Original Article

Risk Assessment of Coronavirus Disease (COVID-19) Transmission among Physicians Working at a COVID-dedicated Tertiary-care Hospital

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ABSTRACT

Background and aims: *In the earlier stage of pandemic, a sizeable number of physicians and other healthcare workers were infected with SARS-CoV-2. The aim of this study was to assess the factors associated with the risk of SARS-CoV-2 infection among physicians working at a COVID-dedicated tertiary care hospital, within and outside the medical workplace.*

Methods: *This case control study was conducted among the physicians and surgeons working at different departments of Mugda Medical College and Hospital and undergone different pattern of exposure to COVID patients within the period of 20 April, 2020 and 20 July, 2020. Respondents were queried regarding job description, workplace exposures, respiratory protection, hospital policy of disease prevention, and extra-occupational activities during duty period. Chi-square test was done and odds ratios for physicians' infection were calculated. A p-value <0.05 was considered as statistical significant.*

Results: *Increased risk of SARS-CoV-2 infection in physicians was associated with the use of mobile phone during duty hour (OR, 15, 95% confidence interval 1.971 to 121.905, p=0.001), and breech of PPE during doffing (OR, 2.52, 95% confidence interval 0.821 to 7.76, p=0.099). Extra-occupational risk factors included contact with known COVID patient (OR, 5.735, 95% confidence interval 2.072 to 15.872, p=<0.001), and visit any gathering (OR, 1.076, 95% confidence interval 0.412 to 2.81, p=0.881). Physicians worked in roster group (50%) and round group (34.38%) were mostly infected than other facilities.*

Conclusion: *COVID-19 transmissions to physicians was associated with exposure at workplace, breech in PPE during doffing, use of device during round/roster period, extra-occupational exposure to known COVID patients outside the hospital, and visit any gathering. Close monitoring of infection control measures in workplace and increase awareness of the risks of outdoor activities in pandemic situation, may reduce the incidence of infection among physicians.*

Keyword*: COVID, Transmission Risk, Physicians, Tertiary-care Hospital.*

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INTRODUCTION

While the COVID-19 pandemic continues unabated, healthcare workers (HCW) at the forefront are in contact with and caring for COVID patients are among the high risk groups in terms of disease transmission. [1-3] Nosocomial transmission remains to cause anxiety in healthcare professionals who are struggling with many factors as excessive working hour, psychological stress, extreme fatigue, occupational burnout and stigma.[4] Direct contact and aerosol generating procedures constitute the highest risk in terms of contamination, especially in departments with confirmed or suspected COVID-19 patients. [5] The protection of HCW's is one of the most critical points in dealing with the pandemic. Therefore, determining the dynamics of nosocomial transmission within the group of HCW's is of great

importance in preventing nosocomial outbreaks and protecting HCW's from infection.

The study aimed to investigate the incidence of nosocomial transmission and the factors affecting the transmission in physicians working in a COVID dedicated tertiary care hospital in Bangladesh.

METHODS

This case control study was conducted among the physicians and surgeons working at different departments of Mugda Medical College and Hospital and undergone exposure to COVID patients while delivering treatment at the same hospital setting from 20th April 2020 (date of operating as a COVID-dedicated hospital) to 20th July 2020. Data were collected using a semi-structured questionnaire which was filled-up by the individual respondent.

Respondents were categorized into three groups – (1) diagnosed with laboratory confirmed COVID-19 ("cases"), (2) had experienced an illness suspicious for COVID-19 that was not laboratory-confirmed ("possible cases"), and (3) had remained healthy while continuing to work ("controls"). Laboratory confirmed COVID-19 was defined as report of a polymerase chain reaction (PCR) test detecting severe acute respiratory coronavirus virus 2 (SARS-CoV-2). Cases and possible cases were asked the date of symptom onset and requested to report their exposures during the 14 days prior to symptom onset. Controls were asked to complete the questionnaire with respect to the 14 days prior to survey completion. A 14-day exposure window was chosen to correspond with the incubation period of SARS-CoV-2.We collected demographic data followed by questions about exposures to different healthcare settings (cabin/ward round, cabin/ward roster, ICU/HDU, emergency department, triage room, laboratory, radiology department, and medical college/hospital control room), activities outside the workplace, and institutional policies regarding the use of PPE. Respondents were asked about specific exposures and respiratory protection used during the care of such patients. Disposable surgical mask, KN95, N95, N99, FFP2, and FFP3respirators (new or reused), powered air-purifying respirators (PAPRs), and reusable elastomeric respirators were considered respirator-level protection.

Descriptive statistics included mean and standard deviation for age, and percentage and frequencies for categorical variables. Pearson χ^2 test was done for calculation of continuous and categorical variables. Odds ratios with 95% confidence intervals with respect to respondents infected with COVID-19 were calculated for all exposures. Statistical package of social sciences (SPSS) version 23.0 was used for statistical analysis of data.

Ethical clearance was obtained from Institutional Review Board (IRB) of Mugda Medical College to undertake the current study. According to Helsinki Declaration for Medical Research involving Human Subjects 1964, all the participants were informed about the study design and the right of the participants to withdraw themselves from the research at any time, for any reason.

RESULTS

This case-control study included total 92 physicians worked at Mugda Medical College Hospital between the period from 20 April, 2020 (date of operating as a COVID-dedicated hospital) and 20 July, 2020. Among them, 32 were case, and 60 control. Case and control were similar demographically. Overall, the mean age of the case was 38.28 years and that of control was 40.35 years. Sixty eight percent respondents were male in case group and 63% in control group (Table-1). Most of them had no comorbidities (65.63% in case group and 83.33% in control group). Half of the cases were from roster group, followed by round group (34.38%). Those who were engaged in cabin round and emergency department, were most commonly infected (31.25% and 28.13% respectively)

Table-I: *Demography*

Characteristics	Cases (n=32)	Control (n=60)
Age, mean (±SD)	38.28 (±7.52)	40.35 (±7.76)
Sex		
Male	22 (68.75%)	38 (63.33%)
Female	10 (31.25%)	22 (36.66%)
Type of job		
Round group	11 (34.38%)	24 (40.00%)
Roster group	16 (50.00%)	28 (46.67%)
Administrative	1 (3.13%)	6 (10.00%)
Others	4 (12.50%)	2 (3.33%)
Place of work		
Cabin	10 (31.25%)	25 (41.67%)
Ward	4 (12.5%)	14 (23.33%)
Emergency	9 (28.13%)	12 (20.00%)
Triage room	1 (3.13%)	3 (5.00%)
ICU	3 (9.38%)	6 (10.00%)
Operation theatre	1 (3.13%)	0
Radiology	2(6.25%)	0
Pathology/Microbiology	2(6.25%)	0
Comorbidities		
Yes	11 (34.38%)	10 (16.67%)
No	21 (65.63%)	50 (83.33%)

Most of the respondents used reused mask (75% in case group and 81.6% in control group). In case group, KN95 was the most commonly used respirator (46.88%), followed by N95 (40.63%). In control group, N95 and N99 was mostly used (38.33%). In both groups, respondents used double masks i.e. respirator plus surgical mask .

Table-II : *Respiratory protection utilized*

	Cases n=32	Control n=60
Mask type (Respirators)		
KN95	15 (46.88%)	13 (21.67%)
N95	13 (40.63%)	23 (38.33%)
N99	3 (9.38)	23 (38.33%)
Surgical mask+ respirators	23 (71.87)	47 (78.33%)
Surgical mask only	0	1 (1.67%)
Pattern of mask used		
Single time	8 (25.00%)	11 (18.33%)
Reused	24 (75%)	49 (81.67%)

Most of the cases were symptomatic (73.3%), only 4 cases (12.5%) needed hospitalization .

Table-III: *Clinical presentation and hospitalization status*

	Cases (n=32)	
	Number	Percent
Clinical presentation		
Symptomatic	22	73.3
Asymptomatic	8	26.7
Hospitalization status		
Hospitalized	4	12.5
Not hospitalized	28	87.5

Use of mobile phone during duty hour was associated with increased rate of COVID infection (odds ratio 15,95% confidence interval 1.971 to 121.905,p = 0.001). Those who notified any breech of PPE during doffing were mostly infected (odds ratio 2.524,95% confidence interval 0.821 to 7.76,p=0.099). Institutional training on donning and doffing was protective against acquiring disease (Table-IV).

Contact with known COVID patient was the most common factor of infection outside the healthcare setting (odds ratio 5.735, 95% confidence interval 2.072 to 15.872,p =<0.001). Visiting any gathering was another factor of infection outside hospital (odds ratio 1.076, 95% confidence interval 0.412 to 2.81,p= 0.881).

Table-IV: *Odds Ratios associated with occupational factors and extra-occupational exposures*

Variables	OR all cases (n=32)	P value
Occupational factors		
Occupational factors		
Institutional training on donning/doffing	0.429	0.058*
(95% CI)	(0.177-1.039)	
Use of full PPE on duty	0.925	0.907
(95% CI)	(0.249-3.430)	
Any breech of PPE during doffing	2.524	0.099
(95% CI)	(0.821-7.760)	
Use of mobile phone on duty time	15.00	0.001*
(95% CI)	(1.971-121.9)	
Extra-occupational exposure		
Contact with known COVID patient	5.735	0.000*
(95% CI)	(2.072-15.872)	
Visit any gathering	1.076	0.881
(95% CI)	(0.412-2.81)	
Use of public transport	0.714	0.596
(95% CI)	(0.205-2.489)	

DISCUSSION

This case control study conducted at a COVID-dedicated tertiary-care hospital may put some valuable inputs for risk assessment of SARS-CoV-2 infection among physicians and other healthcare workers at workplace and outside of hospital setting. This may also help policymakers to formulate guidelines to reduce infection in healthcare workers in different healthcare settings during COVID pandemic.

We observed that physician infection was more common among those who did their duty in cabin block and emergency department of our hospital.

Relatively lower incidence of infection was noted among those who worked in ICU, which is a potential place of aerosol generating procedures (e.g. high flow nasal cannula, CPAP, BiPAP, mechanical ventilators etc.). This is probably due to more cautious practice of mask and PPE in this area. Round and roster group doctors were mostly infected, probably due to prolonged contact with COVID patients. Lentz R et al. in their study also observed that nosocomial transmission to healthcare professionals were more common during routine contact with COVID-19 patients than during aerosol generating procedures.[6]

Use of medical mask is paramount in infection prevention.[7-9] The World Health Organization recommends medical masks for respiratory protection during non-aerosol generating procedures, whereas the US CDC advised for respirators.[10,11] In our study, we observed that most of the respondents (both case and control) used respirator and surgical mask for better protection. KN95 and N95 was the most commonly used in case group, whereas N95 and N99 in control group. As we have institutional policy on reusing masks, it was commonly practiced by all.

We also observed that institutional training on donning/doffing and use of full PPE during duty hour was associated with lower odds of nosocomial infection. At the outset of the pandemic, Directorate General of Health Services (DGHS) arranged a training program for the healthcare workers at Mugda Medical College Hospital on infection control and donning/doffing. This had tremendous impact on infection prevention among physicians at workplace. This type of training has a great impact in lowering transmission of infection among healthcare workers.[7]Physicians, who noted any breech in PPE during doffing, got infected. Though the hospital authority arranged training for all, a large bulk of physicians, especially who were deputed on later period, could not be trained and they were infected more. Many centers in different countries recruit PPE observers, whonotify any breech during doffing. This can reduce the rate of contamination. Studies showed that appropriate PPE, familiarity with it's use, and dedicated PPE observers may reduce infection rate at workplace.[6]

Many physicians, especially junior doctors, use mobile phone during duty hour to communicate with others. They are often bound to do this as the senior colleagues and administrative persons ask them regarding individual patient's condition. It is also used to follow health-related news, following updated guidelines, photography, sharing medical documents, conducting telecommunications etc. In this study, it was observed that the use of mobile phone in duty hour was associated with higher odds of infection among physicians. They carry the device during ward or cabin round, make phone calls while close to COVID positive patients, may often bring it to the duty room without proper disinfection. Mobile phone is a particular high risk object, which can directly come in contact with the face and mouth, while talking over phone, and a potential vehicle of transmission of infection, even if hands are properly disinfected. Breech in mobile phone hygiene is a potential source of SARS-CoV-2 transmission.[13-16]

In our study, it was observed that some physicians contacted the disease outside the workplace. There were higher odds of disease acquisition among those who gave history of contact with known COVID patients at home or elsewhere (e.g. sick relatives). Visiting gathering i.e. grocery, market, mosque etc. was another factor of extra-workplace infection. Same observation was found in other study.[6] Surprisingly lower odds of infection were observed among those who used public transport, although most of the respondents used hospital arranged service or personal transportation.

Our study had several limitations. First, the sample size was too small; hence the result may not depict the real scenario. Second, the cohort included the physicians only. If sample design could include all the healthcare professionals (i.e. nurses, technicians, ward boy etc.) we could estimate the risk factors more precisely. Third, the study duration was only three months at the earlier period of pandemic. Extending the study period with prolonged vigilance might clarify the risk factors. Fourth, we may have many asymptomatic cases that were undiagnosed and may underscore the total cases and risk factors.

The strength of this study is that we recruited the subjects in the earlier phase of disease in our country to evaluate the risk factors of infection in hospital setting and to alleviate the further risk by implementing the study result. Controls were matched as closely as possible to cases. Data on exposure and respiratory protection were collected in detailed manner.

CONCLUSION

This study enlightens our knowledge regarding various factors associated with physician infection with SARS-CoV-2 in hospital as well as outside of workplace settings. It was observed that physicians not exposed to potential aerosol-generating procedures were equally or more infected and a big portion of them acquired disease from outside of hospital environment. Mobile phone using is an important risk factor. Proper uses of PPE, careful practice of hand hygiene, vigilance during outside works are all

important measures to mitigate physician infection. The results of this study have an impact on healthcare workers and public health policy makers to reduce infection now and in future.

REFERENCES

1. World Health Organization. Risk assessment and management of exposure of health care workers in the context of COVID-19. Interim guidance, 2020.
2. Wu Z, McGoogan JM. Characteristics and important lessons from the Coronavirus Disease 2019 (COVID-19) outbreak in China: Summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. *JAMA* 2020;323.
3. Belingheri M, Paladino ME, Riva MA. COVID-19: health prevention and control in non-healthcare settings. *Occup Med* 2020;70:82-83.
4. Koh D. Occupational risks for COVID-19 infection. *Occup Med* 2020;70:3-5.
5. CDC COVID-19 Response Team .Characteristics of Health Care Personnel with COVID-19 – United States, February 12 – April 9, 2020. *MMWR Morb Mortal Wkly Rep* 2020;69:477-81.
6. Lentz RJ, Colt H, Chen H, et al. Assessing coronavirus disease 2019 (COVID-19) transmission to healthcare personnel: The global ACT-HCP case-control study. *Infection Control & Hospital Epidemiology* 2021;42:381-387.
7. Brooks JT, Butler JC. Effectiveness of mask wearing to control community spread of SARS-CoV-2. *JAMA* 2021;325(10):998–999. doi:10.1001/jama.2021.1505.
8. Bartoszko JJ, Farooqi MAM, Alhazzani W, Loeb M. Medical masks vs N95respirators for preventing COVID-19 in healthcare workers: a systematic review and meta-analysis of randomized trials. *Influenza &Other Respir Viruses* 2020;14:365–373.
9. Wang X, Pan Z, Cheng Z. Association between 2019-nCoV transmission and N95 respirator use. *J Hosp Infect* 2020;105:104–105.
10. Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages. World Health Organization website. http://www.who.int/publications-detail/rationaluse-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages. Accessed August 21, 2021.
11. Interim infection prevention and control recommendations for patients with suspected or confirmed coronavirus disease 2019 (COVID-19) in health care settings. Centers for Disease Control and Prevention website. http://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html.Published February 11, 2020. Accessed August 21, 2021.
12. Chu DK, Akl EA, Duda S, et al. Physical distancing, face masks, andeye protection to prevent person-to-person transmission of SARS-CoV-2and COVID-19: a systematic review and meta-analysis. *Lancet*2020;395:1973–1987.
13. Panigrahi SK, Pathak VK, Kumar MM, et al. Covid-19 and mobile phone hygiene in healthcare settings. *BMJ Global Health* 2020;5:e002505
14. Jayalakshmi J, Appalaraju B, Usha S. Cellphones as reservoirs of nosocomial pathogens. *J Assoc Physicians India* 2008;56:388–9.
15. Chao Foong Y, Green M, Zargari A, *et al*. Mobile phones as a potential vehicle of infection in a hospital setting. *J Occup Environ Hyg* 2015;12: D232–5.
16. Pal S, Juyal D, Adekhandi S, *et al*. Mobile phones: reservoirs for the transmission of nosocomial pathogens. *Adv Biomed Res* 2015;4:144.