Position paper[1]

Testosterone blockers and their effects in female athletics

Ilse Koelewijn [1] and Matthijs van den Broek [2] and George Kontos [3]

[1] Applied Physics, TU/e, 5612 AJ, the Netherlands
[2] Mechanical Engineering, TU/e, 5612 AJ, the Netherlands
[3] Industrial Design, TU/e, 5612 AJ, the Netherlands

Emails: i.b.koelewijn@student.tue.nl, m.g.v.d.broek@student.tue.nl, g.condos@student.tue.nl

Submitted: 04/11/2021

Abstract: In 2018, World Athletics has issued new regulations that ban intersex female athletes with higher testosterone levels than usual (hyperandrogenism) from competing on international level. These athletes should either compete in the male category, or take testosterone blockers to lower their testosterone levels. The regulations were put in place because World Athletics says research has shown that high testosterone levels give these athletes a significant advantage. However, this research is debated by other scientists. Also, these athletes identify themselves as female and are also recognized by society as female, so opponents say that hyperandrogenism should just be seen as a natural advantage, just like tall people have an advantage in basketball. In this position paper it will be explained why the regulations are unfair, and should be removed.

Keywords: athletics; testosterone; blockers; ethics; female category

1. Introduction

In 2009, the whole world saw the 18-year-old female athlete Caster Semenya win the 800-meter race at the athletics World Championships in Berlin. However, questions were raised about her sex, because of her low voice, facial hair and muscular appearance [1]. World Athletics (the governing body of athletics) even made her do a sex test to verify that she was actually female [2], but with a Difference in Sexual Development (DSD) [3] (also called intersex). In her case this means that she has XY-chromosomes (normally typical for males), but still developed a female body. However, her XY-chromosomes cause hyperandrogenism, which means that she produces more testosterone than usual [3].

And this is where the problem lies, according to World Athletics. From 2018, they have banned athletes with DSD who have testosterone levels higher than 5 nmol/L in their blood (most women have testosterone levels between 0.6 and 1.9 nmol/L [4]), from competing in the elite female category on the events between 400 m and one mile [5], because “testosterone, either naturally produced or artificially inserted into the body, provides significant performance advantages in female athletes” [5]. Female athletes with elevated testosterone levels are therefore only allowed to compete on international level if they take medicines that lower their testosterone levels, so-called testosterone blockers.

On the other hand, Semenya and other athletes with DSD argue that they have done nothing wrong, since they are not artificially injecting testosterone in their body. Their bodies just provide them with a natural advantage, just like tall people have an advantage at basketball.

[1] This template is an adapted version of the Proceedings template of MDPI Publishers

In this position paper, this difficult question will be addressed with the help of two experts: Ton van Hoesel, experienced running trainer and former trainer of Sifan Hassan, and Asimakis Talamagkas, biologist researcher and professor in the National and Kapodistrian University of Athens. It will be explained why the rules made by World Athletics are not fair, and why hyperandrogenic female athletes should be allowed to participate in international competitions without having to lower their testosterone levels.

2. Societal – User challenges

The challenges associated with testosterone blockers can be divided into two parties. On one side it might not be fair for athletes with normal levels of testosterone to compete with those who have naturally higher levels. The athletes with normal levels may feel disadvantaged and the viewers may not enjoy sports if someone seems to have a significant advantage. Some say that this person is supposed to run in the men's category. World Athletics justifies their decision to ban athletes with a higher concentration of testosterone by saying "then DSD and transgender athletes will dominate the podiums and prize money in sport, and women with normal female testosterone levels will not have any chance to win." [12]

On the other side, the athletes with higher levels did not use doping or try to cheat. They just have a natural advantage. For these athletes it is not fair to have to change their hormone levels to be allowed to compete in sports. To compete in the women's category they have to take testosterone blockers and with every kind of blocker there is a chance of side effects [6]. Also, the blockers can have a mental effect on the athlete. Another option is to undergo surgery to stop the body from producing that much testosterone, which was the case for Annet Negesa. She was banned from the Olympics and stayed alone, depressed, for months. She had undergone a surgery to remove her internal testes, so she would still be able to compete. She was told it was "a simple surgery – like an injection", but she suffered headaches and achy joints in the years after. She never regained her former fitness levels. [13]

There are various papers stating that hyperandrogenism is not strongly related to a performance advantage for athletes. World Athletics used a paper that proved testosterone was related to a better performance, but this paper is debated by other experts. They recognize significant flaws in the data that was used, which leads to unreliable results. These errors have not been corrected, meaning this was a comprehensive failure of scientific integrity. More research should be done to say for certain that testosterone has a significant impact on an athlete's performance. [14-15]

Transgender women are facing the same problem as the women with DSD. They get a hormone therapy to suppress their testosterone. However, after two years of therapy the physical advantage is still not completely gone. For push-ups and sit-ups there was no measurable difference, but the transgender women could still run the 1.5 mile 12% faster than cisgender women [16]. In elite sports, where every millisecond counts, this difference is too large to ensure a fair competition. The problem in that "muscular advantage enjoyed by transgender women is only minimally reduced when testosterone is suppressed". [17]

There is no way to reach fairness and inclusion at the same time. The question is what is more important. You can either include athletes with more testosterone who identify as female or draw the line somewhere to ensure a fair competition, but then where do you draw the line? The biggest challenge is the consideration between discriminating against intersex/transgender people and fairness in the sport.

3. State of the art

The high levels of testosterone, that are naturally produced by the body of some female athletes, give them a significant competitive advantage, enough to make them winners at the global and Olympic level. This sparks international controversy over whether athletes, such as South African Caster Semenya, will have to undergo hormone therapy or even surgery in order to compete. The dilemma does not concern the athletes who are doped with extra androgens and thus violate the regulations of World Athletics. It only concerns athletes whose body itself produces excessive male hormones. World Athletics regulations initially imposed hormone therapy on these athletes to reduce their testosterone. However, in April 2018 World Athletics issued new regulations on the eligibility of women in the category, for athletes with DSD and for specific events (from 400m to mile), with emphasis on endogenous testosterone level (below 5 nmol / L) to avoid androgenic effect. The new regulations concern athletes with chromosomes "46 XY DSD" and are valid since November 2018, but there was a pending decision of the Arbitration Sports Court. The regulations mean that women with high testosterone are required to undergo humiliating and invasive physical examinations and harmful medical procedures. [18-19]

Data about the side effects that excessive male hormones have on women is scarce and have not been studied meticulously yet. In a study, executed in Karolinska Institutet, Stockholm, researchers have found evidence that higher testosterone levels on women athletes only contribute mostly in aerobic activities such as running long distances. [20]

The researchers commissioned 48 physically active and healthy women aged 18-35 years to undergo 10 weeks of daily treatment with 10 mg of testosterone cream or 10 mg of inactive substance (placebo). The scientists tested the effect of the hormone on aerobic performance, counting the time women could run on a treadmill before reaching the point of exhaustion. The effects on anaerobic performance, measuring leg strength and muscle strength were also tested.

The results showed that mean circulating testosterone levels increased from 0.9 nmol / l blood to 4.3 nmol / l among women taking the hormone cream. There was no increase in the inactive cream group. Among women taking testosterone, the run-to-exhaustion time increased by 8.5% compared to those taking the inactive substance. There were no significant changes between the two groups in any of the anaerobic performance measures neither in weight between the two groups. But the women who received the testosterone cream had much larger changes in lean muscle mass than those who received the inert cream: 923 grams versus 135 grams, in total. In particular, the lean mass increased by 398 grams compared to 91 grams respectively.

The researchers acknowledge that their study did not include elite athletes and was relatively small. However, they point out that the average increase in testosterone levels to 4.3 nmol / l among women who have taken the hormone cream is below the average range seen in men. However, the time they could run before reaching exhaustion increased significantly.

Another study confirms that higher testosterone levels indeed influence the performance of female athletes between 2 to 5 per cent. As it can been seen in Figure 1 the evolution of the performance of female athletes, with hyperandrogenic disorder, over the course of three years has decreased after they consumed testosterone blockers. The study also shows that visuospatial abilities are not depended on chromosomes but on exposure to androgen hormones, something that explains the decrease in performance on women that undergone testosterone reduction treatment. [7]

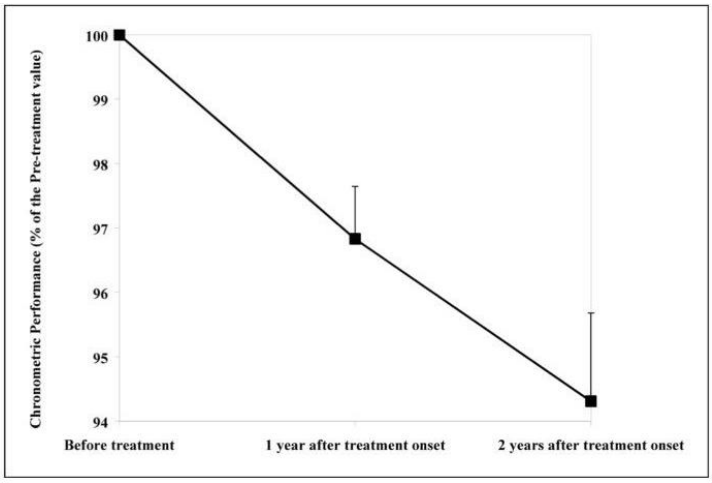


Figure 1. Evolution of seasonal best performances in three female distance runners, with a hyperandrogenic DSD, before and after reducing their testosterone level to the normal female range [7].

Despite this data, female athletes of short distances are required to lower their higher testosterone levels. But how is this done? Currently, experts recommend a combination of medication and lifestyle changes to treat the symptoms. Some treatments may also be used to control unwanted hair growth. [20]

More specifically, the drugs that are usually given to treat high testosterone in women include:

- eflornithine, a cream that is applied directly to the skin and which slows down the growth of new hair in the facial area.
- glucocorticoids, a type of steroid hormone that reduces inflammation
- metformin, which is mainly used to treat type 2 diabetes
- progestin, a hormone that regulates the menstrual cycle and improves a woman's fertility
- Spirinolactone, a diuretic that helps regulate water and salt levels in the body, while reducing excessive hair growth
- Taking oral contraceptives to stop overproduction of testosterone. However, it is not a suitable treatment for women who want to conceive.

At the same time, major lifestyle changes can both lower testosterone levels and help manage symptoms.

Even though the treatments are effective, sometimes their effects are significant. For women, side effects can be increased risk of depression, higher risk of birth defects, hepatitis, breast tenderness or even anti-androgen resistance, which means that the medication stops working. Moreover, for female athletes that are unwillingly forced to undergo such treatments, changes in their appearance are unwanted and their lifestyle is drastically and negatively influenced. [21]

4. Envisioning the future

At this moment, the last word has not yet been spoken about hyperandrogenic athletes in elite athletics. There is still a big discussion between those who think World Athletics has a duty to ensure a level playing field for all athletes, and those who say it is discriminatory to abandon certain athletes from competing. Technology will certainly continue to advance in the meantime, so could this possibly provide an answer to this debate?

Prof. Talamagkas suspects that the pharmaceutical industry might develop new testosterone blockers that do not block any other pathways than that of the testosterone receptors, which means these blockers will have minimal physical side effects [6]. However, these blockers will not remove the possible mental side effects athletes can experience, due to their decreasing performance or changing body. These mental side effects can never be solved with technology, because they arise

from the main goal of the application of this technology: decreasing the testosterone levels of hyperandrogenic athletes (and therefore decreasing their performance) [7]. So, advances in technology will not solve this problem, we can only change the way we look at this problem.

For this reason, the real question that needs to be asked in order to envision the future of this debate is not "*How will the testosterone blocker technology develop?"*, but *"How will society's view to hyperandrogenic athletes develop?"*.

One of the possible future scenarios is expressed by dr. Stéphane Bermon, the head of the World Athletics Health and Science Department. He thinks that within 5 to 10 years, there will be a separate category for intersex female athletes with high testosterone levels, although he does acknowledge that "we will need to consider religious and cultural sensitivities. … there needs to be a shift in public opinion." [8]. However, we don't think this is a very likely scenario, since not only the public opinion might be a problem, but also the number of people eligible to compete in this category. It is estimated that only around 2% of the population is born with intersex traits [9], which means there would be two categories for 49% of the population each (men and women), and an additional one for only 2% of the population. It would not be interesting for World Athletics to start such a small separate competition, since also the interest of the public and sponsors will be lower when there are so little people eligible to compete in this competition.

A different future scenario is expressed by running trainer Ton van Hoesel: "I hope that in the future all athletes who are identified as female are allowed to compete together, irrespective of testosterone levels. Athletes with higher testosterone levels do not have an unfair advantage, it is just like any other advantage in sports. If you are from Kenya and you have thin arms and legs, you also have an advantage on the marathon." [10]. We tend to agree with Mr. van Hoesel and think that the most likely scenario is that all female athletes will be allowed to compete together without having to take testosterone blockers in the future. In this scenario, World Athletics would follow the example of other sports, since no other sport requires intersex women to take testosterone blockers to compete. Also, there is a general societal trend towards more inclusivity nowadays [11], so accepting DSD athletes would fit perfectly within this societal trend. This would mean that athletes like Caster Semenya will be allowed to participate in international competitions again, without taking medication. If the regulations are changed, it will most likely be too late for Semenya to compete again (she is nearing the end of her career as she is 30 years old), but it will certainly affect a lot of athletes after her.

5. Ethical considerations

An ethical consideration that should be kept in mind, while examining the discussions surrounding the testosterone levels in female athletes, is what fairness means in sports. Opinions, of course, differ but according to one of them, from a biomedical ethics professor, for a sport to be fair athletes are not required to be equal in every aspect. There are countless examples where this way of seeing fairness in sports is accepted. One does not need to look further than one of the most popular sports on the planet: basketball. Players can be taller, stronger, or quicker than others giving them the edge. However, almost everyone approves of such natural talents. The other side, that is to have an even playing field, is also widely used in top level athletic competitions. One example is that of the Paralympics. In the 2008 Paralympics, in the 100 meters dash alone there were 13 and 12 different finals for men and women respectively. In this way, any physical inequality is diminished and only talent and the training are on display. For these reasons, it is clearly visible that fairness is not as simple as it may seem, and it varies for a multitude of different reasons. [23]

A reason that the current ruling of World Athletics is unjust is that the ruling only affects the worst off in our society. Intersex people are already stigmatized, discriminated against and in many cases cannot have children. They are already disadvantaged, and this ruling only adds up to that. Also, these androgenous people are typically raised as female. However, they are not acknowledged as such if they have to prove that their testosterone levels are low in order to be allowed to compete in the female's category. The rules just tell them that they are not female, while they do identify as female, which is unjust [3]. On top of this discrimination, it is not even proven that successful athletes

have higher testosterone levels than less successful athletes [14-15, 22]. If there is no certainty about the effects of testosterone it is not right to base rules on the concentration of this hormone. So, it becomes clear that there are several ethical problems with the ruling of World Athletics.

We believe that when all problems are considered, there is never going to be a solution in which everyone is satisfied. Maybe if a separate competition is started for people who do not fall in either the men's or the women's category you might reach fairness and no discrimination. However, this is also not ideal, since we are discussing people who identify as female and putting them in a any other category will not feel right. You have to decide whether fairness or inclusion in sports is more important. In this case we would say inclusion has the upper hand. We believe we will have to accept that sports are never going to be completely fair, simply because there are always natural advantages. To discriminate against intersex people, while there is no hard proof that they have a significant advantage, is a very hard measure to try to reach a fair game.

6. Critical reflections

The topic of this position paper is still very relevant today. As this position paper is written, the discussion about hyperandrogenic athletes competing in the female category is continuing [24]. During the writing of this position paper we also discovered that this is a very complicated topic, where both sides can have convincing arguments. When we first started this project, we were in doubt about whether or not hyperandrogenic athletes should be allowed to compete in the female category. We saw that on one side it was not really fair to these athletes to disallow them to compete, but on the other side World Athletics would not make these regulations without a good reason. After we did some research, we came across an article with the opinion of dr. Stéphane Bermone (head of the Health and Science Department of World Athletics), who thinks there will appear a separate intersex category within a few years [7]. This then seemed like a very legitimate solution to us, until we held the interview with running trainer Ton van Hoesel [10]. In his interview, he made a very convincing case that athletes who are identified as female by society and biology should be allowed to participate in the female category. Because why should we disallow someone that is unquestionably female to society to participate in that category? He convinced us that having a body that produces more testosterone than usual, is just a competitive advantage like any other. We also don't disallow really tall women to play basketball, or women from Kenya with thin arms and legs to run marathons.

However, also this decision brings some difficulties: we should draw a line between the male and female category somewhere, but where is that line? Because transgender athletes should take hormone therapy to be allowed to compete in the female category, but women with DSD with possibly similar hormone levels would then not have to take hormone blockers. This could also be a breeding ground for future discussion.

This remains a very difficult topic, and the fact that it is only applicable to elite levels sports is certainly not helpful. Ideally, we would have liked to interview people from World Athletics that could explain the details of why the rules were set up, or athletes that must deal with these rules. However, unfortunately there are only a handful of these elite athletes in the world, and World Athletics were not available for comment, so we had to interview people closer to us. These interviews were helpful, but not as insightful as interviews with World Athletics or elite athletes would have been.

All in all, the solution to this problem will never be black-and-white, but grey. Both sides can give convincing arguments for their case, and it will eventually be up to World Athletics, to determine the final regulations that will determine the future of hyperandrogenic female athletes.

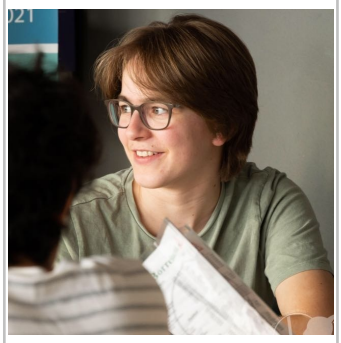
References

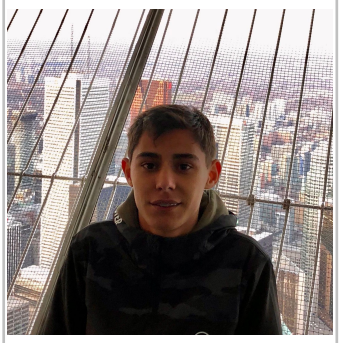
1. Fordyce, T. (2009, August 19). *Semenya left stranded by storm*. BBC Sport. Retrieved September 30, 2021, from https://www.bbc.co.uk/blogs/tomfordyce/2009/08/semenya_left_stranded_by_storm.html
2. *Statement on Caster Semenya*. (2009, September 11). World Athletics. Retrieved September 30, 2021, from https://www.worldathletics.org/news/news/statement-on-caster-semenya
3. Savulescu, J. (2019, May 9). *Ten ethical flaws in the Caster Semenya decision on intersex in sport*. The Conversation. Retrieved October 15, 2021, from https://theconversation.com/ten-ethical-flaws-in-the-caster-semenya-decision-on-intersex-in-sport-116448
4. Susan Davis, Jane Tran, What Are "Normal" Testosterone Levels for Women?, *The Journal of Clinical Endocrinology & Metabolism*, Volume 86, Issue 4, 1 April 2001, Pages 1842–1846, https://doi.org/10.1210/jcem.86.4.7436-10
5. *IAAF introduces new eligibility regulations for female classification*. (2018, April 26). World Athletics. Retrieved September 30, 2021, from https://www.worldathletics.org/news/press-release/eligibility-regulations-for-female-classifica
6. Interview with Asimakis Talamagkas, biologist researcher and professor in the National and Kapodistrian University of Athens
7. Bermon, S. (2017). Androgens and athletic performance of elite female athletes. Current Opinion in Endocrinology & Diabetes and Obesity, 24(3), 246–251. https://doi.org/10.1097/med.0000000000000335
8. Ingle, S. (2018, 26 April). *IAAF doctor predicts intersex category within 5 to 10 years*. The Guardian. Retrieved October 17, 2021, from https://www.theguardian.com/sport/2018/apr/26/iaaf-doctor-calls-for-intersex-category-athletics-caster-semenya
9. Blackless, M., Charuvastra, A., Derryck, A., Fausto-Sterling, A., Lauzanne, K. & Lee, E. (2000). How sexually dimorphic are we? Review and synthesis. *American Journal of Human Biology*, 12, 151-166. https://doi.org/10.1002/(SICI)1520-6300(200003/04)12:2<151::AID-AJHB1>3.0.CO;2-F
10. Interview with Ton van Hoesel, experienced running trainer and former-trainer of Sifan Hassan.
11. Aviles, G. (2019, November 12). *LGBTQ acceptance grew globally over past four decades — but not everywhere*. Retrieved October 28, 2021, from https://www.nbcnews.com/feature/nbc-out/lgbtq-acceptance-grew-globally-over-past-four-decades-not-everywhere-n1080706
12. BBC. (2019, February 14). *Semenya is unquestionably a woman.* BBC Sport. Retrieved October 28, 2021, from https://www.bbc.com/sport/athletics/47244017
13. Human Rights Watch. (2020, December 7). *They're Chasing Us Away from Sport.* Retrieved October 28, 2021, from https://www.hrw.org/report/2020/12/04/theyre-chasing-us-away-sport/human-rights-violations-sex-testing-elite-women
14. Pielke, R., Tucker, R., & Boye, E. (2019). *Scientific integrity and the IAAF testosterone regulations.* The International Sports Law Journal, 19(1–2), 18–26. https://doi.org/10.1007/s40318-019-00143-w
15. Ferguson-Smith, M. A., & Bavington, L. D. (2014). *Natural Selection for Genetic Variants in Sport: The Role of Y Chromosome Genes in Elite Female Athletes with 46,XY DSD*. Sports Medicine, 44(12), 1629–1634. https://doi.org/10.1007/s40279-014-0249-8
16. Deutsche Welle. (2021, July 24). *Do trans athletes have an unfair advantage?* DW.COM. Retrieved October 28, 2021, from https://www.dw.com/en/fact-check-do-trans-athletes-have-an-advantage-in-elite-sport/a-58583988
17. Hilton, E. N., & Lundberg, T. R. (2020). *Transgender Women in the Female Category of Sport: Perspectives on Testosterone Suppression and Performance Advantage*. Sports Medicine, 51(2), 199–214. https://doi.org/10.1007/s40279-020-01389-3
18. Farrell, S. (2021, June 25). *How do IAAF regulations affect female athletes with high testosterone levels*? Global Sport Matters. Retrieved October 1, 2021, from https://globalsportmatters.com/health/2019/11/15/iaaf-regulations-for-female-athletes-with-high-testosterone/
19. Wood, R. I., & Stanton, S. J. (2012). Testosterone and sport: Current perspectives. Hormones and Behavior, 61(1), 147–155. https://doi.org/10.1016/j.yhbeh.2011.09.010
20. Hirschberg, A. L., Elings Knutsson, J., Helge, T., Godhe, M., Ekblom, M., Bermon, S., & Ekblom, B. (2019). *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. https://doi.org/10.1136/bjsports-2018-100525

21. Osborn, C. O. (2018, September 18). *Your Guide to Anti-Androgens*. Healthline. https://www.healthline.com/health/anti-androgen#side-effects
22. Karkazis, K., Jordan-Young, R., Davis, G., & Camporesi, S. (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. https://doi.org/10.1080/15265161.2012.680533
23. Thomas H. Murray. (2010). Making Sense of Fairness in Sports. Hastings Center Report, 40(2), 13–15. https://doi.org/10.1353/hcr.0.0241
24. Mashigis, L. (2021). *Human Rights Commission to fight for Caster Semenya on global stage*. Retrieved November 4, 2021, from https://www.iol.co.za/the-star/news/human-rights-commission-to-fight-for-caster-semenya-on-global-stage-2eeafde3-3e37-4ad1-bf53-5e750428025a

Motivation USE Introduction to Sport, Physical Activity and Vitality

Student photos





Names	Faculties	Student numbers
Ilse Koelewijn	**Applied Physics**	**1583069**
George Condos	**Industrial Design**	**1531409**
Matthijs van den Broek	**Mechanical Engineering**	**1620061**

Student 1: Describe shortly your motivation to follow this course and give an example of a a good and a bad (less good) application of technology in sport, physical activity or vitality.

I chose this course because it seemed to be the most suitable use learning line for me. Firstly, I really like practicing and watching sports and secondly, I was really interested in the data acquisition course, since I really enjoyed the basic course data analysis.I think a good application of technology in sports is the clap skate. I speed skate myself and it was really great to see that my speed increased when I started using this kind of skate. A bad application might be golf balls that get too good, so it become too easy to play golf.

Student 2: Describe shortly your motivation to follow this course and give an example of a a good and a bad (less good) application of technology in sport, physical activity or vitality.

The reason for choosing this course is because I found it the most interesting. I like sports as I was a track and field athlete and I was drawn to the technology behind sports from a robotics competition I took part called FLL that had a sports related challenge. Additionally, I believe the third course of the USE line will give me more experience in the user and society expertise area that I haven't touched upon much. A positive example of technology in sport is a device called swim-off flotation rig. In the past in the start of a water polo game the ball was thrown in the middle of the field by the referee but that was not accurate. The device prevents that by keeping the ball still in the middle making the game as fair as possible. An example of a bad

Student 3: Describe shortly your motivation to follow this course and give an example of a a good and a bad (less good) application of technology in sport, physical activity or vitality.

When I had to choose my study, I was deciding between mechanical engineering and human movement sciences. Eventually I chose mechanical engineering, but I am nevertheless very interested in sports. When I saw this course it seemed like the perfect combination between the two, since it addresses technology (related to mechanical engineering) in sports (related to human movement sciences).
An example of a good application of technology in sports is the use of the hawkeye system in tennis, which can very accurately decide whether a ball was in or out. An application of technology in sports that is not (yet) so good is the VAR in football. Right now, checks by the VAR often take quite some time, slowing the game

Week 2 --- USE Introduction to Sport, Physical Activity and Vitality

Brainstorm as a group about possible topics for your position paper. Select 1 or 2 topic(s) and give a short explanation in the ield below why you choose this at the moment.

1. Female athletes that have to take testosterone blockers because their testosterone levels are too high. We think this is an interesting case because these athletes are not doing anything illegal, but still they have an unfair advantage. A famous example of this is Caster Semenya who used to win all races on 800 metres, but who had too high testosterone levels. Now she can't participate anymore unless she takes testosterone blockers. Is it ethical to force someone with a natural advantage to give this up?

2. Can games help to make people more physically active? A few years ago, Pokémon Go became really popular. To catch Pokémon people had to go outside and walk. However, it might also cause dangerous situations, because people are looking at their phone while they are walking. Also, does it help people to move more in the long term because trends like these wear out fast?

Brainstorm about the possible social challenges associated with this topic. Write these down in the field below.

1. It creates discrimination to ban athletes because of how their body works. On the other hand it is not fair if women with "normal" testosterone levels can never win a race anymore, because athletes with higher testosterone levels will always be better because of that. Can you view it as talent that someone has higher testosterone levels?

2. Children might be looking at their phone all the time, while it is maybe better for them to interact with other childeren, for example by doing sports. Also, it can be dangerous if people look at their phone too much when they are walking or cycling on the street. However, if it supports an active lifestyle and motivates to go outside, it might still be worth it.

Think about possible experts who you could interview and note them down in the field below.

1. -A physiologist, who knows how the human body and hormones work.
-A (professional) female athlete, who you could ask if she thinks this is fair.
-A coach/training researcher, who knows what you can achieve with training, and if it is possible for "normal" athletes to compete with women with higher testosterone levels.
-Someone from the athletics federation, who can explain why they set these rules.
2. -Someone who has been addicted to Pokémon Go, to ask how it helped to go outside and if it was dangerous.
-Researcher who has investigated what the effect of Pokémon Go is on the physical activity of people.
-A teacher or someone else who has a lot of contact with children, if they see a difference in the physical activity of the children.

Week 3 --- USE Introduction to Sport, Physical Activity and Vitality

Write down the topic you have selected for your position paper and the key aspects you want to focus on in the position paper.

The topic that we selected is female athletes that have to take testosterone blockers because their testosterone levels are too high.

Key aspects:
Fairness of the competition (could you consider it as natural doping?)
Discrimination of the athlete
How is it possible that some athletes have higher testosterone levels than others?
How do the testosterone blockers work?
Are there other solutions to this problem without testosterone blockers?

Brainstorm about possible USER challenges that could be associated with this topic. Write these down in the field below.

The challenges associated with tetosterone can be divided to two parties. On one side it is not fair for athletes with normal levels of tetosterone who compete with those with naturally higher levels. On the other side the athletes with higher levels of tetosterone did not do anything illegal, it is just a natural advantage.
Another challenge for the athlete that has to take testosterone blockers is that their body changes due to the medication. They will get less muscles for example. This can also influence their mental health. Also, we should investigate if there are any side effects of the medication.
Also for the athletes with normal testosterone levels, all the testing can be annoying, especially if they have to test multiple times.
A challenge for society can be that the sport becomes less interesting to watch if it is already known who is going to win beforehand. So if the athletes don't have to take testosterone blockers, the races will change entirely.

Give an outline for the state of the art section of your paper (based on scientific literature).

- Which medicines do the athletes have to take and what are the effects on the atlete (maybe ask a doctor)?
- Does every athlete with higher testosterone levels have to take the same testosterone blockers?
- How is this treated in different sports?
- How was this done in the past?
- What do high-level athletes/coaches think of this?

Week 4 --- USE Introduction to Sport, Physical Activity and Vitality

Write down the working title for your position paper

Testosterone blockers and their effects in female sports.

Which elements / parts of your position paper are difficult or challenging? Why?

- Explaining/understanding how the testosterone blockers work. This will be challenging, because the human biology is very complex, and to understand and explain how that works clearly and concisely will be difficult.

- Finding experts/people with experience on the topic; only elite level athletes have to deal with testosterone tests and opponents that have to take testosterone blockers. Since there are not a lot of elite athletes it will be difficult to find someone to interview.

- Envisioning the future; at this moment we have no clue how this debate will develop, so we will have to do a lot of research to come to a thought-out prediction.

Week 4 --- USE Introduction to Sport, Physical Activity and Vitality

Write a first extended summary (500 words) containing the following aspects: Introduction / Societal – User challenges / State of the art).

Introduction:

In 2009, the whole world saw the 18-year-old female athlete Caster Semenya win the 800 meter race at the athletics World Championships in Berlin. However, questions were raised about her sex, because of her low voice, facial hair and muscular appearance [1]. World Athletics (the governing body of athletics) even made her do a sex test to verify that she was actually female [2], but with a difference in sexual development (DSD) [3].

From 2018, World Athletics has banned athletes with DSD that have testosterone levels higher than 5 nmol/L in their blood, from events between 400m and one mile [4]. Caster Semenya is one of the athletes that is not allowed to participate anymore. She argues that she (and other athletes) is being discriminated and have done nothing wrong, but World Athletics insists that this rule is necessary to ensure a fair competition.

In this position paper, it will be explained why female athletes with elevated testosterone levels should (not) be allowed to participate in elite athletics.

Societal - User Challenges:

The challenges associated with testosterone blockers can be divided into two parties. On one side it is not fair for athletes with normal levels of testosterone to compete with those who naturally have higher levels. For the society this also less interesting, because they want to watch a fair game in which you cannot predict who will win, which is impossible if someone is just a lot better than the rest of the field. On the other side, the athletes with higher levels did not do anything illegal, it is just a natural advantage. For these athletes it is not fair to have to take testosterone blockers. They might also suffer from mental consequences due to the blockers. Essentially, this is a problem of a high discomfort for a small group or a lower discomfort for a large group.

State of the Art

The high levels of testosterone, that are naturally produced by the body of some female athletes, give them a significant competitive advantage, enough to make them winners at the global and Olympic level.

This sparkles international controversy over whether athletes, such as South African Caster Semenia, will have to undergo hormone therapy or even surgery in order to compete.

The dilemma does not concern the athletes who are doped with extra androgens and thus violate the regulations of the International Association of Athletics Federations. It only concerns athletes whose body itself produces excessive male hormones.

IAAF regulations initially imposed hormone therapy on these athletes to reduce their testosterone. However, in April 2018 the IAAF issued new regulations on the eligibility of women in the category, for athletes with DSD and for specific events (from 400m to mile), with emphasis on endogenous testosterone level (below 5 nmol / L) to avoid androgenic effect.

The new regulations concern athletes with chromosomes "46 XY DSD" and are valid since November 2018, but there was a pending decision of the Arbitration Sports Court. The regulations mean that women with high testosterone are required to undergo humiliating and invasive physical examinations and harmful medical procedures.

Sources:

1.Fordyce, T. (2009, August 19). Semenya left stranded by storm. BBC Sport. Retrieved September 30, 2021, from https://www.bbc.co.uk/blogs/tomfordyce/2009/08/semenya_left_stranded_by_storm.html

2.Statement on Caster Semenya. (2009, September 11). World Athletics. Retrieved September 30, 2021, from https://www.worldathletics.org/news/news/statement-on-caster-semenya

Week 5 --- USE Introduction to Sport, Physical Activity and Vitality

Write down the working title of your position paper.

Testosterone blockers and their effects on female athletics.

Write down the names and functions of the people you will interview (or already have interviewed).

For our interviews we are trying to come in contact with people of two different professions that would help us in our report. On one side we want to examine the opinion from someone who works in the field of athletics and knows from first hand how running competitions are being organized in regards with the rules for athletes with high testorenone levels. Niels Groen is a floormanager for the World Athletics who we contacted but unfortunately cannot arrange an interview for us. On the other side specialists in biology and specifically in hormones such as endocrinologists are the best experts to get informed about the technical part of the issue, namely what the existing technology could offer to athletes with high testosterone levels, what are the negative effects and what are fututre solutions or technologies that are being currently developed to overcome this problem in a better way. An expert in the field of biology is Asimakis Talamagkas, a biologist researcher and professor in the National and Kapodistrian University of Athens. We intend to interview him next week. Jerome Kisters and Mirjam Oosterwerff are endocrinologists at the Catharina Hospital in Eindhoven. These experts could also shed light on the topic of testosterone levels on athletes. We currently are awaiting their response of the email we have sent to the hospital.

Which questions do you need to ask the people you will interview? (If you already interviewed them, which insights did you get?)

Questions for an athlete/coach:
- Do you think athletes with high testosterone levels have an unfair advantage?
- What is the best solution for this problem?

Questions for an endocrinologist (someone who knows a lot about hormones):
- How is it possible that some athletes have high testosterone levels and what is the effect of that?
- What are the ways to reduce testosterone levels and what are the side effects?
- Do you think it is fair that they can compete with regular athletes? Does it give them an unfair advantage?
- Are there other ways in development to lower testosterone levels? Maybe safer/better methods?

Questions for someone from World Athletics:
- Why has World Atheltics chosen to not allow these athletes to compete anymore?

Week 6 --- USE Introduction to Sport, Physical Activity and Vitality

Write down the (working) title of your position paper.

Testosterone blockers and their effects in female athletics.

Write down 5-7 key scientific references (use a consistent referencing style) you will use to support the claims you will make in the "introduction" and "societal /user challenges" sections of your position paper.

Introduction:

1. Ingle, S. (2019, June 18). Caster Semenya accuses IAAF of using her as a ‘guinea pig experiment’. The Guardian. Retrieved September 30, 2021, from https://www.theguardian.com/sport/2019/jun/18/caster-semenya-iaaf-athletics-guinea-pig
2. IAAF introduces new eligibility regulations for female classification. (2018, April 26). World Athletics. Retrieved September 30, 2021, from https://www.worldathletics.org/news/press-release/eligibility-regulations-for-female-classifica

Societal/user challenges:

3. Savulescu, J. (2019, May 9). Ten ethical flaws in the Caster Semenya decision on intersex in sport. The Conversation. Retrieved October 15, 2021, from https://theconversation.com/ten-ethical-flaws-in-the-caster-semenya-decision-on-intersex-in-sport-116448

Write down 5-7 key scientific references (use a consistent referencing style) you will use to support the claims you will make in the "state of the art", and "envisioning" sections of your position paper.

State of the art:

1. Farrell, S. (2021, June 25). How do IAAF regulations affect female athletes with high testosterone levels? Global Sport Matters. Retrieved October 1, 2021, from https://globalsportmatters.com/health/2019/11/15/iaaf-regulations-for-female-athletes-with-high-testosterone/
2. Powell, A. (2021, September 17). Harvard biologist discusses testosterone’s role in society. Harvard Gazette. https://news.harvard.edu/gazette/story/2021/09/harvard-biologist-discusses-testosterones-role-in-society/
3. Wood, R. I., & Stanton, S. J. (2012). Testosterone and sport: Current perspectives. Hormones and Behavior, 61(1), 147–155. https://doi.org/10.1016/j.yhbeh.2011.09.010

Envisioning:

Week 7 --- USE Introduction to Sport, Physical Activity and Vitality

Write down the (working) title of your position paper.

Testosterone blockers and their effects in female athletics.

Write down how you envision the role technology will have on the topic of your position paper.

According to Stéphane Bermon (a doctor at World Athletics) there will be an intersex category in athletics within the next 5 to 10 years. Then the athletes will not have to take testosterone blockers anymore, so then the technology will be redundant in female athletics.
As a group, we don't think this will happen, because the group of intersex athletes is just too small (only around 1.7% of the population have intersex traits [1]). Also, there are quite some conservative countries in the world, where intersex people are not accepted, so these countries will most likely not accept an intersex category in athletics. We think that in the future athletes like Caster Semenya (who are officially female) will be allowed to participate again in the women's category, because of the general trend in society towards more inclusivity [2].
1.https://www.amnesty.org/en/latest/news/2018/10/its-intersex-awareness-day-here-are-5-myths-we-need-to-shatter/
2.https://www.nbcnews.com/feature/nbc-out/lgbtq-acceptance-grew-globally-over-past-four-decades-not-every

Write down 1 question you have about the/your position paper you want me to address in the lecture of Monday 25/10.

How should you make a clear difference between the user/society section and the ethical considerations section?