

# How sport and exercise medicine research can protect athlete health and promote athlete performance

Margo Mountjoy,<sup>1,2</sup> Lars Engebretsen<sup>3,4</sup>

American swimming legend, Fran Crippen died on the 23 October 2010 during an open water FINA World Cup event in the heat of Dubai. His untimely death—likely as a result of hyperthermia but never confirmed<sup>1</sup>—directly led to FINA implementing a limit to how hot water could be for swimming competitions. FINA refers to this as the ‘upper limit safe water temperature rule’.<sup>2</sup> This rule followed extensive collaborative research with the IOC and the International Triathlon Union (ITU) to investigate how swimmers respond to varying degrees of warm water temperature. Utilising sport medicine and science research to determine rule changes should be ‘the gold standard’ practice to protect athlete health.

Some of the larger International Sporting Federations, such as football (FIFA), aquatics (FINA), athletics (International Association of Athletics Federation (IAAF)) and skiing (Ski Federation (FIS)) self-fund scientific research on athlete safety; other International Federations accomplish a similar outcome through collaboration with academic institutions that garner research grants from various sources. The IOC funds targeted research through Olympic Solidarity and the IOC Medical and Scientific Commission. In addition, the IOC now has 11 research centres worldwide that carry out sport science research that protects athlete health. This editorial highlights four categories of initiatives by International Federations for athlete protection. All have been influenced by scientific research.

<sup>1</sup>Family Medicine, McMaster University Michael G DeGroot School of Medicine, Waterloo, Ontario, Canada

<sup>2</sup>Bureau, FINA, Lausanne, Switzerland

<sup>3</sup>Division of Ortho Surg, Oslo University Hospital, Oslo, Norway

<sup>4</sup>Medical and Scientific Department, International Olympic Committee, Lausanne, Switzerland

**Correspondence to** Dr Margo Mountjoy, Family Medicine, McMaster University Michael G DeGroot School of Medicine, Waterloo, ON N2G 1C5, Canada; mountjm@mcmaster.ca

## RULE CHANGES TO DECREASE THE RISK OF ATHLETE INJURY AND ILLNESS

Although most sport rules are targeted at providing athletes fair and equitable competition, some are designed to ensure athlete safety. Sport science has provided the background rationale and impetus for rule changes in several International Federations (see online supplementary table 1). To protect athletes from injury risk from unethical player behaviours, FIFA implemented a rule change to impose a ‘red card’ for ‘elbow-to-head’ infractions, resulting in a significant decrease in head injuries.<sup>3</sup> In response to the high prevalence of ACL tears in football, FIFA introduced an exercise-based prevention intervention that decreased these injuries by up to 50%, particularly in subelite athlete populations.<sup>4</sup> The FIS implemented a rule change in ski jumping to minimise the performance benefit of low body weight by decreasing the ski length for those athletes with a lower body mass index. This rule change resulted in a decrease in the dangerously low body masses commonly seen in this sport.<sup>5</sup>

## RULE CHANGES ADDRESSING ENVIRONMENTAL RISK

Athletes train and compete in a variety of environmental conditions and some may pose a health risk to the athlete; for example, extreme temperatures, high altitude or air/water pollution. To address the scientifically documented health risk of exercising in extreme heat, both the athletics (IAAF) and football (FIFA) federations implemented rule changes to the competition structure to provide opportunities for cooling, and to stage events at times of the day when environmental temperatures are cooler.<sup>6,7</sup> In addition to the upper limit water temperature rule in Marathon Swimming (FINA) and Triathlon (ITU),<sup>2</sup> these International Federations also collaborated on a research project to determine a safe lower water temperature limit.<sup>8</sup> In this case, the question was ‘How cold is too cold (for swimming)?’. This study exposed athletes in a controlled swim flume environment

to various low water temperatures and measured both objective (core body temperatures, swim speeds) and subjective (self-report) outcome variables to set the stage for safe lower water temperature regulations.

## POLICY CHANGES BASED ON SPORT SCIENCE

In addition to rule changes in sport to protect athletes’ health protection, it is important that International Federations, and National Olympic Committees implement health-related policies. The IOC’s Games Time Framework on the Prevention of Harassment and Abuse in Sport is an example of science driving policy. This policy statement defines safe sport, and outlines the procedures for how officials should report, investigate and manage allegations of harassment and abuse in sport during the time period of the Olympic Games. Other International Federations and National Olympic Committees are following the example of the IOC to ensure a safe sport environment for all.<sup>9</sup>

## SPORT MEDICINE RESEARCH AT THE HEART OF CONTROVERSY

The application of sport medicine research can also spark controversy and elicit vigorous debate within and outside of sport. For example, the IAAF 2018 eligibility regulations for the female classification (athletes with differences of sex development)<sup>10</sup> document is heavily referenced with numerous scientific studies. This document has stimulated much deliberation over the validity, scientific integrity and reproducibility of the underlying science. In this example, sport and exercise medicine research is attempting to define gender which has implications in society far beyond sport. The vivid debate that occurred in the Court of Arbitration of Sport, the media, social media and in sport science arenas underscores the fact that rule changes in international sport should ideally be based on irrefutable, top-quality science. But such evidence is not always available when questions first surface.

## A CALL TO ACTION

It is time for all International Federations to commit even more strongly to athlete health protection.

1. Every International Federation should introduce competitive peer-reviewed grant funding processes that will attract top quality sport science researchers. This will result in robust scientific outcomes to best inform athlete health

protection regulations. Research projects need to target the effects of venue and equipment modifications, training protocols, rule changes and illness prevention in specific sports as identified by the IOC surveillance study conducted at the past of the six Olympic Games and various World Championships. Competitive grant funding with appropriate expertise on the peer-review committee adjudicated at arm's length from the International Federation may allow International Federations to leverage partner funding.

2. After engaging and collaborating with sport leadership, athletes, coaches and other members of the entourage, we recommend International Federations consider implementing targeted sport-specific injury prevention protocols and then test these interventions for their efficacy.
3. Ideally, as experts in sport safety, Medical Commissions should have representation on the International Federation sport governing boards to prioritise the focus on athlete health.

Through applying sport science, tragedies such as Fran Crippen's premature death may be prevented in the future. Athlete health protection is already central

for the International Olympic Committee—it needs to be a central focus for all International Federations.

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