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Estimates of mortality following COVID-19 Infection; comparison between Europe and the United States

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Abstract

While there have been so many speculations on calculating a more accurate estimate of COVID-19 mortality since the start of this pandemic, the complexity of the issue along with differences in reporting and testing systems has prevented accurate COVID-19 mortality calculations. Some non-controlled variables affect any mortality calculation which makes real estimation of the COVID-19 mortality extremely challenging and even impossible. Here we would like to re-calculate and compare the estimated COVID-19 mortality in Europe and the United States based on the currently available reported data.

Although different countries across the world have been battling with coronavirus disease 2019 (COVID-19) during the last two months and its outbreak has been declared as a "pandemic state" since March 11th 2020 by the World Health Organization (WHO), there are still so much unknown about this global health emergency including its attributed mortality rate (1). COVID-19 has started its exponential phase in Europe and the United States only during the last month, and has claimed more than 92 000 lives in Europe and 35 000 lives across the United States (2). During this short period of time, COVID-19 outbreak has taken more lives across the world than any other acute infections in a single outbreak for more than 100 years (around 150 000 deaths), and the worst of this catastrophic event is yet to come.

There have been so many speculations on calculating a more accurate estimate of COVID-19 mortality since the start of this epidemic. With the spread of COVID-19 out from China, more supervised and transparent access to the COVID-19 epidemiologic data became available which made the calculations of the COVID-19 related epidemiologic data more accurate. Here we would like to re-calculate and compare the estimated COVID-19 mortality in Europe and the US based on the currently available reported data.

If we simply calculate the COVID-19 attributed mortality solely in the symptomatic and positively tested and reported cases based on the 700,000 closed cases across the world reported by the governmental agencies and health-care authorities (cases where the final outcome of the COVID1-19 symptomatic patient is finalized and categorized as either recovered/discharged or death), the estimated COVID-19 mortality come to figures as high as 21% (2). While this method of calculation is inaccurate and associated with an overestimation of the true COVID-19 mortality in the symptomatic cases, as Baud et al (3) correctly pointed out the reported figures based on the number of deaths relative to the number of confirmed cases of infection at a given time and place are also an underestimation of the true mortality. As we are currently in the exponential phase of the COVID-19 pandemic, especially when estimating the COVID-19 attributed mortality, we support the Baud innovative suggestion to re-estimate mortality rate by dividing the total number of deaths on a given time by the number of confirmed symptomatic patients at an earlier time (calculating the data using average reported time lag from onset of pneumonia to death around 13 days) (3-5). The lag time used by Baud et al in their mortality estimation is truly a lag time elapsed between performing diagnostic tests, not the start

of symptoms, and time of death. This estimated lag time is the best estimate available which depends on many variables including availability of tests, reporting delays, accuracy of tests, local health policy and clinical criteria used in making the diagnosis or submitting the tests in the patients. These criticisms are valid for almost all of the mortality estimations based on a lag-time (time from onset of pneumonia to death) especially during the exponential phase of the infections as well as any estimation of true COVID-19 mortality rates. Based on assumption of normal distribution of time from illness to death, Wilson et al (5) and Kim et al (6) supported the lag time concept but suggested including half of the additional cumulative deaths in the numerator plus prior date cumulative death (lag time of 13 days as an average time from illness to death) when calculating COVID-19 crude fatality risk.

We understand that some non-controlled variables affect any mortality calculation which makes real estimation of the COVID-19 mortality extremely challenging and even impossible. These variables include but are not limited to following items; differences in societies in medical advice-seeking habits, local screening strategies used in different countries even for symptomatic patients (at the peak of the epidemic in some countries with lack the resources, the healthcare authorities may choose not to test the symptomatic individuals and less critical cases), and diversity of diagnostic tests used [RT-PCR (nasal swab versus pharyngeal swab)] and chest-CT, blood test (ELISA).

By using the number of cumulative cases on March 25 as the denominator for the adjusted case-fatality risk (aCFR), we assumed that half of the additional cumulative reported deaths on April 7 could be matched with cases reported on March 25. The case-fatality risks, when adjusted for a 13-day lag time from reporting to death, were 10.12% in the US, and 14.57% in the Europe (Table 1). We have to re-emphasize the fact that precise calculation of the morality rate of the COVID-19 is not possible until the current outbreak gets to a steady state in terms of the case distribution and the exponential phase of the disease would be over.

While underestimating the crude mortality rates is associated with the risks of the health-care authorities not be adequately prepared and the public not taking the threat seriously; an overestimation of the risk might lead to unnecessary additional concern or panic in the society (6). We agree with Lipitch et al, that many biases in both directions especially during the outbreak afflicts any mortality rate estimate, and we do not think our calculated COVID-19 mortality estimate is any way immune from those pitfalls. However, we genuinely believe that our estimates could represent a more accurate estimate of the mortality in Europe and the US than the calculated figures currently available (7). As Sun Tzu et al, has famously quoted in the "Art of War"; "*If you know the enemy and know yourself, you need not fear the result of a hundred battles*", we have to know the COVID-19 and the dimensions of its threat more accurately. We also should become more familiar with our health-care strength to be able to adjust our policies and tackle this catastrophic pandemic in the future.

Authors' contribution

AH and HM contributed to conception and design, literature search, writing and editing the manuscript. HM performed the mortality calculations and prepared the table.

Conflicts of interest

The authors declare no conflict of interest regarding the publication of this article.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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Table 1. Crude and adjusted estimates of case-fatality risk for COVID-19 in the United States and Europe

Location	Cumulative deaths[a]	Cumulative confirmed cases[a]	Crude CFR, %	Adjusted deaths[b]	Adjusted cumulative confirmed cases[b]	Adjusted CFR, % (95% CI)[c]
United States	403521	12868	3.19	6948	68673	10.12(9.89-10.35)
Europe[d]	702127	57144	8.14	35647	244659	14.57(14.43-14.71)

*Calculated by using data on laboratory-confirmed 2019 novel coronavirus disease (COVID-19) cases reported by the Worldometer on April 7, 2020; COVID-19, 2019 novel coronavirus disease; CFR, case-fatality risk. [a] Calculated by using cumulative confirmed cases as of March 25, 2020; [b] Calculated using OpenEpi v3 (http://www.openepi.com) by using the Score (Wilson) method; [c] Includes all western and eastern European countries except Russia, 44 countries in total.