EDITORIAL

The Toll of COVID-19

Harvey V. Fineberg, MD, PhD

Everyone dies eventually. But exactly when did a person die and from what cause? How many deaths were attributable to that cause? These straightforward questions can be challenging to answer, and their answers reveal only part of the effects of a disease on a family, community, and nation, as is the case with deaths from the coronavirus disease 2019 (COVID-19) pandemic.

Countries began systematically to record deaths and such events as births and marriages at least since the Registration Act of 1854 in Scotland. The US National Center for Health Statistics (NCHS), within the Centers for Disease Control and Prevention (CDC), operates the National Vital Statistics System (NVSS) for the US. The NVSS compiles data supplied by the 50 states, 2 cities (New York City and Washington, DC), and 5 US territories, each of which has legal responsibility for registering births, deaths, and other vital statistics within their jurisdictions. These jurisdictions vary in the timeliness of their submissions to the NVSS, and it takes time to process, code, and tabulate these data. At any moment in time, therefore, the NVSS death counts are incomplete, especially over the most recent couple of weeks, and the lag, depending on jurisdiction and cause of death, can be as long as 8 weeks. For this reason, some universities, media, and other organizations have taken up the task of tabulating current COVID-19 death counts by counties and states and summing those to provide more current, national tallies that are familiar from daily news reports.

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By September 22, 2020, the number of deaths from COVID-19 in the US had surpassed 200 000, according to such unofficial tallies. As of September 18, 2020, the NVSS reported 184 341 deaths involving COVID-19 through the week ending September 12, 2020.[1] During the same time period (beginning February 1, 2020) according to the NCHS, an even larger number of deaths, 188 170, reportedly involved pneumonia, with or without COVID-19; if deaths involving pneumonia, influenza, or COVID-19 are counted, the number of deaths increases to 295 323. As the NCHS repeatedly explains, its tally of deaths attributed to COVID-19 at any moment is an undercount due to the lag in reporting and tabulation, but how much may be due to underreporting (eg, missed COVID-19 diagnoses among deaths attributed to pneumonia) or overreporting (eg, presumed COVID-19 diagnosis in a patient who died of influenza) are matters of speculation.

Health conditions that predispose to COVID-19, such as diabetes, hypertension, respiratory disease, and obesity, pose an added complication because these concomitant conditions may be listed as contributing causes on death certificates. In late August, after the CDC released data indicating that 94% of COVID-19 death certificates listed other contributing conditions, President Trump retweeted a post falsely claiming the CDC had quietly updated its guidance to indicate that only 6% of the coronavirus death toll was actually attributed to severe acute respiratory syndrome coronavirus 2. Twitter removed the erroneous post, and the chief of the mortality statistics branch of the NCHS hastened to make clear that 92% of all death certificates that mention COVID-19 indicate it as the underlying cause of death, that is, "the condition that began the chain of events that ultimately led to the person's death."[2] Spurning diseases on death certificates as indicative of the actual causes of death or the true start of the chain of events leading to death, McGinnis and Foege[3] identified in *JAMA* the most prominent contributors to mortality in the US in 1990 as tobacco (400 000 deaths), diet and activity patterns (300 000), and alcohol (100 000), followed by microbial agents, with an estimated 90 000 deaths.

Because fatality counts from death certificates are at any moment incomplete, and the listed causes of death reflect varying degrees of uncertainty and the judgment of the certifier, it is important to consider other ways to estimate the number of deaths due to a condition such as COVID-19. One useful metric for this purpose is the number of deaths in excess of the number expected in a specified period of time. The number of deaths in a population such as the US over the course of a year shows a highly regular wave pattern, increasing in the winter months and declining in the summer. When an abrupt event arises, such as a war, famine, or pandemic, the excess mortality can be a revealing indicator of the death toll from that event. Because the pattern of deaths in many countries follows a similarly regular wave, excess mortality has the added advantage of facilitating international comparisons.

In this issue of *JAMA*, Woolf et al[4] update their estimate of excess deaths in recent months in the US. For the 5 months of March through July 2020, the US experienced more than 225 000 excess deaths, a 20% increase over expected deaths. COVID-19 reportedly accounted for approximately two-thirds of these excess deaths. Importantly, a condition such as COVID-19 can contribute both directly and indirectly to excess mortality. The direct contribution occurs among individuals who are infected. The indirect contribution may relate to circumstances or choices due to the COVID-19 pandemic: for example, a patient who develops symptoms of a stroke is too concerned about COVID-19 to go to the emergency department, and a potentially reversible condition becomes fatal. When a portion of excess mortality is attributed to a COVID-19–related condition such as pneumonia, some deaths recorded as due to pneumonia without mentioning COVID-19 probably represent missed COVID-19 diagnoses during a COVID-19 pandemic. Over time, further analyses of mortality patterns may illuminate the direct, indirect, and missed

counts of deaths attributable to COVID-19.[5] If the winter months bring a combined increase in both COVID-19 and influenza, attribution of unassigned excess mortality between COVID-19 and influenza may be problematic.

Beyond individual deaths, the pattern of mortality among population groups can reveal both those at higher risk and the groups who bear a disproportionate burden of the pandemic. Among the striking epidemiological features of COVID-19 are the wide spectrum of disease expression, from asymptomatic to fatal; transmission of infection during the asymptomatic or presymptomatic stage of infection; and steep shift toward more severe outcomes with increasing age. In the US, the disease has also disproportionately affected African American persons, Hispanic persons, and American Indian or Alaska Native persons.[6] As of August 18, 2020, for example, the COVID-19 hospitalization rate among Black or African American persons was 4.7 times higher and the death rate from COVID-19 was 2.1 times higher than those rates among White non-Hispanic persons.[6] The Viewpoint in this issue of *JAMA* by Cooper and Williams[7] highlights the individual, family, and community consequences of COVID-19 on communities of color and places those consequences in the larger legacy of racism, disadvantage, injustice, and health disparities attached to Black and Brown populations in the US.

Deaths attributable to a disease are a partial representation of the health burden imposed by that condition. Because everyone dies eventually, should a country count a death at age 81 the same as a death at 18? Demographers, economists, and health analysts have used metrics, such as years of life lost, to quantitatively answer this question. When trying to measure the effect of a disease on a population, as distinct from the meaning and measure of that disease for an affected individual, attributable years of life lost may be a more useful measure than attributable lives lost. Loss of a year of life or a life altogether does not indicate the quality of life lived or lost in any given year. More sophisticated measures of the burden of disease take account of the quality of life in measures such as quality-adjusted life years or disability-adjusted life years. The latter metric, disability-adjusted life years, has been used in the most comprehensive, periodic global measurements of the burden of disease, organized by the Institute for Health Metrics and Evaluation at the University of Washington. Among the many insights produced by these studies is the high burden imposed by mental and emotional illness, far beyond the number of attributable deaths.[8] In the case of COVID-19, prolonged disruption, grief, and stress add markedly to the burden of disease. In their Viewpoint in this issue of *JAMA*, Simon and colleagues[9] outline a set of individual and community interventions to respond to risk of mental disorder, protect emotional well-being, and restore mental health. It is difficult to apprehend the lasting emotional and psychological effects of the greatest number of excess deaths to occur within a single year in the US since World War II.

A tiny virus reverberates through the whole of society, and a pandemic such as COVID-19 disrupts lives; health and well-being; and schools, workplaces, travel, restaurants, conferences, exhibitions, musical events, and sporting contests. The economic losses are enormous, yet calculable, as clearly described in the Viewpoint by Cutler and Summers.[10] According to the authors, the economic cost of COVID-19 thus far exceeds an estimated $16 trillion, nearly an entire year of the nation's economic output. An estimated 47% of this total is due to lost gross domestic product and the remaining 53% to health loss. Notably reinforcing the message conveyed by Simon et al,[9] the estimates by Cutler and Summers[10] suggest that more than 18% of the health loss is due to mental health impairment.

Every day, new tallies of cases, hospitalizations, and deaths from COVID-19 are reported by universities and the media. When a specific number of deaths appears, count on 2 factors: first, the precise number reported is likely incorrect and second, in the coming months, the true number of cases, hospitalizations, and deaths will continue to increase. Like the stopped clock that is exactly right twice each day, the specific number reported on a given day may have been or will be exactly correct at some point in time. A general indication of the death toll from COVID-19 and the excess deaths related to the pandemic, as presented by Woolf et al,[4] are sufficiently mortifying and motivating. When a pandemic reaches the health, social, and economic scale of COVID-19, regardless of the precise number of deaths that have occurred by a certain date, an intense, persistent, multipronged, and coherent response must be the order of the day and an urgent priority for the nation.

ARTICLE INFORMATION

Author Affiliation: Gordon and Betty Moore Foundation, Palo Alto, California.

Corresponding Author: Harvey V. Fineberg, MD, PhD, Gordon and Betty Moore Foundation, 1661 Page Mill Rd, Palo Alto, CA 94304 (harvey.fineberg@moore.org).

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