International Epidemiological Association

International Journal of Epidemiology, 2022, 1–10
https://doi.org/10.1093/ije/dyac047
Original article

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Excess mortality in Israel associated with COVID-19 in 2020–2021 by age group and with estimates based on daily mortality patterns in 2000–2019

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Received 30 August 2021; Editorial decision 5 January 2022; Accepted 14 March 2022

Abstract

Background: We aimed to build a basic daily mortality curve in Israel based on 20-year data accounting for long-term and annual trends, influenza-like illness (ILI) and climate factors among others, and to use the basic curve to estimate excess mortality during 65 weeks of the COVID-19 pandemic in 2020–2021 stratified by age groups.

Methods: Using daily mortality counts for the period 1 January 2000 to 31 December 2019, weekly ILI counts, daily climate and yearly population sizes, we fitted a quasi-Poisson model that included other temporal covariates (a smooth yearly trend, season, day of week) to define a basic mortality curve. Excess mortality was calculated as the difference between the observed and expected deaths on a weekly and periodic level. Analyses were stratified by age group.

Results: Between 23 March 2020 and 28 March 2021, a total of 51 361 deaths were reported in Israel, which was 12% higher than the expected number for the same period (expected 45 756 deaths; 95% prediction interval, 45 325–46 188; excess deaths, 5605). In the same period, the number of COVID-19 deaths was 6135 (12% of all observed deaths), 9.5% larger than the estimated excess mortality. Stratification by age group yielded a heterogeneous age-dependent pattern. Whereas in ages 90+ years (11% excess), 100% of excess mortality was attributed to COVID-19, in ages 70–79 years there was a greater excess (21%) with only 82% attributed to COVID-19. In ages 60–69 and 20–59 years, excess mortality was 14% and 10%, respectively, and the number of COVID-19 deaths was higher than the excess mortality. In ages 0–19 years, we found 19% fewer deaths than expected.

Conclusion: The findings of an age-dependent pattern of excess mortality may be related to indirect pathways in mortality risk, specifically in ages <80 years, and to the implementation of the lockdown policies, specifically in ages 0–19 years with lower deaths than expected.

Key words: COVID-19, excess mortality, age, mortality curve, Israel

Key messages

- Estimates of age-specific excess mortality provided a complete and timely measure of the mortality burden from COVID-19.
- Excess mortality calculations based on previous years' data accounted for temporal changes such as long-term trends in mortality and population size, annual variations in weather and influenza rates; such adjustments are essential for Israel, which has experienced changes in both population size and mortality rate over time.
- We found an age-dependent excess mortality pattern during the first 53 weeks of the COVID-19 pandemic in Israel.

Introduction

On 11 March 2020, COVID-19 was declared a pandemic and is currently ongoing. In Israel, the first COVID-19 death was reported on 20 March 2020 and in the following months there were many additional cases and fatalities. After almost 13 months, from mid-March 2020 to the end of March 2021, the official death toll from COVID-19 among Israeli citizens was 6135, constituting almost 12% of deaths in Israel over the entire period. Mortality from COVID-19 was especially heavy in September and October 2020 (16% and 21% of all deaths, respectively) and January and February 2021 (26% and 21%% of all deaths, respectively). In general, mortality rates from COVID-19 in Israel were lower than those reported in the USA and some European countries.[1] Since the start of the outbreak there has been a series of containment policies, at both national and local levels, including three national lockdowns, social distancing, mask wearing and closure of businesses and schools. By the end of December 2020, Israel had begun a highly successful vaccination rollout and by 1 March 2021, 37% had received two doses of BNT162b2 (Pfizer) vaccine and 52% had received one dose in a population of 9.3 million. By 31 March these percentages had increased to 53% and 58%, respectively. The vaccination campaign was followed by a notable decrease in the infection rate (a sharp 90-day continuous decline in new infections followed by a >100-fold decrease in documented infections and a >50-fold decrease in severe cases).[2]

Excess mortality provides a complete and timely measure of the mortality burden of COVID-19 and includes direct mortality attributed to the virus, mortality from unidentified coronavirus cases and indirect mortality due to other diseases that were not treated in time for reasons such as avoidance of going to hospitals.[3–8] Comparison of deaths actually attributed to COVID-19 to estimate excess mortality is helpful for elucidating the importance of deaths directly related to COVID-19 as opposed to indirect mortality. The relationship between excess mortality and infection rates 1–2 weeks earlier is also informative.

Previous assessment of excess mortality in several European countries,[9] the USA[7] and Israel[10] adopted relatively simple designs based on pre–post comparisons of death counts that do not account for temporal changes in the risk. Temporal changes include long-term trends in mortality and population size, and yearly variations in risk factors such as weather and influenza illness counts; ignoring these changes might bias estimates of excess mortality. Our estimates exploit an expected mortality curve based on daily mortality monitoring data over the years and taking into account temporal changes in population size, weather and influenza rates. During a pandemic, excess mortality assessment in the general population is a robust means of monitoring the progress of the pandemic[11] whereas morbidity assessment poses methodological challenges because case-incidence counts are affected by external factors (e.g. changes in the policy of locating patients and characterizing them over time). COVID-19 is an age-dependent disease[3,5,6] and ~80% of deaths in Israel occur among people aged ≥75 years. Therefore, excess mortality from COVID-19 should be examined according to age groups. In addition, comparison with previous years must take into account the annual increase in population and declining mortality rates in Israel. The population is ageing and life expectancy is on the rise (in 2019 it was 85 years for women and 81 years for men—one of the highest in the world). Therefore, a direct comparison of the number of deaths in the COVID-19 period (2020 and the first 3 months of 2021) with the average number of deaths in a corresponding period in the previous 5 years, as in the *P*-score approach used by the EuroMOMO (a European mortality monitoring activity) project[9] or by US researchers,[7] does not reflect the full picture. Comparison of mortality rates adjusts for the increase in population but fails to account for the long-term decrease in mortality rates.

Assessing excess mortality is important for decision-makers in dealing with the COVID-19 pandemic. Hence our objectives in this study were to:

- build a basic daily mortality curve in Israel, according to a statistical model based on 20-year data, in various age groups, accounting for long-term and annual trends, influenza-like illness (ILI) counts and climate factors, among others;
- use the basic curve to predict the expected number of deaths in 2020–2021 during the COVID-19 period and to examine excess deaths (the difference between the observed and expected deaths) on a weekly and periodic basis, by age groups and for the entire Israeli population;
- assess the relationship between excess mortality and reported age-specific morbidity for COVID-19.

Methods

Time series design

Daily mortality data from 2000–2019 were used to build age-specific daily mortality rate curves for Israel, accounting for long-term and annual trends, ILI index and climate factors,

These curves were then used to predict the expected number of deaths in 2020–2021 during the COVID-19 period and to estimate excess deaths (the difference between the observed and expected deaths) on a weekly and periodic level, by age groups and for the entire Israeli population.

Data

Mortality data

The number of daily all-cause deaths for the period 1 January 2000 to 31 December 2019 and current data for 2020 and the first 3 months of 2021, stratified by age groups 0–19, 20–59,60–69,70–79,80–89 and 90+ years, were provided by the Israeli Central Bureau of Statistics (CBS). Data on all deaths in Israel are provided to the CBS by the Ministry of Interior and are considered 100% completed with a 1-year lag. The completeness is maintained by the CBS using the National Insurance data and the Ministry of Health data.

COVID-19 deaths of Israeli citizens were retrieved from the Israel Ministry of Health COVID-19 database.

Population size

Total population data for Israel were also provided by the Israeli CBS. Data stratified by age groups were available at an annual level (average population during the year) for the years 2000–2020 and the first 3 months in 2021.

ILI data

Influenza-like illness (ILI) is defined as an acute syndrome involving fever (≥37.8°C) with or without other general symptoms plus at least one respiratory symptom (such as cough, sore throat, rhinitis, etc.). Anonymous information regarding visits to general practitioners coded with diagnoses that correspond to ILI are received at the Israel Center for Disease Control from the two main health-maintenance organizations in Israel on a daily basis. These data cover ∼80% of the total Israeli population and serve to monitor the seasonal activity of influenza and other respiratory viruses. Laboratory validation is achieved by sampling patients with ILI at ∼40 sentinel clinics all over Israel for the presence of influenza virus and other respiratory viruses. The number of weekly ILI cases for the study period was provided for each age group by the Israel Center for Disease Control. The weekly summary value was taken to apply for all days of that week.

Climate data

Daily weather data (minimum and maximum temperature, dew point temperature at time 03:00 and average radiation) recorded at Beit Dagan in central Israel were provided by the Israel Meteorological Service (IMS).

Statistics

Baseline daily mortality rate curve

Data from 2000–2019 were used to establish an Israeli baseline daily mortality rate curve for each age group. The full 20 years of data were used for all models except that for ages 90+ years, which was limited to the period 2009–2019. For that age group, initial inspection of the data showed a large difference in the raw mortality rates through 2008 and after 2008. The CBS confirmed that population size data for this age group were unreliable for the earlier period but were reliable thereafter, following the national census in 2009.

We used quasi-Poisson regression models to relate the logarithm of the mortality rate to the following time-dependent risk factors: an annual trend, a long-term trend, climate variables, ILI index, season and day of the week. The models adjusted for population growth by including the logarithm of the age-group population as an offset. The annual population size data were smoothed over time to produce daily population counts (details in the Supplementary material, available as Supplementary data at *IJE* online). All of these fits reproduce the observed data almost perfectly. The models were fitted to the data using the GAM (Generalized Additive Model) function in the R package mgcv. Examination of residuals from the models showed very good fits to the data with all short-lag autocorrelations <0.05. The annual trend was modelled by a cyclic B-spline, with default settings for the degree of smoothing. The long-term trends were linear in calendar year, with a possible change in slope in 2010. Placing the slope change at 2010 was based on prior graphical review of both daily and annual mortality rates, which showed clearly decreasing rates throughout 2010 and more modest changes thereafter. Day of the week was included as a predictor after noticing that there are distinctly fewer deaths on Saturdays, and to a lesser extent on Fridays, than during the rest of the week. Distinct ILI measures were used for ages 0–19, 20–59 and 60+ years. The latter were used for modelling mortality rates in all age groups for the 60+ population. The reason for combining the ILI data from all these age groups is that the index is not so reliable for the oldest age groups, which have the heaviest mortality but are less likely than the younger population to visit clinics for treatment of influenza. Thus the index is less stable for these age groups. Moreover, there is high correlation of the ILI index across all these age groups. Thus we were convinced that the combined index was more stable and better reflected the state of the annual influenza infection than did the indices for any of the specific age groups in the 60+ population. For all the weather variables, we used 10-day lagged averages (after sensitivity analysis comparing different lags showed small differences). The relation of mortality to weather variables was made specific to season, with summer including June, July, August and September; autumn including October and November; winter including December, January and February; and spring including March, April and May. The division into seasons followed the recommendations of the IMS. Each season-specific variable is assigned the value of the corresponding variable on days that belong to that season and is equal to 0 on all days in other seasons.

Predicting mortality and excess mortality in 2020

The predicted mortality in age group i on day j was computed as $\hat{Y}_{i,j} = P_{i,j}\hat{\theta}_{i,j}$, where $P_{i,j}$ is the population size and $\hat{\theta}_{i,j}$ denotes the estimated mortality rate from our model. Predicted mortality for the entire population, or for broader age groups, is computed by summing the predictions over all relevant age groups. Similarly, predictions for time periods are computed by summing over all the days belonging to that period. Predictions and actual mortality counts are presented on a weekly basis, following the convention of standard epidemiological weeks. Thus Week 1 of 2020 actually began on 30 December 2019 and 2020 includes 53 such weeks. Prediction intervals (at 95%) were computed for each week and age group by using a normal approximation to the weekly number of deaths, accounting for both the natural quasi-Poisson variation in the death counts and the uncertainty in estimating the daily rates. The expected value is the predicted mortality and the standard deviation is the square root of the predicted mortality times the quasi-Poisson scale factor. Tests of the hypothesis that the observed mortality corresponds to the expected mortality used the same normal approximation.

Association between excess mortality and reported COVID-19 counts

Daily morbidity data were used to compute a daily index for COVID-19 mortality. The index is a weighted sum in which the number of cases in each age group is weighted by the age-specific COVID-19 case-fatality rate, estimated as the number of individuals who were reported to have died from COVID-19 through to the end of 2020 divided by the number found who tested positive for COVID-19 [based on polymerase chain reaction (PCR) tests, by Israel Ministry of Health definitions]. The weights adjust for the fact that mortality is a function both of the case count and the death rate, with the latter clearly varying across ages. The morbidity is based on PCR testing for COVID-19 and, unlike mortality, has a strong weekly pattern, with far fewer diagnosed cases on Saturdays and Fridays than during the rest of the week. To remove this feature, the mortality index replaced the initial daily case counts by 7-day moving averages. The mortality index was compared with the estimated excess mortality across a variety of time lags.

Results

Population and mortality rates, 2000–2019

The population of Israel grew by 44%, from just under 6.3 million in 2000 to almost 9.1 million in 2019. Annual death rates for the same period for the entire population decreased from ∼6 per 1000 to 5 per 1000 (see Figure 1).

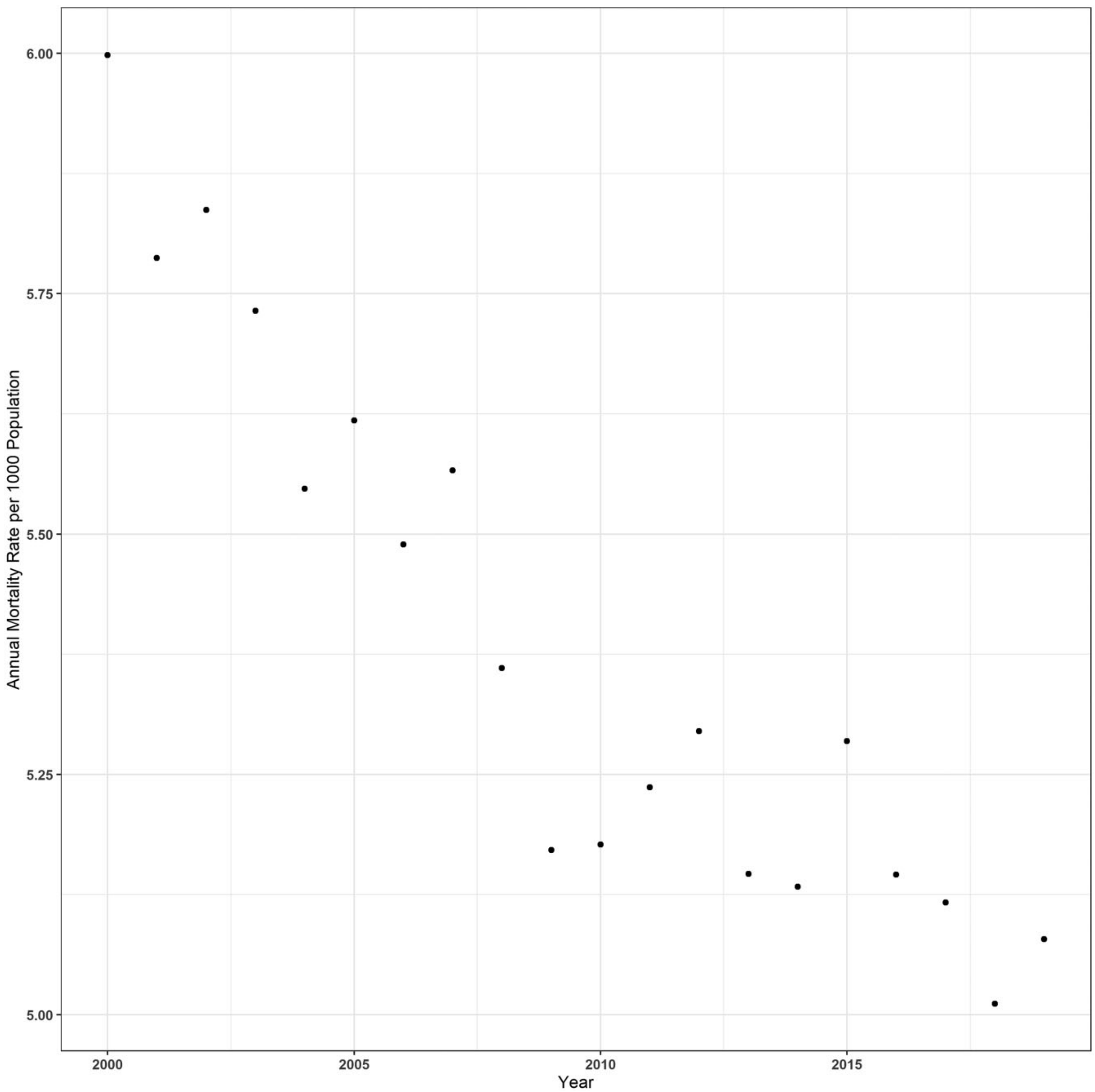

Figure 1 Annual death rate trend, Israel 2000–2019

Note: The *y*-axis does not begin at 0 to highlight the decreasing rate over this period.

The decrease was more dramatic throughout roughly 2010 and was more moderate thereafter. Similar patterns were observed for all the age-group-specific mortality rates.

Mortality from January 2020 through to March 2021

Figure 2 presents the observed and expected number of all-cause deaths for Weeks 1–65 (30 December 2019 to 28 March 2021) by age group and for all ages. Table 1 presents observed and expected all-cause death accumulated for the 65 weeks and stratified to the pre-COVID-19 period (Weeks 1–12) and the COVID-19 period (Weeks 13–65) as well as age-specific COVID-19 deaths, excess deaths and percent attributed to COVID-19 during the pandemic period.

Pre-COVID-19 period, Weeks 1–12

From 30 December 2019 through to 22 March 2020, mortality in Israel was lower than expected by ∼4% (439 persons, $P < 0.0001$). Mortality was less than expected in all age groups except for the very elderly, aged 90+ years (see Table 1a).

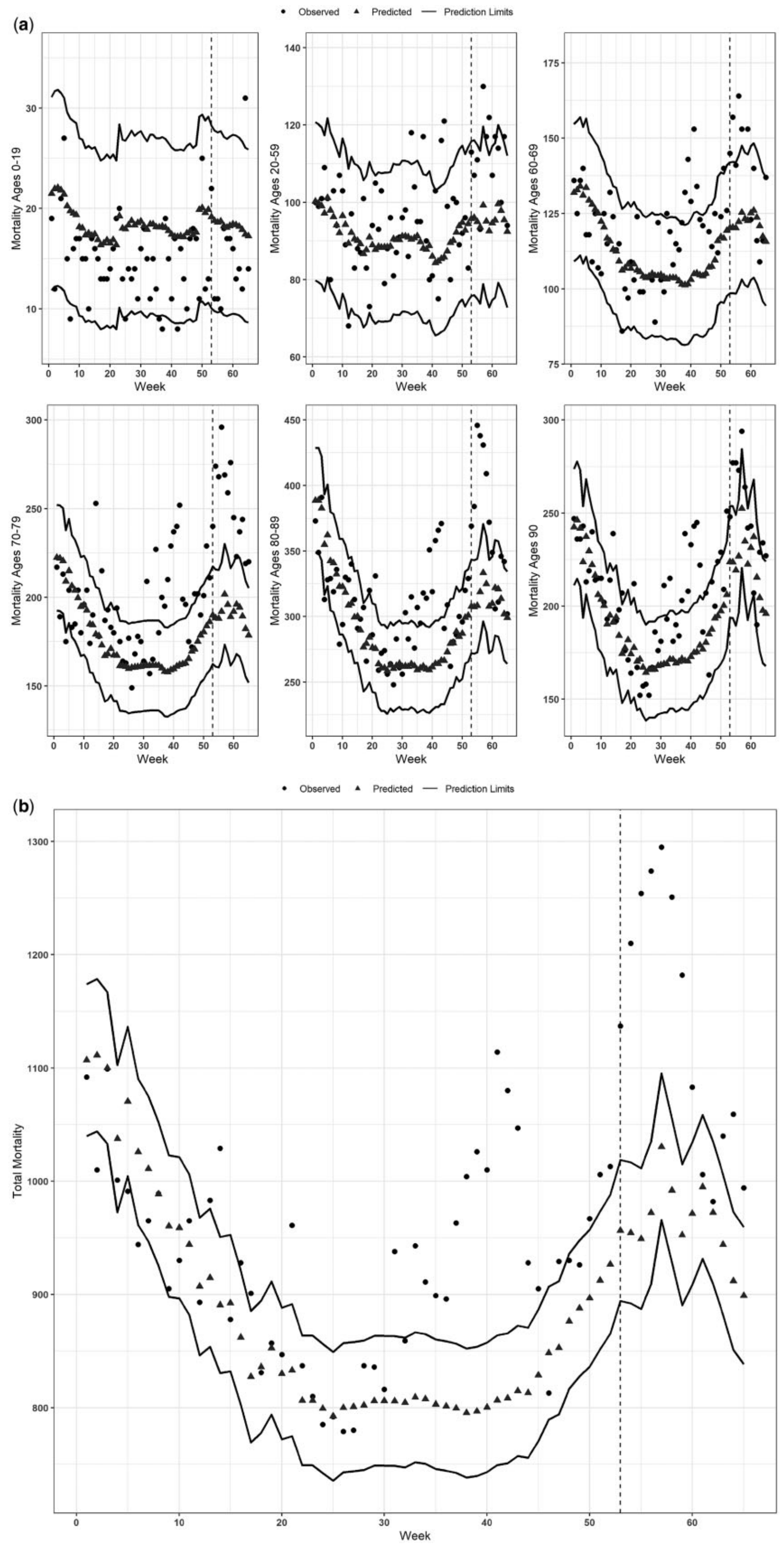

Figure 2 Observed and expected weekly number of all-cause deaths for Weeks 1–65 (30 December 2019 to 28 March 2021) using the Generalized Additive Model

(a) Mortality in six age groups; (b) total mortality. The black circles show the observed mortality, the black triangles the predicted mortality based on our model and the solid lines define 95% prediction intervals. The dashed line separates the results for 2020 from those for 2021. Week start: Week 1—30 December 2019; Week 15—6 April 2020; Week 44—26 October 2020; Week 53—28 December 2020. As the mortality rate varies widely across the age groups, different scales are used for the *y*-axis in each panel.

Table **1** Excess deaths by age group during the 65 weeks (30 December 2019 to 28 March 2021)

(a) Pre-COVID-19, Weeks 1–12 (30 December 2019 to 22 March 2020)[a]

Age group (years)	Expected deaths (95% prediction interval)	Observed deaths	Excess deaths (%)
0–19	241 (209–273)	205	–36 (–14.9%)
20–59	1158 (1088–1228)	1154	–4 (–0.3%)
60–69	1532 (1454–1610)	1459	–73 (–4.8%)
70–79	2467 (2367–2566)	2324	–143* (–5.8%)
80–89	4166 (4034–4297)	3969	–197* (–4.7%)
90+	2660 (2556–2764)	2673	13 (0.5%)
All ages	12 223 (12 000–12 446)	11 784	–439* (–3.6%)

[a]One OVID-19 death was assessed posteriori, not accounted.

(b) During COVID-19, Weeks 13–65 (23 March 2020 to 28 March 2021)

Age group (years)	Expected deaths (95% prediction interval)	Observed deaths	COVID-19 deaths	Excess deaths (%)	Attributed to COVID-19
0–19	954 (890–1018)	772	9 (1.2%**)	–182 (–19.1%)	–4.9%
20–59	4821 (4679–4963)	5186	512 (9.9%)	365 (7.6%)	140.3%
60–69	5857 (5705–6008)	6466	885 (13.7%)	609 (10.4%)	145.3%
70–79	9139 (8948–9330)	11 034	1558 (14.1%)	1895 (20.7%)	82.2%
80–89	14 987 (14 738–15 236)	16 780	2038 (12.1%)	1793 (12.0%)	113.7%
90+	9999 (9798–10 199)	11 123	1133 (10.2%)	1124 (11.2%)	100.8%
All ages	45 756 (45 325–46 188)	51 361	6135 (11.9%)	5605* (12.2%)	109.5%

*$P < 0.0001$; **$9 \times 100/772 = 1.2$.

COVID-19 period, Weeks 13–65

Between 23 March 2020 and 28 March 2021, a total of 51 361 deaths were reported in Israel, 76% in people aged 70+ years (see Table 1b). Expected deaths for the same period were 45 756 deaths (95% prediction interval, 45 325–46 188). Thus the actual mortality exceeded the expected mortality by 12% ($P < 0.0001$). For the same period, 6135 deaths, 9.5% more than the estimated excess, were attributed to COVID-19. Among those aged 70+ years, the excess death rate was 12% and the mortality attributed to COVID-19 was 98%, but with some variation between groups. The mortality attributed to COVID-19 for ages 70–79 years was 82% of excess deaths; for ages 80–89 years, it was almost 14% greater than the estimated number of excess deaths; and for ages 90+ years, it was similar to the number of excess deaths (101%). For ages 60–69 years, the excess death rate was 14% and 45% more deaths than the estimated number of excess deaths were attributed to COVID-19 (885 COVID-19 deaths vs 609 excess deaths). For ages 20–59 years, the excess death rate was 10% and 40% more deaths than the estimated excess were attributed to COVID-19. For ages 0–19 years, there were no excess deaths—rather, there were 19% fewer deaths (182 deaths) than expected. The percentage of deaths attributed to COVID-19 ranged from 1% in ages 0–19 years to 14% in ages 60–79 years; for the entire population, 12% of all mortality was attributed to COVID-19 (Table 1b).

Association between excess death and reported COVID-19 counts

Figure 3 presents the association between the observed vs expected number of all-cause deaths (daily mortality ratio) and our daily COVID-19 mortality index lagged 11 days (mortality index), for the period 30 December 2019 to 28 March 2021. The correlation was 0.62. The correlation between daily excess mortality and the mortality index was checked for lags of 4–28 days. It was >0.5 for all lags of ≤21 days, with a maximal correlation of 0.62 for a lag of 11 days.

Discussion

We estimated excess deaths during 65 weeks of the COVID-19 period in 2020–2021 using a more refined statistical approach than those used by the United States Centers for Disease Control,[12] the EuroMOMO project[9] or the Israeli Ministry of Health.[10] In the USA and in

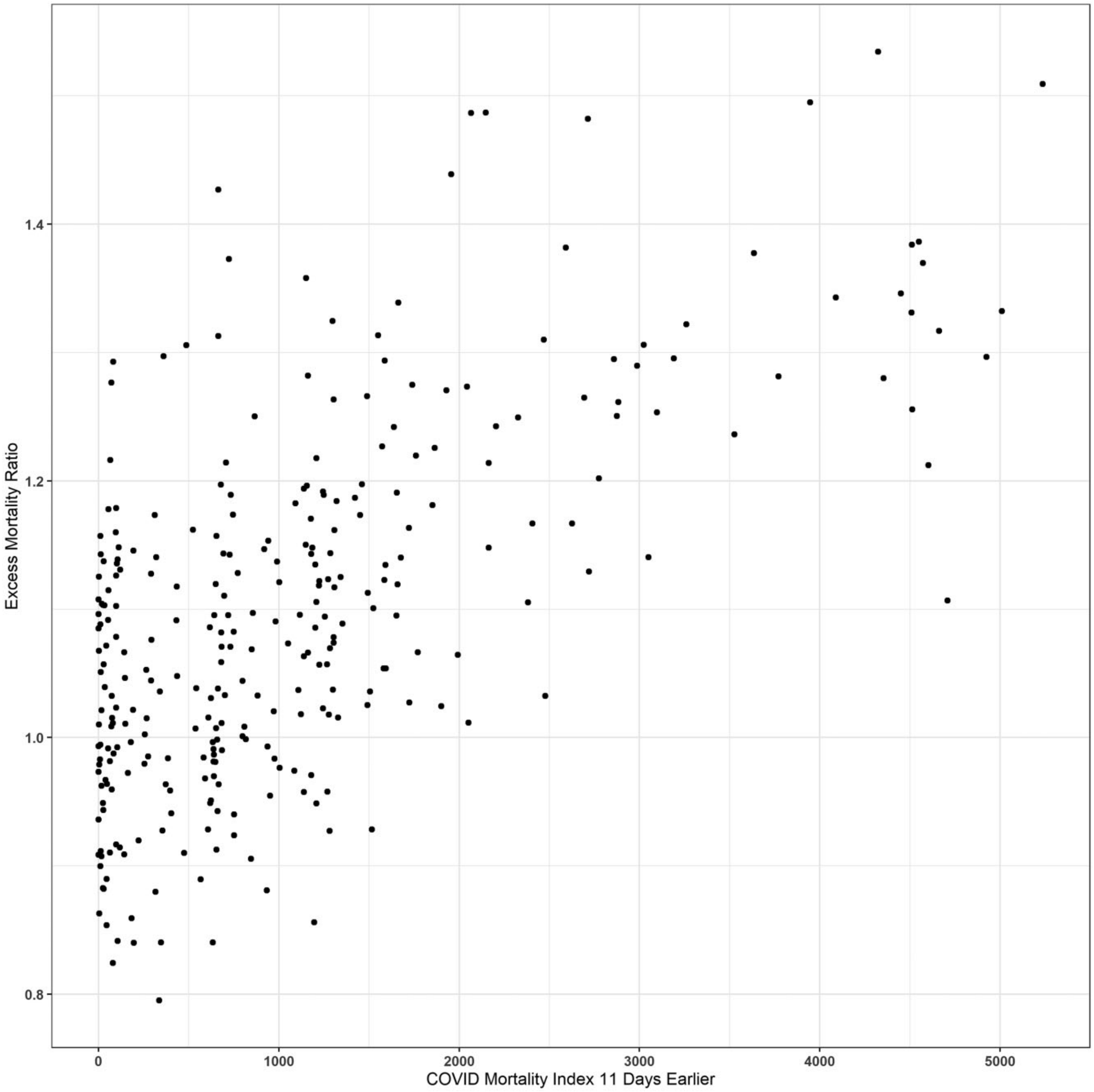

Figure 3 Association between daily excess mortality ratio (observed vs expected) and COVID-19 mortality index[a] lagged 11 days, adjusted to age group, for the period 30 December 2019 to 28 March 2021

[a]COVID-19 mortality index—daily death counts calculated as daily reported morbidity cases multiplied by yearly COVID-19 death rate. R Pearson = 0.62.

western Europe, excess mortality is generally calculated as the difference between the weekly number of deaths occurring in 2020 and the average number occurring in the same week during 4, 5 or 6 previous years (e.g. 2016–2019,[5,9,13] 2015–2019,[1,3,6,8,14–17] 2014–2019[18,19]), 10 previous years[20] or 1 previous year.[7] For Israel, that approach is misleading because the population is increasing annually and over the past 20 years mortality rates have decreased. In our approach, the expected weekly deaths for 2020–2021 were estimated using daily mortality data of the preceding 20 years to fit GAM models that included many predictors (e.g. season, climate variables, ILI index) and adjusted for the changes in both population size and mortality rates. We found that a significant excess of deaths occurred in Israel during the COVID-19 period from 23 March 2020 to 28 March 2021; an estimated 5605 more persons than expected (12%) died during the 53-week period, differing by only 9.5% from the number of deaths that were attributed to COVID-19. Some European countries reported much higher excess mortality, with increases of >10%, but in short time windows (e.g. 29.5% in Italy for 15 February to 15 May 2020,[7] 14% in Portugal for 16 March to 14 April).[21] The Organisation for Economic Co-operation and Development (OECD) calculations report that overall mortality increased over a 10-week period by 61% in Spain, 56% in the UK, 40% in Italy and Belgium, and <5% in Germany, Denmark and Norway.[8] Knowledge of the different risks for different population strata are instrumental for carefully choosing the next steps in coping with the pandemic. The age distribution of deaths in Israel in this 53-week period showed that about three-quarters of all deaths (76%) as well as COVID-19 deaths (77%) were among those aged 70+ years. The presence of co-morbidities as well as living in care homes are known risk factors for COVID-19 morbidity and mortality in this age group.

The pooled mortality estimated for 24 OECD European countries showed an excess mortality level >4 z-scores above the baseline in March 2020,[9] especially in individuals aged 65+ years, but some countries (in particular England and Spain) observed excess mortality in younger ages.[9] In a longer time frame from late January through to 3 October 2020, adults aged 25–44 years in the USA experienced the largest percentage increase in the number of all-cause deaths.[12] For ages 0–19 years in Israel, we found significantly lower mortality than expected (–19%). Potential explanations include the nationwide closure of most of the education system for this period as well as the reduction in accidents. For ages 20–59 and 60–69 years, there was excess mortality but there were more COVID-19 deaths than the estimated excess, possibly indicating prevention of death from other causes. Excess mortality in the 70+ age groups was 12%; it was 11% in the 90+ age group, 12% in the 80–89 age group and 21% in the 70–79 age group. This last age group had the highest excess death rate and the largest gap (18%) between the excess and the number of deaths that were attributed to COVID-19. Potential explanations include misattribution of COVID-19 deaths to other illnesses reflecting complications of COVID-19, delayed access to healthcare to treat conditions other than COVID-19 and social determinants of health (e.g. jobs, income, food security). Interestingly, in Germany during Weeks 10–23 in 2020, the 70–79 age group did not show excess mortality.[5]

The daily excess mortality is clearly related to the COVID-19 morbidity index, further emphasizing the dominant role of COVID-19 as the cause of the excess mortality. It should be noted that in Israel in early 2020, during 12 weeks during the winter before the onset of COVID-19, mortality was lower than expected by 4%, similar to other European countries, due to changes in the effect of seasonal diseases such as influenza.[10]

Comparing excess deaths with reported COVID-19 deaths can also indicate the extent of the pandemic toll. For the first 10-week period of the pandemic, some European countries reported COVID-19-related deaths corresponded closely to the total number of excess deaths (e.g. Belgium).[8] In Israel, for the 53-week period from 23 March 2020 to 28 March 2021, COVID-19-related deaths for all ages were somewhat higher than the excess deaths (109.5%), namely all excess deaths were directly attributed to COVID-19. In the USA, for example, the COVID-19-related deaths were ~75% of excess deaths during the first 10-week period, indicating an indirect effect of COVID-19 on mortality.[14]

The advantages of our study include the methodological approach and statistical modelling of excess deaths, which incorporated 20 years of daily data on deaths as well as on population size, weather variables and ILI counts. This highlights the value of using large-scale linked national data sets. Further, the model included the time patterns of an annual (seasonal) and a long-term trend in death rates alongside the modelling of population growth. The limitations of our study include potentially inaccurate death certificates and modelling assumptions. The differentiation between dying 'with' COVID-19 vs 'from' COVID-19 may be difficult to make and the vast majority of patients with COVID-19 have co-morbidities that contribute to or are the dominant causes of the fatal outcome. Also, we did not have data on deaths in nursing homes and among hospitalized patients that appear to account for a lion's share of COVID-19 mortality.

Conclusion

We found an age-dependent pattern of excess mortality for 65 weeks during 2020 and 2021 in Israel. In this investigation of excess mortality, expected deaths were estimated using daily mortality data from the preceding 20 years and adjustments were made for the changes in both population size and mortality rates. The excess mortality may be related to indirect pathways in mortality risk, specifically in people aged 70–79 years. In addition, the times of peak excess are predicted well by age-specific COVID-19 morbidity. As the pandemic continues, this finding may be useful in minimizing all-cause mortality. Further investigation is required on the causes of the non-COVID-19 deaths to shed light on the mechanism behind this phenomenon to help design appropriate targeted responses to save lives.

Ethics approval

This study did not require ethics approval since the data were obtained from national institutes (the CBS and the Israel Center for Disease Control) where the researchers are involved and the data were properly anonymized.

Data availability

The aggregated death data and the aggregated COVID-19 morbidity data are publicly available from the Israeli Central Bureau of Statistics (CBS); the meteorological data are publicly available from the Israel Meteorological Service.

The routines used for fitting the regression models and predicting mortality are available at https://github.com/dmsteinberg/Israel-Excess-Mortality.

Supplementary data

Supplementary data are available at *IJE* online.

Author contributions

C.P.: conceptualization, methodology, writing original draft. N.R.: conceptualization, data curation, review and editing. L.K.-B.: conceptualization, methodology, data curation, review and editing. A.F.: conceptualization, data curation and review. M.G.: conceptualization, methodology and review. M.B.: analysis and review. D.M.S.: conceptualization, methodology, analysis and writing original draft.

Funding

No agency or organization provided funding for this research.

Conflict of interest

None declared.

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