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Resorting to mathematical modelling approach to contain the coronavirus disease 2019 (COVID−19) outbreak

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The coronavirus disease-2019 (COVID-19) outbreak continues to expand both in terms of its geographical distribution and in terms of the caseload across the world[1]. In fact, the estimates released suggest that till 19 March 2020, a total of 209 839 cases of the disease were reported, of which the Western Pacific and the Eastern Mediterranean region accounts for 85.5% of the overall cases. The global case-fatality ratio is 4.18% and it is rapidly rising in various regions of the world[1]. The outbreak started in the form of a cluster of pneumonia cases in China has promptly spread to more than 150 other nations and became a major cause of public health concern as we have fallen short of our efforts to contain the spread of the novel infection[1].

It is a fact that in order to have a better and an effective public health response against the disease, the basic input is the information pertaining to the epidemiological attributes, insights into the dynamics of the disease transmission, understanding about the spectrum & the severity of the disease, and impact of the prevention & control measures on the incidence and case fatality ratio[2,3]. However, for a better understanding and better anticipation of the future estimates, apart from the usual descriptive analysis of the available clinical & epidemiological data, we have to resort to mathematical modelling as their application will give us improved insights about disease transmission and severity indices[2,3].

In addition, efforts have been taken to apply these mathematical equations to obtain a precise estimate about the incubation period, case fatality ratio, infection fatality ratio and the serial interval[3]. However, for calculating all these indices, we have to provide the case-based data obtained from the surveillance activities and studies focused on understanding the transmission of the cases either in the hospital or household settings[2,3]. In reality, these mathematical models have estimated the incubation period, median incubation period and serial interval to be 14 d, 5-6 d, and 8.2 d respectively[3]. Moreover, the infection fatality ratio has been found to vary between 0.3%-1.0%, which is quite a useful estimate from the perspective of public health authorities[3].

Even though the case fatality ratio is variable inside and outside China at present, the real status is still unknown, and it might change in the days to come. Further more, the current surveillance estimates cannot be considered conclusive, as the potential of missing cases outside China cannot be ruled out due to the lacunae in the surveillance activities[4]. This modeling approach is an effective tool to estimate the missed cases, mild cases, and deaths that happened within a brief span since the onset of disease[3]. At the same time, the modeling approach inferred that by mere imposition of a travel ban in the Wuhan city to minimize the transmission rates of the disease would not give encouraging results, unless it is supplemented with early case isolation, social restriction and behavioral modifications[3].

In conclusion, in the absence of findings from the population-based studies, it has not been possible to get an estimate of the proportion of infected people in the general population until now. Mathematical modeling appears to be an effective tool to bridge the existing gap nevertheless, to enhance its utility we have to improvise the data which is being fed into these models and essentially include information obtained from health workers, predisposing risk factors, travelers and households.

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The authors report no conflict of interest.

Authors' contribution

S.R.S. contributed in the conception or design of the work, drafting of the work, approval of the final version of the manuscript, and agreed for all aspects of the work; P.S.S. contributed in the literature review, revision of the manuscript for important intellectual content, approval of the final version of the manuscript, and agreed for all aspects of the work.

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