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COVID-19 virus case fatality rate: how to avoid errors in calculation of data during the outbreak?

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Dear Sir,

Currently, it is appealing to assess the case fatality rate (CFR) by dividing the number of known deaths by the number of confirmed cases. In the case of COVID 19, the total deaths/total confirmed cases at 25-3-2020 gives a CFR = 18433/413467 = 4.45%. If we calculate for countries that reported > 500 positive cases the CFR will drop to 18230/401100 = 2.14 %. The resulting number, however, does not represent the true CFR and might be off by orders of magnitude. A precise estimate of the case fatality rate is therefore impossible at present using this method (1-3).

The case fatality rate represents the proportion of cases that eventually die from a disease. Once an epidemic has ended, it is calculated with the formula: deaths / cases. But while an epidemic is still ongoing, as it is the case with the current novel COVID19 outbreak, this formula can be "misleading if, at the time of analysis, the outcome is unknown for a non-negligible proportion of patients (3).

In other words, current deaths belong to a total case figure of the past, not to the current case figure in which the outcome (recovery or death) of a proportion (the most recent cases) hasn't yet been determined. The correct formula, therefore, would appear to be: CFR = deaths at day.x / cases at day.x-{T} (where T = average time period from case confirmation to death). (https://www.worldometers.info/coronavirus/coronavirus-death-rate/).

This would constitute a fair attempt to use values for cases and deaths belonging to the same group of patients. For example, the World Health Organization (WHO) data at the end of March 25, 2020 record were reported: 18,230 deaths (cumulative total) and 401,100 cases (cumulative total) worldwide. If we use the formula (deaths /cases) we get: 2.14% CFR (flawed formula). With a conservative estimate of T = 7-9 days, as the average period from case confirmation to death, we would correct the above formula by using March 16, 2020 (4) cumulative cases, which were 166,799, in the denominator: March 25 deaths /March 16 cases = 18,230 / 166,799 = 10.9 % CFR (correct formula and estimating T=9) . Again on the 8th of April 2020, the confirmed deaths globally = 72774, and confirmed cases 9 days back = 693224. This gives CFR of 10.49% (5). Figure 1 represents COVID-19 CFR in different countries calculated on the 8th of April, using the same formula (3).

Wang et al. (5) found that the median time from first symptom to dyspnea was 5.0 days, to hospital ad-

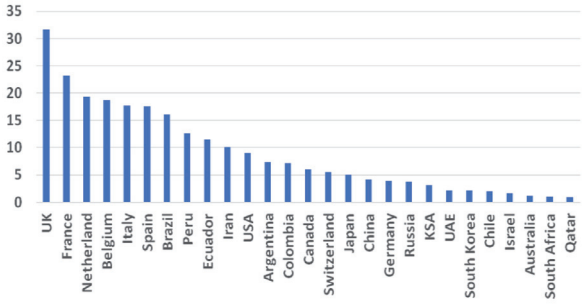

Figure 1. COVID 19 - CFR calculated according to Ghani AC et al. equation (Adapted from ref. 3)

mission was 7.0 days, and to ARDS was 8.0 days. This suggests that T is approximately 9 days. It must be mentioned that unreported cases would have the effect of decreasing the denominator and inflating the CFR above its real value. Public health experts suggest that there were far more cases affected by the virus even though there were only few confirmed cases at a time (6).

An alternative method, which has the advantage of not having to estimate a variable, and that is cited previously as a simple method that, nevertheless, could work reasonably well if the hazards of death and recovery at any time T measured from admission to the hospital, conditional on an event occurring at time T, are proportional, would be to use the formula: CFR = deaths /(deaths + recovered). Using the WHO data on 29 March 2020, to calculate gives: 33174 / (33174 + 141916) = 18.94% CFR (worldwide). On the 8th of April 2020, the total deaths with COVID19 = 82136, and the total cured cases = 302351. This gives CFR = 21.36 % (Worldmeters.info). In Qatar, with extensive screening facilities the number of deaths = 6 and the total cured = 150. This gives CFR = 3.85%.

It is expected that with time, the ability to detect and confirm cases improves with more samples processed that will improve our statistical data to calculate CFR. Therefore, the possibility of a significant number of unreported cases in the initial stages of the crisis should be taken into account when trying to calculate the CFR.

In addition, it must be declared that while the 2003 SARS epidemic was still ongoing, the WHO reported a fatality rate of 4% (or as low as 3%), whereas the final case fatality rate ended up being 9.6%.

In summary, using more accurate statistical methods during this COVID -19 virus pandemic suggests a CFR between 10.5% and 20% which appears much higher than those predicted by the flawed method of dividing the number of known deaths by the number of confirmed cases.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

References

1. Battegay M, Kuehl R, Tschudin-Sutter S, Hirsch HH, Widmer A F, Neher R A. 2019-Novel Coronavirus (2019-nCoV): estimating the case fatality rate – a word of caution. Swiss Med Wkly. 2020;150:w20203.
2. WHO-Coronavirus disease 2019 (COVID-19) Situation Report – 65.
3. Ghani AC, Donnelly CA, Cox DR, Griffin JT, Fraser C, Lam TH, Ho LM, Chan WS, Anderson RM, Hedley AJ, Leung GM. Methods for estimating the case fatality ratio for a novel, emerging infectious disease. Am J Epidemiol. 2005;162:479-486.
4. WHO-Coronavirus disease 2019 (COVID-19) Situation Report – 56.
5. Xinhua Net .Virus-hit Wuhan speeds up diagnosis, treatment of patients. February 2, 2020. www.xinhuanet.com.
6. https://www.theguardian.com/science/2020/jan/26/coronavirus-could-infect-100000-globally-experts-warn.

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