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Comparing methods to predict baseline mortality for excess mortality calculations

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Abstract:

The World Health Organization (WHO)'s excess mortality estimates presented in May 2022 stirred controversy, due in part to the high estimate provided for Germany, which was later attributed to the spline model used. This paper aims to reproduce the problem using synthetic datasets, thus allowing the investigation of its sensitivity to parameters, both of the mortality curve and of the used method, thereby shedding light on the conditions that gave rise to this error and identifying possible remedies. A negative binomial model was used accounting for long-term change, seasonality, flu seasons, and heat waves. Simulated mortality curves from this model were then analysed using simple methods (mean, linear trend), the WHO method, and the method of Acosta and Irizarry. The performance of the WHO's method with its original parametrization was indeed very poor, however it can be profoundly improved by a better choice of parameters. The Acosta-Irizarry method outperformed the WHO method despite being also based on splines, but it was also dependent on its parameters. Linear extrapolation could produce very good results, but was highly dependent on the choice of the starting year, while the average was the worst in almost all cases. Splines are not inherently unsuitable for predicting baseline mortality, but caution should be taken. In particular, the results suggest that the key issue is that the splines should not be too flexible to avoid overfitting. Even after having investigated a limited number of scenarios, the results suggest that there is not a single method that outperforms the others in all situations. As the WHO method on the German data illustrates, whatever method is chosen, it remains important to visualize the data, the fit, and the predictions before trusting any result. It will be interesting to see whether further research including other scenarios will come to similar conclusions.

Journal ranking:

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