# Major strides in forecasting future health

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See Articles page 2052

Around 2008, I asked demography colleagues: "Surely we could better forecast future mortality rates if we first forecast future risk factor trends—like smoking rates?" Their answer then was no—simply using historical mortality rates to forecast future mortality rates was better than any attempt to build in forecast trends for smoking, blood pressure, and other risk factors that are in turn all mathematically linked to likely mortality rates. That was then. Now in *The Lancet*, Kyle Foreman and colleagues[1] forecast mortality rates and years of life lost for 250 causes of death to the year 2040. Their innovative method combined three approaches to forecasting: building in forecasts of 65 risk factors or independent drivers of future health; forecasting future fertility, income, and education, collapsed as the Socio-demographic Index; and autoregressive integrated moving average modelling of historical trends still unexplained by the first two methods. The new method predicted 2014–16 mortality rates using data from 1990 to 2006 with fewer errors than the widely used Lee-Carter demographic method at all ages. These forecasts are likely to be of huge policy interest and importance—perhaps even overshadowing standard outputs from the Global Burden of Disease Study (GBD) over time.

The investigators forecast that, compared with 2016, non-communicable diseases (NCDs) will account for a greater proportion of years of life lost (YLLs) in all GBD regions by 2040. Globally, they estimated a 4·4-year increase in life expectancy from 2016 to 2040 (95% uncertainty intervals 2·2–6·4 and 2·1–6·4 for men and women, respectively). This increase will be a solid improvement if achieved, and a welcome reduction in between-country inequalities as forecast gains will be greater in those countries with currently lower life expectancy. But for high-income countries it will be a slowing down in gains as the low-hanging fruit of tobacco control is realised and other more difficult risk factors such as obesity remain.[1] However, experts have been estimating a slowing of gains or limit to life expectancy for decades, yet global life expectancy has kept increasing linearly[2]—but surely those large linear increases are likely to slow down soon.[3]

Using worst and better scenarios—ie, the 15th and 85th percentile—of annual change from across all country-years for each disease, three of the top five risk factors (high blood pressure, high body-mass index, and high fasting plasma glucose) stood out as having a wide range of potential effects on future health, specifically, a 2·6 times difference in YLLs. Factors that might plausibly alter future trends in these risk factors (eg, government policies of food environments or countervailing food industry practices) hold the potential to affect our future for better or worse. But Foreman and colleagues' study did not specify exactly what interventions offer that promise.

Although NCDs will increasingly dominate the disease burden in most countries, in many lower-income countries, communicable, maternal, neonatal, and nutritional diseases are forecast to still exact a high toll in 2040. The authors also showed a real risk of HIV mortality rebounding if countries lose momentum against the HIV epidemic, pointing to a need for "increased health spending, including development assistance for health targeted to the world's poorest people".[1]

Foreman and colleagues were transparent about many limitations in their work. For example, they noted that predicting stochastic events such as major earthquakes and wars is challenging, and this was incorporated in their study by randomly sampling the occurrence rates after World War 2. Such stochastic use of the past might not be the best way to predict the future as the evidence mounts that climate change and overconsumption of the earth's resources are major threats to human progress.[4] There are further limitations that suggest future research directions to improve the modelling. First, the method relies on forecasting a summary exposure value for each risk factor, averaged across the diseases that each risk factor causally effects. Because the distribution of causes of death in the future will differ from today, this is an approximation that future iterations of this forecasting method should improve upon. Second, the future iterations of this forecasting should allow user flexibility in choosing scenarios. Third, forecasting impact of health inequalities, within and between countries, warrants attention.

Finally, the forecast mortality rates do not tell us what interventions will achieve what health gain, for whom, which is crucial for modelling effects on health inequalities, and the cost effects. Is tobacco tax, down-regulating sodium in the food supply, or another intervention the next best thing to do? Policy makers need quantification of the effect of specific interventions using simulation models that estimate future changes in disease incidence rates, then future mortality rates and health-adjusted life-years (eg, in tobacco control[5,6] and dietary, physical activity, and other interventions[7–10]). Although cost-effectiveness modelling of treatments and health technologies is common place, modelling preventive interventions onto health gains decades into the future, which should be central to policy discussions, is challenging. This study, however, helps to grow this field. First, the forecast estimates provided by Foreman and colleagues provide invaluable baseline scenarios and calibration targets for intervention simulation models. Second, a vision of merging GBD data and intervention simulation models to allow multiple country assessments is achievable. 20 years after the concept of GBD was born,[11] this latest innovation to forecast future health is likely to advance policy, health-services planning, and research prioritisation globally.

*Tony Blakely*
Department of Public Health, University of Otago, Wellington, Wellington 6242, New Zealand
tony.blakely@otago.ac.nz

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