bermon, and Björn Ekblom. 2020. "Effects of moderately increased testosterone concentration on physical performance in young women: a double blind, randomised, placebo controlled study." *British Journal of Sports Medicine* 54 (10):599-604. doi: 10.1136/bjsports-2018-100525.

Holmes, Morgan. 2011. "The intersex enchiridion: Naming and knowledge." *Somatechnics* 1 (2):388-411.

International Association of Athletics Federation. 2006. "IAAF policy on gender verification." International Association of Athletics Federation, accessed 25 February 2013. http://oii.org.au/wp-content/uploads/iaaf_policy_on_gender_verification.pdf.

International Association of Athletics Federation. 2011. "IAAF regulations governing eligibility of females with Hyperandrogenism to compete in women's competition.", accessed 15 March 2019. https://www.sportsintegrityinitiative.com/wp-content/uploads/2016/02/IAAF-Regulations-Governing-Eligibility-of-Females-with-Hyperandrogenism-to-Compete-in-Women's-Competition-In-force-as-from-1st-May-2011-6.pdf.

International Olympic Commitee. 1992. Minutes of the 99th IOC Session, Barcelona, 21st, 22nd and 23rd July 1992. In *Minutes of the IOC Sessions Hard disk*. Lausanne, Switzerland: IOC Historical Archives.

International Olympic Commitee. 1999. Minutes of the 109th IOC Session, Seoul, 17th, 18th, 19th and 20th June 1999. In *Minutes of the IOC Sessions Hard disk*. Lausanne, Switzerland: IOC Historical Archives.

International Olympic Commitee. 2010. "[PRESS RELEASE] Summary of conclusions reached at Gender Symposium." Last Modified 21 November 2010. http://www.olympic.org/content/news/media-resources/manual-news/2010/011/21/press-release-summary-of-conclusions-reached-at-gender-symposium/.

Intersex Human Rights Australia. 2013. "What is Intersex?", accessed 3 July 2018. https://ihra.org.au/18106/what-is-intersex/.

Karkazis, Katrina, and Morgan Carpenter. 2018. "Impossible "choices": The inherent harms of regulating women's testosterone in sport." *Journal of bioethical inquiry* 15:579-587. doi: https://doi.org/10.1007/s11673-018-9876-3.

Karkazis, Katrina, Rebecca Jordan-Young, Georgiann Davis, and Silvia Camporesi. 2012. "Out of bounds? A critique of the new policies on hyperandrogenism in elite female athletes." *The American Journal of Bioethics* 12 (7):3-16.

Karkazis, Katrina, and Rebecca M Jordan-Young. 2018. "The powers of testosterone: Obscuring race and regional bias in the regulation of women athletes." *Feminist Formations* 30 (2):1-39.

Kessel, Anna. 2018. "The unequal battle: privelege, genes, gender and power." *The Guardian*. https://www.theguardian.com/world/2018/feb/18/the-unequal-battle-privilege-genes-gender-and-power.

Larned, Deborah. 1976. "The Femininity Test: A woman's first Olympic hurdle." *Women Sports* 3:8-11.

Ljungqvist, Arne, Maria Jose Martinez-Patino, Aurora Martinez-Vidal, Luisa Zagalaz, Pino Diaz, and Covadonga Mateos. 2006. "The history and current policies on gender testing in elite athletes." *International SportMed Journal* 7 (3):225-230.

Ljungqvist, Arne, and Joe Leigh Simpson. 1992. "Medical examination for health of all athletes replacing the need for gender verification in international sports: The International Amateur Athletic Federation plan." *JAMA: The Journal of the Amercian Medical Association* 267 (6):850-852.

McLachlan, Fiona. 2019. "It's Boom Time! (Again): Progress Narratives and Women's Sport in Australia." *Journal of Australian Studies* 43 (1):7-21. doi: 10.1080/14443058.2019.1575262.

Mitra, Payoshni. 2014. "The untold stories of female athletes with intersex variations in India." In *Routledge Handbook of Sport, Gender and Sexuality*, edited by Jennifer Hargreaves and Eric Anderson, 384-394. New York: Routledge.

Montañola, Sandy, and Aurélie Olivesi. 2016. *Gender Testing in Sport: Ethics, Cases and Controversies*. New York: Routledge.

Organizing Committee of the XVIII Olympiad. 1964. "The Official Report of the XVIII Olympiad Tokyo 1964, Volume 1 & 2." accessed 15 February, 2013. http://www.la84foundation.org/5va/reports_frmst.htm.

Pape, Madeleine. 2016. "Why I now stand with Caster Semenya." https://www.sbs.com.au/topics/zela/article/2016/08/08/why-i-now-stand-caster-semenya.

Pape, Madeleine. 2019. "Expertise and Non-binary Bodies: Sex, Gender and the Case of Dutee Chand." *Body & Society* 25 (4):3-28. doi: 10.1177/1357034x19865940.

Pielke, Roger. 2017. "Sugar, spice and everything nice: how to end 'sex testing' in international athletics." *International Journal of Sport Policy and Politics* 9 (4):649-665. doi: 10.1080/19406940.2017.1369448.

Pielke, Roger, Ross Tucker, and Erik Boye. 2019a. "Correction to: Scientific integrity and the IAAF testosterone regulations." *The International Sports Law Journal* 19 (1):27-28. doi: 10.1007/s40318-019-00149-4.

Pielke, Roger, Ross Tucker, and Erik Boye. 2019b. "Scientific integrity and the IAAF testosterone regulations." *The International Sports Law Journal* 19 (1):18-26. doi: 10.1007/s40318-019-00143-w.

Pieper, Lindsay. 2016. *Sex testing: Gender policing in women's sports*. Urbana: University of Illinois Press.

Rao, Jasmine. 2010. "The caste system: Effects on poverty in India, Nepal and Sri Lanka." *Global Majority E-Journal* 1 (2):97-106.

Reczek, Włodzimierz. 1967. Dear Colleagues. In *Commission medicale: Correspondance alphabetique 1960-1967, ID Chemise: 203687, CIO COMMI-MEDIC-CORR*. Lausanne, Switzerland: IOC Historical Archives.

Ritchie, Ian. 2003. "Sex tested, gender verified: Controlling female sexuality in the age of containment." *Sport History Review* 34 (1):80-98.

Rogol, D Alan, and Lindsay Parks Pieper. 2018. "The Interconnected Histories of Endocrinology and Eligibility in Women's Sport." *Horm Res Paediatr* 90 (4):213-220. doi: 10.1159/000493646.

Schultz, Jaime. 2011. "Caster Semenya and the "Question of Too": Sex Testing in Elite Women's Sport and the Issue of Advantage." *Quest* 63 (2):228-243. doi: 10.1080/00336297.2011.10483678.

Schultz, Jaime. 2012a. "Disciplining Sex: 'Gender Verification' Policies and Women's Sport." In *The Palgrave Handbook of Olympic Studies*, edited by Helen Jefferson Lenskyj and Stephen Wagg, 443-460. London: Palgrave Macmillan UK.

Schultz, Jaime. 2012b. "New standards, same refrain: the IAAF's regulations on hyperandrogenism." *The American journal of bioethics* 12 (7):32-33.

Schultz, Jaime. 2018. "A sexist policy may end the career of one of the Commonwealth's greatest female runners." The Conversation, accessed 3 July 2018. http://theconversation.com/a-sexist-policy-may-end-the-career-of-one-of-the-commonwealths-greatest-female-runners-94390.

Schultz, Jaime. 2019a. "Caster Semenya's impossible situation: Testosterone gets special scrutiny but doesn't necessarily make her faster." The Conversation, accessed 13 May 2019. https://theconversation.com/caster-semenyas-impossible-situation-testosterone-gets-special-scrutiny-but-doesnt-necessarily-make-her-faster-116407.

Schultz, Jaime. 2019b. "Good enough? The 'wicked' use of testosterone for defining femaleness in women's sport." *Sport in Society*:1-21. doi: 10.1080/17430437.2019.1703684.

Shani, Roi, and Yechiel Michael Barilan. 2012. "Excellence, Deviance, and Gender: Lessons From the XYY Episode." *The American Journal of Bioethics* 12 (7):27-30. doi: 10.1080/15265161.2012.681338.

Shapiro, Samantha. 2012. "Caught in the middle." http://espn.go.com/olympics/story/_/id/8192977/failed-gender-test-forces-olympian-redefine-athletic-career-espn-magazine.

Sönksen, Peter, L Dawn Bavington, Tan Boehning, David Cowan, Nishan Guha, Richard Holt, Katrina Karkazis, Malcolm Andrew Ferguson-Smith, Jovan Mircetic, and Dankmar Bőhning. 2018. "Hyperandrogenism controversy in elite women's sport: an examination and critique of recent evidence." *British Journal of Sports Medicine* 52 (23):1481-1482. doi: 10.1136/bjsports-2017-098446.

Sönksen, Peter, Malcolm A Ferguson-Smith, L Dawn Bavington, Richard IG Holt, David A Cowan, Don H Catlin, Bruce Kidd, Georgiann Davis, Paul Davis, and Lisa Edwards. 2015. "Medical and ethical concerns regarding women with hyperandrogenism and elite sport." *The Journal of Clinical Endocrinology & Metabolism* 100 (3):825-827.

Soundarajan, Santhi. 2012. Y can't run. edited by Payoshni Mitra. New Delhi, India.

Sudai, Maayan. 2017. "The testosterone rule — constructing fairness in professional sport." *Journal of Law and the Biosciences* 4 (1):181-193. doi: 10.1093/jlb/lsx004.

Sullivan, Claire F. 2011. "Gender Verification and Gender Policies in Elite Sport:Eligibility and "Fair Play"." *Journal of Sport and Social Issues* 35 (4):400-419. doi: 10.1177/0193723511426293.

Swiss Federal Supreme Court. 2020. "Press Release on the Swiss Federal Supreme Court." accessed 10 September. 2020. https://www.bger.ch/files/live/sites/bger/files/pdf/en/4A_248_2019_yyyy_mm_dd_T_e_18_18_10.pdf.

The Guardian. 2010. "Caster Semenya's comeback statement in full." The Guardian. https://www.theguardian.com/sport/2010/mar/30/caster-semenya-comeback-statement.

Thiébault, Jacques. 1968. Report by Doctor Thiébault on the Grenoble Games, presented to the Medical Commission of the International Olympic Committee In *SP Medical Commission IOC, 1966-1969 Folder*. Lausanne, Switzerland: IOC Historical Archives.

Time Magazine. 1936a. "Sport: Olympic Games." *Time Magazine* 40-42.

Time Magazine. 1936b. "Sport: Olympic Games (Concl'd)." *Time Magazine*, 56-60.

Turnbull, Alison. 1988. "Woman enough for the Games." *New Scientist* 119 (1630):61-64.

Westerhoff, Johann. 1966. Dear Arthur. In *SP Medical Commission IOC, 1966-1969 Folder*. Lausanne, Switzersland: IOC Historical Archives.

World Anti-Doping Agency. 2018. "TUEC Guidlines: Medical information to Support the Decision of the TUE Committee - Male Hypogonadism." https://www.wada-ama.org/sites/default/files/resources/files/tuec_malehypogonadism_version6.1_february2018.pdf.

World Athletics. 2019. "Eligibility regulations for the female classification (athletes with differences of sex development)." accessed 8 September, 2020. https://www.worldathletics.org/download/download?filename=656101dc-7716-488a-ab96-59d37941e9ac.pdf&urlslug=C3.6%20-%20Eligibility%20Regulations%20for%20the%20Female%20Classification.

World Medical Association. 2019a. "Physicians leaders reaffirm opposition to IAAF rules." World Medical Association,, accessed 16 May 2019. https://www.wma.net/news-post/physician-leaders-reaffirm-opposition-to-iaaf-rules/.

World Medical Association. 2019b. "WMA urges physicians not to implement IAAF rules on classifying women athletes." World Medical Association,, accessed 10 May 2019. https://www.wma.net/news-post/wma-urges-physicians-not-to-implement-iaaf-rules-on-classifying-women-athletes/.

Xavier, N, and J McGill. 2012. "Hyperandrogenism and Intersex Controversies in Women's Olympics." *The Journal Of Clinical Endocrinology & Metabolism* 97 (11):3902-3907. doi: 10.1210/jc.2012-2792.