Reviewer’s report

Title: The relationship between government research funding and the cancer burden in South Korea: Implications for prioritizing health research

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Reviewer: Charlie Zhou

Reviewer's report:

Major comments:

1. This paper makes no mention of cancer research funding data from the charitable or private sectors. It is known that both of these sectors are responsible for a large deal of healthcare funding, especially in cancer. For example, in our UK study, even after excluding the largest cancer charity in the UK (CRUK), the charitable sector made up £415 million of the $2.4 billion of public and philanthropic cancer research funding identified in a 14-year period - this was in fact a larger contribution to cancer research than the UK Department of Health. Similarly, it is known that pharmaceutical companies invest substantial amounts of capital in cancer research, although this data is very rarely available in the public domain.

These data could substantially change the conclusions of this paper. It is possible that a site-specific cancer, identified as underfunded relative to disease burden when only looking at government funding alone could be relatively over-funded when considering combined government, charitable and private sector funding, and vice versa. Furthermore, it is conceivable that the government may seek to actively provide additional funding to cancers that are neglected by the private and charitable sectors which would make neglected cancers appear falsely overfunded relative to disease burden when considering government funding alone. These conclusions would have a serious impact on any policy recommendations.

2. This paper presents Pearson correlation coefficients between site-specific cancer research funding with individuals measures of disease burden (including incidence, mortality, YLLs and DALYs). All of these correlation coefficients are highly significant (p<0.001) and roughly the same magnitude ranging between 0.75 - 0.85. However, when looking at the ranked cancers in Table 1, all four measures of disease burden appear to be highly correlated (i.e. a cancer with high incidence is also likely to have high mortality, YLLs and DALYs). It would be useful to explicitly describe the covariance between these disease burden measures. Interesting further analysis would include presenting non-parametric rank correlations and/or generating a compound measure of disease burden from the four separate measures.

3. As a secondary analysis of primary data sources, the conclusions that the authors draw is wholly dependent on reliability of the original data (both disease burden and funding data). It would be useful for the authors to comment on the quality, accuracy and
completeness of these data sources. What are the strengths, weaknesses and key assumptions? Has it been externally validated? There is extensive literature on the Global Burden of Disease studies which can be cited but I am not familiar with NTIS.

Did the authors do any further screening of the data received from the National Science & Technology Information Service? In our previous study, we found that a number of individual grants originally identified as cancer research funding were either not obviously relevant to oncology (e.g. pre-clinical immunology studies where cancer was mentioned only in passing) or not considered for research purposes (e.g. funding dedicated toward the maintenance of cancer research buildings). If the studies were screened - what were the inclusion/exclusion criteria?

4. The authors should take care to temper the language with which they communicate their conclusions. Rather than using the terms underfunded or overfunded it is important to instead emphasize underfunding or overfunding relative to disease burden throughout the manuscript.

There are potentially a number of factors beyond disease burden that could justifiably influence cancer research funding allocation including but not limited to neglected conditions, quality of life considerations, exciting/promising developments in the field, local expertise in an area, advocacy groups etc. The authors should also expand on these factors in the discussion.

Minor comments:

1. [Page 4, line 1] The authors mention that that South Korea's government spending on bio/health in 2016 is 2.13 billion USD. How does this compare to global spend and other national government investments? It would be good to get a perspective on whether South Korea is a major funder of cancer research compared to countries known to invest heavily in biomedical research such as the USA, the EU, Japan and China.

2. [Page 4, line 2] CAGR may not be the best means of demonstrating funding growth as it implies exponential steady growth. I think it would be better to present absolute change and percentage change comparing five years ago to the current period.

3. [Page 4, line 14] Cancer also benefits from a higher certainty in diagnosis compared to other pathologies. Cancers tend to be histologically diagnosed as opposed to radiographically or clinically.

4. [Page 4, lines 19-24] This should probably be reworded. Is there any evidence that healthcare decision makers and policy makers do not pay careful attention to cancers?

5. [Page 4, lines 29-34] I believe the decision to compare funding to South Korea specific disease burden (rather than global disease burden) is probably the right decision - but it would benefit from a sentence of explanation. Do you expect countries to fund more closely to the national disease profile or the global disease profile?
6. [Page 5, line 8] Would be useful to provide the details of the keyword search as an Appendix

7. [Page 5, line 16-23] It would be nice to have a breakdown of research funding by stage (e.g. pre-clinical, phase I-III, translational, public health, etc.) if possible.

8. [Page 6, lines 3-8] Why did you chose to perform analysis only on singular years? More power would be achieved if you used all years in the analysis. Or did you expect significant time variation?

9. [Page 6, lines 19-24] I would rephrase this as "The counterfactual funding amounts for each cancer type if funding what solely determined by disease burden was calculated …" or something to that effect

10. [Page 8, line 29] I presume in Table 3 that Korea-global difference are absolute measures? Please could you clarify in the text

11. [Page 8, line 46-56] Please see Major point 2 for a potential explanation.

12. [Page 9, line 43-46] Is there a citation for government research support being ultimately aimed at preventing an increase in burden?

13. [Page 9, line 50-53] Another potential explanation is that the lag period of 0-2 years is insufficient to capture changes

14. [Page 10, line 1-26] In our analysis we also found that haematological cancers received comparatively more funding (perhaps because it is frequently used as a model cancer) - it may be worth mentioning that your findings differ from this.

15. [Page 11, line 29] - if you are concerned about multiple counting affecting results, you could perform a sensitivity analysis excluding basic research

Spelling mistakes:

1. [Page 3, line 24]: "aim" should be "aims"

2. [Page 4, line 57]: "National Science & Technology Information Service" should be "National Science & Technology Information Service"

3. [Page 11, line 29]: "resluts" should be "results"

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