

## Coronavirus Pandemic

# Estimating case fatality ratio during COVID-19 epidemics: Pitfalls and alternatives

Francesco Chirico<sup>1,2</sup>, Gabriella Nucera<sup>3</sup>, Nicola Magnavita<sup>1,4</sup>

<sup>1</sup> Post-Graduate School of Occupational Health, Università Cattolica del Sacro Cuore, Rome, Italy

<sup>2</sup> Health Service Department, State Police, Ministry of Interior, Milan Italy,

<sup>3</sup> Faculty of Nursing, University of Milan, Italy. ASST Fatebenefratelli and Sacco. FatebeneFratelli Hospital, Milan, Italy

<sup>4</sup> Department of Woman/Child and Public Health, Fondazione Policlinico "A. Gemelli" IRCCS, Rome, Italy

**Key words:** Case fatality ratio; COVID-19; SARS-CoV2.

*J Infect Dev Ctries* 2020; 14(5):438-439. doi:10.3855/jidc.12787

(Received 10 April 2020 – Accepted 18 May 2020)

Copyright © 2020 Chirico *et al.* This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

We read with great interest the paper by Porcheddu *et al.* [1], who showed the similarity (2.3%) in Case Fatality Ratio (CFR) of COVID-19 in Italy and China. However, we believe that both the calculation and comparison of the two mentioned CFRs are deeply biased. Indeed, the formula used by authors for calculating the CFR, i.e. the total number of known deaths divided by the total number of confirmed cases, expressed as a percent, is reliable once an epidemic has ended, but it does not represent the true case fatality rate while the epidemic is still ongoing [2]. Moreover, authors compared data drawn by two time intervals with different lengths, i.e. 21-28 February in Italy (8 days), and 19 January-11 February in China (24 days). We agree with Battegay *et al.* [3], that a precise estimate of the case fatality rate is impossible at present, and, for this reason, we should be cautious when research findings and strategies are taken on the basis of these estimates. To date, there is lack of coordination and resources for an integrated and homogeneous epidemiological surveillance worldwide, which does not allow comparisons to be made between countries. The degree of underreporting COVID-19 cases varies over time as well as between countries. Thus, the CFR may be overestimated, when mild or asymptomatic cases are unrecognized, or may be underestimated, when unclear deaths are not attributed to the SARS-CoV-2 [3]. In confirmation of this, while the 2003 SARS epidemic was still going, the World Health Organization (WHO) reported a CFR of 4%, that became equal to 9.6% at the end of the epidemics.

However, as suggested by Worldometer [2], a reference website that provides real-time world statistics, at the present time, the well-known formula proposed by Ghani *et al.* [4] for calculating the CFR of the 2003 SARS epidemics could be applicable to the current SARS-CoV 2 epidemics as well, as it is needed to divide cases and deaths belonging to the same group of patients. In other words, it would be more accurate to calculate the ratio between the deaths at time T1 (e.g. day 15) and confirmed cases at time T0 (e.g. day 9), where T0 precedes T1 (e.g. 6 days) and depends on the incubation period ("the time between exposure to the virus and the onset of symptoms") of the infection, i.e. that for SARS-CoV2 is ranged from 2 to 7 days, with a mean incubation period of 6.4 days. [5]. Therefore, the formula modified would be as follows:

$$\text{CFR} = \text{deaths at } T_1 / (\text{cases at } T_0 - T)$$

Where T is the average time period from case confirmation to death.

An alternative and simple method proposed by Ghani *et al.* [4] would follow the formula: CFR = deaths / (deaths + recovered).

In any case, whatever the calculation and the formula used, if we want to compare CFR between countries, the most important requirement is the effectiveness and homogeneity of the surveillance systems.

**References**

1. Porcheddu R, Serra C, Kelvin D, Kelvin N, Rubino S (2020) Similarity in Case Fatality Rates (CFR) of COVID-19/SARS-COV-2 in Italy and China. *J Infect Dev Ctries* 14: 125-128. doi:10.3855/jidc.12600.
2. Worldometer (2020) Coronavirus (COVID-19) Mortality Rate. Available: <https://www.worldometers.info/coronavirus/coronavirus-death-rate/>. Accessed: 09 April 2020.
3. Battegay M, Kuehl R, Tschudin-Sutter S, Hirsch HH, Widmer AF, Neher RA (2020) 2019-Novels Coronavirus (2019-nCoV): estimating the case fatality rate – a word of caution. *Swiss Med Wkly* 150: w20203
4. Ghani AC, Donnelly CA, Cox DR, Griffin JT, Fraser C, Lam TH, Ho LM, Chan WS, Anderson RM, Hedley AJ, Leung GM (2005) Methods for estimating the case fatality ratio for a novel, emerging infectious disease. *Am J Epidemiol* 162: 479-486.
5. Backer JA, Klinkenberg D, Wallinga J (2020) Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20-28 January 2020. *Euro Surveill* 25: 2000062.

**Corresponding author**

Professor Francesco Chirico, MD, Contract Professor of Occupational Epidemiology, Post-Graduate Specialization of Occupational Health, Università Cattolica del Sacro Cuore, Rome Health Service Department, State Police, Ministry of Interior, Italy,  
Via Umberto Cagni, 21 20162 Milan, Italy  
Tel: -39334.6904194  
Email: medlavchirico@gmail.com

**Conflict of interests:** No conflict of interests is declared.