Reviewer’s report

Title: Forecasts of COPD mortality in Australia: 2006-2025

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Reviewer: Elizabeth Colantuoni

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Major Compulsory Revisions:

1) I found this paper an interesting application of relatively novel approaches to forecasting using functional data analysis. These approaches are becoming more common with the greater ease of statistical computing in many important areas of research. However, as a statistician I found myself wanting for more details within the methods section. In cases with such complicated analyses it seems appropriate to provide sufficient details that would allow for replication of the analysis. Not sure if the most appropriate approach is to provide as a technical appendix if the journal allowed.

For instance, the authors attempt to keep the statistical jargon to a minimum but then introduce the idea of basis functions and provide Figure 3 displaying the functional coefficient for the first principal component of $K = 4$ selected based on the integrated squared error.

At the minimum it would be great to see a written description of the decomposition of the model. I.e. taking the functional observations (smoothed yearly mortality/age curves) and partitioning them into the location measure, the decomposition of age effects with corresponding time-specific coefficients and error; but in language interpretable to the non-biostat reader.

It may strengthen the paper to do the following in terms of results/figures:

a) Replace figure 2 with figure 1, all information contained in figure 1 is replicated in figure 2.

b) Add to current figure 3, the estimated location function and the corresponding basis function for age and time coefficient functions. This could be a multi-panel figure.

c) consider partitioning the current figure 3 with suggested revisions above into one for males and one for females.

I understand that the majority if the information is extracted within that first principal component but may be best to include the entire decomposition for completeness.

Discretionary Revisions

1) Abstract: COPD is “currently” the fifth leading cause of death….. instead of
2) Abstract: Results section starts with “We develop age-specific mortality curves for annual unadjusted COPD mortality rates from 1922 to 2005 in 5-year age groups separately for males and females. Functional time series models with 5 basis functions are fitted to each population separately.” This information really belongs in the methods section and is redundant to the existing methods paragraph.

3) Abstract: Results section: would be nice to see some quantitative findings i.e. for males of ages X-X the mortality rates are forecast to decline from Y to Z during 2006 to 2025. Similar rates of decline were estimated for males in the other age ranges. Etc.

4) Page 4: “Although COPD mortality has plateaued and is now declining in Australian men, it continued to increase in women through to 2002 and slightly declined thereafter (these are age-standardized rates)”, when did the COPD mortality rate plateau in men?

5) Page 4: COPD is the only major condition for which the burden of disease is continuing to increase. This is because COPD results in progressive respiratory disability, substantial impairment in quality of life and frequent hospital admissions. Admission rates are now declining among men, but continue to increase among women and have not yet reached a peak [2]. COPD is also accompanied by substantial comorbidities including depression, heart disease and osteoporosis.

This paragraph could use a bit of reorganizing. The prior paragraph mentions that mortality rates are decreasing, then this paragraph suggests that the burden of disease (as defined by impaired quality of life and frequent hospital admission) is increasing. However then it is mentioned that admissions rates are declining among men. So why is the burden of disease increasing? It would be great to more explicitly define what is meant by burden of disease: for the individual patient? Due to decreases in mortality rates from COPD resulting in longer lower quality life with high comorbidities. Or is burden of disease measured at the population level so that the increases in burden of disease are a combination of reductions in mortality rates from COPD and just a growing aged population which is at higher risk for developing COPD?

6) Page 5: “Hyndman and Ullah [3] proposed forecasting for age-specific mortality rates observed over time.” This sentence seems incomplete and why would you forecast observed mortality rates. Perhaps the authors intended for: Hyndman and Ullah proposed using functional data analysis techniques to forecast age-specific mortality rates.

**Level of interest:** An article whose findings are important to those with closely related research interests
Quality of written English: Needs some language corrections before being published

Statistical review: Yes, and I have assessed the statistics in my report.

Declaration of competing interests:
I declare that I have no competing interests.