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# Mapping of epidemiological determinants of confirmed COVID-19 cases among health-care workers of municipal corporation of Delhi: A roadmap to risk reduction

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## Abstract:

**BACKGROUND:** Coronavirus disease (COVID-19) is a respiratory illness caused by a novel coronavirus which can spread from person to person. Health-care workers of any medical college and hospital are at more risk to the coronavirus disease (COVID-19) than the general population. The aim of this study was to assess the epidemiological profile of confirmed COVID-19 cases among health-care workers of Municipal Corporation of Delhi.

**METHODOLOGY:** A cross-sectional study was planned among 422 health-care workers of Municipal Corporation of Delhi. The questionnaire consisted of questions about sociodemographic data, personal history, and clinical profile such as signs and symptoms and their duration. Data were analyzed by SPSS software version 21.0, and, Chi-square test and logistic regression were used.

**RESULTS:** Mean age of study subjects was  $41.1 \pm 9.8$  years, and males (57.6%) were more as compared to (42.4%) females. Out of total participants, about one-third (36.4%) of study participants were asymptomatic. Study participants with higher education status adjusted odds ratio (AOR) 2.43 (1.25–4.70), living in overcrowding AOR 3.74 (1.86–7.54), and having some comorbidity AOR 2.78 (1.57–4.92) were at higher risk of being symptomatic.

**CONCLUSION:** This study concludes that about one-third of study participants were asymptomatic. Factors such as higher education status, living in overcrowding, presence of some comorbidity, and smokeless tobacco consumption were significantly associated with symptomatic COVID-19 cases. Hence, there is a need to identify these risk factors at an early stage in order to design prevention strategies for better control of such pandemics in future.

## Keywords:

COVID-19, epidemiological profile, health-care workers, risk factors, SARS-Cov2

## Introduction

Coronavirus disease (COVID-19) is a respiratory illness caused by a novel coronavirus which can spread from person to person. Typical features of this disease include high-grade fever, non-productive cough, fatigue, and difficulty in breathing. The World Health Organization

has declared this disease as pandemic, as it is spread over 200 countries in the world. In India, this disease is also spreading affecting almost all states in the country. A total number of 9,499,710 confirmed cases and 138,159 deaths have been reported in our country so far. In Delhi, this number is increasing on daily basis, and it has

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reached to 574,380 confirmed cases and 9260 deaths till December 2, 2020.<sup>[1]</sup>

Health-care workers of any medical college and hospital are at more risk to the coronavirus disease (COVID-19) than the general population because they are more likely to come in contact of suspected and confirmed cases of this disease. Epidemiological and clinical profile, extent of infection, various route of transmission, and virulence of virus is not clear so far for COVID-19. There is a paucity of literature regarding complete scenario of COVID-19 cases among health-care workers. Therefore, this study was planned to assess the epidemiological profile of confirmed COVID-19 cases among health-care workers of Municipal Corporation of Delhi, in order to design specific strategy and policy for prevention of our frontline workers from COVID-19 infection.

## Materials and Methods

### Study design and setting

A cross-sectional study was planned in all hospitals/dispensaries which comes under North and South Delhi Municipal Corporation which provides comprehensive health-care in their respective areas. All major hospitals come under North DMC. There are five major hospitals (Hindu Rao hospital, Kasturba Hospital, Maharishi Valmiki Infectious Diseases Hospital, Rajan Babu institute of pulmonary medicine and tuberculosis, and Girdhar Lal maternity hospital), two polyclinics (dental and chest clinic) and 37 dispensaries (allopathic, AYUSH including one Unani dispensary), and one medical college under North Delhi Municipal Corporation.

### Study population and sample size

All confirmed COVID-19 cases among health-care workers of North and South DMC hospital/dispensary including regular/contractual/out-sourced staff since March 2020 to July 2020. Health-care workers of hospitals in the study area who gave consent and comes under definition of confirmed COVID-19 case were included in the study. Those who did not give consent were excluded from the study.

### Study tool and variables

A predesigned, semi-structured, pretested, interviewer-administered questionnaire was used for data collection. Epidemiological determinants such as physical, biological, nutritional, psychosocial, and environmental were evaluated. Clinical profile of patients such as signs and symptoms and their duration, history of contact with confirmed COVID-19 patient, history of travel in the past 6 months, and details of treatment received was taken from the study participants. This is the first article related to epidemiological profile of

confirmed COVID-19 cases; we are going to publish other information mentioned above in subsequent articles.

### Case definitions

Health-care worker – A person working in hospital/dispensary set up of Delhi Municipal Corporation. Confirmed case – A person with laboratory confirmation of COVID-19 infection by reverse transcription-polymerase chain reaction method, irrespective of clinical signs and symptoms.

### Data collection

First, the approval was taken from North and South DMC before the start of survey work. Data collectors were first trained how to conduct survey through telephone, interviewing keeping unbiased, nonjudgmental attitude toward study participants, and how to record the findings. After that, confirmed positive COVID-19 cases were identified in the study area, and then data were collected by telephonic interview from all eligible study participants after taking informed verbal consent. Interview for data collection was taken in the local language. Follow-up of all study participants regarding their present status till the sign and symptoms resolved.

### Analysis

The data were entered in Microsoft Office Excel sheet, and analysis was done using a licensed version of SPSS 21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Data were summarized by calculating proportions, mean, and standard deviation. Difference between proportions was assessed using Chi-square test/Fisher's exact test, and quantitative data were analyzed using unpaired *t*-test.  $P < 0.05$  was taken as significant. Factors found associated ( $P < 0.25$ ) with symptomatic COVID-19 cases in univariate analysis were entered into multivariate analysis.

### Ethics

Permission was obtained from the administrative authorities, and approval was sought from the Institutional Ethics Committee. Informed verbal consent was taken from all the participants after explaining the purpose of the study.

## Results

Table 1 shows that the mean age of the study participants was  $41.1 \pm 9.8$  years (range: 23–60). Almost half (51.9%) of the study participants belonged to age group 41–60 years. Among the study participants, males (57.6%) were more as compared to (42.4%) females. More than half (52.8%) of participants were graduates or postgraduates, while only (3.1%) were illiterate. Nearly half (45.0%) of them were professionals. About two-third (68.2%) of the study participants belonged to upper class, while only 3.7% of

**Table 1: Distribution of study population according to socio demographic characteristics (n=422)**

Socio demographic variables	n (%)
Age group (years)	
20–40	203 (48.1)
41–60	219 (51.9)
Gender	
Females	179 (42.4)
Males	243 (57.6)
Education status	
Illiterate	13 (3.1)
Primary	29 (6.9)
Middle	38 (9.0)
Secondary	51 (12.1)
Senior secondary school	68 (16.1)
Graduate	161 (38.1)
Postgraduate	62 (14.7)
Occupation	
Unskilled	94 (22.3)
Skilled workers	159 (37.7)
Semi-professionals	102 (24.1)
Professionals	67 (15.9)
Socioeconomic status*	
Lower middle	16 (3.7)
Middle	55 (13.0)
Upper middle	63 (14.9)
Upper	288 (68.2)
Religion	
Hindu	392 (92.9)
Muslim	15 (3.5)
Christian	8 (1.9)
Others	7 (1.7)
Marital status	
Single	56 (13.3)
Currently married	361 (85.6)
Widowed	5 (1.1)
Total number of family members	
<5	310 (74.7)
>5	105 (25.3)
Number of rooms in the house	
2 or less	136 (32.9)
3–5	230 (55.7)
6 or more	47 (11.4)

\*By modified BG PRASAD Scale 2019

participants belonged to lower middle. Majority (92.9%) of the study participants were Hindu. Similarly, majority (85.6%) of them were currently married. About one-fourth (74.7%) of participants had less than five members in the family, while more than half (55.7%) had three to five rooms in their house.

In Table 2, out of total study participants, more than half (54.0%) had mixed diet. About one-fourth (24.0%) had chronic morbidity. Out of total participants, only 5.2% and 2.6% were smokers and consuming smokeless tobacco, respectively. Majority (87.7%) of study participants did not consume alcohol.

**Table 2: Distribution of study participants according to personal history (n=422)**

Personal history variables	n (%)
Type of diet	
Veg	194 (46)
Mixed	228 (54)
Chronic morbidity	
Yes	101 (24)
No	321 (76)
Smoking	
Yes	22 (5.2)
No	400 (94.8)
Frequency per day (n=22)	
1–2	13 (59.0)
3–4	5 (22.7)
5 or more	4 (18.1)
Frequency in a week (n=22)	
1–2 days	14 (63.6)
3–4 days	2 (9.0)
>5 days	6 (27.2)
Consumption of smokeless tobacco products	
Yes	11 (2.6)
No	411 (97.4)
Frequency per day (n=11)	
1–2	5 (45.4)
3–4	6 (54.5)
Frequency in a week (n=11)	
1–2 days	7 (63.6)
3–4 days	4 (36.3)
Consumption of alcohol	
Yes	52 (12.3)
No	370 (87.7)
Frequency per day (n=52)	
1–2	34 (65.3)
3–4	18 (34.6)
Frequency in a week (n=52)	
1–2 days	42 (80.7)
3–4 days	6 (11.5)
>5 days	4 (7.6)

In Table 3, about two-third (63.5%) of study participants were symptomatic. Out of total participants who were symptomatic, majority (80.2%) of them had fever as the most common presentation. About one-third (32.4%) of them had cough. About one-fourth of them had complained of malaise/body ache (24.2%) and sore throat (21.6%).

Table 4 shows that, on analyzing clinical status of study participants with socio demographic factors, it was observed that education status, occupation, socioeconomic status of participants, and overcrowding were statistically significantly ( $P < 0.001$ ) associated. Factors such as age, gender, religion, marital status of participants, and total number of family members in the family had no statistically significant association with clinical status of study participants.

**Table 3: Distribution of study participants according to the presence of symptoms during illness (n=422)**

Clinical status	n (%)
Symptomatic	268 (63.5)
Asymptomatic	154 (36.4)
Total	422 (100)
Various symptoms* (n=268)	
Fever	215 (80.2)
Cough	87 (32.4)
Cold	36 (13.4)
Myalgia/bodyache	65 (24.2)
Diarrhoea	19 (7.0)
Sore throat	58 (21.6)
Headache	41 (15.2)
Difficulty in breathing	32 (11.9)
Fatigue	46 (17.1)
Anosmia	31 (11.5)
Loss of taste	38 (14.1)
Other (specify)	16 (5.9)

\* Multiple response

Table 5 shows that, on analyzing clinical status of study participants with personal history, it was observed that the presence of chronic morbidity and smokeless tobacco was statistically significantly ( $P < 0.001$ ) associated. Factors such as type of diet, smoking, and consumption of alcohol had no statistically significant association with clinical status of study participants.

In Table 6, after multivariate analysis, it was found that factors such as education status of participants, overcrowding, comorbidities, and smokeless tobacco remain statistically significantly ( $P < 0.001$ ) associated with symptomatic COVID-19 confirmed cases.

## Discussion

In the present study, about half (48.1%) of the study participants belonged to age group of 20–40 years, and mean age of study participants was  $41.1 \pm 9.8$  years. In

**Table 4: Association between clinical status and sociodemographic factors among the study participants (n=422)**

Sociodemographic factors	Clinical status		Total, n (%)	P
	Symptomatic, n (%)	Asymptomatic, n (%)		
Age group (years)				
20–40	127 (62.5)	76 (37.4)	203 (100)	0.698
41–60	141 (64.3)	78 (35.6)	219 (100)	
Gender				
Females	115 (64.2)	64 (35.7)	179 (100)	0.787
Males	153 (62.9)	90 (37.0)	243 (100)	
Education status				
Graduate or above	158 (70.8)	65 (29.1)	223 (100)	0.001
Secondary or less	62 (47.3)	69 (52.6)	131 (100)	
Senior secondary	48 (70.5)	20 (29.4)	68 (100)	
Occupation				
Professional	50 (74.6)	17 (25.3)	67 (100)	0.010
Semi-professional	72 (70.5)	30 (29.4)	102 (100)	
Skilled	96 (60.3)	63 (39.6)	159 (100)	
Unskilled	50 (53.1)	44 (46.8)	94 (100)	
Socioeconomic status*				
Middle or low	37 (52.1)	34 (47.8)	71 (100)	0.016
Upper middle	35 (55.5)	28 (44.4)	63 (100)	
Upper	196 (68.0)	92 (31.9)	288 (100)	
Religion				
Hindu	248 (63.2)	144 (36.7)	392 (100)	
Muslim	9 (60.0)	6 (40.0)	15 (100)	
Others	11 (73.3)	4 (26.6)	15 (100)	
Marital status				
Currently married	223 (61.7)	138 (38.2)	361 (100)	0.072
Single	45 (73.7)	16 (26.2)	61 (100)	
Total number of family members				
<5	203 (64.0)	114 (35.9)	317 (100)	0.694
>5	65 (61.9)	40 (38.1)	105 (100)	
Overcrowding				
Yes	57 (72.6)	16 (21.9)	73 (100)	0.004
No	211 (60.4)	138 (39.5)	349 (100)	

\*By modified BG PRASAD Scale 2019

a similar study<sup>[2]</sup> conducted by Dabholkar YG in Navi Mumbai, it was found that majority (90.0%) of the study participants belonged to age group of 20–30 years. The reason for this difference is due to small sample size in the study conducted in Navi Mumbai. More number of males (57.9%) as compared to females (42.1%) were found in the present study which is similar

finding found in the study<sup>[3]</sup> conducted by Chatterjee *et al.*, Pune, Maharashtra. More than half (52.8%) of participants were graduates or postgraduate and nearly half (45.0%) of them were professionals in our study. In another similar study<sup>[3]</sup> by Chatterjee *et al.* Pune, about one-third (29.3%) of participants were doctors. This can be due to the fact that more educated participants

**Table 5: Association between clinical status and personal history among the study participants (n=422)**

Personal history variables	Clinical status		Total, n (%)	P
	Symptomatic, n (%)	Asymptomatic, n (%)		
Type of diet				
Veg	122 (62.8)	72 (37.1)	194 (100)	0.807
Mixed	146 (64.0)	82 (35.9)	228 (100)	
Chronic morbidity				
Yes	80 (79.2)	21 (20.7)	101 (100)	0.001
No	188 (58.5)	133 (41.4)	321 (100)	
Smoking				
Yes	14 (63.6)	8 (36.3)	22 (100)	0.990
No	254 (63.5)	146 (36.5)	400 (100)	
Consumption of smokeless tobacco products				
Yes	3 (27.7)	8 (72.7)	11 (100)	0.011
No	265 (64.4)	146 (35.5)	411 (100)	
Consumption of alcohol				
Yes	33 (63.4)	19 (36.5)	52 (100)	0.990
No	235 (63.5)	135 (36.4)	370 (100)	

**Table 6: Multivariate analysis of determinants of symptomatic coronavirus disease-19 cases among the study participants**

Determinants	n (%)	Unadjusted		Adjusted	
		OR (95% CI)	P	OR (95% CI)	P
Education status					
Secondary or less	62 (23.1)	1		1	
Senior secondary	48 (17.9)	2.67 (1.43–4.98)	0.002	2.66 (1.33–5.30)	0.005
Graduate or above	158 (59.0)	2.70 (1.72–4.23)	0.000	2.43 (1.25–4.70)	0.008
Marital status					
Single	45 (16.8)	1		1	
Currently married	223 (83.2)	0.57 (0.31–1.05)	0.074	0.72 (0.36–1.43)	0.351
Overcrowding					
Absent	211 (78.7)	1		1	
Present	57 (21.3)	2.32 (1.28–4.22)	0.040	3.74 (1.86–7.54)	0.001
Occupation					
Unskilled	50 (18.7)	1		1	
Skilled	96 (35.8)	1.34 (0.80–2.24)	0.260	0.90 (0.45–1.50)	0.740
Semi-professional	72 (26.8)	2.11 (1.17–3.80)	0.013	1.02 (0.40–2.01)	0.950
Professional	50 (18.7)	2.58 (1.30–05.12)	0.006	1.17 (0.38–2.53)	0.730
Socioeconomic status					
Middle or low	37 (13.8)	1		1	
Upper middle	35 (13.1)	1.14 (0.58–2.26)	0.690	1.08 (0.52–2.27)	0.820
Upper	196 (73.1)	1.95 (1.15–3.31)	0.013	1.60 (0.87–2.93)	0.120
Co-morbidity					
Absent	188 (70.2)	1		1	
Present	80 (29.8)	2.69 (1.58–4.57)	0.001	2.78 (1.57–4.92)	0.001
Smokeless tobacco products					
No	265 (98.9)	1		1	
Yes	3 (1.1)	0.20 (0.05–0.79)	0.020	0.21 (0.05–0.89)	0.035

OR=Odds ratio, CI=Confidence interval

and professionals were exposed to higher risk at their job profiles and involved in direct COVID-19 patient care. About two-third (68.2%) of the study participants belonged to upper class, while only (3.7%) belonged to lower middle, this can be explained by the fact they were more aware and have better access to testing facilities.

In our study, about one-third (36.4%) of study participants were asymptomatic. In another study conducted by Dave *et al.* in Rajasthan,<sup>[4]</sup> it was found that majority (81.3%) of participants were asymptomatic. The reason for this difference from our study is due to small sample size in the study conducted in Rajasthan. A recent systematic review<sup>[5]</sup> estimated that the proportion of truly asymptomatic cases ranges from 6% to 41%, with a pooled estimate of 16% (12%–20%). This highlights the importance of contact tracing and isolation of cases and quarantine of contacts. Out of total participants who were symptomatic, majority (80.2%) of them had fever as the most common presentation. About one-third (32.4%) of them had cough. About one-fourth of them had complained of malaise/body ache (24.2%) and sore throat (21.6%). In a weekly report<sup>[6]</sup> by CDC on confirmed COVID-19 HCWs in the United States, it was found that about one-fourth of HCWs had cough and two-third of them had fever and muscle aches. The reason behind this difference from our study is due to difference in characteristics of study participants and study area.

On univariate analysis of clinical status (symptomatic or not symptomatic) of study participants with sociodemographic factors and personal history, it was observed that education, occupation, socioeconomic status of participants, presence of overcrowding, consumption of smokeless tobacco, and comorbidities were statistically significantly associated ( $P < 0.001$ ). On multivariate analysis, all factors remain significantly associated as on univariate analysis except for occupation and socioeconomic status. In our study, graduate and above study participants were at 2.7 times higher odds to be symptomatic as compared to secondary or less. Similarly, professionals were at highest risk to be symptomatic cases of COVID-19 (odds ratio [OR] – 2.58; 95% confidence interval [CI]). This can be due to the fact that their job responsibility was exposing them to more risk. Study participants belonging to upper class socioeconomic status were at higher risk (OR: 1.95; 95% CI) to be symptomatic as compared to upper middle (OR: 1.14; 95% CI) and middle lower socioeconomic status (OR: 1; 95% CI). This can be due to the reason that noncommunicable disease causing chronic morbidities are more common in people belonging to higher socioeconomic status leading symptomatic or more severe viral infection.

On multivariate analysis, participants with comorbidity were at higher risk (OR: 2.69; 95% CI) to be symptomatic as compared to be participants without comorbidity (OR: 1; 95% CI) with statistically significant difference ( $P < 0.001$ ). In a study<sup>[7]</sup> conducted by Wolf *et al.* in Germany, it was found that participants with diabetes and hypertension were associated with higher risk of COVID-19 infection. In our study, participants consuming smokeless tobacco were at lower risk to be symptomatic (OR-0.20; 95% CI) as compared to those not consuming it (OR-1; 95% CI). There is a lot of speculation about the effects of smoking on coronavirus Disease. One study<sup>[8]</sup> reported that current smoking is associated with higher odds of severe COVID-19. However, it is well known that smokers are more likely than nonsmokers to suffer from comorbidities. It remains unclear that whether smoking or other factors related to comorbidities may be responsible for adverse outcome for the disease. Considering these uncertainties, the generalized advice to quit smoking to improve health remains valid. Study participants exposed to overcrowding were at higher risk to have symptomatic disease (OR: 2.32; 95% CI) as compared to its absence (OR: 1; 95% CI). Multiple studies<sup>[9-11]</sup> provide strong evidence for indoor airborne transmission of viruses, particularly in crowded, poorly ventilated environments.

Our study has some strength which makes it more reliable including informed verbal consent at the time of data collection, pilot tested questionnaire, and complete enumeration of all confirmed COVID-19 cases in MCD with high response rate. First limitation is that the result of this study cannot be generalized to general population across India. Since the study used a self-reported questionnaire, hence underreporting or overreporting may be present which is another limitation of the present study.

## Conclusion

This study concludes that about one-third of study participants were asymptomatic which is a large number and is important as asymptomatic cases can also spread disease. Factors such as higher education status, living in overcrowding, presence of some comorbidity, and smokeless tobacco consumption were significantly associated with symptomatic COVID-19 cases. Hence, there is a need to identify these risk factors at an early stage in order to design prevention strategies for better control of such pandemics in future.

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## Conflicts of interest

There are no conflicts of interest.

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