Review Article

Indian scenario and an institutional experience of fatalities in COVID-19: a narrative review

Naresh P. Singh[1]*, Amit Singh[2], Raj Kumar[3], Ramakant Yadav[4], Anamika Singh[5], Nilima D. Takhelchangbam[1]

[1]Department of Community Medicine, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India
[2]Department of Cardio-vascular and Thoracic Surgery, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India
[3]Department of Neurosurgery, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India
[4]Department of Neurology, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India
[5]Department of Physiology, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India

*Correspondence:
Dr. Naresh P. Singh,
E-mail: nareshpalsingh@gmail.com

ABSTRACT

The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is an ongoing global pandemic that has devastated our globalized economic system. Apart from infecting 12,102,328 human beings and taking a toll of over 551,046 lives globally by the 11th of July 2020, it has fundamentally affected the way we live, work, travel, and relate to each other. Despite imposing early preventive measures, India has crossed a total caseload of 820,916 with a total death of 22,123 till-date, ranking third in the descending list of worst-affected nations. Although comparatively lower, the case fatality rate in India is 2.72% against the global fatality of 4.53%. It is an empirical fact that every process and institution must evolve to meet the needs of its time. A model for categorization of fatality among real-time reverse transcriptase-polymerase chain reaction (RT-PCR) positive COVID-19 patients has been developed at Uttar Pradesh University of Medical Sciences (UPUMS), to address the issue of patients being transferred very late in the course of the disease to level-3 facilities. The UPUMS model of categorization of fatalities of COVID-19 patients at level-3 center comprises of category-1 as 'Institutional COVID-19 fatalities', category-2 as 'Imported COVID-19 fatalities' and category-3 being 'Imminent with Incidental COVID-19' fatalities. This endeavor of categorizing COVID-19 fatalities is an opportunity to analyze facts and contemporary science to assess our response to this pandemic and thereby take lessons to prepare better for the future. Following proper analysis, we noted that most of these fatalities (64%) at the higher center are because of delayed referrals hence termed as imported fatalities, which need a modality of early attention and referral. However, there are fatalities which occur because of severe systemic illness like liver failure, cardiovascular accident (CVA), myocardial infarction (MI), etc. They need due treatment at a regional center. These constitute up to 18%. Authors found that actual COVID-19 deaths constitute only 18% of the total projected fatalities.

Keywords: COVID-19, Imminent fatality, Imported fatality, Institutional fatality

INTRODUCTION

The cluster of cases of pneumonia caused by a novel coronavirus in the seafood market in Wuhan, Hubei Province of China in mid-December 2019, has now spread to 231 countries and territories and has disrupted lives in all its economic, social and medical aspects.[1] The culprit virus named severe acute respiratory syndrome

coronavirus 2 (SARS-COV-2) and the resulting disease, coronavirus disease 2019 (COVID-19), was subsequently declared a Public Health Emergency of International Concern (PHEIC) on 30th of January 2020 and finally a pandemic on the 11th of March 2020 by the World Health Organization (WHO).[2-4] Current available evidence, including the extensive genome sequencings, suggests that the SAR-COV-2 virus is an enveloped ribonucleic acid (RNA) coronavirus related to severe acute respiratory syndrome (SARS) and believed to have a zoonotic origin.[5]

The bionomics of the disease

With the basic reproduction number $R_o>1$, SARS-COV-2 is highly transmissible.[6] It gets transmitted from an infected person to another through close contact, predominantly respiratory droplets generated while coughing, sneezing, or talking and via fomites. The incubation period ranges from 2-14 days with a median of 5.1 days. Although the role of asymptomatic cases in the transmission is not yet clear, it is postulated that the infectivity of symptomatic cases starts two days before the onset of symptoms and may last up to 8 days.[7]

Clinical aspects of the disease

The SARS-CoV-2 infection has a wide range of clinical manifestations ranging from asymptomatic infection and mild upper respiratory tract illness to severe viral pneumonia that may culminate in failure of the respiratory system and sometimes death.[8] The disease predominantly affects the respiratory system, with the majority presenting with cough, fever, and fatigue. Other symptoms include shortness of breath, expectoration, myalgia, rhinorrhea, sore throat, diarrhea, and anosmia. However, only a small proportion of cases progress to severe diseases like acute respiratory distress syndrome (ARDS), multiple organ dysfunction syndrome (MODS), disseminated intravascular coagulation (DIC), septic shock, to name a few.[9] The integrated health information platform (IHIP)/ integrated disease surveillance programme (IDSP) of India reported the details of the presence of signs and symptom for COVID-19 (n=15,366) as fever (27%), cough (21%), sore throat (10%), breathlessness (8%), weakness (7%) and others (27%).[9] Similar findings were reported by a researcher from rural setting in India.[10] Severity is seen to increase with increasing age and in people with underlying co-morbidities such as diabetes, hypertension, cerebro-vascular disease, cardiac disease, chronic lung disease, disorders with immune-suppression, chronic kidney disease, and cancer.[11]

Real-time reverse transcriptase-polymerase chain reaction (RT-PCR) tests is performed for the qualitative detection of nucleic acid from upper and lower respiratory tract specimens (i.e. nasal, lower respiratory tract aspirates, sputum, nasopharyngeal or oropharyngeal swabs, nasal aspirate) of infected person.[12] Performing RT-PCR testing for COVID-19 will most probably remain main detection method, however it is expensive, complicated, and time-consuming for countless patients with a lack of time and also other methods are required to detect infected patients. It may be noted that the detection of lung involvement by chest X-ray may predict a potentially life-threatening outcome in patients with COVID-19.[13] Imaging features of the X-ray image of coronavirus affected persons vary as these depend on the stage of infection. The spectrum of radiological findings varies from normal (18%) to 'whiteout lung'. The usual abnormality seen is bilateral peripheral subpleural ground-glass opacities (GGO) and consolidations. There may be a rapid progression in the extent of the lesion within 24 to 48 hours to multipolar or total lung involvement in severe disease resulting in mortality.[14] Apart from these microbiological and radiological parameters, there are other biochemical, hematological changes in COVID-19 patients that need to be evaluated during the course of treatment for effective management of cases.
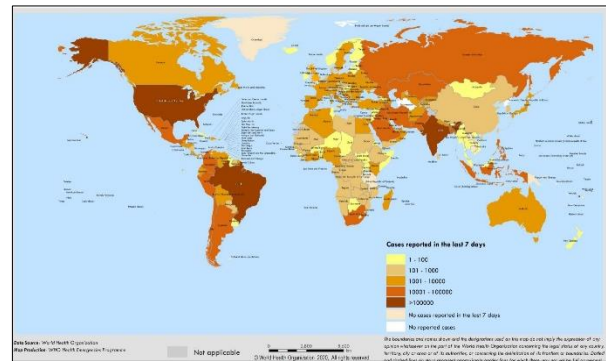

Source: World health organization (COVID-19 situation report-172).[15]

Figure 1: Number of confirmed COVID-19 cases reported in the last seven days by country, territory or area, 4th July to 10th July, 2020.

Fatalities in COVID-19

After creating havoc worldwide for the last almost six months, the disease has resulted in a total case tally of 12,102,328 and total death of 551,046 as of the 11th of July 2020, globally.[15] The top ten affected nations of the world are USA, Brazil, India, Russia, Peru, Chile, Spain, United Kingdom, Mexico and Iran.[15] An interesting observation which everyone has noticed is that although the state of affairs started with a burst of cases from the Republic of China, gradually the European group of nations were gripped by this pandemic and later on the United States of America becoming the top most hotspot. Many of these nations had a robust health care delivery system, but this outbreak devastated the whole network thereby leaving everyone in despair. Figure 1 shows the number of confirmed COVID-19 cases reported in the last seven days by country, territory, or area, i.e., 4th July to 10th July, 2020.[15]
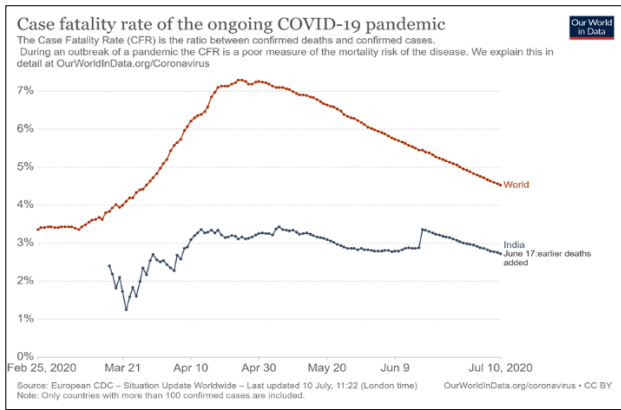
Source:https://ourworldindata.org/search?q=case+fatality+rate[19]

**Figure 2: World versus India: case fatality rate.**
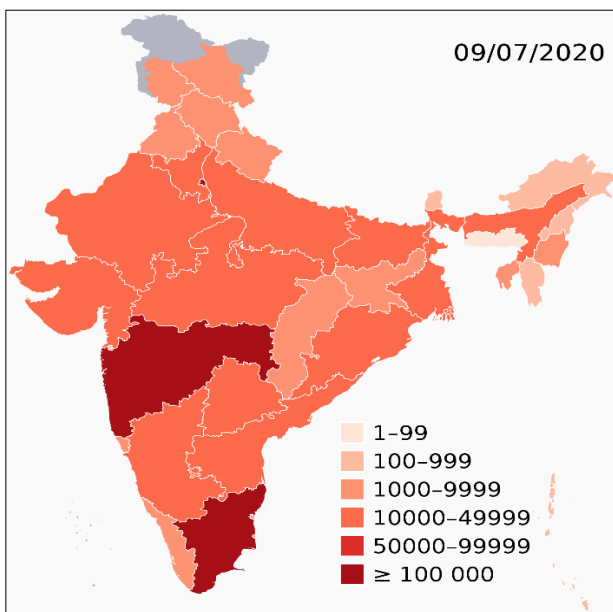
(Source of data: MoHFW).[18]

Figure 3: Indian state-wise confirmed case.

The first case in India was identified on the 30th of January 2020 in Thrissur, Kerala, which one can say, was imported from China as the concerned student returned from Wuhan.[16] India being a developing nation with a comparatively less developed health care delivery system, did try to break the chain of transmission in the initial phase itself by various initiatives like "Janta Curfew" and various phases of lockdown.[17] Despite imposing early preventive measures, India has crossed a total caseload of 820,916 with a total death of 22,123 till 11th of July 2020, ranking third in the descending list of worst-affected nations. As on the same date, the state of Uttar Pradesh, as reported by the Ministry of Health and Family Welfare, has a total case of 33,700 and a total death of 889.[18]

The case fatality rate worldwide is 4.53%. In India, comparatively lower, the case fatality rate of 2.72% has been reported (Figure 2).[19] Similarly, after reviewing case

reports of the states of Maharashtra, Delhi (these two regions having reported highest number of cases till date) and Uttar Pradesh, the case fatality rates stand at 4.6%, 3.2% and 3.0% respectively (Figure 3 and 4).[18]
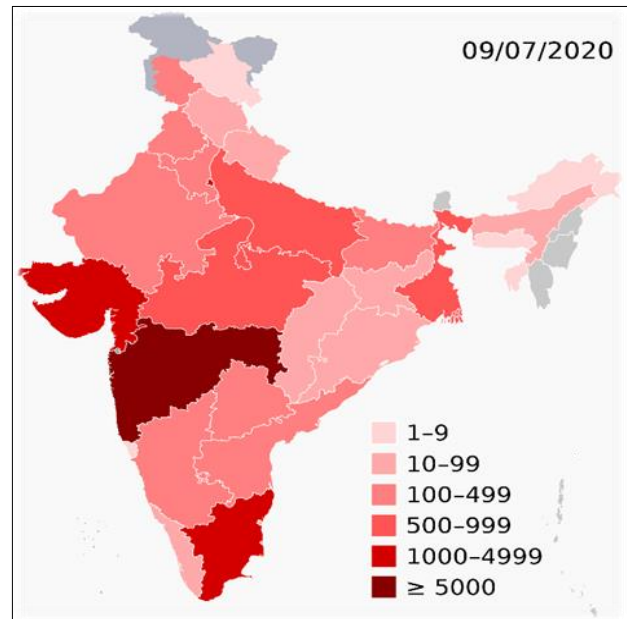
(Source of data: MoHFW).[18]

Figure 4: Indian state-wise death.

DISCUSSION

Authors observed that many patients in dire need of expert management at dedicated tertiary care centers were being referred very late in the disease process, causing an increase in the death toll. Similarly, the fatalities due to pre-existing severe systemic diseases, incidentally found to be COVID-19 positive on screening, were also included in COVID-19 deaths, increasing the panic amongst common population. Hence, we introduced a scientific and factual way of dividing these fatalities into three categories.

Categorization of fatalities of COVID-19 patients at level-3 centre: UPUMS model

1. Category-1: Institutional COVID-19 fatality

- COVID-19 positive patients presenting with ARDS/ Septic Shock/ DIC/ MODS or with classical findings of COVID-19 on Chest X-ray who die during treatment at tertiary care center.

2. Category-2: Imported COVID-19 fatality

- Death of COVID-19 positive patients, presenting with ARDS/septic shock/DIC/MODS or with classical findings of COVID-19 on chest X-ray, and who were referred from other hospitals with the following criteria:

a. Death occurring within 48 hours following admission at higher center.
b. Oxygen saturation < 80% at the time of admission and admitted directly in Intensive Care Unit (ICU).
c. Prognosticated as grave prognosis at the time of admission, based on severity scoring system in critically ill patient.

3. Category-3: Imminent fatality (incidentally found COVID-19 positive on screening)

- Patient presenting with hepatic/ renal/ cardiac failure/ stroke due to pre-existing severe systemic illness and COVID-19 positive on screening.
- Terminally ill patients (e.g. Advanced cancer and heart disease) and COVID-19 positive on screening.
- Trauma patients succumbing to grave injuries and found COVID-19 positive on screening.
- Suicidal deaths due to poisoning/hanging and COVID-19 positive on screening.
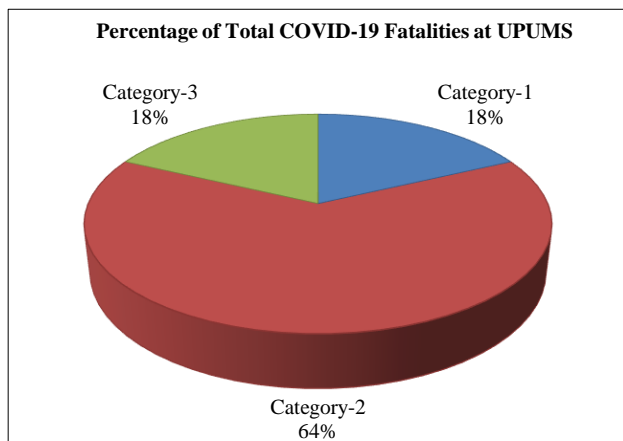

Figure 5: Categorization of the COVID-19 fatalities (Percentage of total).

A model for categorization of fatality among RT-PCR positive COVID-19 patients has been developed by the authors at the Uttar Pradesh University of Medical Sciences, Saifai, to address the issue of patients being transferred very late in the course of the disease to level-3 facilities, which increases morbidity and mortality. Such is the fear of this pandemic, that even unstable and dyspnoeic patients are being shifted to higher centers, without proper supplemental oxygen availability in transit. Authors have observed such patients, gasping for breath, arriving at triage and being shifted directly to the COVID-19 ICU, peripheral oxygen saturation (SpO_2) on admission being <80% and being intubated immediately, and succumbing to ARDS despite vigorous management. These patients have been categorized as "Imported" fatalities. Many of these patients, with co-morbidities, had been managed with supplemental O_2 at level-1 and level-2 centers, and transferred to our center after a precipitous fall in SpO_2. Many such cases of full blown

ARDS, MODS, septic shock or DIC eventually succumb to the irreversible pathological cascade within 24-48 hours despite all management protocols. A total of 236 COVID-19 patients were admitted and treated at our University, which is a 'level three-plus' COVID care center with dedicated intensive care unit (ICU) equipped with ventilators. Out of the total number of fatalities that occurred, 64% were such "Imported" COVID-19 fatalities (Figure 5). The time duration between admission and death denotes the effectiveness and adequacy of patient transfer protocols in the face of a fulminant disease process which in turn can influence the existing management protocols (Figure 6).
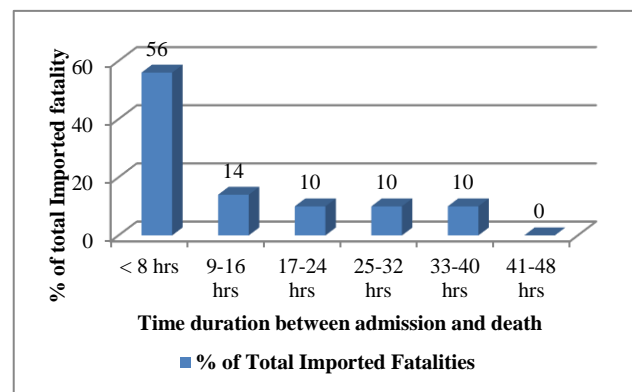

Figure 6: Time duration between admission and death of 'imported' COVID-19 fatalities (% of total 'imported' COVID-19 fatalities).

Another important subset of perceived COVID-19 fatality is "Imminent" fatalities due to chronic systemic diseases causing organ failure, terminal malignancies, traumatic injuries or suicidal deaths. These are misinterpreted statistically as COVID-19 fatality despite the fact that they are incidentally found positive for COVID-19 with no contribution at all to the disease process leading to mortality. In authors experience, 18% of the total fatalities caused were such "Imminent with incidental" COVID-19 fatalities. They cannot be labelled as COVID-19 death just because they were found to be positive for SARS-CoV-2 on screening for the treatment of their presenting diseases. The true 'Institutional' COVID-19 fatality, comprising of patients who were managed electively in the isolation ward, and shifted and managed in the ICU as per guidelines and protocol, were 18% of the total fatalities (Figure 5).

Learning from the model we have proposed, it is pertinent that all such patients who are COVID-19 positive and have medical co-morbidities are monitored on hourly basis and shifted to nearest level-3 centers way in advance in a well-equipped ambulance, before they become critical. This will certainly avoid urgent intubation with complications of its own, and allow for proper compliance with the institutional management protocols. Hence, it can be noted that only remaining deaths of about 18% only can be labelled as fatalities of

higher center where they die despite all positive and proactive efforts availed for saving them.

CONCLUSION

The rapid progression of the severity of COVID-19 leading to critical illness and subsequent death demands an urgent requirement of a system which categorizes the fatality with an acceptable level of accuracy, to determine the actual case fatality due to SARS-CoV-2 infection. Analyzing and classifying the deaths appropriately, as suggested in our model, will give a clear picture of mortality primarily due to COVID-19, help formulating effective guidelines for timely transfer of the subset of patients at higher risk to level-3 health centres for better management with resultant decrease in morbidity and mortality. As evident that 64% of total fatalities occurred due to unduly delayed referrals and 18% of total fatalities occurred due to other systemic diseases. Only 18% of the total fatalities were institutional deaths of COVID-19 cases despite optimum treatment instituted as per protocol.

REFERENCES

1. Hui DS, Azhar EI, Madani TA, Ntoumi F, Kock R, Dar O, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health: the latest 2019 novel coronavirus outbreak in Wuhan, China. Int J Infect Dis. 2020;264:66.
2. Wu F, Zhao S, Yu B, Chen YM, Wang W, Song ZG, et al. A new coronavirus associated with human respiratory disease in China. Nature. 2020;12:579.
3. Ghebreyesus AT. WHO Director-General's opening remarks at the media briefing on COVID-19. In World Health Organization. Available at: https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov). March 2020:4.
4. Ghebreyesus, AT. WHO Director-General's opening remarks at the media briefing on COVID-19. In World Health Organization. Available at: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---29-june-2020. March 2020:4.
5. Andersen KG, Rambaut A, Lipkin WI, Holmes EC, Garry RF. The proximal origin of SARS-CoV-2. Nature Med. 2020:1-3.
6. Liu Y, Gayle AA, Wilder-Smith A, Rocklöv J. The reproductive number of COVID-19 is higher compared to SARS coronavirus. J Travel Med. 2020;27(2):21.
7. CDC. Available at: https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html?CDC_AA_refVal. Accessed on 20th April 2020.
8. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020;395(10229):1054-62.
9. Welfare F. Clinical management protocol: COVID-19. Government of India Ministry of Health and Family Welfare, Directorate General of Health Services (EMR Division), Version 3; 2020.
10. Kumar R, Yadav R, Rawat R, Bajpai PK, Sharma IK, Kumar S, et al. A novel ayurvedic preparation in RT-PCR positive COVID-19 cases: an Interventional study. Int J Med Sci Current Res. 2020;3(3):430-40.
11. Singh NP, Kumar R, Singh AS, Takhelchangbam ND, Chauhan M. COVID-19 Outbreak: Reviewing Various Factors Affecting its Fate. Int J Med Sci Curr Res. 2020;3(3):184-93.
12. Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N, et al. Chest CT findings in coronavirus disease-19 (COVID-19): relationship to duration of infection. Radiol. 2020:200463.
13. Rodrigues JC, Hare SS, Edey A, Devaraj A, Jacob J, Johnstone A, McStay R, Nair A, Robinson G. An update on COVID-19 for the radiologist-A british society of thoracic imaging statement. Clin Radiol. 2020;75(5):323-5.
14. Li M, Lei P, Zeng B. Coronavirus disease (COVID-19): Spectrum of CT findings and temporal progression of the disease. Acad Radiol. 2020;27(5):603-8.
15. World Health Organization (WHO), Coronavirus disease (COVID-19). Situation Report-172 Highlights; 2020. Available at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200710-covid-19-sitrep-172.pdf?sfvrsn=70724b90_2. Accessed 11 July 2020.
16. Kerala confirmed first novel coronavirus case in India, 2020. India Today. Available at: https://www.indiatoday.in/india/story/kerala-reports-first-confirmed-novel-coronavirus-case-in-india-1641593-2020-01-30. Accessed on 20th April 2020.
17. UN India News. COVID-19: Lockdown across India, in line with WHO guidance UN News; 2020. Available at: https://news.un.org/en/story/2020/03/1060132. Accessed on 20th April 2020.
18. Government of India, (2020), MoHFW Home, In Ministry of Health and Family Welfare, Govt. of India, https://www.mohfw.gov.in/, Accessed on: 11th July 2020.
19. Our World in data. Coronavirus pandemic: daily updated research and data, 2020. Available at: https://ourworldindata.org/search?q=case+fatality+rat. Accessed on 11th July 2020.