

# Covid-19 and Intensive Care Unit: Infection, Contact Time & Procedures Performed

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## ABSTRACT

**Background:** Safety of front-line health care workers dealing with critically ill patients is of prime importance during COVID-19 pandemic. We have limited skilled workforce and intensive care units (ICU).

**Aim:** To determine the frequency of COVID 19 among ICU staff and find association with contact time and procedure performed.

**Methods:** A comparative cross-sectional study was conducted on 95 subjects working in ICU settings of tertiary care hospitals of Lahore. Data was collected about COVID-19 infection, prevention practices, contact time & procedures performed through google forms. Data was entered & analyzed by SPSS v23 while performing descriptive statistics, T Test, Chi square test & binary logistic regression.

**Results:** Among 95(100%) subjects 25(26.31%) had covid-19 infection whereas 70(73.68%) did not had infection. Age> 30(p=.041), female gender (p=.022), use of re-useable personal protective equipment PPE(p=.009), contact time (p=.020), performing procedures: Nebulization(p=.023) & non-invasive positive pressure ventilation (p=.011) were significantly associated with COVID-19 infection among ICU staff.

**Conclusion:** There was high frequency of COVID-19 infection among ICU staff. Age> 30, female gender, re-useable PPE, contact time, performing procedures: Nebulization & non-invasive positive pressure ventilation were significantly associated with COVID-19 infection among ICU staff.

**Keywords:** COVID-19, Contact time, Intensive care unit, Infection, Procedures

## INTRODUCTION

As on 12<sup>th</sup> November 2021, 251,788,329 cases and 5,077,907 deaths have been reported globally by World Health Organization<sup>1</sup>. In Pakistan 1,279,142 cases and 28,584 deaths has been reported. <sup>2</sup> Health care facilities are limited in developing countries including Pakistan. Disease has added an extra burden on health care system and in a resource limited setting; health care worker safety is of prime concern<sup>3</sup>.

In a study conducted on health care workers in United Kingdom to determine the prevalence and risk factors of contracting COVID-19 infection, 29.4% health care workers were either labeled as suspected or confirmed cases. Among them 7.5% tested positive for SARS COV2<sup>4</sup>.

A meta-analysis of COVID-19 in health care staff reported 11% prevalence of PCR positivity and among 7% antibodies were present. Health care staff working in non-emergency wards had more infection and nurses were affected more<sup>5</sup>. Aerosol generating procedures brings an additional risk for health care workers and demands more prevention for them<sup>6</sup>.

In a study conducted in Canada post implementation of preventive measures, Health care workers (HCW) developed COVID-19 infection and lack of infection prevention training, improper use of personal protective equipment and high-risk procedures were found be reasons of getting infection. High risk procedures demand extra protection<sup>7</sup>.

Safety of health care staff is of pivotal importance especially in a resource deficient country like Pakistan. COVID-19 pandemic added an extra burden on the system and even suffering of health care staff doubles the burden. On one side when a health care worker suffers from infection, he may be a source of infection for patients; he will add to the existing burden of the disease but in addition to this problem emerges when no one can replace the staff in skills. We have limited ICU settings and limited staff. So, safety of staff matters more in our setting being first line healers for severely ill patients.

Current study is an effort to determine the frequency of COVID-19 among ICU staff and to determine association with contact time, preventive measures and procedures performed. This study will add in existing knowledge and better strategies can be planned in future.

## MATERIAL & METHODS

An analytical cross-sectional study was conducted during 3<sup>rd</sup> wave of COVID-19 in ICU of tertiary care Hospitals of Lahore after permission from Ethical Committee. A total of 95 subjects were enrolled in study through non-probability convenient sampling technique. Data was collected through online google forms. Questionnaire was pre designed with the help of literature and it was a self-filling, self-response form. Verbal consent was obtained. Participants expressed their willingness & filled the forms. Inclusion criteria for Subjects was 20 years old or above belonging to any gender and working in ICU while spending minimum 1 hour per week in ICU. Students and visitors were excluded from the study. COVID-19 positive was considered on PCR report only.

After taking approval from hospital ethical committee and consent from study participants, all patients fulfilling inclusion criteria were enrolled in study. Demographic information (including name, age, gender) was recorded. Subjects were asked about preventive measures(hand washing, social distancing), PPE, history of contracting COVID-19, contact time spent in ICU and procedures performed (Intubation, Extubation, Chest Compressions, Nebulization, High flow oxygen, including nasal canula, at > 15L, Non-invasive positive pressure ventilation, Oscillatory ventilation, Bronchoscopy, Sputum induction, Open suctioning of tracheostomy or endotracheal tube, Tracheostomy change, Manual ventilation, Disconnecting patient from ventilator, Venturi mask with cool aerosol humidification, Mechanical In-Exsufflator, Ventilator circuit manipulation.

Data was entered and analyzed using SPSS v23.0. Frequencies and percentages were expressed for qualitative variable like gender (Table 1) and Quantitative variable age & contact time were expressed by Mean  $\pm$ S.D. Independent sample T test was applied for equal groups (convenient sample) to compare contact time relation with COVID-19 infection. Chi

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square/ fisher exact test was applied for bivariate analysis. Binary logistic regression was applied for multivariate analysis and to control confounders. A p-value  $\leq 0.05$  was considered significant.

**RESULTS**

Among 95(100%) subjects 25(26.31%) had covid-19 infection whereas 70(73.68%) did not had infection. Mean age of the participants was 30.46+4.7. 100 % subjects reported that they were practicing preventive measures both at duty and routine life including social distancing, face mask, hand washing. Contact time per week in ICU was 32.99+28.09. Descriptive statistics of the qualitative variables are given in table 1.

Those whose had COVID-19 were compared with an equal number of convenient samples. For contact time(quantitative) by independent sample T test. Results were significant as shown in Table 2. On applying chi square test profession (p= 0.004), contact time (0.00) and sputum induction (0.037) was significantly associated with COVID-19 infection.

Binary logistic regression was applied to all the variables. Classification table showing overall percentage of 73.7%. Method Enter was used to enter the variables in regression equation. Omnibus Tests of Model Coefficients had p value 0.04 for step, block & model. Nagelkerke R Square value is 0.551. Hosmer and Lemeshow Test had a p value of 0.548 showing model fitting. Final results are expressed in Table 2. Variables; Age> 30(p=.041), female gender(p=.022), use of re-useable PPE(p=.009), contact time (p=.020), performing procedures: Nebulization (p=.023) &

non-invasive positive pressure ventilation (p=.011) were significantly associated with COVID-19 infection among ICU staff (Table 3).

Fig 1: Frequency of covid-19 among ICU staff

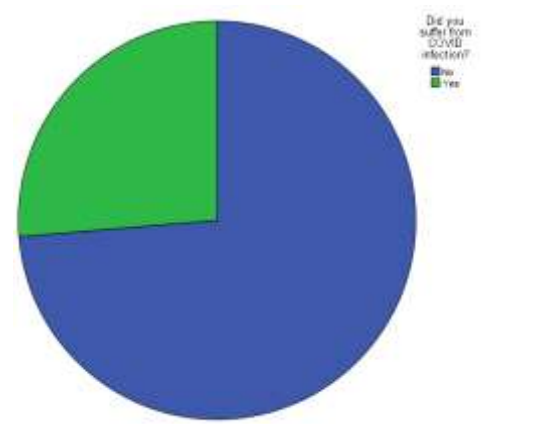


Table 1: Descriptive statistics of study variables

Variables	All subjects Frequency% (n=95) (100%)	Had covid-1, Frequency (row%), (column%) (n=25)(26.31%)	Did not had covid-19 Frequency (row%), (column%) (n=70) (73.68%)
Age < 30	60(63.2)	15(25), (60)	45(75), (64.3)
Age >30	35(36.8)	10(28.6), (40)	25 (71.4), (35.7)
Gender-male	66(69.5)	16(24.2), (64)	50(75.8), (71)
Gender-female	29(30.5)	9(31), (36)	20(69), (28)
Profession-doctors	56(58.9)	15(26.8), (60)	41(73.2), (58.6)
Profession-paramedical staff	39(41.1)	10 (25.6), (40)	29(74.4), (41.4)
Re-useable ppe	8(8.4)	4(50.0), (16)	4(50.0), (5.7)
Contact time <50 hours/week	78(82.1)	23(29.5), (92)	55(70.5), (87.6)
Contact time >50 hours/week	17(17.9)	2(11.8), (8)	15(88.2), (21.4)
Not trained in donning & doffing	12(12.6)	3(25.0), (12)	9(75.0), (12.9)
Improperly fitted mask	19(20)	3(15.8), (12)	16(84.2), (22.9)
<b>Procedure performed</b>			
Intubation	67(70)	16(23.9), (64)	51(76.1), (72.9)
Extubation	38(40)	9(23.7), (36)	29(76.3), (41.4)
Chest compressions	60(63.2)	14(23.3), (56)	46(76.7), (65.7)
Nebulization	58(61.1)	18(31.0), (72)	40(69.0), (57.1)
High flow o2	85(89.5)	21(24.7), (84)	64(75.3), (91.4)
Non-invasive positive pressure ventilation	72(75.8)	20(27.8), (80)	52(72.2), (74.3)
Oscillatory ventilation	12(12.6)	2(16.7), (8)	10(83.3), (14.3)
Bronchoscopy	7(7.4)	0(0), (0)	7(100), (10)
Sputum induction	6(6.3)	0(0), (0)	6(100), (8.6)
Open suctioning	34(35.8)	11(32.4), (44)	23(67.6), (32.9)
Tracheostomy change	4(4.2)	0(0), (0)	4(100), (5.7)
Manual ventilation	50(52.6)	11(22), (44)	39(78), (55.7)
Disconnecting ventilator	43(45.3)	12(27.9), (48)	31(72.1), (44.3)
Venturimask	10(10.5)	2(20), (8)	8(80), (11.4)
Mie	4(4.2)	2(50), (8)	2(50), (2.9)
Ventilator circuit manipulation	33(34.7)	8(24.2), (32)	25(75.8), (35.7)

Table 2: COVID-19 & contact time

Variable	Had COVID-19 (n=25) MEAN+ SD	Did not had COVID-19 (n=25) MEAN+ SD	T Test value (P value)	95% CI Upper limit	95% CI Lower limit
Contact time/week	28.72+21.534	25.76+ 51.922	5.96(0.00)	25.758	51.922

Table 3: Multivariate Variate Analysis of Variables by Binary logistic regression

Variable	P value	Adjusted odds ratio	95% CI		Reference category
			Lower	Upper	
Age >30	.041	7.639	1.083	53.901	< 30
Gender-female	.022	.122	.020	.735	MALE
Profession-doctors	.964	1.042	.178	6.114	OTHERS
Re-useable ppe	.009	41.508	2.564	671.885	DISPOSABLE
Contact time < 50 hours/week	.020	16.03	1.535	167.4	>50
Not trained in donning & doffing	.544	.519	.062	4.320	TRAINED
Improperly fitted mask	.338	.391	.057	2.668	Properly fitted mask
Intubation	.418	.485	.084	2.799	Not performed

Extubation	.758	1.350	.200	9.139	Not performed
Chest compressions	.381	1.959	.436	8.813	Not performed
Nebulization	.023	8.679	1.348	55.893	Not performed
High flow o2	.154	.220	.027	1.766	Not performed
Non invasive positive pressure ventilation	.011	10.375	1.694	63.530	Not performed
Oscillatory ventilation	.090	.072	.003	1.514	Not performed
Bronchoscopy	.999	.000	.000	.000	Not performed
Sputuminduction	.999	.000	.000	.000	Not performed
Opensuctioning	.159	3.429	.618	19.014	Not performed
Tracheostomychange	.999	.000	.000	.000	Not performed
Manualventilation	.819	.841	.190	3.713	Not performed
Disconnectingventilator	.613	.635	.109	3.689	Not performed
Venturimask	.999	.000	.000	.000	Not performed
Mie	.998	19138858100.254	.000	.000	Not performed
Ventilatorcircuitmanipulation	.170	.272	.042	1.750	Not performed

## DISCUSSION

High frequency of COVID-19 had been found among ICU staff in current study. Previous studies supported our findings. Many studies reported high prevalence of COVID-19 among health care workers due to more chances of exposure and scarcity of preventive resources. Our study reported a little high prevalence. Most of the studies reported prevalence generally among HCW and usually range from 15-20% whereas 26.3% is reported in the present study among ICU staff. Working in ICU may have increased the risk<sup>5,9-10</sup>.

All study participants reported that they were practicing preventive measures both at duty and routine life including social distancing, face mask & hand washing. Those who were not trained in donning & doffing were not found at risk maybe they got indirectly trained by peers or through online videos. Wearing mask served as protective measure even when few subjects reported that their masks were not properly fitted, they were not found at higher risk of getting infection. Staff who wore re-useable PPE had more chances of getting infection as compared to those who used disposable PPE. As they may not be properly washed, handled or reused. In a study conducted in the peak of pandemic in Pakistan reported that two third participants did not have recommended PPE and only one fourth were trained in donning & doffing formally<sup>11</sup>. In a resource limited setting like Pakistan in pandemic situation, things were bit difficult. ICU staff is usually provided with more resources. A study pointed out that due to limited resources reuse of PPE and face mask was adopted and may be this was the reason for high prevalence of COVID-19 among HCWs, they reported that HCWs were more concerned about preventive measures in their routine lives in order to protect their families as they may be exposed at their jobs<sup>12</sup>.

Majority of the subjects spent quite a long time in ICU settings. Spending more time in ICU settings was found to be associated with carrying infection. Mean time of COVID-19 group was higher & statistically significant when compared with those who did not have COVID-19. When time was stratified, < 50 contact hours/ weeks had a strong association with COVID-19 in this study. Long duty hours leads to more exposure and chances for getting infected<sup>10,12</sup>.

Females were more at risk of carrying infection when were compared to male colleagues. In a study collecting data from ten European countries, it was found that females were more in number than men among COVID-19 cases in working age group and vice versa in near retirement age<sup>13</sup>.

Doctors were more affected with COVID-19 as compared to non-doctors. A systematic review reported that nurses were more affected by infection and most of the health care workers were employed in non-emergency settings.<sup>5</sup> In another study conducted in Italy 12.2% of the health care workers were seropositive and odds of infection were higher among those dealing with subacute disease and working in emergency department<sup>9</sup>. Another study compared prevalence of HCW & non HCW and found high prevalence among HCW<sup>9</sup>.

Among the long list of procedures that are commonly performed in ICU by the staff and with the commencement of

COVID-19 pandemic there was a huge concern built up among health care workers that the procedures may made them more vulnerable to infection by enhancing chances of direct exposure or due to limited social distancing while performing the procedure. In the current study sputum induction on bivariate analysis whereas Nebulization & non-invasive positive pressure ventilation on multivariate analysis were significantly associated with high risk of getting COVID-19 infection. Intubation is considered to be more infectious procedure and reducing the need and replacing with NIPPV was considered to be a bit safe choice for health care workers in a study.<sup>14</sup> But in current study NIPPV had been predicted to be at risk of infection. A study recommended use of non-invasive therapies and avoiding administration of nebulization therapy.<sup>15</sup> Front line HCW were affected specially performing aerosol generating procedures so special precautions must be observed. Special recommendations to provide respiratory care to patients must be followed<sup>7,16,17</sup>.

Smaller sample size, cross sectional study design, convenient sampling technique were the limitations. A large-scale comparative study is recommended to further evaluate the facts. High risk procedures must be performed as per need as with special recommendations of self-protection. Studies must be planned to see administrative role and availability of resources and their adequate and equitable use.

## CONCLUSION

There was high frequency of COVID-19 infection among ICU staff. Age > 30, female gender, re-useable PPE, contact time, performing procedures: Nebulization & non-invasive positive pressure ventilation were significantly associated with COVID-19 infection among ICU staff.

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