Author's response to reviews

**Title:** The impact of the major causes of death on life expectancy in China: a 60-year longitudinal study

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**Author's response to reviews:** see over
Dear editors and reviewers,

Thank you very much for your reviewing work and the constructive comments.

We went through the comments one by one and updated the manuscript. Here we give the point-by-point response to the reviewers’ comments.

If you have any further requirements please do not hesitate to contact us. We look forward to hearing from you.

Sincerely,

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The response to Dr. Joop de Beer

Reviewer: Joop de Beer

Reviewer's report:
The authors show how the sharp decline in infectious and parasitic diseases has contributed to the strong increase in life expectancy in China since 1950, while the number of years lost due to chronic diseases has increased. They calculate Potential gains in life expectancy (PGLE) which is a good indicator of the contribution of different diseases to changes in life expectancy. In addition they show possible changes for the next ten years. The methodology is not new, but the results are interesting.

Major Compulsory Revisions
1. The authors refer to the goal of the Chinese government to increase life expectancy by one year in the next five years. They make projections of life expectancy for the next ten years. However, the authors do not discuss whether the goal can be reached and under what conditions. They should discuss whether this goal can simply be reached if current trends continue or whether stronger policies will be needed.

It is added to the Conclusion now. We did make projections of life expectancy for the next ten years in our research. With current trends, life expectancy will increase by 0.86 year from 2010 to 2015, which means the goal cannot be reached. Based on the results in our manuscript, chronic diseases and accidental injuries have emerged as the major factors influencing life expectancy in recent years. Therefore, the prevention and control of chronic diseases and accidental injuries should be emphasized in efforts to promote life expectancy to achieve the goal. Stronger policies such as public education, modification of behaviors, and introduction of safety measures should be needed.

2. The authors examine the effects of four categories of disease on changes in life expectancy between 1950 and 2010. They do not argue why they chose these four categories. The proportion of deaths due to maternal diseases has been low during the whole period. So it is not clear why this cause of death is included.

The four categories were classified by the Tenth Revision of the International Classification of Diseases (ICD–10), which covered most of the major diseases. The classification was consistent with WHO as well (http://www.who.int/research/en/).

Furthermore, although the proportion of deaths due to maternal diseases has been low, the reasons why we included it were: first, the maternal mortality rate was very high worldwide in the early years of the People's Republic of China (PRC), and declined noticeably between 1950 and 2010; second, the maternal mortality rate is one of three indicators commonly used to evaluate a population’s health. Therefore, we assessed the impact of maternal diseases on life expectancy in this study.

The reasons why we chose the other three categories were that the infectious and parasitic diseases were the major causes of death in the early years of the PRC, while the chronic diseases and accidental injuries have accounted for more than 70% of total deaths since 1990. We wanted to evaluate the sharp changes in the trends of the impacts on life expectancy between 1950 and 2010.
3. The authors project a “natural trend” of PGLEs, but do not explain what this trend is and how they calculated this. This is particularly important, because in table 2 they project an increase in PGLE by tumours, whereas Figure 2 shows that PGLE by tumours declined between 1985 and 2005, but has shown a small increase in the most recent years. Is their projection based on the recent increase or on the average increase between 1950 and 2010?

Upon your suggestion, we added the explanation and calculation of “natural trend” in detail in paragraph 1 of the section Predicting trends of PGLEs for 2011–2020. The projection was based on the average trend of the mortality between 1950 and 2010.

Based on the trends in total mortality and the mortality of each age group during 1950-2010, we used time series modelling to fit the trend curve of disease mortality (goodness of fit > 0.8). We predicted the disease mortality trend in each age group during 2011-2020 in accordance with the fitting curve. Then, we calculated the PGLEs of different types of diseases using the cause-eliminated life table from 2011 to 2020, which were regarded as “the natural trend of PGLEs”.

4. The authors try to assess the effects of prevention and control of diseases by assuming that death rates decline or increase by 10%. These percentages are rather arbitrary. Can the authors argue whether these percentages seem reasonable in view of past developments? Furthermore the results suggest that these alternative projections are symmetric compared with the natural trend. So I guess that the alternative projections are not based on a 10% decline or increase, but on some variation relative to the natural trend. The authors should explain their calculations.

Yes, as you mentioned, the alternative projections were based on the mortality of diseases as the index of control relative to the natural trend of the PGLEs. We have added the calculation in paragraph 1 of the section Predicting trends of PGLEs for 2011–2020 with red mark.

The decrease and increase percentages in the death rates were determined by consultation with several practice experts from public health centers (personal communication). Based on their work experience, the consultants suggested an interval for the changes in the percentages, with a 10% increase as the upper limit and a 10% decrease as the lower limit. In this study, we used a 10% change in the death rate as an example to show the trend changes in the PGLEs. We also added the details into the manuscript.

**Minor Essential Revisions**

5. The section Study setting gives two reasons why A Province is selected. The first reason is that it is a developed province with a high socioeconomic status and that the life expectancy trends were very similar to China as a whole and therefore representative of China. If the authors aim for representativeness they should not look for a province with average rather than high socioeconomic status. The second reason given by the authors is that health development showed rapid progress. Again, I would expect that the
authors select a province with average rather than rapid progress. So it is not clear whether the analyses of changes in health are really representative for the entire nation. At the end of the discussion section the authors point out that because of differences in developments between provinces, one should be careful in interpreting the results. Do they mean that the results are representative for the whole of China but not for all provinces? The authors should make clear what they mean.

We admit that we have made an inaccurate expression about the representativeness of A Province in the previous version of our manuscript.

Based on geographical location and socioeconomic status (e.g., per capita GDP), China was divided into Eastern (relatively well developed), Middle (moderately developed), and Western Regions (under-developed). A province locates in the Eastern Region, and ranked the fourth in terms of per capita GDP among the eight provinces in the Eastern Region in 2010. We selected A province as the sample, due to the accessibility of the death data on the diseases by age group required in this study, while it was difficult to obtain the data in other provinces. Therefore, the result of this study might reflect the trends in the well-developed areas of Eastern China, but could not represent for the entire nation due to the differences in socioeconomic development among the provinces. We have made updates in paragraph 2 of Study setting and the penultimate paragraph of Discussion with red mark.

6. In table 1 the numbers in the third column are higher than in the first column, as one would expect. However, this is not the case for the first row (infectious and parasitic diseases). Is this a mistake or is there an explanation?

We are very sorry that we made a mistake here. We have corrected the numbers in the manuscript: for the first row in table 1, the number in the third column was 0.0424, higher than in the first column (0.0386). We have also checked the numbers in all the tables.

**Discretionary Revisions**

7. In the second paragraph of the background section I would replace 199.9‰ by 19.99% and 2.7‰ by 0.27%. This would be in line with the next sentence.

We quite agree with reviewer’s suggestion, and we have revised the expression in the second paragraph of the background section.

8. The section Data sources mentions that several years of data were missing. Which years?

Death data on the diseases by age group were missing between 1955 and 1960, while the data on the overall mortality of those years were available. We simulated the missing data through a time series model based on historical data, and adjusted the result by the overall mortality.
9. In the section Historical trends of PGLEs from 1950-2010 the authors mention that the PGLEs of infectious and parasitic disease have decreased to 0.07 years in 2010, “and have remained low.” But there are no observations after 2010. Do the authors mean that the PGLEs have decline until 2000 and have remained low since?

We have replaced “and have remained low” with “and have remained low in recent years since 2000” in the second paragraph of the section Historical trends of PGLEs from 1950-2010.

10. Reference 4 concerns the 2002 revision of the UN projections. Why not refer to more recent projections?

We have checked revisions of the UN projections since the year 2000. However, only the 2002 revision gave the exact projection of China's elderly population in recent 20 years, so we referred to this revision.

11. Last sentence of Discussion section: “indictors” should be “indicators”.

Thank you so much. We are very sorry for our incorrect writing and have corrected it.

The response to Dr. Susanna Conti

Reviewer: Susanna Conti

Reviewer's report:
It is a fairly good manuscript, regarding a study conducted using appropriate statistical (demographic) methods, having an interesting Public Health impact.

My only suggestion is to describe the main socio-demographic characteristics -such as age and gender structure of the population, work categories - of the "A Province", selected for the study in comparison with the whole PRC, to evaluate the representativeness.

Thank you for your advice. We admit that we have made an inaccurate expression about the representativeness of A Province in the previous version of our manuscript. It was selected as the sample for the accessibility and well preservation of the historical death rate data. However, due to the differences among the provinces in the nation, A province might only reflect the trend of well-developed areas in Eastern Region of China, but could not represent for the whole PRC. We have made revision in paragraph 2 of the section Study setting and the penultimate paragraph of Discussion with red mark.

We have listed the main socio-demographic characteristics among the whole China, A province, Eastern Region, Middle Region, and Western Region in the table below to show the differences between regions, including per capita GDP, life expectancy, maternal mortality rate, age and gender structure of the population in 2010. We can see the differences among the regions, and the characteristics of A province is similar to the Eastern Region.
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Whole China</th>
<th>Eastern Region</th>
<th>A Province</th>
<th>Middle Region</th>
<th>Western Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per capita GDP (RMB)</td>
<td>32622.0</td>
<td>51799.5</td>
<td>52664.0</td>
<td>25764.0</td>
<td>22685.2</td>
</tr>
<tr>
<td>Life expectancy (year)</td>
<td>74.83</td>
<td>76.45</td>
<td>78.50</td>
<td>73.59</td>
<td>70.22</td>
</tr>
<tr>
<td>Maternal mortality rate (1/100000)</td>
<td>30.0</td>
<td>10.1</td>
<td>6.24</td>
<td>18.4</td>
<td>34.2</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>51.3</td>
<td>51.3</td>
<td>50.4</td>
<td>51.0</td>
<td>51.4</td>
</tr>
<tr>
<td>female</td>
<td>48.7</td>
<td>48.7</td>
<td>49.6</td>
<td>49.0</td>
<td>48.6</td>
</tr>
<tr>
<td>Age (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-14</td>
<td>16.5</td>
<td>14.3</td>
<td>13.2</td>
<td>16.9</td>
<td>18.9</td>
</tr>
<tr>
<td>15-64</td>
<td>74.1</td>
<td>76.7</td>
<td>75.3</td>
<td>74.3</td>
<td>72.1</td>
</tr>
<tr>
<td>65-</td>
<td>9.4</td>
<td>9.0</td>
<td>11.5</td>
<td>8.8</td>
<td>9.0</td>
</tr>
</tbody>
</table>