Dear Dr. Junjie Xiao

MS: 1478775010129615 Revision 1
Relationship between age and elite marathon race time in world single age records from 5 to 93 years

We thank you for your e-mail from June 27, 2014.

Find below the answer to the questions raised by the reviewers.

All changes are marked in red in the revised manuscript.

We hope the revised manuscript will be suitable for publication in BMC Sports Science, Medicine and Rehabilitation.
Yours sincerely,

Beat Knechtle

Enclosure: Manuscript via central website

EDITOR'S COMMENTS:
"Based on the advice received, your manuscript could be reconsidered for publication should you be prepared to incorporate major revisions."
Answer: We thank the editor for his comment; we have changed the manuscript regarding the comments of the reviewers.

EDITORIAL REQUIREMENTS:
*Acknowledgements: We strongly encourage you to include an Acknowledgements section between the Authors? contributions section and Reference list. Please acknowledge anyone who contributed towards the study by making substantial contributions to conception, design, acquisition of data, or analysis and interpretation of data, or who was involved in drafting the manuscript or revising it critically for important intellectual content, but who does not meet the criteria for authorship. Please also include their source(s) of funding. Please also acknowledge anyone who contributed materials essential for the study. Authors should obtain permission to acknowledge from all those mentioned in the Acknowledgements. Please list the source(s) of funding for the study, for each author, and for the manuscript preparation in the acknowledgements section. Authors must describe the role of the funding body, if any, in study design; in the collection, analysis, and interpretation of data; in the writing of the manuscript; and in the decision to submit the manuscript for publication.
Answer: We have no acknowledgements.

*We note that the figures have been included in the manuscript file. Please upload the figures as separate figure files using the "upload" form on the submission system only, and delete the figure from the manuscript file. The figure file should not include the title (e.g. Figure 1... etc.) or the figure number. The legend and title should be part of the manuscript file, given after the reference list. Please ensure that the order in which your figures are cited is the same as the order in which they are provided. Every figure must be cited in the text, using Arabic numerals. Please do not use ranges when listing figures. For more information, see the instructions for authors: http://www.biomedcentral.com/info/ifora/figures
Answer: We agree with the editor and uploaded the figures now separately.
Reviewer's report

Title: Relationship between age and marathon race time in world single age records from 18 to 80 years

Version: 1

Date: 4 June 2014

Reviewer: Eric Goulet

Reviewer's report:

Manuscript Revision for BMC Sports Science, Medicine and Rehabilitation
Title: Relationship between age and marathon race time in world single age records from 18 to 80 years
2014-06-03

General comments

This is an interesting and novel research study investigating the relationship between marathon race times and age/sex in 1-year intervals by using the world single age records in marathon running. The article is within the scope of BMC Sports Science, Medicine and Rehabilitation, well-structured and well-written. It demonstrated that marathon race times show a linear progress from 18-35 years and started to increase in a curvilinear manner at the age of ~35 years for both women and men. The sex difference in marathon race time was a U-shaped and was lowest at the age of ~49 years. I only have a few comments/suggestions to improve the quality of the article.

Major Compulsory Revisions
- With the aging of the population, the popularity of running events and the expected rise in the participation of older persons in mass endurance running events there is a clear need to include data for runners of up to the age of 90 years. Please, perform the statistical procedures including the range of age 18 to 90 years.

Answer: We agree with the expert reviewer and performed the analyses for 5-93 years and for 18-80 years

- It is remarkable that data exists for persons younger than 18 years old, and this for both men and women. Although the lowest age for entering a marathon is 18 years old, it would be extremely informative and educative if you could run a full analysis containing the best running times from the ages of 5 to 90 years old, and this for both men and women. It would be an eye opener for many to learn that
young people can run that fast but, most importantly, it would shed some light on the training possibility and adaptations of the human body. So, what I suggest is to perform a first analysis including the age group 18-90 years old and a second analysis including the age-group 5-90 years old. If it is done, please discuss the fact that below the age of 15 years old men and women seem to perform very similarly. Why above that age men start to run faster needs to be discussed.

Answer: We agree with the expert reviewer and insert now a figure 5-93 years and a figure 18-90 years. In a table, we present the equations for the non-linear trends. Unfortunately, we are not able to insert the regression line in two graphs. We therefore present the data without the regression line. We think the figures look quite well.

Considering the change in performance, we insert a new section with ‘An interesting observation was that fact that from 5 years to ~15 years, boys and girls performed very similar. After the age of ~15 years, male adolescents started to run faster than female adolescents. Before puberty, body dimensions are very similar in both boys and girls and boys and girls are only different in having different genitalia (sex organs). With puberty, body characteristics such as bone length, fat mass and muscle mass start to change. With the start of puberty testosterone starts to increase in boys leading to an increase in skeletal muscle mass whereas fat mass increases in girls. Due to the higher muscle mass strength is higher in boys compared to girls. Additionally, aerobic capacity will become higher in boys compared to girls and endurance performance will be higher in body than in girls’.

- Of the 126 running records, please indicate how many are held by different persons?
Answer: We agree with the expert reviewer and insert a table with the names of the athletes with more than one record and the ages when these records were achieved.

- Figures 3, 4 and 5 are not necessary, as they replicate figures 1 and 2.
Answer: We agree with the expert reviewer and deleted these figures.

- For figure 1, add the best fit lines for both the men and women and also add the two regression equations.
Answer: We agree with the expert reviewer, however, we are not able to insert the lines in the figures for both women and men. We therefore combined women and men in the figures and present the equations of the non-linear regressions in a separate table.

- For figure 2, add the best fit line along with the regression equation.
Answer: We agree with the expert reviewer and present now in figure 1 the relationship between marathon race times and age and in figure 2 the relationship between sex difference and age.

- The Y axis of figure 2 should be titled "Change in performance between men
and women”.
Answer: We agree with the expert reviewer and changed as requested.

- For figure 2, if possible, please report the sex difference performance not in % changes but rather in minute changes. The figure would be easier to understand that way.
Answer: We agree with the expert reviewer and changed as requested.

- An important limitation of your study is that data are cross-sectional. With longitudinal data different results could have been observed. This needs to be stated as a limitation of the study.
Answer: We agree with the expert reviewer and inserted in the limitations ‘A further important limitation of the study is that the data are cross-sectional. With longitudinal data, different results could have been observed’.

Level of interest: An article of importance in its field
Quality of written English: Acceptable
Statistical review: No, the manuscript does not need to be seen by a statistician.
Declaration of competing interests: I declare that I have no competing interests

Reviewer's report
Title: Relationship between age and marathon race time in world single age records from 18 to 80 years
Version: 1
Date: 16 June 2014
Reviewer: Laura Goldberg

Reviewer's report:

Minor:
1. Discussion: conclusions are made based on a reference that need further support. "There seemed to be differences between the sexes regarding....but not in women [18]" It is unclear to me what you are referencing without reading those articles. Likely rewording will help to make clear these are not your findings but just discussion of why sexes may differ in marathon performance time.
Answer: We agree with the expert reviewer and added ‘In men, the muscle quality is more important to functional performance than in women’.

2. Title/abstract: recommend change to "elite marathon race time"
Answer: We agree with the expert reviewer and changed as recommended.

3. Aim: need to state clearly the aim is {to investigate relationship between elite marathon race times and age (18-80yrs) and to evaluate difference in elite
marathon race times by gender and age.} ("sex difference" is a less clear term)
Answer: We agree with the expert reviewer and changed in both the figures and the text.

4. Conclusion: Elite marathon race times
Answer: We agree with the expert reviewer and changed throughout the manuscript.

5. Methods: is it necessary to show the linear data as well?
Answer: We compared the linear and the non-linear trends using Akaike's Information Criterion, however, all calculations showed that the trends were clearly non-linear, we insert the equations in a new table. In the new figures requested by reviewer 1, we were not able to insert the lines.

6. Discussion: midparagraph you state "we can confirm" how can you confirm? Consider restating it "it has been shown by ..." or something similar
Answer: We agree with the expert reviewer and changed as suggested.

7. Discussion: ADR= ??
Answer: We agree with the expert reviewer and inserted the full term

8. Conclusions: consider rewording to "In summary, world single age record marathon race times, ...
Answer: We agree with the expert reviewer and changed as suggested.

9. figure 2 is confusing by label alone. Again sex difference is a confusing term. At 13000 days, males were ~14% faster?? maybe label which sex is faster? Or summary men faster at all points?
Answer: We agree with the expert reviewer. Following reviewer 1, we changed the figures; the axis is now 'change in performance between women and men (min)'

Discretionary revisions:

1. Background last paragraph- "in an actual study" can be removed or changed to say "In a study by Lara et al"
Answer: We agree with the expert reviewer and changed to ‘In a study by Lara et al., the association between elite marathon race time and age in 1-year intervals from 18 to 75 years in elite women and men competing in the ‘New York City Marathon’ in 2010 and 2011 was investigated'.

2. "Elite marathon race time" should be changed throughout document as it is not all marathon race times but elite ones
Answer: We agree with the expert reviewer and changed as suggested.

3. Last sentence of background needs reworked or removed. Removal of the word actual as you are only reviewing actual studies. Also, the main point is your
aim sentence. Consider ending with "The aim of the present study was to further investigate the relationship...advancing age."

Answer: We agree with the expert reviewer and changed to ‘Based upon the findings in….’ Furthermore, we changed to ‘A second aim of the present study was to further investigate the relationship between sex difference in elite marathon running performance and advancing age’.

4. Results: wording could improve understanding in the second paragraph. "For the sex difference.." could read "However, the difference in performance by sex and age was u-shaped (figure 2). The time difference by gender was lowest at the age of ~49 (~18000 days)"

Answer: We agree with the expert reviewer. We write now a new section for sex difference with ‘Figure 2 presents the relationship between sex difference and age from 5 to 93 years (Figure 2A) and from 18 to 80 years (Figure 2B). In contrast to the relationship elite marathon race time and age with a U-shaped curve, sex difference increased in 5 to 93 years (Figure 2A) non-linearly (i.e. non-linear polynomial regression 7th degree) from 5 to ~20 years, remained unchanged at ~20 min from ~20 to ~50 years and increased thereafter. In 18-80 years (i.e. non-linear polynomial regression 4th degree, Figure 2B), the sex difference remained unchanged at ~20 min from ~20 to ~50 years and increased thereafter. The sex difference was lowest at the age of 49 years (i.e. 7.5%, 10.5 min)."

5. Discussion: suggest rewording sentence to "the most important finding was association between marathon race time and age was curvilinear for both elite women and men."

Answer: We agree with the expert reviewer and changed as suggested.

Level of interest: An article of limited interest

Quality of written English: Needs some language corrections before being published

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests: I declare that I have no competing interests

Reviewer's report

Title: Relationship between age and marathon race time in world single age records from 18 to 80 years

Version: 1

Date: 25 June 2014

Reviewer: Catherine Fieseler

Reviewer's report:

No major compulsory revisions
I am not an expert in statistics and must rely on other reviewers' comments on this component.

Minor Essential Revisions
In the background, masters classification is age 40 years and older (not 35). There are marathons in the U.S. that allow runners younger than 18 years to participate.

Answer: We agree with the expert reviewer and changed as suggested.

In results - the fastest marathon was 2:03:02 in Boston. Because this is a point to point course, it is not accepted as a world record. Therefore the world record is not the fastest marathon and should be labelled the fastest age group record or the world record. This is noted in the discussion but should be clarified in the results.

Answer: We agree with the expert reviewer and inserted in the results.

In the discussion - you list sarcopenia as a cause of increasing marathon times. VO2 max decreases with age and is a factor in slower times with increasing age. You do acknowledge that you did not have available data on the runners when discussing limitations of your study.

Answer: We agree with the expert reviewer and inserted a section ‘Performance decreased after the age of ~50 years where the decrease became dramatic after the age of ~80 years. The decrease in performance is mainly due to the decrease in maximum oxygen uptake (VO2max). VO2max decreases with age and is a factor in slower times with increasing age. The decline in VO2max with age appears to be inevitable. VO2max declines by ~10% per decade in both women and men regardless of the activity level. However, high-intensity exercise may reduce this decrease by ~50% in young and middle-aged men, but not older men. Middle-aged and older women do not appear to be able to reduce loss rates in VO2max to less than 10% per decade’.

Level of interest: An article of limited interest

Quality of written English: Needs some language corrections before being published

Answer: We agree with the expert reviewer and checked again for spelling errors.

Statistical review: Yes, but I do not feel adequately qualified to assess the statistics.

Declaration of competing interests: I declare that I have no competing interests