Reviewer's report

Title: Widening social inequality in life expectancy in Denmark. A register-based study on social composition and mortality trends for the Danish population

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Reviewer: Emmanuelle Cambois

Reviewer's report:

The manuscript provides information on trends over two decades in mortality differentials, using both educational and income stratification. The authors have adequately defined the research question and propose analyzing data based on population register providing robust results. The results are interesting, although very descriptive. Some methodological points should be clarified. Some issues should be further discussed or added to improve the relevance of the conclusions. The paper could also better stress its added value both in terms of methods (using quartiles) and results (new trends? Age differences? Sex differences?). Please find below more specific questions that the authors need to address.

1. One of the social stratification used is supposed to be based on educational level, but it actually mixes education and occupation (unskilled/skilled workers). It is unusual as these two classifications are based on different social situations. Their combination, as proposed, does not seem to follow an educational gradient. It seems not applicable for inactive groups. It is not clear if people which are in one of the intermediary groups (neither "highly educated" nor "with no diploma") should be unskilled or skilled workers and what if they are not working. It is also not clear to which group the skilled or unskilled workers with less than secondary schooling belong. Please clarify how the classification is constructed.

2. As the paper suggests that the educational group have significantly changed over time, the population distribution in the educational groups should be provided for both men and women and for different dates in order to show how far the "quartile" classification adds to the "group" classification. Following this question, how comes the two educational classifications bring the same life expectancies values if it is as different as it is suggested in the paper? Are the major changes essential concentrate within groups so they are not visible when using the 4 groups? Please clarify.

3. The assumption on educational differentials for the elderly is a very strong one; the literature looking specifically at older ages rather attests of remaining inequalities. Also, the authors show widening gaps at older ages with the income stratification (table 3), so it is surprising to assume there are no differentials with educational groups. Finally the authors also demonstrate widening gaps before age 65 over the period; this should progressively impact the gap after age 65, while the cohorts aged. The gap after 65 should also change over time. The
authors have proposed alternative assumptions in the discussion to consolidate the findings. I think it is an important issue. This could be more discussed, especially by providing the part of the differentials that is due to the observation (ie below age 65) and to the assumptions of "no inequalities" vs. "same inequalities" (ie. after age 65). Going further the "partial life expectancy", it could be appropriate to apply the decomposition technique to the educational groups (by extending Table 3); it would show what is due to each age group and what is attributed to the 65+.

4. More results could be provided or commented to further present mortality differentials:

4a. The decomposition results are not so much described and discussed: what can explain that the gap below age 20 have reduced over time (better access to prevention and care in the lowest income group for children?), what make the 30-49 (and even more for the 50-65) in highest group lowering their mortality risks more than in lower income? Why opposite trends in men and women elderly and why such a gain in the lowest income in women at these ages? Table 3 could be extended to present the contribution of age group in the educational differential as suggested in the comment 3.

4b. The figures 1 to 3 show different trends over the period: a stagnation in life expectancy the first period for the lowest income group, then an increase at different paces across the SES groups; this could be commented.

5. Figures 1 to 3 shows fluctuations from one year to the next one. It seems that the fluctuations are not affecting the different groups in the same way at the same time, inducing that the differentials between groups can increase and then decrease annually. The fluctuations are more pronounced with the educational stratification. So to what extent the gap which is widening using only the 1987 and 2011 values could be seen ad reducing if using other dates? Can this issue be further discussed?

6. The discussion section is developing the "smoking practices" explanation for the widening gap. But as we don't know the proportion of smokers in the various groups and over time, it is not possible to figure out how much changing smoking habits might or might not contribute to the widening differentials. So it seems odd to develop that much this point which cannot be tested by the results and I suggest reducing this issue to further develop others that are not discussed (see below).

7. Smoking might be part of the explanations, but others factors deserve to be discussed as much as smoking: change in living and working conditions, job insecurity, family structure for men and women can have altered over time the association between education, income and mortality and have changed the mortality risks in the social groups.

Regarding the results for women in the intermediate income categories: could it be due to the specificity of these population groups for women? Who are they?
Do these category correspond to different groups of women across generations, while the disposal income might have progressed from one (husband's) income to both spouses' incomes or one (own) income: these groups of women might represent progressively less advantaged women over time?

8. In my view, the discussion section does not need to bring such detailed information regarding the life expectancy differentials in other countries; the social stratification being country-specific, the magnitude of the gap is not directly comparable across country. Instead, I would suggest shortening this description (focussing on general patterns) but giving more room to the explanations for this widening trend in mortality differentials in Denmark (see comments 4a, 7…).

**Level of interest:** An article whose findings are important to those with closely related research interests

**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