Review

Understanding the variations in death rates during coronavirus pandemic and their preventive implications

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Abstract

Since the emergence of the COVID-19 pandemic, the mortality statistics are constantly changing globally. Various factors like variations in strains of the virus, population composition, co-morbid physical conditions, preparedness of the country for tackling the infection, health infrastructure, testing procedures, reporting process, even honesty and transparency in various sectors may influence the mortality statistics. Variation in the mortality statistics during the pandemic conveys several important messages, which has potential implications in prevention as well as policy recommendations. This article describes the change in mortality statistics due to COVID-19, globally, and its implications in the prevention of the pandemic.

Key words

Coronavirus, COVID-19, Death Rate, Mortality, Pandemics, Prevention

Introduction

Coronavirus pandemic has resulted in lockdown in many parts of the world. Till date (04 July 2020, 09:29 GMT) a total of 11,209,025 confirmed coronavirus infection cases with 529,471 deaths and 6,356,170 completely recovered cases have been reported worldwide.[1] The outcome of this illness can be recovery or death. If death as an outcome is measured, then the death rate at present is 4.72% (i.e. 529,471/ 11,209,025*100).[1] China, the initial epicentre of the virus, has reported 83,545 cases till now (22nd among all the countries), of which 78,509 recovered completely and 4,634 died; a death rate of 5.55%.[1] The United States of America meanwhile reported 2,890,588 (the highest among all countries) cases with 1,235,488 recovered and 132,101 deaths (most among all countries); a death rate of 4.57%.[1] Looking at figures from the rest of the world (excluding China), the total number of cases is 11,113,733 with 6,264,341 completely recovered and 524,563 deaths, which translates to a death rate of 4.72%.[1] India is a country of south Asian region (with similar population composition like China), has reported

649,889 cases with completely recovered and 18,669 deaths, a death rate of 2.87%.[1] There have been gross variations in the rates of COVID-19 testing across various countries. As per the report (by 8th July 2020), 358,259 COVID-19 tests per million population, are done in the United Arab Emirates.[2] In the United Kingdom, it is 158,741/million and in the USA, it is 117,211/million population. Similarly, China conducts 62,814 tests/million and India conducts 7588 tests/million population.[2]

Variations in death rates due to COVID-19

There are minor variations in the death rates of China and the rest of the world. The estimation of mortality due to novel coronavirus pandemic is also challenged as it includes only the diagnosed cases, irrespective of their clinical status.[3] Similarly, there might be many more cases in the community, who are not investigated due to many logistic and technical restraints (either due to lack of travel history or absence of definite evidence of contact with an infected person or due to asymptomatic state). The death rate estimation depends heavily on the test rate, together with other factors such as the proportion of seniors, prevention measures of public health, health response, etc. In addition, even if someone is positive for COVID-19, there are instances where COVID-19 is not mentioned as one of the causes of death for various reasons. So, the current estimation of mortality is unlikely to be a true reflection of reality. As every country is attempting to improve the health infrastructure and testing a greater number of people, the number of positive cases is increasing rapidly, so a change in the mortality rate is expected.

It is important to understand the factors that attribute to a gross difference in death rates around the globe. The key questions that need to be answered are: Whether the death rate related to COVID-19 is related to the differences in safety measures taken across countries, the population composition (as the elderly population is at higher risk), or the herd immunity or a combination of these factors. Another area that needs evaluation is the possible variations in the strains of the virus leading to variations in death rates in different regions. It is also important to assess, if there are any reporting bias in the countries.

Table 1: COVID-19 mortality							
30 April 2020				**1 July 2020**			
Country	*Total cases*	*Deaths*	*Mortality rate (in %)*	*Country*	*Total cases*	*Deaths*	*Mortality rate (in %)*
USA	1003974	52428	5.22	USA	2573393	126573	4.92
Spain	212917	24275	**11.40**	Brazil	1368195	58314	4.26
Italy	203591	27682	**13.60**	Russia	654405	9536	1.46
UK	165225	26097	**15.79**	India	585493	17400	2.97
Germany	159119	6288	3.95	UK	312658	43730	**13.99**
France	127066	24054	**18.93**	Peru	282365	9504	3.37
Turkey	117589	3081	2.62	Chile	279393	5688	2.04
Russia	106498	1073	1.01	Spain	249271	28355	**11.38**
Iran	93657	5957	6.36	Italy	240578	34767	**14.45**
China	84373	4643	5.50	Iran	227662	10817	4.75
Brazil	71886	5017	6.98	Mexico	220657	27121	**12.29**
India	33050	1074	3.25	Pakistan	213470	4395	2.06
Peru	31190	854	2.74	Turkey	199906	5131	2.57
Mexico	16752	1569	9.37	Germany	194723	8985	4.61
Pakistan	15759	346	2.20	France	157194	29760	**18.93**
Chile	14885	216	1.45	China	85232	4648	5.45
World	3090445	217769	7.05	**World**	10357662	508055	4.91
World excluding China	3006072	213126	7.09	**World excluding China**	10272430	503407	4.90

Countries that focus on restricting the test to mainly patients with symptoms can indicate a higher mortality rate in comparison with countries that have wider coverage of testing the asymptomatic contacts or those in particular occupations such as health care staff. Actions taken to estimate COVID-19 mortality have also varied between countries and even between states in the same country e.g. India.[4] The quality and transparency of the available data can also be important factors for releasing sensitive data, such as the death rate.

The fatality rate due to COVID-19 can be affected by molecular variations of the different viral strains of the SARS-CoV-2 and a better understanding of these variations is of great significance. A study that analysed genome sequences of the virus found that the regional differences based on molecular variations like number as well as the nature of mutations could guide the overall fatality outcomes. While some of these are pathogenic, some may also be favourable; and it has been inferred that such favourable changes may limit the increase of fatality. Such mutations were found in some strains of the virus from India, Australia, and Sweden.[5] As the virus travelled across various nations, it has evolved, and especially in countries with a higher prevalence of the infection, higher regional differences in the viral strains were seen. These differences may be assigned to the differences in ethnic composition and the travel pattern of the people affected. Further studies need to be undertaken to study the relationship between the type of the coronavirus and host

ethnicity which may in turn affect the host-virus interaction and hence the outcome.[6] Understanding the genomic variability of SARS-CoV-2 virus can help to explain the varying geographical outcomes and also guide further antiviral strategies.[7]

In the current scenario as the number of cases and associated deaths continue to rise the analysis of mortality statistics is of vital importance in implementing evidence-based policies. Hence maintaining high standards for accurate reporting of mortality data is of paramount importance. The World Health Organisation (WHO) has published definitive protocols to be followed by different countries to notify COVID-19 cases including reporting of deaths. These data are being routinely integrated into daily situation reports published by WHO. For better epidemiological evidence, countries across the world need to strengthen the medical certification of deaths, only then the mortality analysis can become a helpful guide in addressing the current pandemic.[8] COVID-19 death certification has a considerable influence on efforts to mitigate the spread of the virus. Various countries have taken steps to ensure accurate reporting of COVID-19 related deaths. The NCHS (National Center for Health Statistics) assigned a new ICD code that has been introduced for specifying the cause of death in Death Certificates. The code U07.1 was immediately implemented to accurately capture the COVID-19 mortality related statistics.[9] In India, the National Centre for Disease Informatics and Research (NCDR) has

developed an e-Mortality software application which aids in death reporting as per National standard guidelines. It has been advised that these applications should be used for reporting deaths in hospitals and district local registrar offices. This software uses ICD coding for recording the cause of deaths and will help in minimizing errors.[10]

Especially in some countries like India, where not all deaths are registered and the cause of death is not always identified, the likelihood of under-reporting of COVID-19 deaths increases. In addition to this, despite National guidelines on Death certification, some states have undoubtedly under-reported COVID-19 deaths owing to official confusions. For instance, in Maharashtra which by far has the largest number of fatalities following changes in protocols for recording deaths, had excluded patients with comorbidities from COVID-19 fatalities; and the number of reported deaths was characteristically lower than the expected numbers.[11] Moreover, in countries with very low per capita testing numbers, the cases itself may be under-reported, hence many COVID-19 cases are not identified and the cause of fatality are not attributed to it. Also taking into account the allegations that some regions may be deliberately under-reporting deaths, it can be said that the impact of COVID-19 fatalities is not fully being justified by the current mortality data which is officially published by different countries.

Changing trend of mortality due to COVID-19

A comparison between the dataset of 30th April 2020 and 1st July 2020 reveals a major shift in the paradigm of the coronavirus mortality worldwide (Table 1). In respect to the order of the most affected nations worldwide, apart from the United States of America, rest other nations have witnessed a major shuffle. As of April 30th, 2020 Russia, Brazil, and India were holding the rank of 8th, 11th, and 12th respectively but analysing the ranking on 1st July 2020, Brazil, Russia and India were holding the rank 2nd, 3rd, and 4th, depicting how drastic the rankings have changed. While China which was previously holding the rank of 10th went much down the ladder that on 1st July it was at 22nd place. The United Kingdom climbed down from 4th to 5th place while Spain and Italy which were at 2nd and 3rd place went down to 8th and 9th place respectively.[12,13]

The number of cases in America exponentially increased from 1 million to 2.5 million within 2 months. The same trend was observed in other nations also. Brazil had a total number of about 71 thousand cases which climbed to more than 1.36 million. In Russia, the cases were 0.106 million and within 2 months, increased to more than 0.65 million. In France, the number of cases rose from 1.2 million to 1.57 million. A similar trend was noted in India, where 0.33 million cases increased to about 0.58 million.[12,13]

In terms of mortality, as the number of cases has increased, most nations have witnessed a rising trend in the number of deaths as well. In America, the death toll increased from about 52 thousand to 126 thousand but simultaneously the mortality rate has decreased from 5.22% to 4.92%. In Brazil, the death toll rose from 5 thousand to more than 58 thousand and but the overall mortality rate has decreased from 6.98% to 4.26%. In Russia, the number of deaths was 1073 which increased to more than 9500, thereby changing the initial mortality rate from 1.01% to 1.46%. India witnessed the same trend with the death toll rising from 1,074 to 17,400 with the initial mortality rate of 3.25% changing to 2.97%. Countries like the United Kingdom, Spain, and Italy have high death rates of 15.79%, 11.40%, and 13.60% initially, which later changed to 13.99%, 11.38%, and 14.45% respectively. France, which was initially at 6th position though had moved down to 15th, nevertheless, have suffered from a high mortality rate of 18.93% which has fluctuated over time but on 1st July it was still 18.93%. In China, the number of deaths has increased by only 5 deaths over two months, which is quite fascinating considering the population of the nation and the fact that China was the epicentre during the initial phase of the spread of the virus.[12,13]

The initial reports estimated the fatality rate due to COVID-19 to be 2%.[14] Subsequent reports mentioned an increased rate of 3.4%.[15] As the pandemic progresses, over time the infected population will gradually march towards the ultimate outcomes (recovery or deaths) altering the death rates. Over two months (30th April to 1st July 2020) as shown in Table 1, most countries had shown a decline in the mortality rate (except Italy, Mexico, and Germany). This happens due to disproportionation between the recovery rate and death rate (more number of recovered cases than the number of deaths).

Impact on the older adults

The lockdown process during the COVID-19 pandemic has restricted the travels, recreations, physical activities, and access to healthcare. The lifestyle changes seen during the COVID-19 pandemic are perceived to be stressful and evoke anxiety and fear among the general population.[16] Elderly people are likely to be affected more due to the restrictive effect of COVID-19 related life-style changes, access to healthcare; which is expected to worsen the underlying medical conditions such as diabetes, hypertension, obesity, and dyslipidaemia. It may further increase the risk of mortality in the elderly population during this COVID-19 pandemic.

It has been seen that people above 65 years of age have a multi-fold risk of mortality due to COVID-19 in comparison to younger individuals.[17,18] There are variations in the death rates among the elderly in various geographical regions of the world. The European countries and Canada have two to three times higher mortality than the average global mortality of elderly due to COVID-19; whereas the African and some South-East Asian countries have two to three times lower mortality in the elderly population.[18] The higher elderly mortality in European and American countries may be due to higher life expectancy in those countries leading to a greater number of elderly living there. High rates of medical co-morbidities are seen with increasing age, which further

increased the risk of mortality due to COVID-19. Similarly, different strains of the COVID-19 virus may also attributes to variations in the mortality.[17,18]

Implications of mortality statistics

Mortality statistics during the pandemic are important measures in epidemiology. The changing mortality statistics gives insight about variations in the virulence of the virus, changes in the herd immunity, geographical variations about at-risk (vulnerable) population. It also suggests about Governmental policies for testing and reporting, preparedness of the nation to manage the COVID-19 pandemic. Honest and transparent reporting about testing and death is essential to get the actual picture and to plan for effective measures; however In some situation it has been questioned. The statistics also influence general public and professionals towards personal protective measures and changes their attitude. These understandings will help the policymakers and researchers to develop recommendations and action plans for the effective management of COVID-19 pandemic.

Conclusion

Our understanding of COVID-19 as a highly contagious and less fatal disease may change with time. Usually, the epidemics and pandemics have a shorter life span as a result of which the case fatality rate and mortality rate usually coincide. However, when the epidemic/pandemic has a long course, the case fatality rate and mortality rates often show gross variations, and with time, towards the end of the pandemic, they come close to each other. There are considerable variations in the death rates due to COVID-19 across countries. Population characteristics, presence of potential vulnerability factors, along with reporting parameters play a role in determining the death rates. It is important to understand these factors, which will help in the successful management of the COVID-19 pandemic.

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