Longer-term mortality and morbidity impacts of the pandemic

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Summary

In addition to the short term mortality effects of the pandemic (deaths caused directly and indirectly by the coronavirus) and the medium term effects (from the impact of fewer obese people and diabetics in the surviving population, for instance), there will be many longer-term effects.

This Bulletin considers the plausible mortality and morbidity consequences in respect of economic shock, physiological impacts on 'severe symptoms' survivors, behavioural changes, and mental health. We conclude that the sum total of these is likely to be material and negative, although we do not try to quantify the impact.

Introduction

Our recent Bulletins[i] on mortality impacts of the pandemic considered the likely (short-medium term) mortality of the surviving population, and how a mortality investigation could reasonably be done post-pandemic.

In this Bulletin we consider the longer-term impacts of the pandemic with regard to how mortality improvement assumptions might be affected. We are not considering here possible future 'direct' COVID-19 deaths.

Likely drivers of mortality in the longer term

There are four main sources of likely material impact on long-term mortality:

i) **Economic**: The economic impact of the pandemic is likely to be felt at a societal level, with reduced funds available for healthcare and social care; and individually by the many who suffer material economic hardship. This impact is compounded by the backlog of treatments attributable to the initial stages of the pandemic.

ii) **Physiological**: the long-term health of those who survive serious manifestations of COVID-19 is of course currently unknown, but the experience of SARS and Spanish Flu allows us to reasonably infer a material negative effect.

iii) **Behavioural**: COVID-19 has resulted in massive short-term behavioural change. Many of these changes seem positive for health, many negative. Which changes are more likely to persist, and will the balance of these be positive or negative?

iv) **Mental**: the prolonged isolation effect of the lockdown, the general increase in anxiety for many, and the traumatic impact of hospitalisation on severely affected patients may all persist to some extent, leading then to an associated negative impact on physical health.

Economic effects

The OECD is projecting heavy reductions in GDP for all major Western economies – for instance, a reduction in the UK's GDP of around 11.5%[ii] (more in the event of a second wave). Such impacts are likely to be felt for some time in the public health sector, given that – all other things being equal (i.e. barring a phenomenal increase in Government borrowing) – reduced tax income for Governments will lead to reduced funding for public health. In the UK, the NHS is the single largest recipient of public spending (around 19%[iii] of the estimated 2020 total), and it would be extremely hard for a department representing such a large share to escape some proportionate sharing in the reduction. (A further complication in the UK is likely to be pressure to increase the salaries of NHS staff.)

Over the last five or so years, there has been much study of the effect of reduced Government expenditure on health, social care etc on mortality. For instance, 'Effects of health and social care spending constraints on mortality in England' by Watkins et al.[iv] concluded that spending constraints were associated with material mortality impacts, estimating around 45,000 deaths to have ensued from the 2010-2014 funding constraints.

The magnitude of the economic downturn this year, compounded by other pressures on Government expenditure (e.g. in the UK, the furlough scheme), together with the impact of deferred medical treatments and similar (eg reduced public appetite to attend hospital during the pandemic, reductions in screening etc) will very likely lead to reduced mortality improvements. The reduction could reasonably be expected to be greater (in size and duration) than that part of the early 2010s 'improvement slowdown' attributable to austerity.

Physiological effects

The experience of the 2003 SARS pandemic provides useful insights into plausible long-term impacts on health for COVID-19 'severe symptoms' survivors. For instance, the paper 'Long-term outcomes in patients with severe acute respiratory syndrome'[v] by Guo et al. notes 'significant long-term morbidity [impacts], including cardiopulmonary impairment, renal problems and decreased quality of life'.

A 2010 collation of various studies noted 'significant impairment of health status among SARS survivors and their carers', noting also 'persistent lung function abnormalities' (but limited to around one-third of survivors)[vi].

Equivalent studies on COVID-19 survivors are starting to emerge, although clearly with greatly reduced timespans (months, not years, of follow-up). The recently published article 'Emerging long-term complications of Covid-19'[vii] notes a range of interesting studies and their main findings, including:

- Extensive lung scarring (even in some 'asymptomatic' cases);
- Blood clots;
- Cardiac damage.

While the emerging evidence (including that from SARS) does not provide the sort of mortality differentiation that would be useful to inform long-term mortality adjustments, it seems likely that COVID-19 survivors may have materially worse long-term respiratory and heart disease mortality than people who have not suffered from the disease.

Behavioural changes

The pandemic has led to the largest changes in behaviour ever seen in the living memory of most. Some of the areas affected are:

- Driving
- Alcohol and smoking use
- Diet

- Personal hygiene
- Exercise
- Pollution (from general industrial change)

Although many of these could lead to observable differences in mortality, such an impact would not be likely to persist at a material level much beyond the period of the changed behaviour. If, therefore, society is largely 'back to normal' in (say) 1-2 years, it is unlikely that there would be much long-term impact from these areas.

Mental health

'At least half a million more people in UK may experience mental ill health as a result of Covid-19', suggested the UK's Centre for Mental Health in May[viii], noting a lasting 'longitudinal' impact as well as the immediate effect.

One of the earlier reports cited on SARS survivors concluded that 'the long period of isolation and extreme uncertainty during the SARS illness created enormous psychological stress and mood disturbances … personal vulnerability, and psychosocial stressors might have jointly contributed to the development of psychosis in some patients'.

Several of the papers on SARS outcomes note PTSD as a common condition for survivors, and the Centre for Mental Health's note also reports on studies that ICU survivors from all conditions often experience PTSD (typically affecting 20% of cases).

In addition to the effects analogous to those observed from SARS, in this pandemic we can also expect a 'second wave' in mental health problems coming from the economic shock, to the extent that it brings unemployment (and at best, job insecurity and/or reduced income) in its wake.

Rather like the first two factors, economic and physiological, at this stage we can reasonably assert a long-term negative effect on mortality.

Overall effect

The factors considered above will vary in several 'dimensions':

- Magnitude
- Duration
- Socio-economic differentiation
- Age group

A debatable omission from this list is 'direction' or 'sign': whether the changes are positive or negative in mortality impact. We think that the economic, physiological and mental health factors all lead to negative outcomes. The 'behavioural' factor is a mix of different directions, but these are unlikely to persist. The overall impact therefore is likely to be a material adverse impact on mortality.

One way to attempt a quantification of the overall impact is via a 'bottom-up' analysis, seeking to quantify these aspects as much as possible across the factors considered. As with much modelling, the output may well prove to be far from the eventual truth, but the process itself is an important aid to understanding the underlying drivers and their variability. The process also lends itself well to sensitivity testing, exploring how different parameterisation of the drivers affects the result.

Finally, consideration should of course be given to how these impacts should be applied to a mortality basis. Given perfect knowledge of the impacts, an appropriate method may be an increase in base mortality (varying by age and socio-economic group), attenuating either to zero or to some minimum plateau over the next 5-10 years (say). Given our very approximate knowledge, however, a more practical route could be via adjustment to the future improvement pattern.

Adjustments to mortality projections

There is significant variation in the models used to set mortality projection assumptions. Pension schemes typically use the CMI Mortality Projections Model. Insurers and reinsurers use a wider variety of approaches, including bespoke in-house models and more complex parameterisations of the CMI Mortality Projection Model. Here we consider the case where the CMI Mortality Projection Model is the established approach; these considerations may also be of relevance to other cases.

The CMI Mortality Projection Model can be viewed conceptually as having three components:

i)   **Short-term improvements**: these are data driven, being derived from recent past mortality variations, but heavily influenced by parameter choices (especially regarding how much credence is attributed to the most recent data);

ii) **Long-term improvements:** these are user determined, typically set using expert judgement after considering a range of analysis;

iii) **Convergence from short- to long-term improvement:** the speed and path of convergence can be tailored through advanced parameters.

Without modification to the structure of the CMI model, adding a year with exceptionally high deaths (and a significant negative improvement rate) would decrease the projected short-term improvements. It seems clear that this would not be a reasonable reflection of the shape of improvements, as the model is designed to interpret data as a potential 'signal' pertaining to the future, while deaths from the pandemic are (absent second waves etc) 'one-offs'.

With this in mind, a pragmatic approach for work undertaken in 2019 would be to retain the existing mortality projection models (e.g. CMI_2019 or CMI_2018 for many insurers) as a prior view of future mortality variation, and consider adjusting either the short term improvements (for example using the A parameter) or the long-term rate assumption (which may be a more familiar parameter) in respect of the issues discussed earlier.

Further work in this area

We are looking to release a bulletin shortly on the effect of deferral of treatment (which arises for many reasons, eg prioritisation of COVID-19 patients, or patient concerns that may limit the seeking of medical treatment).

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References

[i] Bulletins 27 and 38 at www.covid-arg.com
[ii] http://www.oecd.org/economic-outlook/june-2020/
[iii] https://www.ukpublicspending.co.uk/current_spending
[iv] https://bmjopen.bmj.com/content/7/11/e017722
[v] http://www.ijcem.com/files/ijcem0074733.pdf
[vi] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7127710/
[vii] https://www.vox.com/2020/5/8/21251899/coronavirus-long-term-effects-symptoms
Note that https://www.thailandmedical.news/news/must-read-covid-19-long-term-effects-covid-19-survivors-could-suffer-chronic-medical-conditions-for-years (not quoted above) also provides a range of interesting observations about the long-term physiological effects on survivors.
[viii] https://www.centreformentalhealth.org.uk/covid-19-nations-mental-health
https://www.centreformentalhealth.org.uk/sites/default/files/2020-05/CentreforMentalHealth_COVID_MH_Forecasting_May20.pdf