

Response to Comment on “Health consequences of an elite sporting career – long-term detriment or long-term gain? A Meta-Analysis of 165,000 Former Athletes”

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Dear Editor,

We would like to thank the authors for their Letter to the Editor [1] which provides a detailed consideration of our recent review discussing the health consequences of an elite sporting career [2].

As highlighted by Zhou et al. [1], in our review we contend that the available evidence in elite athletes does indeed indicate that the 'J' shaped hypothesis should be rejected for both endurance- and team-based sports, with both having favourable mortality ratios compared to the general population, despite their years of intensive training. However, we do not dispute that a 'J' shaped exercise-longevity relationship may be present in some instances, such as power sports athletes whose risk of mortality and cardiovascular disease (CVD) did not differ from the general population reference groups [2]. Indeed, it is possible that the physiological demands of power sports, and the associated training regimes, offer no benefits beyond certain limits. More specifically, even a single session of resistance exercise is enough to significantly reduce flow mediated dilation in trained individuals [3], with the long-term consequences still to be fully established in elite athletes. Given the distinct physiological stressors according to exercise type, the authors feel it would be unwise to discount training methods as a contributing factor to the differences in all-cause and CVD mortality presented in this review. Future work should consider both physiological and environmental factors (e.g., socioeconomic status, diet, and lifestyle factors) to ascertain the contribution of each to long-term health, as highlighted within the review. Further exploration of specific lifestyle factors within our review was not possible due to the lack of relevant, robust data available in the included studies.

We agree with Zhou et al. [1] that "health records collected by health management institutes of regional or national level may serve as useful data sources", given such data sources likely contain the best population-level data to act as a reference group. However, we disagree with the notion that "future research may deliberate over choosing athletes, especially the professional ones, as experimental participants when exploring the relationship between intensive exercise and longevity". In contrast, we contend that to rigorously determine the validity of the 'J' shaped hypothesis, the full spectrum of activity levels are required [4, 5]. Indeed, few members of the general population will engage in sufficient training volumes to be able to fully address the 'J' shaped hypothesis unless we consider athletes. Nevertheless, with the increase in recreational athletes participating in extreme sporting events [6], a potential avenue for future research would be to assess these 'non-elite' but highly-trained athletes to

aid comparisons with the general population. By conducting research across the continuum, more evidence on the optimal and/or the minimal dose required for health-related benefits will be revealed, which may be crucial for worldwide public health policies. As noted by Zhou et al. [1], risk adjustment models represent the next logical step in exploring the trade-off between the physiological, environmental, and lifestyle contributions to long-term health, with modelling principles potentially mitigating some of the difficulties in comparing general and elite populations. Moreover, well-formed risk adjustment models potentially allow the role of ethnicity to be explored and specific populations to be highlighted who may be predisposed to greater risks, allowing appropriate interventions to be implemented.

Zhou et al. [1] correctly identify that there were “no studies from Asia, Africa, or other continents”, which is a gap in the literature that urgently needs to be addressed given the effect of ethnicity on all-cause, CVD and cancer mortality [7]. However, the scant literature available suggests that the African-American-White mortality gap still persists after a professional basketball career [7, 8]. We also wish to take this opportunity to further highlight another population, namely females, who, as highlighted within our review, are vastly under-represented within the literature to date [9]. Indeed, such little literature was available that sub-analyses in our meta-analysis were unable to be conducted for CVD- or cancer-specific mortality, with just four studies available assessing all-cause mortality. Given fundamental physiological sex differences, the findings from men cannot, and should not, be generalised to women. Finally, in our review we consider the role of genetic predisposition, discussing many of the points raised by Zhou et al. [1] and highlighting that differences in all-cause, CVD and cancer mortality are unlikely to be fully explained by genetic factors as it has recently been shown that elite athletes undertaking strenuous aerobic exercise exhibit similar disease-trait-related genotypes to the general population [10].

In conclusion, we hope our review and these associated discussions have identified important avenues for future research in this area, whilst highlighting key design considerations that should be accounted for and reported.

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