Original Research Article

Predictors of recovery from COVID-19: a retrospective study in one of the aspirational district of India

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) is the third corona virus that has emerged among the human population in last two decades. The main aim of this study was to describe the epidemiology and recovery predictors of Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) patients admitted at COVID health facilities.
Methods: A retrospective observational study was conducted from April 2020 to September 2020. The categorical and continuous variables were expressed as frequency, percentages and as mean and standard deviation respectively. Pearson chi square test and multivariable logistic regression were applied to ascertain the associations. Mean recovery time was compared by Kaplan-Meier analysis.
Results: The mean age of participants was 36.8±17.54 years with a male preponderance. The age group of 20-39 years was the most affected group (43%). Age and pre-existing co morbidities were found to be significant factors affecting the recovery duration of patients. Mean recovery time with respect to age groups and gender was 15 and 18 days respectively. Mortality rate of 2% was recorded.
Conclusions: In conclusion, COVID-19 affects a wide-range of population. Although age was not found to be a significant factor for acquiring the disease, however younger age group was significantly associated with early recovery. Considering our findings, we suggest additional measures to protect the vulnerable population.

Keywords: COVID-19, Aspirational, Epidemiology, Recovery predictors, Kaplan Meier, Regression

INTRODUCTION

In late December 2019, few cases of pneumonia with an unknown etiology were reported in Wuhan, China, and later on in January 2020, a new type of corona virus was identified as the cause of those pneumonia cases.[1] The World Health Organization (WHO) named this disease as Coronavirus disease 2019 (COVID-19), as well as the term severe acute respiratory syndrome- Corona virus- 2 (SARS-CoV-2) for the virus. On March 11, 2020, the Director-General of WHO characterized the COVID-19 situation as a pandemic due to its alarming level of spread and by alarming levels of inaction.[2]

After the outbreak of two viruses i.e., severe acute respiratory syndrome corona virus (SARS-CoV) outbreak in 2002 and the Middle East respiratory syndrome corona virus (MERS-CoV) outbreak in 2012, COVID-19 is the third corona virus that has emerged among the human population in the last two decades. The rapid transmission of this outbreak and the increased pressure across healthcare systems led to emergency measures resulting in substantial social and economic disruption.[3]

Although currently the number of new infections is decreasing, the COVID-19 epidemic is still ongoing and is a major challenge for clinicians. Up to December 2020, around 70,476,836 confirmed cases of COVID-19 and 1,599, 922 confirmed deaths have been reported globally. India has reported 98,84,100 Confirmed Cases and 1,43,355 total deaths by December 2020.[4] As on 31st December, in Himachal Pradesh total number of cases was 55229, including 2615 active cases, 51692 cures and 922 deaths.[5] And in District Chamba, 2861 cases were reported till December 2020.

This study was conducted in Chamba district of Himachal Pradesh (India); which has been identified as one of the aspirational district under Aspirational District Programme by Government of India. The aim of this study was to describe the epidemiology and various predictors of recovery of patients with polymerase chain reaction (PCR)–confirmed SARS-CoV-2 infection.

METHODS

A retrospective observational study was conducted on first 518 patients over a period of six months from 1st April 2020 to 30th September 2020 in one of the aspirational district of India i.e. District Chamba of State Himachal Pradesh, a state in trans Himalayan region of India. Only those individuals who were confirmed to have COVID-19 by SARS-CoV-2 real-time reverse transcriptase–polymerase chain reaction (RT-PCR) and whose follow up samples were further taken were included in this study. We obtained demographic, epidemiological, clinical, laboratory data including age, sex, nationality, travel history, symptoms, duration of stay, co-morbidities etc. from the medical records of patients infected with SARS-Cov-2. There were two outcomes: Recovery and death. The confirmed patients were retested as per testing criteria and were considered recovered only after obtaining a negative COVID-19 test result.

Statistical analysis

All the people who were tested COVID positive till September 2020 were enrolled in the study. The data was analyzed using the Excel version 2010, Epi info 7 and Statistical package for social sciences (SPSS) 20 software.

Firstly, descriptive analysis was undertaken for the patient characteristics. The categorical variables were expressed in terms of frequency and percentages and the continuous variables were expressed as mean and standard deviation. In addition to descriptive analysis, Pearson's chi- square test was applied to ascertain the associations between certain variables. Multivariable logistic regression model was also used to estimate the correlation between recovery from COVID-19 and predictors (age group, gender, co morbidity). Level of significance was set at $\alpha \leq 0.05$. Kaplan-Meier (KM) survival analysis was done to estimate the average recovery time with respect to gender and age of COVID-19 patients.

RESULTS

Till September 2020, a total of 22117 samples were collected from different health blocks of District Chamba and out of which 518 turned positive. Thus positivity rate of 43% amongst tested was found in this study. Out of 518 samples, 516 were collected from alive persons and 2 samples were taken after the death of person (death was due to non COVID reason). Majority of the patients were of 20-39 years age group and there was male preponderance (Table 1).

Table 1: Socio-demographic and epidemiologic characteristics.

Variables	N (%)
Total patients	518 (100)
Age in years (Mean±SD), 95% CI	36.8±17.54, 35.3 to 38.3
Age groups (in years)	
0-19	77 (15)
20-39	221 (43)
40-9	160 (31)
60-79	53 (10)
80 and above	7 (1)
Gender	
Male	344 (66)
Female	174 (34)
History of travel outside India in last 30 days	2 (0.4)
History of travel within India in last 30 days	165 (83)
No of primary contacts turned positive	247 (48)
No. of secondary contacts turned positive	54 (10)

Majority (83%) of the patients was treated at Dedicated COVID health facilities and few (17%) were home isolated as per the treatment guidelines recommended by Government of India.[6] Only 4% patients were found to be severe and admitted at Dedicated COVID Hospital. Co morbidities were present among 14% of the patients. Mortality rate of only 2% was recorded in this study (Table 2).

Correlation of various predictors (age groups, co-morbidity, gender) with recovery

As compared to younger age groups, older patients had slower recovery. Majority of the younger and middle age group recovered within 1-10 days, whereas majority of the elder age group >60 years recovered within 16-20 days. Statistically significant association was also found between age and recovery days among all patients (p<0.05).

41% patients with pre-existing co morbidities recovered within 20 days and 36% recovered within 10 days.

However, majority (61%) of the patients without co-morbidities recovered within 10 days. This difference was also found to be statistical significant (p<0.05) (Table 3).

Also, majority of male (56%) and female (59%) patients recovered within 10 days. Only 6% male and 5% female patients recovered slowly (more than 20 days). Statistical significant association was not found between gender and recovery days.

Multivariable logistic regression was also applied to correlate the relation of various predictors (Age, sex, co morbidity) with recovery and age was found to be significant variable for multivariate regression model (Pearson Chi-Square (χ^2)=36.1, p=0.001, Cox and Snell=0.05) (Table 4). However, no statistical correlation was found between gender and recovery as well as between co morbidities and recovery (p>0.05).

KM survival analysis

Log-rank test was used to study the recovery time of Covid-19 patients with respect to gender and age.

Table 2: Clinical characteristics.

Variables	N (%)
Categorization of patients	
Very mild/mild/pre-symptomatic	397 (77)
Moderate	96 (19)
Severe	23 (4)
Co-morbidities	
Yes	70 (14)
Types	
Respiratory disorders	10 (2)
Non-communicable diseases (NCDs)	53 (10.2)
Cardiovascular disease (CVDs)	4 (0.7)
Chronic kidney disease	3 (0.6)
No	448 (86)
Days to recover (Mean±SD), 95% CI	12.9±4.28 , 12.58 to 13.32
Days to recover	
10	295 (58)
11-15	135 (27)
16-20	48 (9.5)
21-25	24 (4.7)
>25	3 (0.6)
Outcomes	
Cured	505 (98)
Death	11 (2) {Male=10, Female=1}
Age groups (years)	
20-39	1
40-59	2
60-79	6
80 and above	2

Table 3: Correlation between various predictors (age and co-morbidity) and recovery.

	1-10, N (%)	11-15, N (%)	16-20, N (%)	>21-25, N (%)
Age in years				
0-19	54 (70)	18 (23)	2 (2.6)	3(3.8)
20-39	129 (59)	59 (27)	23 (10.4)	9 (4.1)
40-59	93 (59)	19 (12)	36 (23)	10 (6.3)
>60-79	18 (35)	7 (13)	21 (40)	6 (12)
Pearson Chi-Square (χ^2) 40.46, df=9, p=0.001				
Co-morbidity				
Yes	25 (36)	12 (17)	29 (41)	4 (6)
No	275 (61)	109 (24)	41 (9)	23 (5)
Pearson Chi-Square (χ^2) 21.2, df = 4, p value=0.001				

**Table 4: Multivariable regression between age and recovery.**

	Recovery days	B	Std. Error	Sig.	Exp (B)	95% Confidence Interval for Exp (B)	
Recovered within 1-10 days	Intercept	1.253	0.463	0.007*			
	0-19	1.638	0.752	0.030*	5.143	1.177	22.473
	20-39	1.410	0.577	0.015*	4.095	1.321	12.694
	40-59 and above	0.977	0.570	0.087	2.657		
Recovered within 11-15 days	Intercept	0.154	0.556	0.782			
	0-19	1.638	0.836	0.050*	5.143	1.000	26.458
	20-39	1.726	0.662	0.009*	5.619	1.537	20.546
	40-59 and above	1.127	0.661	0.088	3.086	0.844	11.278
Recovered within 16-20 days	Intercept	1.099	0.471	0.020*			
	0-19	-1.504	1.027	0.143	0.222	0.030	1.665
	20-39	-0.160	0.614	0.794	0.852	0.256	2.837
	40-59 & above	-0.457	0.612	0.456	0.633	0.191	2.103

*p<0.05.

Table 5: KM Survival analysis of COVID- 19 patients' w.r.t. age and gender.

| Variables		Mean	95% Confidence Interval		Log Rank (Mantel – Cox)
			Lower Bound	Upper Bound	
Age group (in years)	0-19	15.391	13.649	17.133	
	20-39	14.975	14.084	15.866	
	40-59	16.157	15.127	17.187	0.016*
	60-79	18.334	16.370	20.298	
	80 & above	18.000	13.042	22.958	
	Overall	15.801	15.164	16.438	
Sex	Male	18.228	17.175	19.281	
	Female	16.561	15.321	17.802	0.592**
	Overall	18.056	17.202	18.911	

*p<0.05, **p>0.05.
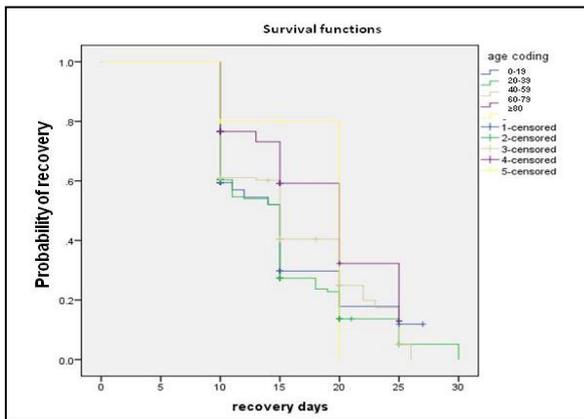
Figure 1: KM curve with respect to age.

The average recovery time of patients of age less than 60 years was estimated to be between 14-16 days while the average recovery time of COVID-19 patients of aged 60 years and above was found to be little bit higher i.e., 18 days.

Amongst all the age groups, the age group of 20-39 years recovered earlier than other age groups. This difference in recovery time of Covid-19 patients with respect to age groups was found to be statistically significant (Log Rank value=0.016). Male patients recovered slowly (18 days) as comparison to female patients (16 days). However, this difference was not statistically significant (p>0.05) (Table 5).
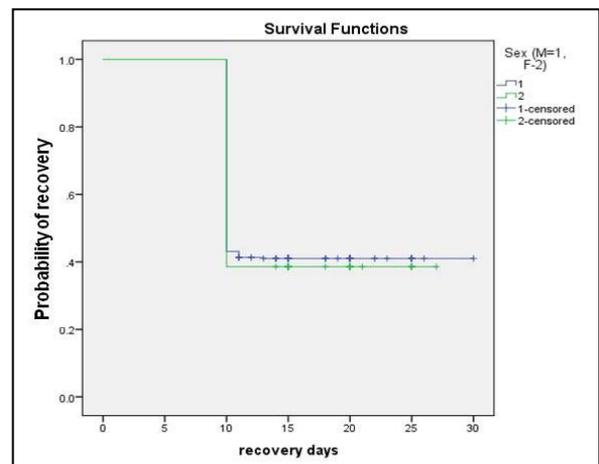
Figure 2: KM curve with respect to gender.

KM curve with respect to age and gender

KM survival curves representing the recovery time of the COVID-19 patients with respect to gender and age are also constructed. Drop in the survival curve occurs whenever the variables shows effects in recovery (Figure 1, 2).

DISCUSSION

COVID-19 has now become a global issue and declared as pandemic by WHO. This virus spread out from China to the entire world. In this study, we studied epidemiology and predictors of recovery of patients in one of the aspirational district of India.

The most affected age group was of 20-39 years which is consistent to previous research suggesting higher representation of younger groups.[3] The possible reason for higher representation of younger population in our sample could also be due to specific exposure to cluster of cases through workplaces. However, in most other countries infected were found to be older.[7,8] Male preponderance was found in this study (66%) which is consistent to previous research studies that reported male predominance.[3,9] This male predominance may have happened due to increased travel by males for occupational or educational purposes as comparison to females.

The clinical spectrum of covid-19 varies widely, from an asymptomatic infection to severe and critical pneumonia with high fatality rates. In our study, majority (77%) of the COVID-19 infected patients were classified as mild/very mild/pre-symptomatic. This is consistent with previous studies which classified majority of COVID-19 confirmed cases as mild.[3,9,10] Mortality rate of 2% was reported and it was higher in males. Also similar to previous research, in our study mortality was found to be higher in males as comparison to females.[11]

Similar to findings from several other countries, we found the elderly to be more vulnerable with lower probabilities of recovery.[2,3,7,12] Compared to younger age groups, older patients had lower recovery. It is evident that the presence of pre-existing medical conditions in the elderly predisposes them to delayed recovery. Similar to previous studies, recovery time of patients belonging to different age groups was found to be statistically significant. However, the recovery time of male and female patients was not statistically different.[12,13]

To the best of our knowledge this was the first kind of study in any of the aspirational district of India. We also tried to find out the association between certain variables. Our study adds to the limited evidence based on potential predictors of recovery among confirmed COVID-19 cases.[12,14]

Despite the clarity of findings, this study has few limitations. The sample size in the current study is characterized by a small cohort. Due to revised discharge policy of not taking follow up samples, more patients couldn't be enrolled.[15] Therefore, these results may be difficult to generalize at national or international level.

CONCLUSION

In conclusion, COVID-19 affects a wide range of population, from youth to the elderly. Random testing may play an important role to contain the spread of the virus at community level as asymptomatic patients are difficult to trace out. Considering our findings, we suggest additional measures to protect the vulnerable population that are less likely to recover from the infection. As a future work, this analysis can be extended by adding more attributes in the dataset.

ACKNOWLEDGMENTS

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