Demographic and Mortality Trends across three COVID-19 waves in Kashmir Division, India

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ABSTRACT

Background: The demographic profile and fatality varied across different waves with the appearance of new variants. Further the trends varied from country to country and within the country. We have analyzed the trends from a selected geographic area. **Aims and Objectives:** To assess the trends in COVID-19 cases and deaths and to compare the characteristics of three different COVID-19 waves in Kashmir Division. **Materials and Methods:** It is a cross sectional study based on secondary data. **Results:** The mean age of deaths increased from 64.53 years in first wave to 65.02 years in the second wave and further to 69.23 years in the third wave (p-value = 0.006). An overall CFR of 0.85% was observed in our population with a maximum case fatality of 1.67% in first wave followed by 0.79% in second wave and only 0.13% in third wave (p < 0.0001). Lowest CFR of 0.04% was observed in the age group of <20 years and maximum CFR of 6.12% was observed in the subjects with age more than 60 years. It was also observed that the CFR increased with the increase of age across all the three waves (p < 0.0001). **Conclusion:** Our study suggests that the Case Fatality Ratio declined with time despite new variants appearing which spread at very fast rate. The mortality remained higher in elderly and in males in all the three waves.

Key words: COVID-19; Trend; Case fatality ratio

INTRODUCTION

Since the start of the coronavirus disease-19 (COVID-19) many estimates were made for the infectiousness and case fatality due to it. Different countries got affected differently across different COVID-19 waves. Globally 6,220,390 deaths have been reported by the World Health Organization (WHO) till 25th April 2022[1] and in India 522223 deaths have occurred till 25th April 2022 with overall case fatality rate of 1.2%.[2] Mostly people remain asymptomatic or experience mild to moderate respiratory illness and recover without special treatment following infection with the COVID-19 virus, however, older people having underlying chronic medical conditions are more likely to develop serious illnesses.[3] The case fatality rate (CFR) of 5.65% was predicted for the first wave of

COVID-19 in China, however, in critically ill patients it was observed 3.6 times higher.[4] A study reported more deaths among males, higher age group, Negroes, lower socioeconomic status, having more than four family members, presence of comorbidities, early discharge from hospital and transmission of disease from asymptomatic health care workers.[5]

The reported data also shows that the different features varied between the waves.[6] The differences between the waves may be in the proportion of local clusters, personal contact transmission and routes of transmission.[7] The third wave in India in contrast to the first and second wave showed rapid rise of cases yet there was no observed tangible rise in deaths.[2] The union territory of Jammu & Kashmir has experienced 3 major COVID-19 waves as of

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February 2022. The current study was carried out with the objectives to compare the characteristics and impact of three COVID-19 waves in Kashmir Division.

Aims And objectives

1. To assess trends in COVID-19 cases and deaths across three waves in Kashmir Division
2. To compare the characteristics of three different COVID-19 waves in Kashmir Division

MATERIAL AND METHODS

From the start of the COVID-19 (March 2020) in Kashmir Division of Jammu and Kashmir Union Territory a COVID-19 Control Room was established at the Divisional Level from where all the COVID-19 related activities are being monitored and mentored by the experts from the health department. Besides all the COVID-19 data of testing, cases and deaths is submitted daily to Divisional COVID-19 Control Room, Kashmir for analysis and public health action.

Study area

The data of all the ten districts of Kashmir Division of Jammu and Kashmir, India was used for the study.

Study design

This was a cross-sectional study where existing COVID-19 data that was recorded for reasons other than research (mainly surveillance) was used for the analysis.

Study period

The data from 18th March 2020 to 24th February 2022 was used for the study. The data used for final analysis was from three main waves as follows:

Wave 1st: March 2020–February 2021
Wave 2nd: February 2021 – August 2021
Wave 3rd: January 2022 – February 2022

Study population

All the subjects who tested positive for COVID-19 during the three main waves of COVID-19 were taken for the study.

Exclusion criteria

The cases with incomplete information were excluded. Further the data from 01st Sep 21 to 31st Dec 21 was excluded (N= 12657) because two small waves appeared during the period which were unrelated to other three major waves.

Sample size

A total of 274307 subjects tested positive for the COVID-19 during the three waves. All the cases were included in the study.

Data collection

The data of confirmed cases was collected either through COWIN app as developed and recommended by ICMR or through the formats requiring same information as required for the COWIN app by the Divisional COVID-19 Control Room Kashmir between March 2020 and February 2022.

Ethical consideration

In this study the routine surveillance data which was mainly used for contact tracing at Divisional level during COVID-19 pandemic was used for the study. Hence, approval for publication of the COVID-19 related data was sought from Divisional Commissioner Kashmir.

Data analysis

The data was either downloaded or entered in excel format and analyzed using SPSS (version 20.0). The data has been presented as frequency and percentage and the comparison between the groups was done using Chi square test for categorical data and t' test for continuous data. The p- value of <0.05 was considered as significant.

RESULTS

Table 1 shows the distribution of cases and deaths across three waves of COVID-19 in Kashmir Division. A total of 274307 cases and 2334 deaths were observed during the three waves. Of the total cases 26.8% occurred in first wave, 47.0% occurred in second wave and 26.2% occurred in third wave. The majority of the deaths 1226 (52.5%) occurred in first wave followed by 1016 (43.5%) in second wave and only 92 (3.9%) in third wave. An overall CFR OF 0.85% was observed in our population with a maximum case fatality of 1.67% in first wave followed by 0.79% in second wave and only 0.13% in third wave. The difference observed in CFR across the waves was found to be statistically significant (p < 0.0001).

Table 2 shows the gender wise distribution of COVID-19 cases and deaths in our study population. Of the total cases 160944 (58.7%) were males and 113363 (41.3%) were females. Among the deaths, 1441 (61.7%) occurred among males and only 893 (38.3%) among females. The CFR of 0.90% was observed among males and 0.79% among females. The difference in CFR across the gender was found to be statistically significant (p = 0.0025). The relative risk of dying due to COVID-19 was higher among males 1.137 (1.046-1.235) as compared to females.

Table 2 also shows the age wise distribution of COVID-19 cases and deaths in our study population. Of the total cases 12.7% occurred in age group of <20 years, 50.7% in the age group of 21-40 years, 27.7% in the age

Table 1: Distribution of cases, deaths and case fatality rate across three waves of COVID-19 in Kashmir Division

Wave	Cases	Percent	Deaths	Percent	CFR	P-value
1st Wave	73583	26.8%	1226	52.5%	1.67%	<0.0001
2nd Wave	128813	47.0%	1016	43.5%	0.79%	
3rd Wave	71911	26.2%	92	3.9%	0.13%	
Total	274307	100.0%	2334	100.0%	0.85%	

Table 2: Gender and Age Distribution of cases, deaths and case fatality rate of COVID-19 in Kashmir Division

Variable	Cases	Percent	Deaths	Percent	CFR	Relative risk (95% CI)	P-value
Gender							
Male	160944	58.70%	1441	61.70%	0.90%	1.137 (1.046-1.235)	0.0025
Female	113363	41.30%	893	38.30%	0.79%		
Age in Years							
<20	34778	12.70%	13	0.60%	0.04%		<0.0001
21-40	139111	50.70%	113	4.80%	0.08%		
41-60	76008	27.70%	715	30.60%	0.94%		
> 60	24410	8.90%	1493	64.00%	6.12%		

group of 41-60 years and only 8.9% occurred in the age group of >60 years. Lowest percentage of deaths (0.6%) & CFR of 0.04% was observed in the age group of <20 years followed by 4.8% deaths and 0.08% CFR in the age group of 21-40 years, 30.6% deaths and 0.94% CFR in the age group of 41-60 years and maximum percentage of deaths (64.0%) and CFR of 6.12% was observed in the subjects with age more than 60 years. The difference in CFR across the age was found to be statistically significant (p < 0.0001). It was also observed that the CFR increased with the increase of age across all the three waves as shown in Figure 1.

The age difference in cases and deaths across three waves is shown in Table 3. The mean age dropped from 40.44 years in first wave to 36.41 years in the second wave and 36.51 in the third wave. The mean age of deaths increased from 64.53 years in first wave to 65.02 years in the second wave and further to 69.23 years in the third wave. The difference in age across three waves among cases and deaths was found to be statistically significant, the p-value being < 0.0001 and 0.006, respectively.

The occurrence of COVID-19 cases per million population is shown in Figure 2. Kashmir Division observed an overall of 35591 cases per million population and 303 deaths per million population across three waves. Maximum of 63503 cases per million population and 569 deaths per million population were observed in District Srinagar. A minimum of 19437 cases per million population and 182 deaths per million population were observed in District Shopian.

DISCUSSION

Our study is based on the data of COVID-19 cases and deaths which was submitted for surveillance purposes.

Table 3: Mean age difference of cases and deaths across three COVID-19 waves in Kashmir Division

Group	Wave	Mean age in years	Std. Deviation	p-value
Case	1st Wave	40.44	17.181	<0.0001
	2nd Wave	36.41	15.983	
	3rd Wave	36.51	14.991	
Death	1st Wave	64.53	13.171	0.006
	2nd Wave	65.02	13.673	
	3rd Wave	69.23	16.710	

During the three waves Kashmir Division witnessed 274307 COVID-19 cases and 2334 deaths. The trend of COVID-19 case incidence in Kashmir division followed a pattern similar to India with two exceptions. First, the peak of the all the waves in our division occurred approximately 12- 14 days later than the country. Second, there was relatively less burden of cases during the first wave corresponding to Kashmir's regional lockdown. The second wave had exponential growth of cases and the world's largest peak and absolute number of cases.[8] The percentage of cases was higher (47% of the total cases) during the second wave of COVID-19 pandemic can be attributed to the fact that the dominant mutant strain (delta) was more transmissible, more virulent and was escaping the immune system of our body. Simultaneously the lockdown measures were seen less effective due to various socioeconomic constrains among the masses which made them to have complacency in adapting COVID appropriate behavior during the second wave. Lately, during the third wave the percentage of cases again came down (26.2%) despite the highly transmissible mutant variant of the virus
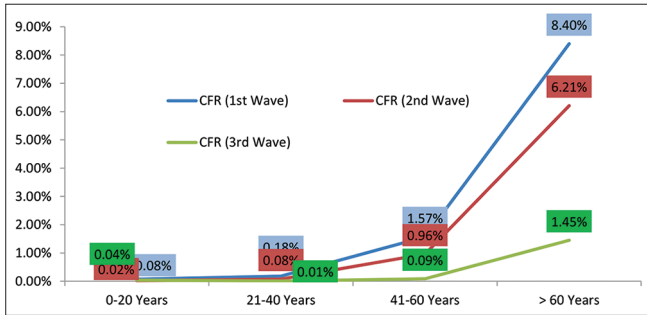
Figure 1: Age-wise trend of case fatality ratio across three COVID-19 waves in Kashmir division
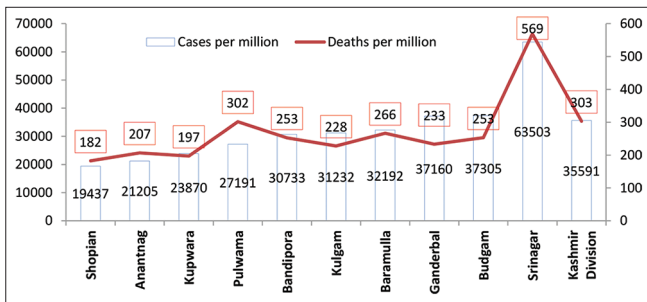
Figure 2: District-wise status of COVID-19 cases and deaths per million population across three COVID-19 waves in Kashmir division

because the population was less susceptible this time as most of the people had been infected during the first two waves of the pandemic. Second contributing factor for less percentage of cases was the higher vaccination coverage amongst all the eligible population who had received both doses of vaccination during this phase of pandemic. The majority of the deaths 1226 (52.5%) occurred in first wave followed by 1016 (43.5%) in second wave and only 92 (3.9%) in third wave. An overall CFR of 0.85% was observed in our population with a maximum case fatality of 1.67% in first wave followed by 0.79% in second wave and only 0.13% in third wave. The difference observed in CFR across the waves was found to be statistically significant (p < 0.0001). Bogam P et al., (2022) found that overall case fatality ratio was 1.7% in Pune city,[9] higher than the reported nationwide case fatality ratio of 1.2% while we had overall CFR of 0.85% which is very much lesser than national average. The main reason is that Kashmir Division constitutes around 0.57% population of the country but we have been able to detect around 0.66% cases of the country while as contributed only 0.46% to the COVID-19 deaths in the country; thus authenticating much higher COVID-19 detection rate (due to higher testing per million population) than the national average and at the same time confirming lesser mortality. This can also be attributed to the better COVID-19 mitigation and control efforts viz enhancement of oxygen supply to all the primary, secondary and tertiary care hospitals which even included our panchayat care centres that did not led

to the increase in mortality due to lack of oxygen supply in this part of the country irrespective of being a limited resources union territory of the country.

In our report the gender wise distribution of COVID-19 cases and deaths were found predominantly in males than females. Of the total cases 160944 (58.7%) were males and 113363 (41.3%) were females. We observed higher mortality among men 1441 (61.7%) than females 893 (38.3%) similar to prior study in USA.[10] In consistent to our CFR estimates across the age and gender a survival analysis from a study showed that mortality was independently associated with older age with a stepwise increase in the adjusted hazard ratio of time to death for each successive age group.[11] The CFR of 0.90% was observed among males and 0.79% among females in our study. The difference in CFR across the gender was found to be statistically significant (p = 0.0025). The relative risk of dying due to COVID-19 was higher among males 1.137 (1.046-1.235) as compared to females. It can be attributed to the fact that sex differences in the prevalence and outcomes of infectious diseases occur at all ages, with an overall higher burden of bacterial, viral, fungal and parasitic infections in human males.[12-15] Other studies on COVID-19 outbreaks have demonstrated the same sex bias. The Hong Kong SARS-CoV-1 epidemic showed an age adjusted relative mortality risk ratio of 1.62 (95% CI = 1.21, 2.16) for males.[16] During the same outbreak in Singapore, male sex was associated with an odds ratio of 3.10 (95% CI = 1.64, 5.87; p ≤ 0.001) for intensive treatment unit admission or death.[17] Survival analysis of another study from India showed an adjusted hazard ratio of 1.62 (1.52 to 1.73) for males as compared to the females.[11] These data suggest that whilst socio-economic factors may be influencing some aspects of the pandemic, fundamental differences in the immune response between males and females are likely to be a driving factor behind the significant sex-bias observed in the COVID-19 pandemic.

In our report the age wise distribution of COVID-19 cases was found predominantly in the age group of 21-40 years which comprised of 50.7%, followed by 27.7% in the age group of 41-60 years,12.7% occurred in age group of <20 years, and only 8.9% occurred in the age group of >60 years. The predominance of these two age groups 21-40 years and 41-60 years which comprised of more than 78.4% of our cases is attributed to the fact that these are the working force of any country and had the greater chance of being susceptible to any type of infection especially those spreading by droplets and are also even more prone for any adverse eventuality in their lives. Further the children got less effected in this pandemic because they have less developed ACE2 receptor in their body, the protein that provides the entry point for the coronavirus to hook into

and infect a wide range of human cells,[18] secondly due to closure of all the educational institutions in the division during the entire period of pandemic was the another contributing factor.

We also found that the mortality from this COVID-19 pandemic was seen highest 64% (1493) in the age group 60 years and above, followed by 30.6% (715) in the age group of 41-60 years, 4.8% (113) in the age group of 21-40 years and only 0.6% (13) occurred in the age group of 0-20 years. Highest CFR of 6.12% was observed in the subjects with age more than 60 years, followed by 0.94% in the age group of 41-60 years, 0.08% in the age group of 21-40 years and lowest CFR of 0.04% was observed in the age group of <20 years. The difference in CFR across the age was also found to be statistically significant (p < 0.0001). It was also observed that the CFR increased with the increase of age across all the three waves as shown in Figure 1. Similar finding were seen in the study carried by Iftimie S et al. (2021). They found that the patients who died were significantly older than the survivors.[6]

Our study showed that the mean age of the cases dropped significantly from 40.44 years in first wave to 36.41 years in the second wave and 36.51 in the third wave. These findings in mean age can be attributed towards the fact that during these waves the people who were more susceptible were the working class group of the community who were moving out from their homes for their daily assignments. The mean age of deaths however increased significantly from 64.53 years in first wave to 65.02 years in the second wave and further to 69.23 years in the third wave. Another study also reported that those who died in the second wave were older than those in the first wave (83 ± 10 vs. 78 ± 13 years; p = 0.042).[6] This trend of increasing age in mortality can be attributed to circulation of less virulent strains and various strategies adopted by the government like early case detection, isolation, timely hospitalization, sufficient oxygen supply and better management of the cases.

In our report the occurrence of COVID-19 cases in Kashmir Division was observed 35591 per million across three waves. Maximum of number of cases and deaths per million population were observed in District Srinagar which is the most densely populated district of the Division. The minimum number of cases and deaths per million population were observed in least densely populated District Shopian. The difference in the number of cases and deaths across the districts can be attributed to the difference in population density, testing strategy, contact tracing, vaccination status, primary health infrastructure and compliance to the COVID appropriate behavior across those districts during the entire course of pandemic.

Limitation of the study

The study was conducted on secondary data hence the limitations in verifying the missing data. There are chances that severe cases may have been reported more often than the asymptomatic or less severe cases, hence the actual CFR is expected to lower than we observed in this study.

CONCLUSION

Despite these limitations, this is the rare study to compare outcome in all the three waves which affected our Division which is relatively isolated from rest of the country. Our study suggests that the Case Fatality Rate declined with time despite new variants appearing which spread at very fast rate. The mortality remained higher in elderly and in males in all the three waves.

ACKNOWLEDGEMENT

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