Author’s response to reviews

Title: Workforce requirements for comprehensive ischaemic stroke care in a developing country: the case of Saudi Arabia

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Reviewer comment: Like HRH planning, demographic and epidemiologic projection are scientific disciplines unto themselves. Appreciating that a comprehensive set of modeling scenarios related to these parameters is outside the scope of this study, it would be worth acknowledging that the scenario the authors have identified as predictive of expected future stroke numbers represents one possible future. A few additional sentences providing more detail on exactly how the historical demographic and stroke data were converted into future projections (e.g. trend analysis) would also strengthen the paper. For example, am I correct in interpreting that the authors have assumed that the age-specific stroke incidence rates will remain constant, and that the increased numbers of strokes they project are due to growth in the Kingdom's older population?

Author response: The reviewer is correct that our model predicts one possible future scenario, using specific data which contains uncertainty. We have made several additions to the text to provide further detail on this aspect. Further changes are described in relation to the second comment received from the reviewer. The ‘Epidemiological modelling’ section has been amended as follows:

“The movement of non-Saudis in and out of the country (many arrive to work but return to their home countries upon retirement) was also factored into the analysis. Thus, year-by-year population estimates were obtained by modelling births, deaths and the gradual ageing of the population. These data were then combined with Saudi age- and gender-specific rates of first stroke to estimate the number of first strokes occurring per year, of which 85% were assumed to be ischaemic (16,17). In each year, the population was stratified into age groups and multiplied by the stroke incidence rates for the corresponding age bands to estimate the number of new strokes occurring. The age- and gender-
specific stroke risks were assumed to be constant over the horizon of the analysis, and therefore the growth and ageing of the underlying population drove the changes in predicted number of strokes over time. Recurrent strokes were excluded due to a lack of robust data on their incidence.”

Reviewer comment: Related to this point, the future scenario the authors have used nicely illustrates how the combination of increased population need for stroke care and a changed care delivery model will, other things equal, require substantially more personnel to deliver that model to all those in need. This holds true despite the fact that the specific numbers predicted are likely - simply because the future cannot be predicted with precision - to turn out to be at least somewhat inaccurate. To be clear, I am suggesting the authors adjust the language with which they characterize their projection - I take no issue with the projection methods or results themselves.

Author response: Agreed – further discussion of this should be given to provide context for the population estimates and stroke projections. We have added some further text to the limitations section of the discussion related to this point, as below:

"Extrapolation of the population and stroke incidence data mean that the estimates of stroke burden over ten years are subject to uncertainty, and thus the projected staffing requirements should also be interpreted with this uncertainty in mind. Use of alternative stroke incidence data would lead to different estimates of staff requirements; nevertheless, the population growth projection of 12.8% over ten years is consistent with estimates of 2% per year from the World Bank (33). Hence, this growing and ageing population would lead to significant increases in the number of strokes regardless of the underlying data used to represent stroke incidence."

Reviewer comment: It seems to me that the reference the authors have added to estimating future staff requirements under the heading "Current stroke workforce in Saudi Arabia" on page 7 belongs instead under the corresponding heading on page 10.

Author response: Thank you for highlighting this – we have now removed the reference to ‘future staff requirements’ from the ‘Current stroke workforce in Saudi Arabia’ sub-section (please see page 7).

Reviewer comment: I am not sufficiently familiar with Saudi Arabia's context to comment on whether the author's assumptions of 1) additional nurses being sufficiently available through reorganization of staff and services and 2) additional beds and units being obtainable by repurposing existing infrastructure are valid for the country. It seems to me that neither of these assumptions is necessary - the authors could simply indicate that these factors were outside the scope of their study. The latter assumption causes me to wonder whether demand for other types of health care associated with heart disease, chronic respiratory illnesses, dementias, and other age-related illnesses can be expected to increase similarly to the demand for stroke care.

Author response: This is an interesting point. We agree with the reviewer that both nursing and bed requirements are effectively out of scope – however, we believe it is important to mention these aspects as their exclusion could seem like an oversight if not mentioned. For the nursing component, we have amended the text on page 11 to say the following:
“Nursing staff are considered outside the scope of the study since sufficient numbers were assumed to be available via re-organisation of existing staff.”

Regarding the exclusion of bed requirements from the analysis, we have made the following change on page 17:

“Based on this approach, our results indicate that significant expansion of existing hyper-acute stroke units would be needed to meet rising demand, with 329 additional beds required over the ten-year period to manage patients according to the proposed care model. From our analysis of existing services, however, these additional beds could be found via reconfiguration of existing services and were beyond the scope of the study due to our stated focus on staff requirements.”