



Authors' Response to: Comment on: "Potential Long-Term Health Problems Associated with Ultra-Endurance Running: A Narrative Review"

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Dear Editor,

We really appreciate the Letter to the Editor by Jouffroy and colleagues [1], which added valuable information and discussion to our narrative review titled "Potential Long-Term Health Problems Associated with Ultra-Endurance Running" [2]. One of the primary aims of the paper was to "stimulate more open debate about the potential implications for long-term health" [2]. As such, the letter we received is evidence that this aim was fulfilled.

Before we address the authors' comments point by point, we would like to reiterate that the purpose of our review was to provide the current state of evidence of ultra-endurance running (UER) and its impact on long-term health because "there remain many unknowns that warrant further exploration" [2]. Thus, it was never intended as a concluding scientific consensus on the topic. Indeed, the word "potential" appears several times throughout the article, including in

the title. By noting this at the beginning of our response, we believe we are pre-empting several of the points highlighted by Jouffroy et al. [1].

First, we agree that UER has complex pathophysiological implications on different organ systems leading to adaptive responses and may lead to maladaptations in susceptible individuals. We agree that defining "long-term follow-up" as 1 year would not be appropriate. However, we did not invoke this terminology. Our paper states explicitly that "Long-term health problems have been defined as conditions that last one year or longer and/or require ongoing medical attention or limit activities of daily living or both" [3]. Thus, long-term health can be characterized by periods of *at least* 1 year. This should also be considered distinct from long-term follow-ups in research design.

Second, we agree that studies in this particular group and sport are needed and indeed, in our review we stated and recommended several times that more epidemiological studies with larger cohorts are needed to better elucidate the complex pathophysiology of long-term health problems in UER [2]. The notion of a "dose response" and the effect on physiological function is an important aspect that remains to be studied. Moreover, it has been hypothesized that the

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physiological stress of periodic racing/competition may be more important than that evoked by long-term training [4]. We, therefore, must make more effort to distinguish UER from more generic endurance sports like marathons and triathlons.

Third, as outlined, we agree that further studies are needed and agree that a multifactorial approach will be helpful. However, we disagree with the simplistic assessment by Jouffroy et al. [1] that older athletes, “because they run slower have fewer overuse injuries” [1]. This is in contrast to the need to examine multiple variables as previously recommended (e.g., elite level, running speed, age, sex, terrain, running distance) [5, 6], to be able to assess the risk of long-term health issues in UER.

Last, it is well established that regular physical activity reduces all-cause mortality and can prolong life, particularly when compared with a sedentary lifestyle. We particularly highlight this in our review [2]. We agree that moderate physical activity should be promoted across all age groups; however, our aim was to examine the growing evidence that UER may have potential pathological implications for multiple body systems in the long term. One does not have to choose between a sedentary lifestyle and extreme endurance exercise. Ultra-endurance running is not just a “form of physical activity” as suggested by Jouffroy et al. [1]. Ultra-endurance running is arguably the most extreme form of physical exercise for one to undertake. Thus, there is a great deal of ‘middle ground’ between the two extremes of sedentary lifestyle and UER. Choosing to participate in UER, therefore, requires careful consideration of the risk-to-benefit ratio, i.e., shared decision making between the athlete and physician, as stated in our paper [2]. We anticipated that readers might try to frame our arguments as a false dichotomy, and we carefully considered our phrasing in an attempt to pre-empt this. For example: “Moderate physical activity is well known to have positive effects on health, being preventative in numerous life-style related diseases and reducing all-cause mortality. Similarly, many of these benefits can be derived from participation in UER, and the sport can generally be considered a safe and healthy pastime. However, it should also be recognized that with increased participation in UER comes an increased risk that susceptible individuals may experience chronic maladaptations leading to adverse effects on health and possible long-term health problems in later life” [2]. We later noted that: “There are many health benefits of participation, and UER rarely evokes serious adverse events. However, there is a growing body of evidence suggesting that UER may have implications for long-term health, particularly affecting the cardiovascular, respiratory, and musculoskeletal systems ... The

notion of shared decision making is relevant for UER in that clinicians and athletes should work cooperatively to consider the evidence and make an informed decision that balances the risks/expected outcomes of UER with patient preferences and values” [2]. Accordingly, we feel our conclusions are appropriately conservative in this regard.

We particularly highlighted youth athletes as they may represent a group that may be more vulnerable to potential long-term health issues in UER. Further detailed information on this athlete group is provided in a recent consensus statement on recommendations on youth participation in UER events [7], which may be of interest.

In conclusion, the points raised by Jouffroy et al. [1] highlight important aspects and the particular need for further multidisciplinary discussions and investigations of potential long-term health problems in UER.

Declarations

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Conflict of interest Volker Scheer, Nicholas Tiller, Stéphane Doutreleau, Morteza Khodaei, Beat Knechtle, Andrew Pasternak, and Daniel Rojas-Valverde declare that they have no conflicts of interest relevant to the content of this letter.

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