Reviewer’s report

Title: The Cross-Sectional Average Length of Healthy Life (HCAL): A measure that summarizes the history of cohort health and mortality

Version: 0 Date: 31 Jan 2020

Reviewer: Tim Adair

Reviewer's report:

This study introduces a new measure - the Healthy Cross-Sectional Average Length of Life (HCAL) - that uses the cross-sectional average length of life (CAL) with health prevalence data. It describes this measure and demonstrates its application to data from some European countries. The study largely explains the new method well and its advantages over the conventional Sullivan method of healthy life expectancy. However, it would be good to see a concise definition of HCAL which could be used when interpreting results, e.g. it is the sum, over all cohorts, of the probability of surviving to time t and being in good health. Related to the above point, I don't quite follow the statement (page 13, line 49) that "HCAL, on the other hand, summarizes healthy life years for the entire population by taking into account the past health and mortality experience". Health is only measured at time t, so health in the past for these cohorts is not directly relevant, especially as HCAL is measured for a specific year (e.g. 2014). But maybe I have not interpreted the arguments correctly. In the introduction, the study frames the importance of this method in the context of the compression of morbidity debate, so it is a little disappointing to not see it discussed in this respect. This would be a valuable addition to the Discussion. Page 8, line 13: It could be more explicit that age weights relate to the age distribution of deaths. Table 1: It is noticeable that differences between HCAL and HE are relatively small, which suggests that the conventional HE measure is still worthwhile using. It would be good to have some more information about the GALI data. Is it from the same survey at conducted the same time in each country? For what years are data available? Can a table of health prevalence be included in the appendix for each country. This relates to interpretation of Table 2: Why is there a decline in HE in some countries - has prevalence of poor health risen? Also in Table 2, for Finland females, LE has risen by 0.84 years and HE has declined by 3.80 years - this implies an increase in "unhealthy" years lived by 4.64 years. This is a very large change in the space of a few years - is this a correct interpretation and how much did prevalence change? The study smoothed age-specific prevalence using the Mort2Dsmooth package that was developed for poisson distributed counts - the prevalence data would be binomially distributed (presumably) - can you provide a rationale as to why you used the Mort2Dsmooth package? Could the authors discuss the HE and HCAL methods with respect to the timeliness of their results - that is, the hypothetical cohort survival data in the HE method are more current that the CAL survival data.

Minor comments
Abstract: "due to conceptual similarities" - this would be better worded as "due to conceptual advantages" or "due to conceptual coherency"
Abstract: In the Results section, it should state "...larger gains in recent years in healthy life years..."
Abstract: Replace "losses in the proportion of healthy life years are higher" with "declines in the proportion of healthy life years are greater".
Page 2, line 9: replace "over the last" with "recent"
Page 2, Line 42: "incidence death rates" - is incidence meant to be included here? I haven't seen that term before.
Page 2, Line 41: Replace "does not come without limitations" with "has limitations"
Page 3, Line 1: replace "until today" with "previously"
Page 3, Line 1: replace "we want to close this research gap" "we seek to address this research gap"

Level of interest
Please indicate how interesting you found the manuscript:

An article of importance in its field

Quality of written English
Please indicate the quality of language in the manuscript:

Acceptable

Declaration of competing interests
Please complete a declaration of competing interests, considering the following questions:

1. Have you in the past five years received reimbursements, fees, funding, or salary from an organisation that may in any way gain or lose financially from the publication of this manuscript, either now or in the future?

2. Do you hold any stocks or shares in an organisation that may in any way gain or lose financially from the publication of this manuscript, either now or in the future?

3. Do you hold or are you currently applying for any patents relating to the content of the manuscript?

4. Have you received reimbursements, fees, funding, or salary from an organization that holds or has applied for patents relating to the content of the manuscript?

5. Do you have any other financial competing interests?

6. Do you have any non-financial competing interests in relation to this paper?

If you can answer no to all of the above, write 'I declare that I have no competing interests' below. If your reply is yes to any, please give details below.
I declare that I have no competing interests

I agree to the open peer review policy of the journal. I understand that my name will be included on my report to the authors and, if the manuscript is accepted for publication, my named report including any attachments I upload will be posted on the website along with the authors' responses. I agree for my report to be made available under an Open Access Creative Commons CC-BY license (http://creativecommons.org/licenses/by/4.0/). I understand that any comments which I do not wish to be included in my named report can be included as confidential comments to the editors, which will not be published.

I agree to the open peer review policy of the journal