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Cumulative Excess Deaths in New Zealand in the COVID-19 Era: Biases from Ignoring Changes in Population Growth Rates

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Abstract

Accurate data on health and economic outcomes are needed to evaluate policy responses to COVID-19. A potentially comprehensive health indicator is excess deaths, which shows the gap between all-cause deaths and deaths to be expected under normal circumstances. New Zealand's public health community has seized upon an excess deaths series that seemingly shows negative cumulative excess mortality in the first three years of COVID-19—in other words, fewer deaths than expected. This is a flawed measure because it ignores changes in population growth. There was a rapid rise in deaths in New Zealand in the 2015-19 period, due to immigration-driven population growth rates of two percent per annum. This growth came almost to a standstill after the border closed in March 2020 so methods of extrapolating from the past to predict future deaths, to ascertain if actual deaths exceed the projection, must take account of this sharp change in population growth rates. Rather than New Zealand being unique, in having negative cumulative excess deaths in the COVID-19 era, as claimed by public health commentators, cumulative deaths are about four percent above expected deaths once population changes are accounted for. Several developed countries had better outcomes according to this indicator.

JEL Codes

F22

I18

Keywords

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migration

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I. Introduction

Evaluation of New Zealand's policy response to COVID-19, which involved border closures, lockdowns, mask and vaccine mandates and costly monetary and fiscal stimuli, requires accurate health and economic data. The notion of "excess deaths"—the gap between all-cause deaths and the deaths to be expected under normal circumstances—is a comprehensive health indicator. If interventions reduce some deaths but increase others, excess deaths show the net effect. However, there is no consensus on how to estimate expected deaths; some studies use a simple mean of deaths in a prior 5-year period, others extrapolate from that prior period using a time trend, some allow for population changes, while others base analyses on death rates (so population changes are eventually needed to convert back into death numbers).

New Zealand public health figures have seized upon a particular measure of excess deaths that seemingly shows negative cumulative excess mortality in the first three years of COVID-19—in other words, fewer deaths than expected. For example, when interviewed on the third anniversary of the first lockdown, former director-general of health Sir Ashley Bloomfield said he was greatly satisfied that, three years on, New Zealand still had negative excess mortality. He argued, "we had less deaths than you would have predicted based on the previous years … [which] … is unique, virtually unique around the world" (Olley, 2023). Likewise, Summers et al (2022) claimed that although Australia, Taiwan, and Japan all had periods of negative excess deaths at some point in the COVID-19 era, only New Zealand maintained negative excess mortality throughout. The particular measure that underpins these claims is one of several available from Our World in Data: "Excess mortality: Cumulative deaths from all causes compared to projection based on previous years" which is based on estimates originally made by Karlinsky and Kobak [hereafter, K&K] (2021).[1]

II. Evidence on the Bias from Ignoring Changes in Population Growth Rates

This measure is badly flawed for the New Zealand context because it ignores changes in population growth. Expected deaths are simply an extrapolation from 2015 to 2019, when deaths were rising by 2.05% per year, due largely to (migration-driven) population increases of 1.94% per year. Specifically, K&K use a regression to forecast expected deaths after 2019:

$$D_{w,T} = \delta_w + \beta \cdot T + \varepsilon \quad (1)$$

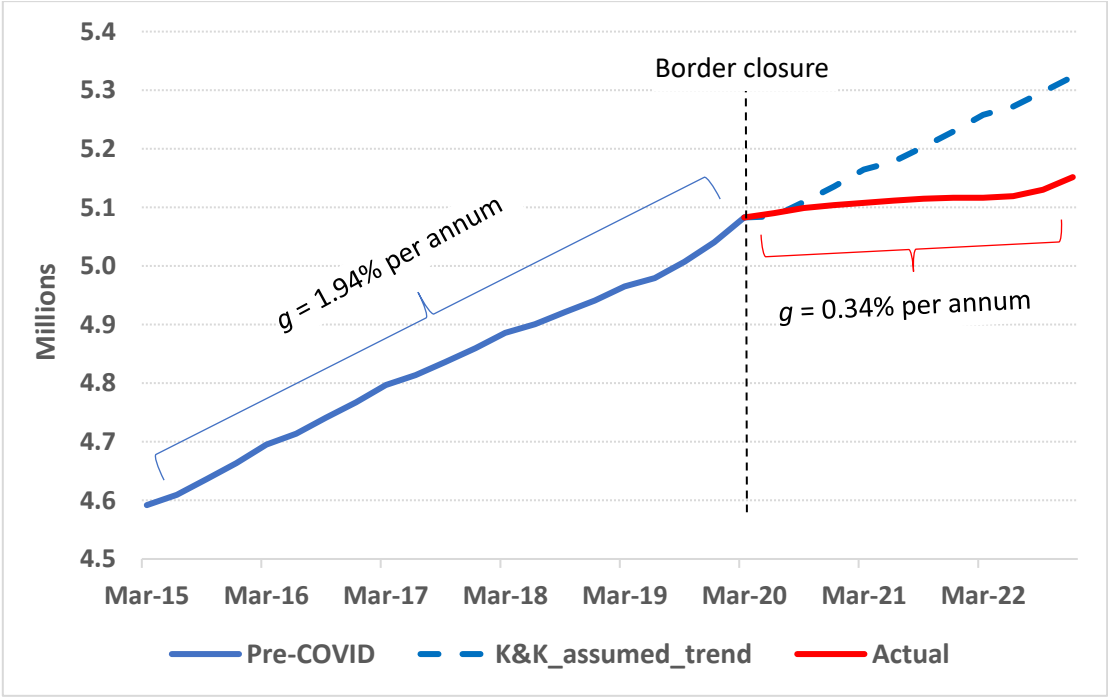
where $D_{w,T}$ is deaths in week w of year T from 2015 to 2019, δ_w is a set of fixed effects for each week of the year, T is a linear time trend (2015=1, 2016=2 and so on) and ε is a random

[1] Data are available here: https://ourworldindata.org/excess-mortality-covid

error. There is no control for population in this regression so whatever was the growth rate in population between 2015 and 2019 is implicitly projected forward into the future.

The flaw in this procedure can be seen in Figure 1, showing New Zealand's resident population each quarter from the beginning of 2015 until the end of 2022.[2] The population growth rate fell sharply from March 2020 after closing the border; instead of 1.9% per annum the growth rate fell to just 0.3% per annum. By the end of 2022 the K&K approach assumes an extrapolated population that is over 0.17 million above New Zealand's actual population then. Using the average death rate in 2022, this exaggerated population yields 1290 more "expected" deaths that year than the actual population would warrant. This error grows over time: at the end of 2021 the K&K assumed trend population was 0.11 million above actual population, overstating expected deaths that year by 850 while at the end of 2020 the overstatement of population (expected deaths) was only 0.03 million (240). For the claims about cumulative excess mortality, these errors accumulate over time.

Figure 1: New Zealand Resident Population: Actual and K&K Assumed Trend



A clear way to show the flaw in the K&K approach is to supplement equation (1) with a population variable. Deaths data for this test are from the Short-Term Mortality Fluctuations (STMF) database (Németh et al, 2012), which is also the source K&K use for New Zealand. The *F*-test for excluding the Statistics New Zealand quarterly resident population estimates

[2] Data are available from: https://www.stats.govt.nz/topics/population

from equation (1) is $F_{1,363}$=77.4 (p<0.001). Population estimates can also be derived from the death totals and death rates in the STMF database; to enable comparisons with other countries as well. The F-test for excluding this population series, when predicting New Zealand deaths, is $F_{1,363}$=74.9 (p<0.001). Only two out of the 36 STMF countries have larger effects from excluding population estimates. In other words, New Zealand is a country where the K&K approach of projecting deaths into the future with no adjustment for changes in population is least applicable despite the appetite of local public health figures for using this method.

Another way to show that population growth drove the rising deaths in the 2015-19 period is to re-estimate equation (1) using death *rates* as the dependent variable. Unlike the clear trend of deaths increasing by 2.1% per annum (680 extra deaths each year with a linear specification), all-ages death rates for New Zealand showed no trend increase.[3] The reason for static overall death rates, even as population shifted into older groups with high mortality risk (the 65 years and above share rose from 18.5% in 2015 to 19.5% in 2019), is that death rates *within* some age groups fell quite sharply. For example, death rates for the 65-74 year olds fell 1.2% per annum (p<0.002) and for the 75-84 year olds fell by 1.9% per annum (p<0.001) from 2015-19. Simply attributing rising numbers of deaths in New Zealand to an aging population is incorrect because it ignores these within- and between-age group effects that were tending to offset each other.

III. Policy Implications

The flawed K&K measure of excess deaths that ignores population changes may skew policy discussion in at least two ways. First, complacency about increased deaths may occur because some of the rise may seem 'expected' due to using a population projection that is too high. For example, New Zealand recorded 3640 more deaths in 2022 than in 2021— a rise of 10.4%— Statistics New Zealand attributed the rise to COVID-19 and population aging (Gabel and Knox, 2023). Yet net effects of aging are more complex, as seen above, and aging did not drive rising deaths in 2015-19. Notably, the exaggerated population under the K&K approach (as seen in Figure 1) equates to 1290 more annual deaths than actual population would imply in 2022; an error equivalent to more than one-third of the actual year-on-year increase.

The attribution of the extra deaths in 2022 to COVID-19 also cannot not be the full story given that fewer than 2700 deaths have been attributed to COVID-19 over the entire

[3] The coefficient when regressing New Zealand's log death rates on a time trend (and weekly dummies) is 0.001 with the null hypothesis that this equals zero not rejected (p<0.57). In contrast, the time trend in the regression for deaths is statistically significantly greater than zero (p<0.001).

three-year COVID-era.[4] Thus, in 2022 approximately 1000 extra deaths are likely to be from causes other than COVID-19 but there seems to be little questioning about these non-COVID deaths. Instead, public health figures are able to rely on the upwardly biased K&K population projections to buttress claims that much of what was actually an unprecedented rise in deaths in 2022 was, on the contrary, to be expected, so really there is nothing to see here.

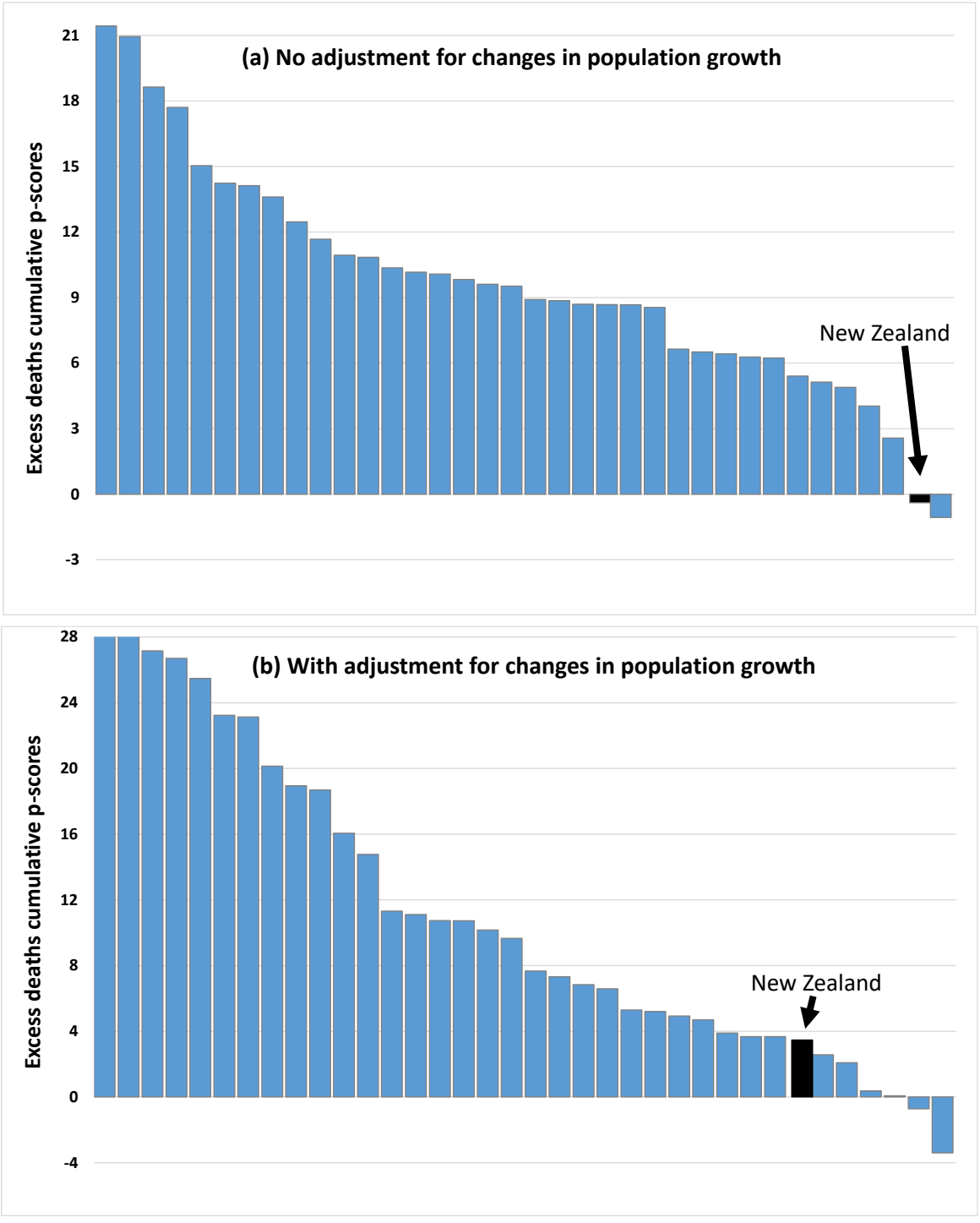
The second way that use of the K&K excess deaths measure may distort local policy discussion is when comparisons are made to other countries; usually such comparisons can help to prompt reflective critique of local policy responses. Yet the claims by public health figures of our unique negative cumulative excess mortality experience are likely to suppress such critique and lead to more of a self-satisfied "didn't we do well" perspective. This theme runs through the interview with Sir Ashley Bloomfield; seemingly oblivious to the research-based literature that finds lockdowns had little to no effect on mortality (Herby et al, 2022), he argues: "Lockdowns were an important tool in the overall response and …we…know that if we are in a similar situation in the future…it is a tool that we can deploy." People in other countries can clearly see their cumulative excess death tolls and may ask sharper questions of what was gained (and what was lost) by using lockdowns and other novel interventions. In contrast, such questions are barely raised in New Zealand and this may partly be because a misleading statistic is helping to lull the population into a false sense that our policy response was spot-on (e.g. according to Radio New Zealand 'New Zealand got it right' (Olley, 2023)).

To show the difference made by failing to account for population changes, Figure 2 shows p-scores for cumulative excess mortality from 2020-22 (the p-score is the percentage by which actual deaths exceeds expected deaths). The data are for the 36 countries in the STMF database with deaths data for 2015-22. In panel (a) excess mortality is based on the K&K approach, with a time trend that ignores changes in population growth rates. In line with claims by public health figures, New Zealand seems to be one of just two countries with negative cumulative excess mortality (Luxembourg is the other). Yet once the lower rate of population growth from March 2020 is allowed for in panel (b) it is apparent that there is no negative cumulative excess mortality in New Zealand. Instead, we are amongst a group of four countries with cumulative p-scores just below four percent.[5] There is another group of six countries (Luxembourg, Canada, the Netherlands, Iceland, Israel and Australia) with even lower

[4] https://covid19.govt.nz/news-and-data/covid-19-data-and-statistics/#covid-19-data-portal
[5] For the three-year period, New Zealand's deaths were about 3.5% higher than expected (effectively spreading the 10.4% rise in deaths in 2022 over three years, given that 2020 and 2021 did not have excess deaths).

(negative for some) cumulative p-scores. While the New Zealand cumulative p-score is certainly better than middling, given the median for the countries in Figure 2 is 8.6%, there does not seem to be anything particularly remarkable about this excess deaths outcomes for New Zealand despite a large amount of local commentary that suggests otherwise. It should be especially apparent that claims that New Zealand had uniquely negative cumulative excess deaths during the first three years of the COVID-19 era lack firm foundation.

Figure 2: Cumulative p-scores, With and Without, Population Adjustment



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