Drugs, Sex, AI, etc - threats to sport integrity

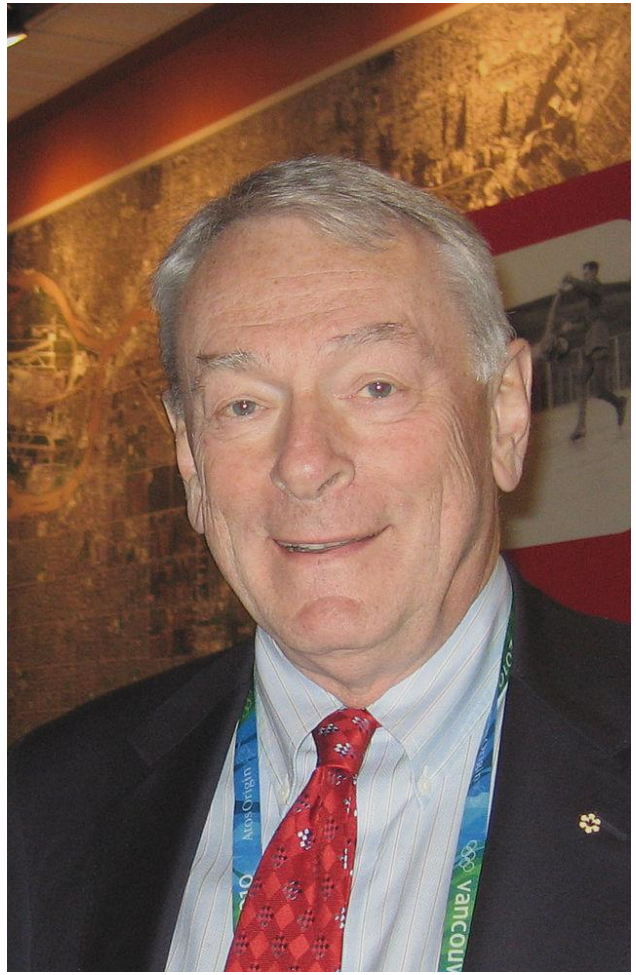
Yannis P Pitsiladis, MMEDSci., PhD, FACSM

Following 15 years at the University of Glasgow, Scotland, where he created the largest known DNA biobank from world-class athletes and one of the largest DNA biobanks in school-aged children, Yannis was recently appointed Professor in the Department of Sport, Physical Education and Health (SPEH) at Hong Kong Baptist University, Hong Kong, where he plans to create a new center of excellence in sport and exercise science and medicine.

His current research interest is in exploring human enhancement technologies applicable to health and disease with particular focus on responsible paradigms. His most recent research is funded by the World Anti-Doping Agency (WADA) and by the International Olympic Committee (IOC), he is currently a member of the IOC Medical and Scientific Commission, a member of the Executive Committee and Chair of the Scientific Commission of the International Sports Medicine Federation (FIMS), a member of the Scientific and Education Commission of the European Federation of Sports Medicine Associations (EFSMA), a member of WADA's Health Medical Research Committee (HMRC) and is a Fellow of the American College of Sports Medicine (ACSM). He has published over 250 peer-reviewed papers, written and edited a number of books and has featured in numerous research documentaries (e.g. ESPN, BBC, NHK Japan, CNBC) and popular books (e.g. Bounce, The Sports Gene).

“Sport is digging its own grave”

Chairman of Olympic Broadcasting Services	
Incumbent	
Assumed office	April 4, 2014
Preceded by	Hein Verbruggen
1st President of the World Anti-Doping Agency	
In office	November 10, 1999 – December 31, 2007
Preceded by	*Position established*
Succeeded by	John Fahey
17th Chancellor of McGill University	
In office	July 1, 1999 – June 2009
Preceded by	Gretta Chambers
Succeeded by	H. Arnold Steinberg
Vice-President of the International Olympic Committee	
In office	1996–2000
President	Juan Antonio Samaranch
In office	1987–1991
President	Juan Antonio Samaranch
President of the Canadian Olympic Committee	
In office	1977–1982
Preceded by	Harold Wright
Succeeded by	Roger Jackson
Personal details	
Born	Richard William Duncan Pound March 22, 1942 (age 80) St. Catharines, Ontario, Canada
Political party	Liberal
Spouse(s)	Julie Keith
Residence(s)	Westmount, Quebec, Canada
Alma mater	McGill University Sir George Williams University
Occupation	Lawyer · author



Richard William Duncan Pound
“Dick Pound”

"People will say: 'I'm not going to watch something that's <u>fixed</u>.' If they stop watching, sponsors will question why they are sponsoring this, and broadcaster will ask why they are wasting air time. The whole thing could dry up in a nanosecond."

2024 Olympic boxing: Imane Khelif earns gold medal in final match amid continued gender controversy

The Algerian took down her toughest test to date -- and a familiar foe -- to walk away from Paris as champion

By Brent Brookhouse Aug 9, 2024 at 5:32 pm ET • 2 min read

Getty Images

Lin follows Khelif by winning gold amid controversy

Lin Yu-ting beats Poland's Julia Szeremeta to win women's featherweight gold

10 August 2024

An emotional Lin Yu-ting became the second boxer in 24 hours to win women's Olympic gold despite the ongoing row over her gender eligibility.

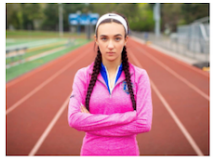
The Taiwanese beat Polish 20-year-old Julia Szeremeta by unanimous decision to claim the featherweight title, a day after **Imane Khelif became the welterweight champion**.

Lin and Khelif have been allowed to compete in Paris despite being disqualified from last year's World Championships after reportedly failing gender eligibility tests.

inside the games
The inside track on world sport

Petition urges IOC to "never sacrifice women's sport"

By Inside The Games Wednesday, 4 December 2024



A joint open letter to the International Olympic Committee, signed by over 40,000 individuals worldwide, calls for the protection of "women's sports, private spaces, and basic fairness" and raises concerns over alleged pressure to allow biological males to compete in female categories.

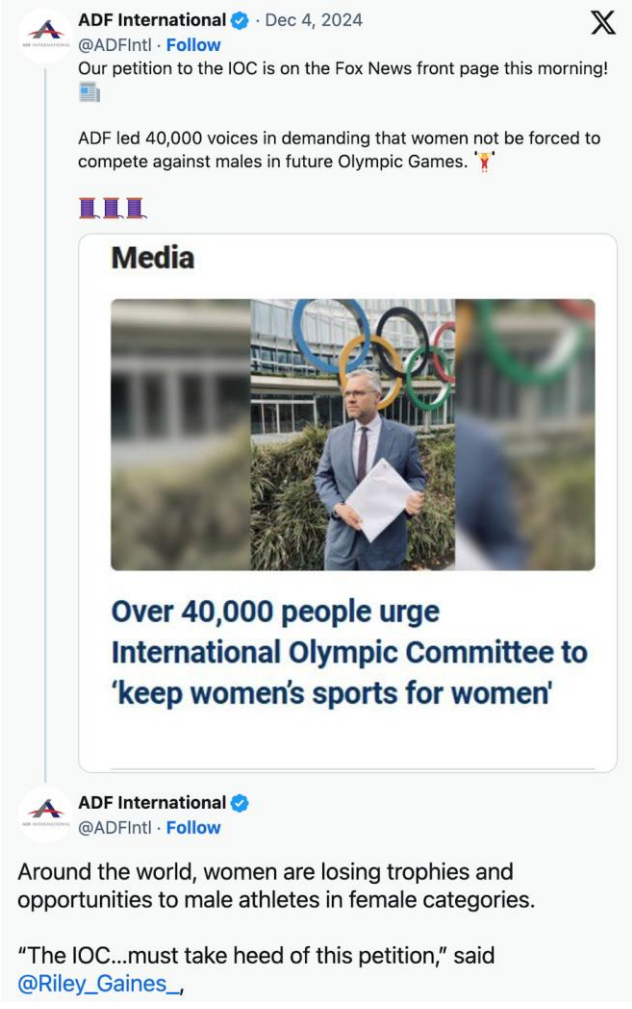
ADF International hand-delivered the letter to the IOC headquarters in Lausanne, Switzerland this week. It asserts, "Men and women are different. Their physical differences give men athletic advantages in sports. Scientific research continues to acknowledge this reality."

It further critiques current policies, stating, "However, governments and organisational bodies like the IOC have adopted policies that allow males who identify as female to compete in women's sports. These policies prioritise feelings over fairness, ideology over truth."

Riley Gaines, an advocate for fairness in women's sports who faced competing against males in swimming, commented on the petition. "As a college athlete, my safety and privacy in the locker room was repeatedly jeopardised because of sports bodies which put ideology before women's rights. I'm one of so many young women that have lost out on medals and opportunities – simply because I wasn't a male. What kind of message does that send?"

With the transgender debate in sports as vivid as ever, Gaines highlighted ongoing concerns raised by women athletes, stating, "Women have raised concerns repeatedly about safety, privacy and fairness in women's sports. The IOC is looked upon as a leader on sports policies. It must take heed of this petition, and take a stand for women around the world in protecting our sports – not only for this generation of athletes, but the little girls who one day dream of winning the gold."

According to a report by Reem Alsalem, the UN Special Rapporteur on Violence Against Women and Girls, women have lost over 890 medals across 29 sports to males competing in women's categories. This report was spotlighted during a recent panel event hosted by ADF International at the UN Headquarters in New York.



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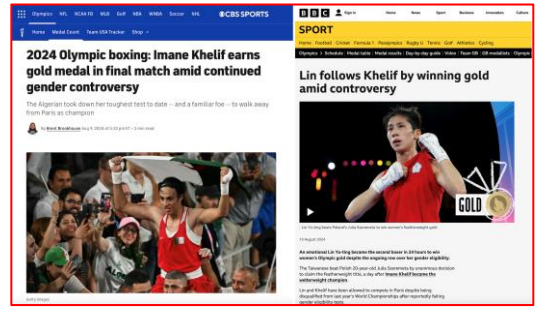

INTERNATIONAL OLYMPIC COMMITTEE

https://stillmed.olympics.com/media/Documents/Athletes/IOC%20Framework/Presentation-IOC-Framework.pdf?_ga=2.252238859.347339146.1653930355-124331033.1653930355

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12 APR 2011 IAAF NEWS DAEGU, KOREA

IAAF TO INTRODUCE ELIGIBILITY RULES FOR FEMALES WITH HYPERANDROGENISM

The IAAF today became the first international sports federation to approve the adoption of new rules and regulations governing the eligibility of females with hyperandrogenism* to compete in women's competition.

The IAAF Council's decision is the culmination of an 18 month-long review by an IAAF expert working group who have studied issues relating to the participation of female athletes with hyperandrogenism in athletics. This group has worked in close co-ordination with the IOC Medical Commission throughout this period and also participated in a series of international expert meetings held on the subject in 2010.

The new rules and regulations, which will be published and come into force for all International Competitions on 1 May 2011, provide for the following key principles:

- Competition in athletics will continue to be divided into men's and women's competition recognising that there is a difference in sporting performance between elite men and women, that is predominantly due to higher levels of androgenic hormones in men;

- A female with hyperandrogenism who is recognised as a female in law shall be eligible to compete in women's competition in athletics provided that she has androgen levels below the male range (measured by reference to testosterone levels in serum) or, if she has androgen levels within the male range she also has an androgen resistance which means that she derives no competitive advantage from such levels;

- A pool of international medical experts has been appointed by the IAAF to review cases referred to it under the regulations as an independent expert medical panel and to make recommendations to the IAAF in such cases to decide on the eligibility of female athletes with hyperandrogenism;

- A 3-level medical process under the regulations shall ensure that all potentially relevant data is made available to the expert medical panel for the purposes of evaluating an athlete's eligibility. This medical process may include, where necessary, the expert medical panel referring an athlete with potential hyperandrogenism for full examination and diagnosis in accordance with best medical practice at one of the 6 IAAF-approved specialist reference centres around the world;

- The medical process under the regulations shall be conducted in strict confidentiality and all cases shall be referred to the expert medical panel on an anonymous basis;

- A female athlete who declines, fails or refuses to comply with the eligibility determination process under the regulations shall not be eligible to compete in women's competition.

2012 Summer Olympics

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INTERNATIONAL OLYMPIC COMMITTEE

IOC Consensus Meeting on Sex Reassignment and Hyperandrogenism
November 2015

Participants:

Prof Dr Uğur Erdener	Chairman, IOC Medical & Scientific Commission
Prof Arne Ljungqvist	Former Chairman, IOC Medical Commission
Dr Stéphane Bermon	Monaco Institute of Sports Medicine & Surgery, IAAF Medical & Scientific Senior Consultant
Michael Beloff, QC	Barrister, Blackstone Chambers
Prof Gerard Conway	Professor of Clinical Medicine, University College London
Prof Myron Genel	Professor Emeritus of Pediatrics and Senior Research Scientis Yale Child Health Research Center Yale University School of Medicine
Ms Joanna Harper	Chief Medical Physicist, Radiation Oncology, Providence Portland Medical Center
Prof Angelica Linden Hirschberg	Department of Woman & Child Health, Division of Obstetrics & Gynecology, Karolinska Institutet
Prof Dr Maria Jose Martinez Patino	Faculty of Sport Sciences, University of Vigo
Prof Martin Ritzén	Professor Emeritus, Dept of Woman and Child Health Karolinska Institutet
Dr Eric Vilain	Professor of Human Genetics, Pediatrics and Urology Director, Center for Gender-Based Biology Chief, Medical Genetics, Department of Pediatrics Co-director, Clinical Genomic Center David Geffen School of Medicine at UCLA
Jonathan Taylor	Partner, Bird & Bird
Liz Riley	Barrister, Bird & Bird
Dr Robin Mitchell	Vice-Chair, IOC Medical & Scientific Commission
Dr Rania Elwani	Member, IOC Medical & Scientific Commission
Dr Vidya Mohamed-Ali	Member, IOC Medical & Scientific Commission
Prof Yannis Pitsiladis	Member, IOC Medical & Scientific Commission
Dr Richard Budgett	IOC Medical & Scientific Director
Dr Lars Engebretsen	IOC Head of Scientific Activities
Christian Thill	IOC Senior Legal Counsel

1) Transgender guidelines

In this spirit, the IOC Consensus Meeting agreed the following guidelines to be taken into account by sports organisations when determining eligibility to compete in male and female competition:

1. Those who transition from female to male are eligible to compete in the male category without restriction.

2. Those who transition from male to female are eligible to compete in the female category under the following conditions:

   2.1. The athlete has declared that her gender identity is female. The declaration cannot be changed, for sporting purposes, for a minimum of four years.

   2.2. The athlete must demonstrate that her total testosterone level in serum has been below 10 nmol/L for at least 12 months prior to her first competition (with the requirement for any longer period to be based on a confidential case-by-case evaluation, considering whether or not 12 months is a sufficient length of time to minimize any advantage in women's competition).

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2016 Summer Olympics

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26 APR 2018 PRESS RELEASE MONACO

IAAF INTRODUCES NEW ELIGIBILITY REGULATIONS FOR FEMALE CLASSIFICATION

The IAAF this week issued new Eligibility Regulations [**English** | **French**] for Female Classification (Athlete with Differences of Sexual Development) for events from 400m to the mile, including 400m, hurdles races, 800m, 1500m, one mile races and combined events over the same distances ('Restricted Events').

The new regulations require any athlete who has a Difference of Sexual Development (DSD) that means her levels of circulating testosterone (in serum) are five (5) nmol/L or above and who is androgen-sensitive to meet the following criteria to be eligible to compete in Restricted Events in an International Competition (or set a world record in a Restricted Event at competition that is not an International Competition):

(a) she must be recognised at law either as female or as intersex (or equivalent);

(b) she must reduce her blood testosterone level to below five (5) nmol/L for a continuous period of at least six months (e.g., by use of hormonal contraceptives); and

(c) thereafter she must maintain her blood testosterone level below five (5) nmol/L continuously (ie: whether she is in competition or out of competition) for so long as she wishes to remain eligible.

ALL PAGES RELATED TO THIS ARTICLE

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Sports Medicine
https://doi.org/10.1007/s40279-020-01380-y

LETTER TO THE EDITOR

Response to the United Nations Human Rights Council's Report on Race and Gender Discrimination in Sport: An Expression of Concern and a Call to Prioritise Research

Blair R. Hamilton[1,2,3] · Maria Jose Martinez-Patiño[4] · James Barrett[3] · Leighton Seal[3] · Ross Tucker[5] · Theodora Papadopoulou[6,7,8,9] · Xavier Bigard[6,7,10] · Alexander Kolliari-Turner[1] · Herbert Löllgen[6] · Petra Zupet[6] · Anca Ionescu[6] · Andre Debruyne[6,7] · Nigel Jones[8,11] · Juergen M. Steinacker[6,7,12] · Karin Vonbank[13] · Giscard Lima[1,14] · Federica Fagnani[14] · Chiara Fossati[14,15] · Luigi Di Luigi[7,14] · Fabio Pigozzi[6,7,14,15] · Maurizio Casasco[6,7,16] · Michael Geistlinger[7,17] · Bernd Wolfarth[7,18] · Jane T. Seto[19,20] · Norbert Bachl[6,7,21,22] · Richard Twycross-Lewis[23] · David Niederseer[24] · Andrew Bosch[25] · Jeroen Swart[7,25] · Demitri Constantinou[7,26] · Borja Muniz-Pardos[27] · José Antonio Casajus[27] · Victoriya Badtieva[7,28,29] · Irina Zelenkova[27,28] · James L. J. Bilzon[7,8,30] · Michiko Dohi[7,31] · Christian Schneider[7,32] · Sigmund Loland[33] · Michele Verroken[34,35] · Pedro Manonelles Marqueta[36] · Francisco Arroyo[7,37] · André Pedrinelli[7,38] · Konstantinos Natsis[6,7,39] · Evert Verhagen[40] · William O. Roberts[7,41] · José Kawazoe Lazzoli[7,42] · Rogerio Friedman[43] · Ali Erdogan[7,44] · Ana V. Cintron[7,45] · Shu-Hang Patrick Yung[7,46] · Dina C. Janse van Rensburg[7,47] · Dimakatso A. Ramagole[7,47] · Sandra Rozenstoka[6,7,48] · Felix Drummond[6,7,49] · Nick Webborn[50] · Fergus M. Guppy[1,2] · Yannis P. Pitsiladis[1,6,7,14]

Accepted: 24 October 2020

"~~Unnecessary Medical Intervention~~"

Dear Editor,

Caster Semenya recent
tion of blood testostero
World Athletics [2, 3],
orders of Sex Develop
testosterone concentrat
least six months, and t
testosterone continuou
for events between 400
resolution 40/5, on rac
published by the Unit
(UNHRC) which calls
The UNHRC [4] and World Medical Association [5] argue that World Athletics regulation [2] denies DSD women the right to participate in certain events unless they accept "unnecessary medical intervention", and that athletes are being coerced into such treatment.

The authors agree that there is currently no direct scientific evidence that DSD women athletes with higher testosterone levels have a performance advantage in sporting events between 400 and 1500 m. This evidence will be difficult to obtain, given the low number of DSD athletes and the ethical considerations in such research. The principles

that underlie a performance advantage as a result of biologi-
ls of testosterone have
]. and are robust, but it
ffered in support of the
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and 400 m, as well as
t 100, 200, and 400 m.
levels in the 1500 and
lated by the policy, the
latter is not.

Given the influence of high testosterone concentrations, there is concern that 6 months of testosterone suppression is not long enough to negate potential advantages from lifelong exposure. There is growing support for the idea that development influenced by high testosterone levels may result in retained anatomical and physiological advantages [7]. One such inherent "legacy" effect may be the phenomenon of muscle memory [8], that has been defined as the ability to rebuild muscle mass and strength after a long intervening period of inactivity and muscle mass loss [9].

The debate over sporting fairness, highlighted by the UNHRC, is particularly pertinent in DSD athletes [1,

Extended author information available on the last page of the article

Published online: 08 December 2020

Sports Medicine
https://doi.org/10.1007/s40279-021-01451-8

REVIEW ARTICLE

Integrating Transwomen and Female Athletes with Differences of Sex Development (DSD) into Elite Competition: The FIMS 2021 Consensus Statement

Blair R. Hamilton[2,3] · Giscard Lima[1,4] · James Barrett[3] · Leighton Seal[3] · Alexander Kolliari-Turner[2] · Guan Wang[61] · Antonia Karanikolou[2] · Xavier Bigard[5,6,7] · Herbert Löllgen[6] · Petra Zupet[6] · Anca Ionescu[6] · Andre Debruyne[6,7] · Nigel Jones[8,9] · Karin Vonbank[10] · Federica Fagnani[4] · Chiara Fossati[4,11] · Maurizio Casasco[6,7,12] · Demitri Constantinou[7,13] · Bernd Wolfarth[7,14] · David Niederseer[15] · Andrew Bosch[16] · Borja Muniz-Pardos[17] · José Antonio Casajus[17] · Christian Schneider[7,18] · Sigmund Loland[19] · Michele Verroken[20,21] · Pedro Manonelles Marqueta[7,22] · Francisco Arroyo[7,23] · André Pedrinelli[7,24] · Konstantinos Natsis[6,7,25,26] · Evert Verhagen[27] · William O. Roberts[7,28] · José Kawazoe Lazzoli[7,29] · Rogerio Friedman[30] · Ali Erdogan[7,31] · Ana V. Cintron[7,32] · Shu-Hang Patrick Yung[7,33] · Dina C. Janse van Rensburg[34] · Dimakatso A. Ramagole[34] · Sandra Rozenstoka[6,7,35] · Felix Drummond[6,7,36] · Theodora Papadopoulou[6,7,37] · Paulette Y. O. Kumi[38] · Richard Twycross-Lewis[39] · Joanna Harper[40] · Vasileios Skiadas[41] · Jonathan Shurlock[42] · Kumpei Tanisawa[43] · Jane Seto[44,45] · Kathryn North[44,45] · Siddhartha S. Angadi[46] · Maria Jose Martinez-Patiño[47] · Mats Borjesson[7,48,49] · Luigi Di Luigi[7,50] · Michiko Dohi[7,51] · Jeroen Swart[7,52] · James Lee John Bilzon[7,53] · Victoriya Badtieva[7,54,55] · Irina Zelenkova[17] · Juergen M. Steinacker[6,7,56] · Norbert Bachl[6,7,57,58] · Fabio Pigozzi[4,6,7,11] · Michael Geistlinger[7,59] · Dimitrios G. Goulis[60] · Fergus Guppy[2,61] · Nick Webborn[62] · Bulent O. Yildiz[63] · Mike Miller[64] · Patrick Singleton[64] · Yannis P. Pitsiladis[1,2,4,6,7]

Accepted: 10

"Necessary Intervention for Gender Classification for Sport"

Abstract
Sport is his
governing
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sports to in
to be based on peer-reviewed scientific evidence made available to policymakers from all scientific communities. However, even the most evidence-based regulations are unlikely to eliminate all differences in performance between cisgender women with and without DSD and transwomen athletes. Any remaining advantage held by transwomen or DSD women could be considered as part of the athlete's unique makeup.

1 Introduction

Since antiquity, athletic and Olympic competitions have been separated according to the traditional binary concept of male/female to promote fairness and equity, as well as being divided by criteria such as weight, age, affiliation,

Extended author information available on the last page of the article

Published online: 24 March 2021

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2021 Summer Olympics

The IOC guidelines (2021)

Transgender women have to keep the levels of their testosterone, a male hormone, below 10 nanomoles per litre for at least 12 months if they are to participate in the Olympics.

Key Milestones

1. KEY MILESTONES

2009
First public investigation on hyperandrogenism around Caster Semenya's case

2015
CAS ruling on Dutee Chand suspends any hyperandrogenism rule

2019
World Medical Association takes position on unethical medical intervention

2019
The World Health Organization (WHO) removes "gender identity disorder" from its global manual of illnesses

2020
Swiss Tribunal presents its decision on CAS and Caster Semenya's case

2003
IOC allows transgender athletes to compete, provided they undergo sex reassignment surgery

2011
IAAF introduces eligibility rules

2015
Consensus Statement removes surgery requirement, but still requires 10 nmol/l level of testosterone for transgender female athletes

2019
IOC revamps process to include, for the first time, consultation with affected athletes

2019
Human Right Council (HRC) condemns use of medical intervention on athletes on basis of human rights standards

2020
HRC presents its report on discrimination on sport and gender identity

2021
Tokyo 2020 Games with first openly transgender athletes

IOC finalizes consultations and releases Framework

2022
Roll-out of the IOC Framework

INTERNATIONAL OLYMPIC COMMITTEE

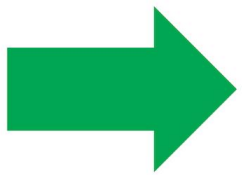
https://stillmed.olympics.com/media/Documents/Athletes/IOC%20Framework/Presentation-IOC-Framework.pdf?_ga=2.252238859.347339146.1653930355-124331033.1653930355

IOC Framework

5. NEW IOC FRAMEWORK - REDEFINING THE ROLE THAT THE IOC PLAYS

2015 Consensus Statement
(Current approach)

The IOC **recommends** a ***one-size-fits-all*** approach that all International Federations should apply to define eligibility.



Proposed Framework
(replaces previous approach, including Consensus Statement 2015)

The IOC **offers guidance** to International Federations on how to design eligibility criteria **that work for their own sport/context**, while considering **fairness**, **inclusion** and **non-discrimination**.

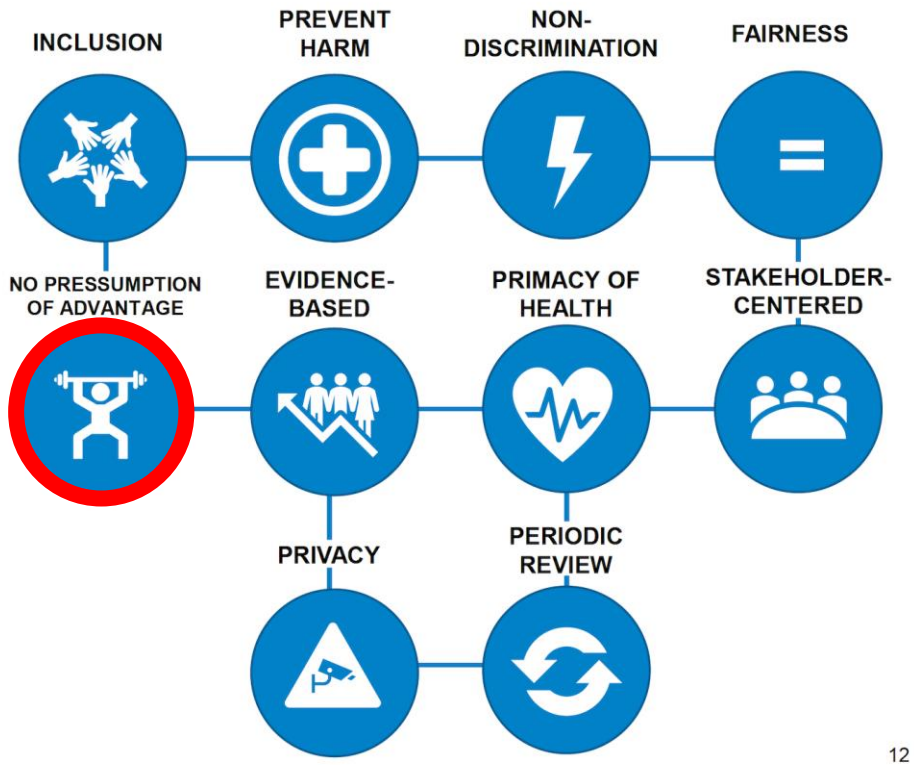
https://stillmed.olympics.com/media/Documents/Athletes/IOC%20Framework/Presentation-IOC-Framework.pdf?_ga=2.252238859.347339146.1653930355-124331033.1653930355

IOC Framework

A 10-PRINCIPLE APPROACH TO DECISION-MAKING

"Unnecessary Medical Intervention"

INTERNATIONAL OLYMPIC COMMITTEE



INTERNATIONAL OLYMPIC COMMITTEE

https://stillmed.olympics.com/media/Documents/Athletes/IOC%20Framework/Presentation-IOC-Framework.pdf?_ga=2.252238859.347339146.1653930355-124331033.1653930355

BMJ Open Sport & Exercise Medicine

Joint position statement of the International Federation of Sports Medicine (FIMS) and European Federation of Sports Medicine Associations (EFSMA) on the IOC framework on fairness, inclusion and non-discrimination based on gender identity and sex variations

Fabio Pigozzi ,[1,2,3] Xavier Bigard,[1,4,5] Juergen Steinacker ,[1,6] Bernd Wolfarth ,[1,7] Victoriya Badtieva ,[1,8,9] Christian Schneider ,[1,10] Jeroen Swart ,[1,11] James Lee John Bilzon ,[1,12] Demitri Constantinou ,[1,13] Michiko Dohi ,[1,14] Luigi Di Luigi,[1,15] Chiara Fossati ,[1,2,3] Norbert Bachl,[1,16,17] Guoping Li,[1,18] Theodora Papadopoulou,[1,4,19] Maurizio Casasco,[1,4,20] Dina Christina (Christa) Janse van Rensburg ,[1,21,22] Jean-François Kaux,[1,23] Sandra Rozenstoka,[1,24] Jose-Antonio Casajus ,[1,25] Irina Zelenkova,[1,25] Emre Ak,[1,26] Bulent Ulkar,[1,27] Francisco Arroyo ,[1,28] Anca Ionescu,[4,29] André Pedrinelli ,[1,30] Mike Miller,[31] Patrick Singleton,[31] Malav Shroff,[31] Nick Webborn,[32,33] James Barrett,[34] Blair Hamilton ,[32,35] Michael Geistlinger,[36] Gianfranco Beltrami,[37,38] Sergio Migliorini,[39] Lenka Dienstbach-Wech,[40] Stéphane Bermon ,[41,42] Yannis P Pitsiladis ,[1,4,32,35] on behalf of the International Federation of Sports Medicine (FIMS) and the European Federation of Sports Medicine Associations (EFSMA)

To cite: Pigozzi F, Bigard X, Steinacker J, *et al*. Joint position statement of the International Federation of Sports Medicine (FIMS) and European Federation of Sports Medicine Associations (EFSMA) on the IOC framework on fairness, inclusion and non-discrimination based on gender identity and sex variations. *BMJ Open Sport & Exercise Medicine* 2022;**8**:e001273. doi:10.1136/bmjsem-2021-001273

For numbered affiliations see end of article.

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ABSTRACT

The IOC recently published its framework on fairness, inclusion and non-discrimination based on gender identity and sex variations. This framework is drafted mainly from a human rights perspective, with less consideration for medical/scientific issues. The framework places the onus for gender eligibility and classification entirely on the International Federations (IFs), even though most will not have the capacity to implement the framework. The position of no presumption of advantage is contrary to the 2015 IOC consensus. Implementation of the 2021 framework will be a major challenge for IFs that have already recognised the inclusion of trans and women athletes with differences of sexual development (DSD) using a scientific/medical solution. The potential consequences for sports that need to prioritise fairness or safety could be one of two extremes (1) exclusion of all transgender or DSD athletes on the grounds of advantage or (2) self-identification that essentially equates to no eligibility rules. Exclusion of all transgender or DSD athletes is contrary to the Olympic charter and unlawful in many countries. While having no gender eligibility rules, sport loses its meaning and near-universal support.

Key messages

What is already known

- Athletes are currently excluded from the female category in sport based on transgender or differences of sexual development status.
- The IOC published its new framework on fairness, inclusion and non-discrimination based on gender identity and sex variations in November 2021.
- The publication of this framework has generated debate and discussion in sport and exercise medicine.

Athletes should not be under pressure to undergo medical procedures or treatment to meet eligibility criteria. However, if an athlete is fully informed and consents, then it is their free choice to undergo carefully considered or necessary interventions for gender classification for sport to compete fairly and safely in their chosen gender. Free choice is a fundamental human right, but so is the right to fair and safe competition.

CONSEQUENCES

The potential consequences of these imposed constraints could be one of two unwanted extremes (1) exclusion of transgender or DSD athletes on the grounds of performance advantage or (2) self-identification that all but equates to no eligibility rules. By adopting the recent IOC framework without the possibility of necessary interventions for gender classification (the authors preferred use of the term rather than the unhelpful and emotionally charged concept of 'unnecessary medical intervention'),

Some examples - Regs/Guidelines

- **World Rugby:** In 2020, WR launched their guidelines. To play women's rugby, transgender women must provide medical documentation confirming they have not experienced and are suppressing a testosterone-driven puberty. Transgender men, regardless of whether they transitioned pre- or post-puberty, may play men's rugby if they provide confirmation they have the physical ability to ensure they are not putting themselves at unacceptable risk. Transgender men who have begun a sex reassignment process that includes supplementing with testosterone may not play women's rugby.
- **International Swimming Federation (FINA):** In June 2022, FINA voted to bar all transgender athletes from competing in professional women's swimming, with the exception of athletes who "can establish to FINA's comfortable satisfaction that they have not experienced any part of male puberty beyond Tanner Stage 2 (of puberty) or before age 12, whichever is later". FINA also announced the creation of an "open" category for transgender swimmers to compete in.
- **World Boxing Council (WBC):** On Monday (15 August 2022), the international professional boxing organisation announced new guidelines on the eligibility of trans boxers in its tournaments. WBC firmly and unequivocally supports transgender rights. Neither trans women nor trans men can compete against cis athletes as it would be “unfair. A combat sport bout should occur between two equally matched competitors. At present, there is no consensus whether a bout between a transgender woman against a cisgender (biological) woman is a fair bout between two equally matched competitors. Metric such as testosterone level less than 10 nanomoles per litre (achieved by using testosterone suppression medication in the transgender woman), in isolation is inadequate to ensure fairness at the time of the bout.
- **World Athletics:** March 24, 2023. World Athletics has banned transgender women from competing in elite female competitions and tightened testosterone restrictions for other athletes, the governing body said on Thursday. World Athletics president Sebastian Coe said that the decision to exclude transgender women who had gone through male puberty was based "on the overarching need to protect the female category". The tighter measures around one of the most contentious and divisive issues in sport follow a similar move by World Aquatics in 2022
- **UCI:** July 15, 2023 UCI bans transgender women from competing in elite international races. Governing body claim their actions are to 'protect the female class. The UCI has followed other sports and banned transgender women from competing in women's category races in international competition.
- **ICC:** 21 November 2023. Transgender women have been barred from playing in international women's matches under new regulations from the International Cricket Council. Any player who has gone through male puberty will not be eligible for women's internationals regardless of any surgery or treatment undertaken. In September, Canada's Danielle McGahey became the first transgender cricketer to play an official international game. The new regulations will be reviewed within two years, the ICC said. Following a nine-month consultation process, the governing body said its new policy, which takes effect immediately, was based on "protection of the integrity of the women's game, safety, fairness and inclusion".

and the list will keep growing.....

BMJ Open Sport & Exercise Medicine

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2024 Olympic boxing: Imane Khelif earns gold medal in final match amid continued gender controversy

The Algerian took down her toughest test to date -- and a familiar foe -- to walk away from Paris as champion

By Brent Brookhouse Aug 9, 2024 at 5:32 pm ET • 2 min read

Getty Images

Lin follows Khelif by winning gold amid controversy

Lin Yu-ting beats Poland's Julia Szeremeta to win women's featherweight gold

10 August 2024

An emotional Lin Yu-ting became the second boxer in 24 hours to win women's Olympic gold despite the ongoing row over her gender eligibility.

The Taiwanese beat Polish 20-year-old Julia Szeremeta by unanimous decision to claim the featherweight title, a day after **Imane Khelif became the welterweight champion**.

Lin and Khelif have been allowed to compete in Paris despite being disqualified from last year's World Championships after reportedly failing gender eligibility tests.

My thoughts on DSD/Trans

- The eligibility criteria to compete in [Olympic] sport must be based on the best available scientific/medical evidence and minimising the unavoidable discrimination needed to ensure fair or safe competition;

- Currently, hormonal control (although imperfect) is the best way to ensure as fair as possible inclusion of DSD/Trans athletes into elite sport;

- Sport specific studies are needed to quantify the impact (i.e., magnitude and time) of hormonal control on health- and performance-related phenotypes;

- Use of routine markers (i.e., free T, estradiol, prolactin, LH, FSH, SHBG, PSA) and discovery of new biomarkers are needed; and

- Political opinions must not dominate.

Framework

EUROPEAN JOURNAL OF SPORT SCIENCE
https://doi.org/10.1080/17461391.2021.1938692

Routledge
Taylor & Francis Group

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Integrating transwomen athletes into elite competition: The case of elite archery and shooting

Blair R. Hamilton [a,b], Fergus M. Guppy [a], James Barrett[b], Leighton Seal[b] and Yannis Pitsiladis [a,c,d,e,f]

[a]Centre for Stress and Age-related Disease, University of Brighton, Brighton, UK; [b]The Gender Identity Clinic Tavistock and Portman NHS Foundation Trust, London, UK; [c]University of Rome "Foro Italico", Rome, Italy; [d]Centre for Exercise Sciences and Sports Medicine, FIMS Collaborating Centre of Sports Medicine, Rome, Italy; [e]European Federation of Sports Medicine Associations (EFSMA), Lausanne, Switzerland; [f]International Federation of Sports Medicine (FIMS), Lausanne, Switzerland

ABSTRACT

The inclusion of transwomen into elite female sport has been brought into question recently with World Rugby banning transwomen from the elite female competition, aiming to prioritise safety over fairness and inclusion, citing the size, force and power-producing advantages conferred to transwomen. The same question is being asked of all Olympic sports including non-contact sports such as archery and shooting. As both these Olympic sports are the polar opposite to the contact sport of rugby in terms of the need to consider the safety of athletes, the IF of both archery and shooting should consider the other elements when deciding the integration of trans individuals in their sports. Studies on non-athletic transwomen have reported muscle mass and strength loss in the range of 5–10% after 1 year of their transition, with these differences no longer apparent after 2 years. Therefore, based on the current scientific literature, it would be justified for meaningful competition and to prioritise fairness, that transwomen be permitted to compete in elite archery after 2 years of GAT. Similarly, it would be justified in terms of shooting to prioritise inclusion and allow transwomen after 1 year of GAT given that the only negligible advantage that transwomen may have is superior visuospatial coordination. The impact of this considered integration of transwomen in elite sports such as archery and shooting could be monitored and lessons learned for other sports, especially where there are no safety concerns from contact with an opponent.

KEYWORDS
Transwomen; archery; shooting; eligibility; competition; sport

Abbreviations: IF: International Sports Federation; FDS: Flexor Digitorum Superficialis; IOC: International Olympic Committee; EA: Elite Archer; NA: Non-elite Archer; INT: International Athletes; NAT: National Athletes; GAT: Gender Affirming Treatment; O_2: Oxygen; cHb: Haemoglobin Concentration in Blood

1. Introduction

The inclusion of transwomen into elite female sport has been brought into question in recent times, not least by the decision of World Rugby to ban transwomen from elite female competition (Rugby, 2020). As the main physical attributes of rugby are strength, speed, and power and the rules and strategies of the game encourage intense physical contact with opponents, in their recent deliberations World Rugby prioritised the safety of athletes over fairness and inclusion as reflected in the proposed decision-making triangle (Figure 1A) (Rugby, 2020). A recent review of studies conducted in non-athletic transwomen undergoing gender affirming treatment (GAT) highlights the time course changes in lean body mass, muscle cross-sectional area, and muscular strength (i.e. 12–36 months) and haemoglobin and/or haematocrit (i.e. 3–4 months) (Harper, O'Donnell, Khorashad, McDermott, & Witcomb, 2021). Similarly, another recent review argued that lean body mass, muscle size, bone density and strength were are only trivially affected by 12 months of GAT; the period previously advocated for inclusion of transgender women in female sports categories (Hilton & Lundberg, 2021). These two recent reviews highlight the urgent need for research examining the impact of GAT in transwomen athletes to inform the decision-making process and properly consider the integration of transwomen in elite female sport (Hamilton et al., 2021). These examples also show that there is a clear need for a roadmap demonstrating how integration

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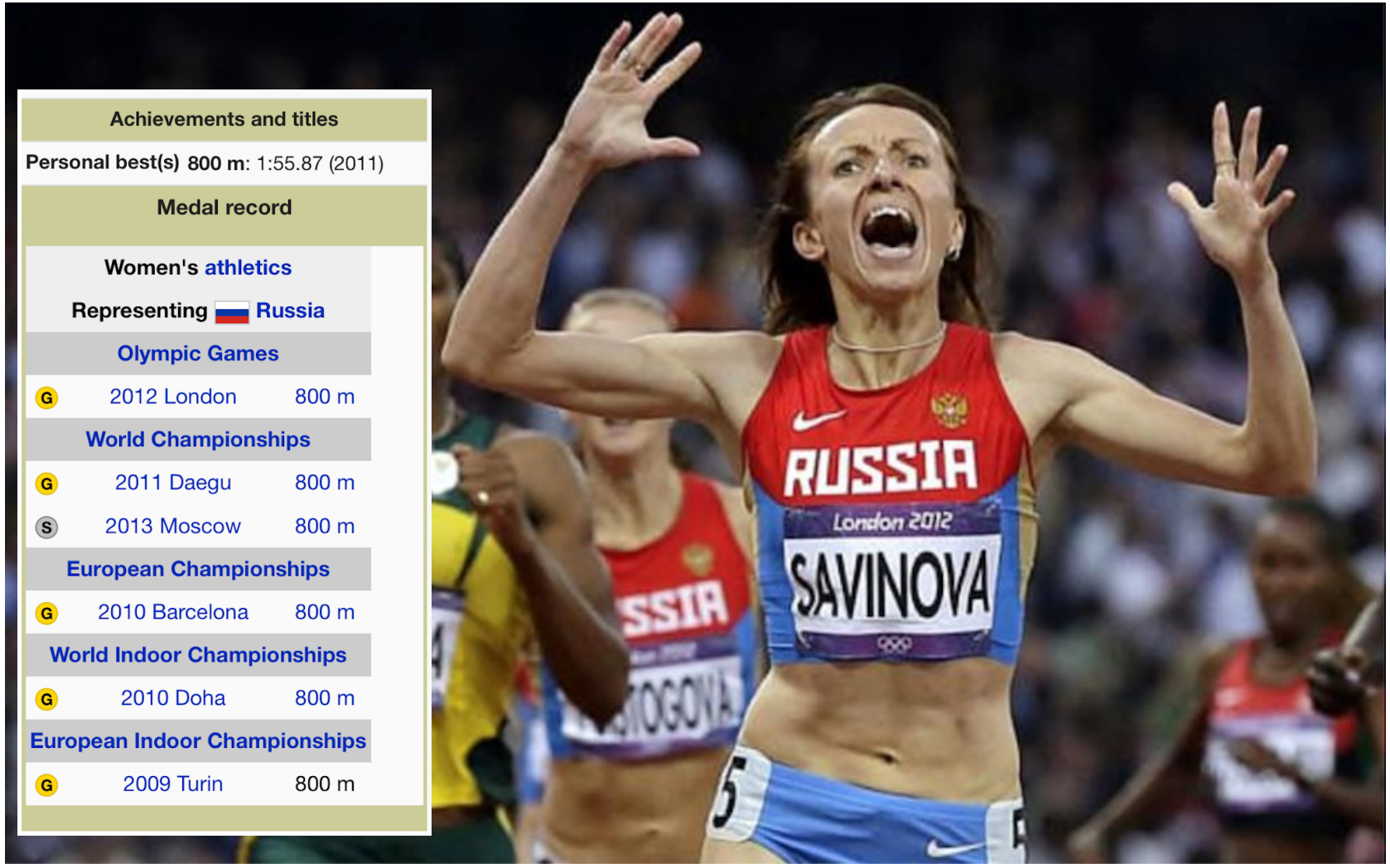
Figure 1. The declared weightings for World Rugby (**A**) and the derived weightings for World Archery (**B**) and International Shooting Sport Federation (**C**) using the three primary criteria for formulating the guidelines and/or rules for the fair and safe integration of transwomen athletes.

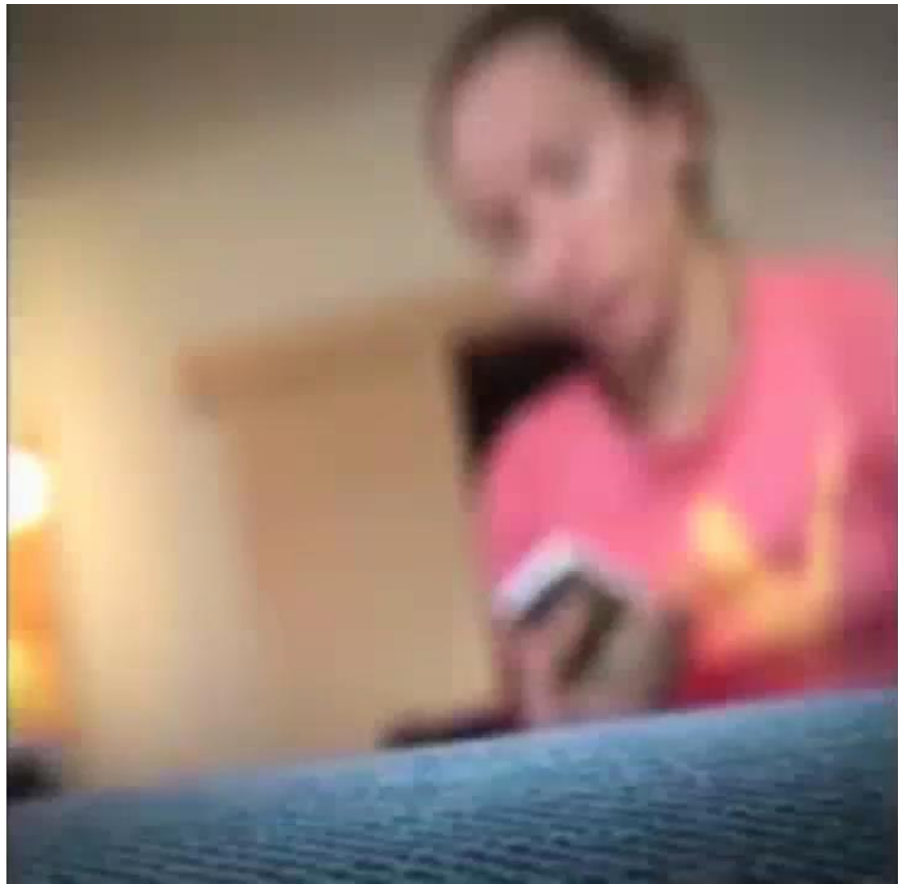
Figure 2. Proposed sliding scale tool that IF's may use to decide what weighting to prioritise in their respective sports for the inclusion/exclusion of transwoman athletes. This sliding scale may be used holistically as a sport to decide their orientation in the decision-making triangle of Figure 1, or it can be used to prioritise what to assess in an individual transwomen's eligibility case for that sport.

2012 Summer Olympics



Achievements and titles		
Personal best(s) **800 m**: 1:55.87 (2011)		
Medal record		
Women's athletics		
Representing Russia		
Olympic Games		
G	2012 London	800 m
World Championships		
G	2011 Daegu	800 m
S	2013 Moscow	800 m
European Championships		
G	2010 Barcelona	800 m
World Indoor Championships		
G	2010 Doha	800 m
European Indoor Championships		
G	2009 Turin	800 m

Russia’s state-sponsored doping system



German television channel ARD, 2014

(voice dubbed)

That is our system and in Russia that only works only with pharma...

My coach fortunately works with Melnikov [*Russian Head Coach*] and he helps to cover up the tests. They allow him to change the dates for the controls.

Oxandrolone [*anabolic-androgenic steroid*] is very quickly out of my body again. It takes less than 20 days. We have tested that.

My husband has very good contacts to the doping control laboratory.

London 2012 Summer Olympics

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Home Football Formula 1 Cricket Rugby U Rugby L Tennis Golf Athletics Sports Personality My Sport All Sport

Russian doping: McLaren report says more than 1,000 athletes implicated

9 December 2016 | Sport

Share

The report's author, Richard McLaren (centre), said doping took place on 'an unprecedented scale'

"The Russian Olympic team corrupted the London Games 2012 on an unprecedented scale, the extent of which will probably never be fully established… The desire to win medals superseded their collective moral and ethical compass and Olympic values of fair play."

2012 Summer Olympics

Rank
G
S
B
4
5
6

The Washington Post

Twelve years after finishing sixth, she's in line for Olympic bronze 1500 m

American Shannon Rowbury feels "some good closure" after another suspension in an infamous London Games race leaves her with the third-fastest time.

BY ADAM KILGORE
SEPTEMBER 4 AT 8:21 AM

On Tuesday morning, Shannon Rowbury was sitting with her family in the lobby of a Quito, Ecuador hotel, the requisite layover on a trip to the Galápagos Islands. The greatest American middle-distance runner of her generation, Rowbury will turn 40 later this year, and the milestone called for a bucket list vacation with her husband and two young children.

Clinical Chemistry 57:5
762–769 (2011)

[1] Swiss Laboratory for Doping Analyses, Epalinges, Switzerland;
[2] International Association of Athletics Federations, Monaco, Monaco.

Prevalence of Blood Doping in Samples Collected from Elite Track and Field Athletes

Pierre-Edouard Sottas,[1*] Neil Robinson,[1] Giuseppe Fischetto,[2] Gabriel Dollé,[2]
Juan Manuel Alonso,[2] and Martial Saugy[1]

	n[a]	Prevalence M1, %[b]	Prevalence M2, %
Males	4028	12 (10–15)	12 (10–15)
Country A	205	48 (35–63)	78 (54–99)
Country B	352	3 (1–11)	1 (0–2)
Country C	257	23 (15–30)	28 (17–36)
Country D	208	6 (3–19)	5 (0–17)
Country E	160	18 (11–30)	18 (7–28)
Country F	148	6 (1–25)	2 (0–22)
Country H	160	39 (20–54)	51 (21–87)

[a] n, Number of samples from which the estimates were derived. Prevalence M1, minimal estimates without any assumptions on the doping method. Prevalence M2, estimates obtained assuming doping with rEPO micro-doses.
[b] 95% CI estimated by bootstrapping methods, with any negative estimates rounded toward 0%.

Table 2. Period prevalence estimates of abnormal blood profiles in elite track and field athletes.

Females	3261	18 (15–21)	18 (15–21)
Country A	445	46 (35–58)	50 (35–68)
Country B	130	8 (4–34)	2 (0–11)
Country C	147	12 (4–20)	14 (1–28)
Country D	103	1 (0–11)	0 (0–3)
Country E	106	11 (7–20)	8 (1–14)
Country F	110	6 (3–19)	0 (0–13)
Country H	65	36 (13–62)	36 (5–66)
All	7289	14 (12–16)	14 (12–16)
All nonendurance	1329	3 (0–8)	1 (0–3)
All endurance	4999	18 (15–22)	19 (16–22)

Paradigm Change


OLYMPIC
AI AGENDA
LAUNCH
International
Olympic
Committee

REVIEW

doi:10.1038/nature24286

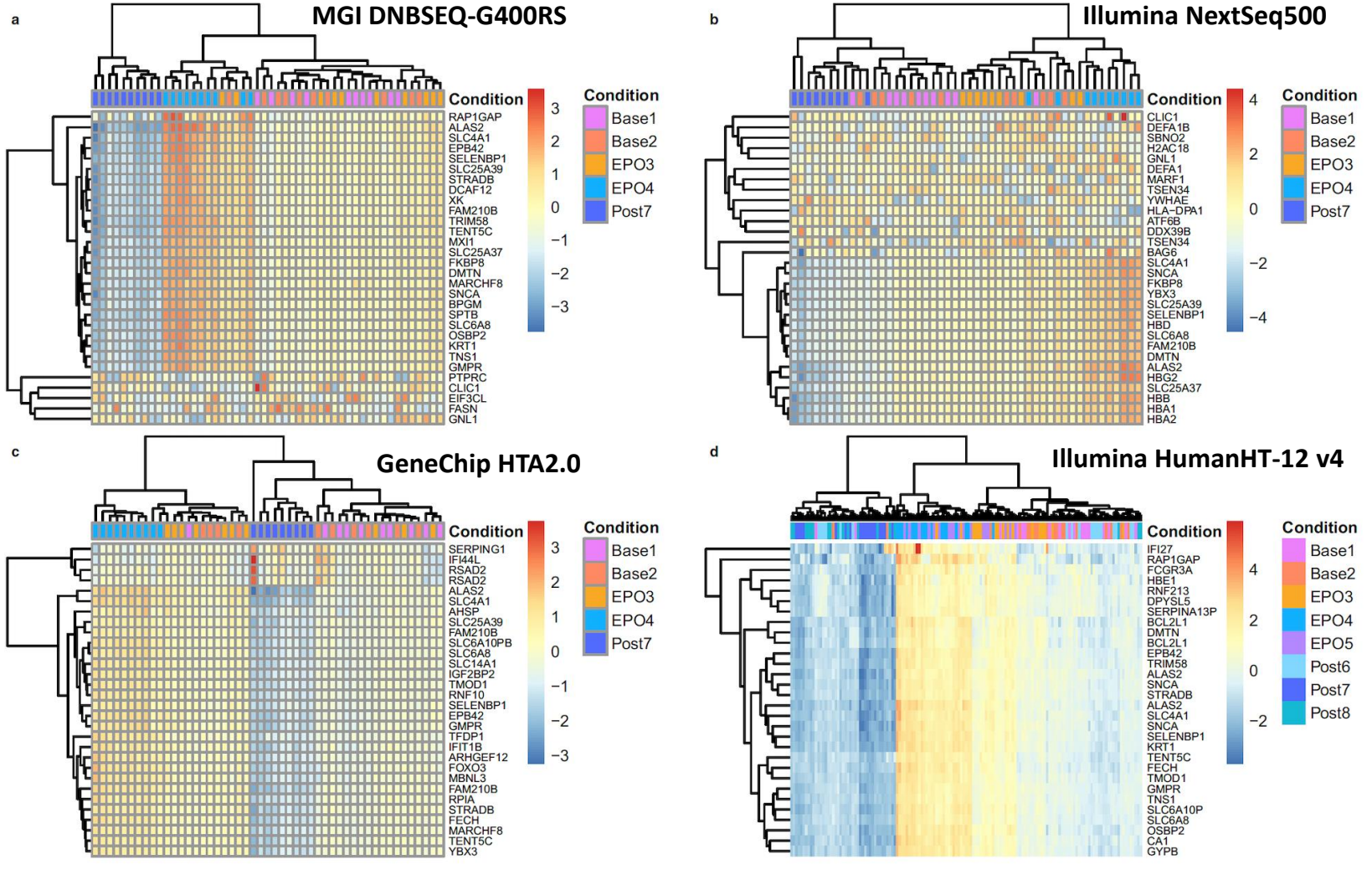
Nature (2017) | doi:10.1038/nature24286
Received 13 July 2017 | Accepted 21 September 2017 | Published online 11 October 2017

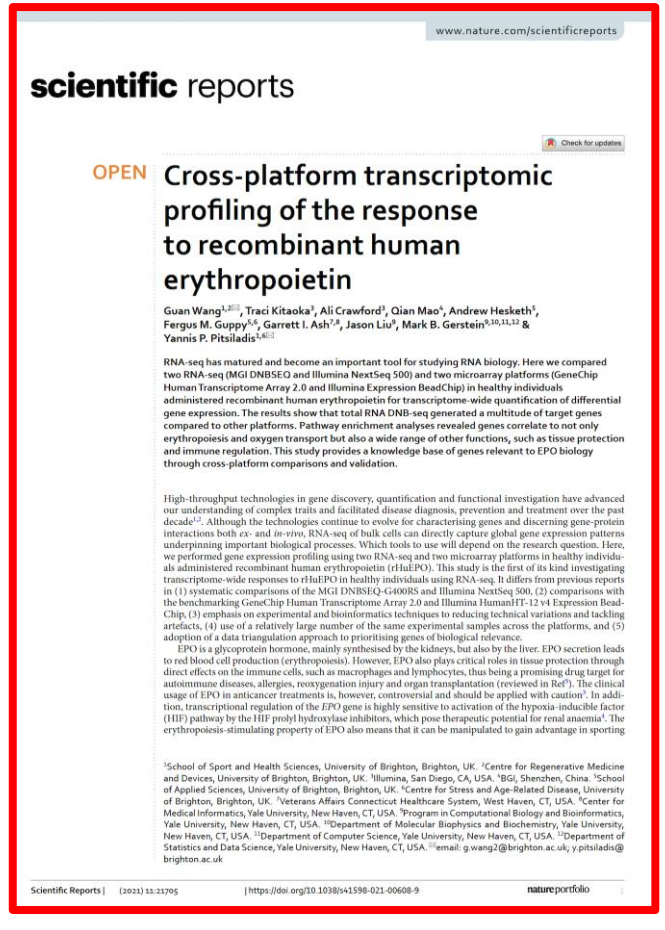
DNA sequencing at 40: past, present and future

Jay Shendure[1,2], Shankar Balasubramanian[3,4], George M. Church[5], Walter Gilbert[6], Jane Rogers[7], Jeffery A. Schloss[8] & Robert H. Waterston[1]

This review commemorates the 40th anniversary of DNA sequencing, a period in which we have already witnessed multiple technological revolutions and a growth in scale from a few kilobases to the first human genome, and now to millions of human and a myriad of other genomes. DNA sequencing has been extensively and creatively repurposed, including as a 'counter' for a vast range of molecular phenomena. We predict that in the long view of history, the impact of DNA sequencing will be on a par with that of the microscope.

Gene clustering analysis of the top 30 genes of high variance across the RNA-seq and the microarray platforms




www.nature.com/scientificreports

scientific reports

OPEN

Cross-platform transcriptomic profiling of the response to recombinant human erythropoietin

Guan Wang[1,2✉], Traci Kitaoka[3], Ali Crawford[3], Qian Mao[4], Andrew Hesketh[5], Fergus M. Guppy[5,6], Garrett I. Ash[7,8], Jason Liu[9], Mark B. Gerstein[9,10,11,12] & Yannis P. Pitsiladis[1,6✉]

RNA-seq has matured and become an important tool for studying RNA biology. Here we compared two RNA-seq (MGI DNBSEQ and Illumina NextSeq 500) and two microarray platforms (GeneChip Human Transcriptome Array 2.0 and Illumina Expression BeadChip) in healthy individuals administered recombinant human erythropoietin for transcriptome-wide quantification of differential gene expression. The results show that total RNA DNB-seq generated a multitude of target genes compared to other platforms. Pathway enrichment analyses revealed genes correlate to not only erythropoiesis and oxygen transport but also a wide range of other functions, such as tissue protection and immune regulation. This study provides a knowledge base of genes relevant to EPO biology through cross-platform comparisons and validation.

High-throughput technologies in gene discovery, quantification and functional investigation have advanced our understanding of complex traits and facilitated disease diagnosis, prevention and treatment over the past decade[1,2]. Although the technologies continue to evolve for characterising genes and discerning gene-protein interactions both *ex-* and *in-vivo*, RNA-seq of bulk cells can directly capture global gene expression patterns underpinning important biological processes. Which tools to use will depend on the research question. Here, we performed gene expression profiling using two RNA-seq and two microarray platforms in healthy individuals administered recombinant human erythropoietin (rHuEPO). This study is the first of its kind investigating transcriptome-wide responses to rHuEPO in healthy individuals using RNA-seq. It differs from previous reports in (1) systematic comparisons of the MGI DNBSEQ-G400RS and Illumina NextSeq 500, (2) comparisons with the benchmarking GeneChip Human Transcriptome Array 2.0 and Illumina HumanHT-12 v4 Expression BeadChip, (3) emphasis on experimental and bioinformatics techniques to reducing technical variations and tackling artefacts, (4) use of a relatively large number of the same experimental samples across the platforms, and (5) adoption of a data triangulation approach to prioritising genes of biological relevance.

EPO is a glycoprotein hormone, mainly synthesised by the kidneys, but also by the liver. EPO secretion leads to red blood cell production (erythropoiesis). However, EPO also plays critical roles in tissue protection through direct effects on the immune cells, such as macrophages and lymphocytes, thus being a promising drug target for autoimmune diseases, allergies, reoxygenation injury and organ transplantation (reviewed in Ref[3]). The clinical usage of EPO in anticancer treatments is, however, controversial and should be applied with caution[3]. In addition, transcriptional regulation of the *EPO* gene is highly sensitive to activation of the hypoxia-inducible factor (HIF) pathway by the HIF prolyl hydroxylase inhibitors, which pose therapeutic potential for renal anaemia[4]. The erythropoiesis-stimulating property of EPO also means that it can be manipulated to gain advantage in sporting

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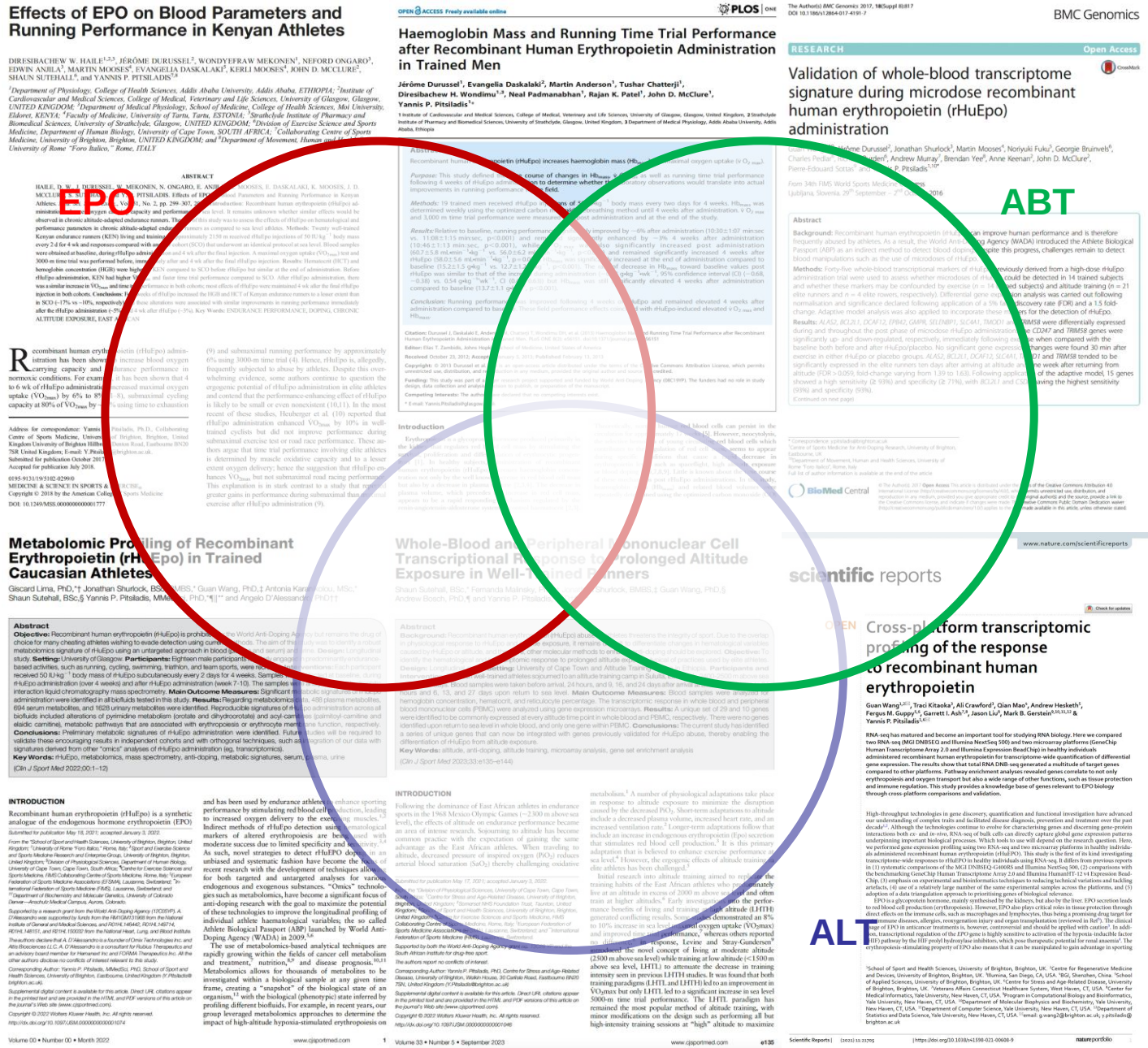
Figure 1. Gene clustering analysis of the top 30 genes of high variance across the RNA-seq and the microarray platforms. (**a**) MGI DNBSEQ-G400RS, (**b**) Illumina NextSeq 500; (**c**) GeneChip HTA2.0; (**d**) Illumina HumanHT-12 v4 Expression BeadChip.



- Altitude
- EPO
- Transfusions

Perspective

Shaun Sutehall, Fernanda Malinsky, Sven Voss, Neil Chester, Xu Xiao and Yannis Pitsiladis*

Practical steps to develop a transcriptomic test for blood doping

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Abstract: Blood doping remains a significant problem that threatens the integrity of sport. The current indirect method for detecting blood doping involves the longitudinal measurement of an athlete's haematological variables and identification of suspicious results that are indicative of doping (i.e., the athlete biological passport). While this has played a significant role in the protection of clean sport, improvements are needed. The development of a transcriptomic test, that can be used to detect the use of blood doping has been discussed and researched for decades and yet, an anti-doping test that can be adopted by the World Anti-Doping Agency (WADA) is yet to be established. With recent advancements in our understanding, as well as in methods of sample collection, the possibility of a transcriptomic test that can be used by WADA, is imminent. There are, however, several practical considerations that must first be made, that will be highlighted in this perspective article.

Keywords: anti-doping; testing; blood doping; EPO; transcriptomics

Introduction

In endurance sports, blood doping has the potential to significantly improve endurance performance, primarily by increasing the oxygen carrying capacity of the users' blood [1].

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The use of rHuEpo to enhance athletic performance was prohibited by the IOC in 1990, however its detection to this day remains a challenge. In 1997, a "no start" rule was introduced by the UCI, with athletes providing a blood sample prior to competition [2] and if their HCT exceeded the predetermined limit, they were not permitted to race. The ABP was later introduced by the UCI in 2008 [3] and soon after adopted by WADA. Since then, it has been a critical element of anti-doping testing programmes.

The ABP measures an athlete's haematological variables longitudinally, and with the use of Bayesian statistics, generates an individual upper and lower limit [3]. If an athlete's haematological variables exceed the calculated upper or lower limit, it suggests that there is only a 1:100 chance that this is due to "natural" physiological variance [4] and can be used as evidence of doping and result in the sanctioning of an athlete [5]. It has, however, been demonstrated that it is possible to use low doses of rHuEpo and avoid detection by the ABP [6], and despite improvements to the ABP [7], questions remain about its reliability as a method of detecting doping and its efficacy as a deterrent, on a global scale [8].

A transcriptomic method of detecting rHuEpo abuse was described in 2001 [9], a year after the first direct test for rHuEpo in urine was established [10]. Recent research into transcriptomics for anti-doping has focused on identifying specific transcriptomic markers that are associated with rHuEpo abuse [11, 12], confounding variables such as altitude exposure [13] and reproducibility of transcriptomic markers in differing sample collection matrixes such as DBS [14].

Despite significant research, a transcriptomic test, that is either standalone, or an addition to the current ABP has yet to be established. There are several theoretical and practical hurdles that must be overcome prior to the adoption of a transcriptomic test as an anti-doping tool. The summary of this article is presented in Figure 1.

Identifying transcriptomic markers

Numerous studies have characterised the transcriptomic response to blood doping in whole blood (e.g., Table 1, [15]) and DBS [16], along with conditions that may confound

Figure 1: Graphical representation of this article. *Figure created with BioRender.*

My thoughts on Blood Doping

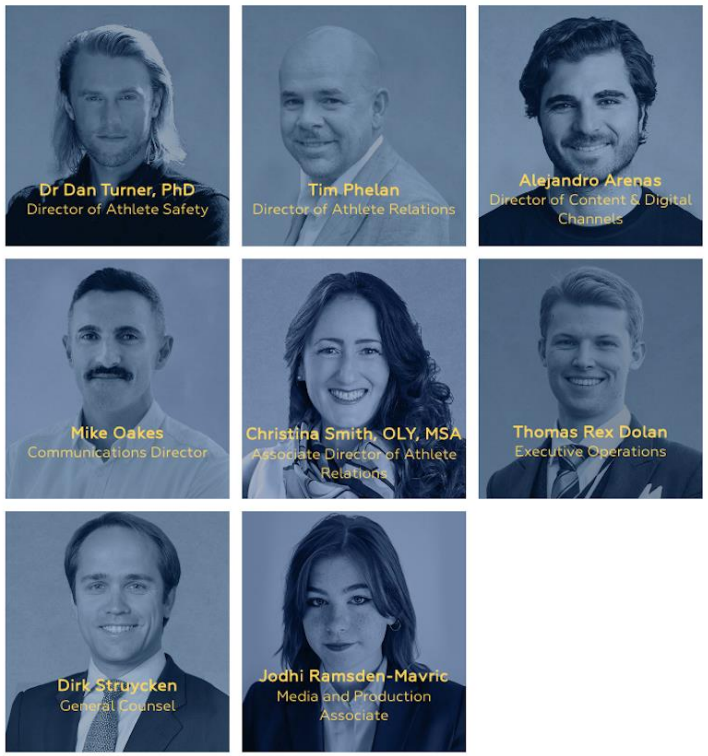
- A haematologic profile approach alone will not be able to resolve the current problem
- More sensitive methods required (i.e. gene expression)
- The notion of the “athletes passport” needs to be further investigated
- Consortium approach needed (e.g. governing bodies, scientists, statisticians, doctors, athletes, managers, lawyers)
- Serious money, not token gestures


So
What?

The Enhanced Games

Leadership

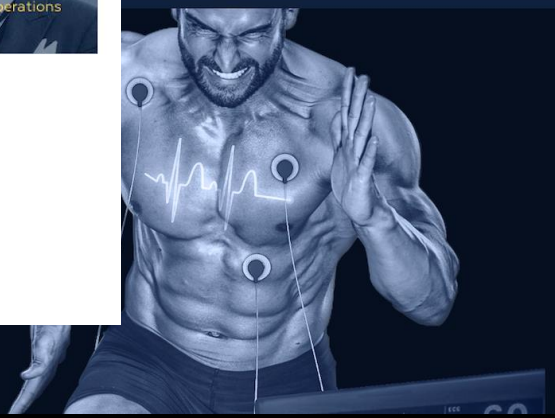
Team



Home Our Plan Our Team The Movement

superhumanity is on.

anced Games, the ultimate
at the human body is capable



The world's best athletes, enhanced.

When 44% of athletes already use performance enhancements, it is time to safely celebrate science.

Investors

Scientific and Medical Advisory Commission

Athletes Advisory Commission

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Sport

ATHLETICS | MATT LAWTON

Team GB athletes interested in competing in Olympics for dopers

Australian plans to stage annual event free of drug testing that he claims would be safer than the Olympics

He founded Sargon, a technology infrastructure company for the pensions and superannuation industry that has more than £25 billion under management and supervision. D'Souza sold his stake in the company in 2018.

He clearly considers himself something of a visionary but he also describes himself as an "agitator", and in this case the International Olympic Committee (IOC) is very much in his sights.

SPONSORED

"We believe that science makes humanity, and sports, better and fairer," D'Souza said. "At the moment doping is on the dark web. It's a black market, it's underground, unsafe. With us it can be done under clinical and scientific supervision."

A handful of former Olympic stars have nevertheless joined Enhanced's athletes advisory commission. e.g., swimming gold medallist Ronald Schoeman. Right now, the plan is to have five sports categories — athletics, swimming, weightlifting, gymnastics and combat sports — with the event held annually.

D'Souza hopes to attract athletes with the comfort of test-free competition and the chance, unlike the majority of Olympic athletes, to make some serious cash. "We will offer them equity".

Ignore History at Your Peril

We want healthy athletes and fair competition

Yannis P Pitsiladis ,[1,2] Fabio Pigozzi,[1,3] Michael Geistlinger,[1,4] José Kawazoe Lazzoli,[1,5] Maher Zahar,[1,6] Norbert Bachl,[1,7] Pedro Manonelles Marqueta,[1,8] William O Roberts ,[1,9] Klaus-Michael Braumann,[1,10] Eduardo H De Rose,[1] Demitri Constantinou ,[1,11] Anca Ionescu,[1,12] Christian Schneider,[1,13] Patrick Shu-Hang Yung,[1,14] Xavier Bigard ,[1,15] International Federation of Sports Medicine (FIMS)

THE ENHANCED GAMES

The Enhanced Games[1] is a planned international multisport event masterminded by Aron D'Souza, Australian businessman, where athletes will not be subject to any form of testing by the World Anti-Doping Agency (WADA) for prohibited list of substances and methods. Initially planned to be held in Australia in 2024, after the Paris 2024 Olympics, the event is now destined to take place in 2025. Reactions from the sporting world have been extremely negative, highlighting the dangers of encouraging performance-enhancing drugs (box 1).

Notably, some countries, such as Austria, France and Italy, have criminalised the use of a World Anti-Doping Code (WADC) Prohibited Substance[2] while many more countries have also enacted sports-specific legislation that criminalises other Anti-Doping Rule Violations beyond the use of a WADC Prohibited Substance including (1) the possession of WADC Prohibited Substances or Methods; (2) the supply or distribution of WADC Prohibited Substances or Methods (trafficking); (3) the administration or prescription of WADC Prohibited Substances or Methods to athletes and (4) failing to cooperate with antidoping investigations being conducted by an International or National Anti-Doping Organization or other public authority.[2]

THE INTERNATIONAL FEDERATION OF SPORTS MEDICINE POSITION

Despite much opposition, the Enhanced Games in some forms are likely to happen given the financial backing.[3] The International Federation of Sports Medicine (FIMS), an international organisation comprising national sports medicine associations that span all five continents, with an executive committee that includes representative members from IOC, WADA, Association of Summer Olympic International Federations and Association of International Olympic Winter Sports Federations, and whose mission is to assist athletes in achieving optimal performance by high-quality medical care and training,[4] is adamantly opposed to the Enhanced Games.

The President of the Enhanced Games holds the opinion that *'Drug testing is about fairness, not safety.'* He states as follows: *'At the Olympics, athletes are drug tested after each competition. Clearly, the goal of the Olympics' drug testing regime is to ensure fairness through the threat of punishment for those who use enhancements. There is little concern for safety, as the Olympics have no mandated health-testing programme. Olympians, 44% of whom have used enhancements in the past year, are able to compete regardless of any undiscovered health risks. This is why athletes competing in the Enhanced Games will receive free medical screening prior to competition, which will ensure that they are healthy and able to compete. The screening will involve an echocardiogram, blood tests and genomic sequencing, in order to build up a full picture of the athlete's health, and allow athletes to make an informed decision about whether they are safe to compete. The Enhanced Games aim to be the safest sporting event in the world. At the Enhanced Games, we prioritise athlete safety. In partnership with top scientists and clinicians, we are developing a full-system medical precompetition screening protocol—to protect athletes competing in the Enhanced Games.'*[5]

FIMS strongly distances itself from this kind of interpretation of competitive sport. In citing the difference between fairness and safety, the president of the Enhanced Games seems to move the discussion onto a philosophical level. The priority of FIMS must be to safeguard the three cardinal principles that form the basis of medical care of athletes without exception: scientific analysis, study of the physical condition of the individual and protection of health.[6] The claim that antidoping tests do not protect the safety of elite athletes has no scientific basis and therefore, this claim can vehemently be dismissed. Notably, for a substance or method to be added to the WADA Prohibited List, it must meet at least two of three criteria of Article 4.3 for Including Substances and Methods on the Prohibited List,[7] that includes an actual or potential health risk to athletes (in addition to having the potential to enhance or enhances sport performance and violates the spirit of sport). Even if there is a reduced health concern to elite athletes participating in the Enhanced Games due to the declared medical controls-although this remains to be determined. Our concern as FIMS also focuses on the health hazards of drug use in young aspiring athletes, especially those who will never make it into the Enhanced Games. The grave concern of FIMS is that young individuals will be exploited in the quest for fame and fortune and the allure of the Enhanced Games.

MEDICAL SCREENING INSUFFICIENT TO GUARANTEE THE SAFETY OF 'ENHANCED' ATHLETES

The procedures and protocols under development by the proponents of the Enhanced Games are reported to safeguard athlete health while upholding the principle of personal choice in the use of enhancements (personal communication with the President of the Enhanced Games). It is their intention to conduct numerous evaluations of athletes participating in the Enhanced Games to inform a multitiered, risk-based approach to informed consent, athlete's eligibility to compete and health insurer coverage. In scenarios where athletes do not meet the specified health criteria for participation, athletes (it would appear), will have the option to appeal the decision or seek continued involvement. This process under development is expected to involve an established system of external arbitration allowing an impartial third party to review the case and consider any appeals or arguments put forth by the athlete regarding their health status and eligibility. The Enhanced Games also intend to apply a similar system of external arbitration to athletes wishing to contest any sporting and/or financial sanctions that may be imposed in the event of alleged use of prohibited enhancements—what enhancements will be permitted and prohibited remain to be declared. The Enhanced Games policy under development will consider all relevant factors in determining whether an athlete can be held responsible and what penalties should be imposed. Considerations will include the athlete's intent, fault, negligence or knowledge of use, as well as a realistic assessment of sporting advantage gained.

TESTING FOR FAIRNESS AND HEALTH

FIMS welcomes medical screening capable of discovering possible health risks for competitors. Indeed, antidoping is not just to guarantee fairness. The fundamental rationale of the WADC is that *'antidoping programmes seek to protect the health of Athletes and to provide the opportunity for athletes to pursue human excellence without the Use of Prohibited Substances and Prohibited Methods.'*[8] Furthermore, the statement above by the President of the Enhanced Games[5] disregards the current distribution of competencies in Olympic sports. The medical screening of athletes to ensure that they are healthy and fit to compete is organised by the Olympic International Federations and not by the IOC itself. Each federation administers their own sport and is responsible for the health of their athletes when competing internationally, including at the Olympic Games. This typically entails them overseeing, or obliging, their members to be responsible for the medical screening of athletes to minimise the risk to their health. As a major tenet of antidoping is the health of athletes, antidoping is an essential part of the all-encompassing medical care for healthy athletes. An athlete, who participates in doping, above all else endangers their own health. FIMS, therefore, holds that medical screening as such is not sufficient to guarantee the safety of athletes. For example, many of the side effects of banned substances will only be observed after several years of use and will not be detected by a single blood test. There are also many examples where screening is ineffective in detecting the long-term side effects of banned substances, such as psychiatric disorders induced by anabolic-androgenic steroids,[8] the effects of growth hormone on reproductive function, the acceptable level of left ventricular hypertrophy or the risk of hepatocellular carcinoma. (eg,[9]). Clearly, the type of medical assessment suggested in the context of Enhanced Games will not be sufficient to detect the side effects of many banned substances.

ACCESS TO RESOURCES

Another consideration relates to access to financial and medical resources. Of concern to FIMS is how aspiring athletes, attracted to the offerings of the Enhanced Games but without significant financial resources, and athletes from developing countries, will access such specialist medical care and 'protect' their health. It is well publicised that enhancements are being prescribed under medical supervision to interested celebrities, influencers and the very rich in exclusive clinics, where a single 1-hour consultation can cost a few thousand dollars. A further unfortunate effect of the Enhanced Games is a likely further widening of the gap between developing and wealthier countries in sporting performance.

ANTI-DOPING MUST EVOLVE

Despite what one may think about the Enhanced Games, its inevitability could ironically help detect those who dope by better understanding the methods used to dope. Currently, due to the secrecy of the drug culture in sport, nobody knows what the dopers are up to until it is too late. As a result, preventative measures are not as effective as they could be and the exact adverse health implications for athletes are yet to be determined. There is also the reputational damage to sport to consider. Sports fans do not know what events are clean, how much doping is going on or how efficient International Federations, the IOC, WADA and other antidoping organisations are at detecting those who dope. And, of course, any detection and punishment is often after the fact.[10] Clean athletes are cheated out of a place on the podium and fans are left in the dark—wondering, cynical or just losing interest. It remains to be determined if the Enhanced Games can bring doping into a light where it can be properly studied. This may involve an uncomfortable evolution of antidoping science so ethical research could be conducted during doping to allow us to understand the life cycle of different substances and/or methods and their effects on elite performance, the body and health. FIMS and antidoping organisations armed with this information could then come up with smarter more directed ways to detect drug use in sport and better inform athletes regarding potential adverse health effects of drug use. With this rigorously researched and peer-reviewed knowledge, antidoping organisations could shorten the periodisation window thus making masking of drug use more difficult and determine the best combination of detection processes to use to make testing more effective.

It would appear that athletes participating in the Enhanced Games must participate in longitudinal studies in order to compete for the riches being offered, then FIMS and antidoping organisations could gather precise data for the first time from a large cohort of athletes who have admitted to doping to determine the long-term effects of various types of drug use. This information could be used to demonstrate the true health consequences of drug use or to dispel myths and inform decisions about the prohibited list. Ironically, the inevitable negative health impact of performance-enhancing drugs could act to discourage athletes from participating in the Enhanced Games and the increased knowledge on doping practices and the development of new antidoping tests could also strengthen the trust of athletes in drug free Olympic sport. However, all these possibilities and options cannot overrule the commitment of all sports and medical people involved to comply with the WADA. FIMS must insist that the Enhanced Games respect the ethical principles of sport medicine. Like never before in the history of modern day sport, there is an urgent need to protect the ideals of the Olympics and Olympism. FIMS remains thoroughly dedicated to the Olympic values and committed to the Olympic Movement Medical Code.[11]

Box 1 Reactions from the sporting world highlighting the dangers of encouraging performance-enhancing drug

'There's only one message and that is if anybody is moronic enough to feel that they want to take part in that, and they are from the traditional, philosophical end of our sport, they'll get banned and they'll get banned for a long time.'[12]

'Joining with WADA, other governments and the International Olympic Committee to express deep concerns over both the planned 'Enhanced Games' without antidoping requirements and the Russian organised 'Friendship Games' alternative to the Olympics'[13]

'The idea of the Enhanced Games does not merit any comment. If you want to destroy any concept of fair play and fair competition in sport, this would be a good way to do it.'[14]

Members of the Executive Committee (ExCo) of the World Anti-Doping Agency (WADA) also affirmed their opposition to the so-called 'Enhanced Games', an event that would encourage the use of performance-enhancing drugs by athletes. The ExCo was united in condemning the 'Enhanced Games' as a dangerous and irresponsible concept. The health and well-being of athletes is WADA's number-one priority. Clearly, this event would jeopardise both by promoting the use of potentially harmful substances and methods. As we have seen throughout history, performance-enhancing drugs have taken a terrible physical and mental toll on many athletes. Some have died. The ExCo stressed WADA's position on this subject, warning athletes and support personnel, who wish to participate in clean sport, that if they were to take part, they would risk committing Anti-Doping Rule Violations under the Code. To be clear, WADA will encourage anti-doping organisations worldwide to test involved athletes before, during and after this event, in order to protect the integrity of legitimate sport.'[15]

Lord Coe, President of World Athletics[12]; Dr. Rahul Gupta, Director of the White House Office of National Drug Control Policy[13]; Statement from the International Olympic Committee (IOC)[14]; Statement from the WADA.[15]

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Collaborators International Federation of Sports Medicine (FIMS): The International Federation of Sports Medicine (Fédération Internationale de Médecine du Sport or FIMS) is an international organisation comprising national sports medicine associations that span all five continents, with an Executive that includes representative members from IOC, WADA, Association of Summer Olympic International Federations (ASOIF) and Association of International Olympic Winter Sports Federations (AIOWF), and fundamental purpose to assist athletes in achieving optimal performance by high-quality medical care and training (www.fims.org).

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Competing interests YPP, FP and MZ are members of the IOC Medical and Scientific Commission. All authors are members of the Executive Committee of the International Federation of Sports Medicine (FIMS)

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Drugs, sex, and enhancement: Threats to sports integrity at the Olympics

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BACKGROUND

The Olympic Games represents a majestic sporting showcase on a uniquely global scale. The Paris 2024 Olympics could mark the start of a new era for the Olympic Movement. This viewpoint focuses on three existential threats to modern Olympic Games: doping, gender issues, and enhancement, while cutting-edge research and science need to be at the heart of a concerted reaction to restore integrity of competition and protect the concept of "true" sport. Performance enhancement in the context of sport denotes or relates to a drug or other substance or method used with the prospect of improving an athlete's performance; specifically, substances and methods that enhance any number of components of physical and mental performance, such as agility, speed, strength, power, endurance, and competition preparation and execution.

ANTI-DOPING CHALLENGES

The World Anti-Doping Agency (WADA) was established in 1999 to harmonize doping control and provide educational strategies to avoid doping. However, some 20 years later, the prevalence of doping in sport has not substantially abated. While the true prevalence of doping in sport is impossible to accurately determine, it is substantially higher than the adverse analytical findings reported. For example, the figures for adverse analytical findings have varied between 1.1% (2008) and 1.6% (2016), while a recent large systematic review of 175 studies published between 1975 and 2019 reported doping prevalence rates in competitive sport ranging from 0% to 73% for doping behavior, with most falling under 5%.[1] It is important, therefore, that new methods are developed with greater sensitivity and specificity to detect blood doping—a method of choice by those wishing to cheat and gain a significant performance advantage (Figure 1).

Despite a number of positive developments in anti-doping, the last major development aimed at providing a step change in blood doping detection was the Athlete Biological Passport (ABP) and implemented in 2009. While urine testing is the main method of detecting recombinant human erythropoietin (rHuEpo), its relatively short window of detection (less than 24 h in some cases) renders this method ineffective for blood doping detection. The hematological module of the ABP uses Bayesian inference techniques and longitudinal measurements of blood parameters. Despite its appeal, the ABP has important limitations due to the simplicity of metrics and its impact by confounding factors such as hydration status and the natural hematological response to altitude training that complicate interpretation of ABP profiles. The ABP is also unable to effectively detect administration of micro-doses of rHuEpo, given the relatively small fluctuations in hematological parameters.[2] Therefore, there is an urgent need for a paradigm shift away from "in sport, the cheats are usually a step ahead" to "in sport, the testers need to be a few steps ahead."

A potential game changer that has, until now, not been used substantially in the anti-doping field is "omics" technologies: genome, transcriptome, proteome, and metabolome. In a series of closely interconnected studies conducted in our laboratory and funded by WADA and the International Olympic Committee (IOC) using "omics" from microarrays to RNA sequencing technology, we successfully identified, replicated, and validated the blood "molecular signature" of rHuEpo administration,[3] indicating that "omics" technologies can improve current anti-doping methods such as the ABP. The results we have generated to date, replicated by others, confirm that it is only a matter of when rather than if "omics" methods will revolutionize anti-doping.

GENDER ISSUES: INTEGRATION OF INTERSEX AND TRANSGENDER ATHLETES INTO ELITE SPORT

Sport is historically designated by binary categorization of male and female that conflicts with the science of sex and modern society. This frequently overlooked fact, appreciated since antiquity, has come to the fore more recently with attempts to include transgender athletes and athletes with differences in sex development (DSD) into elite sports.[4] The issue is that the performance-enhancing effect of testosterone, which is widely accepted in the literature, and the exposure to higher concentrations of testosterone in trans women and DSD women athletes is expected to provide a competitive performance advantage. This expectation has led to an ever-increasing number of international federations (IFs) banning participation of trans female athletes in elite sports, and the same expected for DSD athletes. While these policy rules and their backing assumptions to primarily ban these athletes from competing may, in time, be proven correct, until data from longitudinal transgender and DSD athlete case comparison studies that control for variations in hormonal exposure and involve numerous indices of performance become available, there is just as much circumstantial evidence to support the policy to ban these athletes than there is to oppose it. The International Federation of Sports Medicine (FIMS) published its position with the European Federation of Sports Medicine Associations on the IOC framework on fairness, inclusion, and non-discrimination based on gender identity and sex variations, highlighting the need for innovative longitudinal research studies with specific athlete populations to generate physiological and sport performance knowledge and more reliable biomarkers for a fairer classification of athletes. The statement highlighted the fact that serum testosterone can be a valuable marker to regulate the inclusion of transgender athletes and DSD athletes into the elite female category but has limitations due to the multifactorial nature of sports performance. This led the authors of the joint position to conclude that longitudinal and sport-specific gender affirmation hormone therapy studies are needed to enhance our knowledge of impact of testosterone on performance and identify biomarkers of testosterone sensitivity/responsiveness, including molecular tools to determine the functional status of androgen receptors. Subsequently, the IOC published its position after consulting with many stakeholders, including FIMS. In general, it re-affirmed the position of FIMS but, also, importantly, assigned to individual IFs the responsibility to establish their own rules to ensure equitable and fair competition. How this complex situation resolves will depend on the outcomes of research studies using appropriate experimental designs and state-of-the-art technologies that remain to be commissioned and how individual IFs prioritize fairness, safety, and inclusion in sport. There is also the need to consider the ever-changing legal landscape, where more and more countries are supporting the right to self-identify. Policy makers must also consider the Olympic Charter, which clearly stipulates that "The enjoyment of the rights and freedoms set forth in this Olympic Charter shall be secured without discrimination of any kind, such as race, colour, sex, sexual orientation, language, religion, political or other opinion, national or social origin, property, birth or other status."

ENHANCED GAMES

The Enhanced Games is a planned annual international event involving five sports (track and field, swimming, gymnastics, weightlifting, and combat sports), masterminded by Aron D'Souza, an Australian businessman, where athletes will not be tested by WADA. The premise of the Enhanced Games is to safeguard athlete health while upholding the principle of personal choice to use any enhancements. Despite much opposition, the inaugural event is destined to happen in 2025. The primary concern, especially of the sports medicine community,[5] is the health hazards of drug use in young aspiring athletes, who could be exploited in the quest for fame and fortune and the allure of the Enhanced Games. Although the Enhanced Games plan to conduct medical screening capable of discovering possible health risks for competitors, it is obvious that medical screening is insufficient to detect the side effects of many banned substances and methods. Many health side effects of banned substances and methods can be expected only after several years of use and not even with a most comprehensive medical assessment after only short-term use; for example, psychiatric disorders induced by anabolic-androgenic steroids or the risk of hepatocellular carcinoma.

Despite what one may think about the Enhanced Games, ironically, its launch may help detect those who cheat by better understanding the methods used to dope. Due to the secrecy of the drug culture in sport, there is limited knowledge about sophisticated doping practices. A particular difficulty in anti-doping science is the inaccessibility to samples from doped athletes to allow new testing to be developed, improved, and perfected. With this in mind, the Enhanced Games could bring doping into focus, where it can be properly studied, but this would involve an uncomfortable evolution of anti-doping science so ethical research could be conducted during doping associated with the Enhanced Games to allow anti-doping science to better understand the life cycle of different substances and/or methods and their effects on elite performance and health. This partnership of convenience between the Enhanced Games and anti-doping organizations could result in smarter, more effective ways to detect drug use in sport while at the same time informing athletes about the true adverse health effects of drug use.

PROTECTING THE CONCEPT OF "TRUE" SPORT

In this viewpoint, we highlight three major threats to the future of the Olympics, but we also highlight solutions that are firmly based on science, experimentation, innovation, and application of cutting-edge technologies. Common to the doping and gender issues we address, it is the real or perceived unfairness that underpins both of these existential threats for Olympic sport, but also limited consensus on what constitutes "fairness." Part of the confusion is due to the use of terms to set the rules of sport, such as "the spirit of sport," that have no universal meaning. For example, WADA states that anti-doping policies have been developed to protect certain values in sport. The World Anti-Doping Code 2021 states that "The spirit of sport is the celebration of human spirit, body and mind. It is the essence of Olympism and is reflected in values we find in and through sport, including: Health; Ethics; fair play and honesty; Athletes' rights as set forth in the Code; Excellence in performance; Character and Education; Fun and joy; Teamwork; Dedication and commitment; Respect for rules and laws; Respect for self and other Participants; Courage; Community and solidarity. The spirit of sport is expressed in how we play true. Doping is fundamentally contrary to the spirit of sport." But such descriptions can only serve their purpose if these terms mean the same thing to different societies and people, which clearly is not the case. For example, the Enhanced Games use the same term, "spirit of sport," very differently. The only way forward is for each sport to decide what constitutes the "true" essence of their sport and prioritize its main constituents, such as inclusion, safety, and fairness. Such a decision-making process to achieve meaningful competition is already being explored in the integration of trans women into elite competition. Once there is consensus, it is essential that all stakeholders who participate in that sport must agree to play by the rules, and these rules need to be enforceable so that everyone has a chance to succeed, albeit not an equal chance. This decision-making approach and a concerted effort involving cutting-edge research and scientific data are urgently needed and represent the best response to the three major threats to integrity of competition we will witness in Paris in 2024.

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Thank you

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