

# Knowledge attitude and Practice on Infection Prevention and Control Measures among Intensive Care Unit Staff during Corona Virus Disease Pandemic in a Tertiary Care Hospital

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## ABSTRACT

**Introduction:** Healthcare workers (HCWs) play an important role in fighting the corona virus disease (COVID-19) pandemic and are at greater risk of infection with prevalence ranging from, 3.1% to 19.2% as estimated in previous studies. Prevention by practicing Infection prevention control (IPC) measures remains the best option. Identifying existing IPC knowledge, attitudes, and practices (KAP) among health care workers is essential for understanding risk prevention.

**Material and Methods:** A cross sectional study was done in 81 intensive care unit (ICU) staff of a Dedicated Covid care hospital during February 2021 to May 2021 to identify knowledge, attitude and practice (KAP) on Infection prevention and control (IPC) practices during health care interactions (HCI) and aerosol generating procedures (AGP) as recommended by World Health Organisation (WHO). Data collected using a pretested semi-structured with four sections (demographic characteristics, Knowledge, attitude, practices on IPC). Chi-square statistic was used and  $p < 0.05$  was considered as statistically significant.

**Results:** Proportion of HCWS with score more than 80% of maximum score with respect to Knowledge, attitude practice scores during HCI and practice during HCI + AGPs were 72.8%, 84%, 92.6% and 94.4% respectively. KAP scores were more than 80% in, more proportion of females (91.3%), those who were postgraduates (90%) by qualification statistically significant.

**Conclusions:** A change of culture and training in relation to IPC is needed, so that good IPC practices are modelled by seniors to cultivate and sustain such practices amongst other staff.

**Keywords:** Knowledge, attitude, practice, Infection prevention and control measures, Intensive care unit staff, Corona pandemic.

studies showed healthcare workers are more likely to be exposed to SARS-COV-2 virus and are, therefore, at higher risk of COVID-19 infection than the general community.<sup>4,5</sup> The proportion of HCWs with COVID-19 disease was 3.1% and 6.8% in studies by Baker M A et al and Butchele et al respectively and the proportion with SARS-CoV-2 infection (not necessarily meeting criteria for COVID-19) was 19.2% in study by El-Boghdadly K et al.<sup>6,7,8</sup> In study by Mahajan N N et al, 11% prevalence of SARS-CoV-2 infection among HCWs, 4% co-infection and 1% mortality was identified.<sup>9</sup> One of the major causes for these high rates is, the lack of infection control programs, which have been neglected due to limited resources, competing priorities, and other barriers.<sup>10</sup> Prevention is the best option for protecting healthcare workers against the COVID-19 pandemic.<sup>11</sup>

Infection prevention and control (IPC) as defined by World Health Organisation (WHO) is: A scientific approach with, practical solutions designed to prevent harm, caused by infections to patients and health care workers, grounded in principles of infectious diseases, epidemiology, social science and health system strengthening, and rooted in patient safety and health service quality.<sup>12</sup> Indeed, correct and consistent compliance with IPC protocols is effective in minimizing the risk of COVID-19 infection.<sup>3,5</sup> Compliance with IPC protocols is facilitated by training of healthcare workers on IPC, provision of IPC materials and regular audit of IPC practices.<sup>13</sup>

Principles of IPC strategy as per WHO guidelines, includes Standard precautions (includes hand hygiene, risk assessment, appropriate use of personal protective equipment (PPE), respiratory hygiene, prevention of needle

## INTRODUCTION

In December, 2019, an outbreak of pneumonia of unknown cause was detected in Wuhan (Hubei, China), and the cause established, was a novel coronavirus, namely severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).<sup>1</sup> In India 3,31,39,981 were infected, with 4,41,749 deaths due to Corona virus disease (COVID-19) with case fatality rate 1.13% as on 9th September 2021.<sup>2</sup>

Healthcare workers (HCWs) play an important role in fighting the COVID-19 pandemic and are at greater risk of COVID-19 virus infection in the line of duty.<sup>3</sup> Also, data from recent

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stick injuries, environmental cleaning, linen management, waste disposal, patient care equipment) early recognition, physical distancing, triage, and source control. Empiric additional transmission-based precautions (includes contact precautions, droplet precautions with PPE and when applicable airborne precautions with PPE including N95 mask or FFPs for AGP) for suspected cases of COVID-19, administrative controls; environmental and engineering controls, education of HCWs, policies, etc.<sup>12,13,14,15</sup>

Identifying existing infection control knowledge, attitudes, and practices (KAP) among health care workers is a key first step in developing a successful infection control program.<sup>16</sup> There is no much available research, on IPC practices among Intensive care unit (ICU) staff, hence the current study was done to assess the knowledge, attitude and practice on IPC measures as recommended by WHO during COVID-19 patient care.

## MATERIAL AND METHODS

A cross sectional study was done in intensive care unit (ICU) staff of a Dedicated Covid care hospital during February 2021 to May 2021 to identify knowledge, attitude and practice (KAP) on Infection prevention and control (IPC) practices during health care interactions (HCI) and aerosol generating procedures(AGP) as recommended by World Health Organisation (WHO).

Inclusion criteria: Intensive Care Unit staff who gave informed consent and who were associated with care of COVID 19 disease patient for more than 1 month, were included in the study.

Exclusion criteria: those not involved and those who were associated for less than 1 month in COVID-19 patient care and who did not give consent.

Sample size calculated using formula for finite population.

Where,  $Z_{\alpha}$  is the standard normal deviate, 1.96 at 95% confidence interval.

$P =$  Prevalence is 50%. (when prevalence is unknown) Hence  $P = 0.5$ ,  $1-P = (1-0.5)$

$e =$  allowable error taken as 5% (10% of prevalence)

$N =$  study population (ICU staff involved with COVID 19 patient care during study period) = 83, The total ICU staff was 83 health workers (24 doctors, 42 nurses, 6 lab technicians, 3 pharmacist, 4 clerical staff, 4 housekeeping staff)

$$\text{Sample size (n)} = \frac{\frac{(z^2 X p(1-p))}{e^2}}{1 + \frac{(z^2 X p(1-p))}{(e^2 N)}}$$

$$\text{Sample size (n)} = \frac{\frac{((1.96)^2 X 0.5(1-0.5))}{(0.05)^2}}{1 + \frac{((1.96)^2 X 0.05(1-0.5))}{((0.05)^2 \times 83)}}$$

Sample size(n) required is = 69.5

Corrected sample size with non response rate as 15% was

$69.5 + 10.5 = 80$ . Sampling method used was simple random sampling.

Data collection: Data collected using a pretested semi-structured questionnaire. A pilot study was conducted by distribution of 10 questionnaires to other department faculty, to assess the validity, reliability, and bias of the questionnaire. Cronbachs alpha of the questionnaire was 0.8, which showed high reliability and consistency of the questionnaire items.

Procedure: Institutional ethical committee clearance was obtained. After explaining the purpose of the study and confidentiality of information, informed consent was taken from study participants. Data collected by self administered questionnaire (English and regional language telugu) which takes about 10 minutes. Study participants were approached on rotational basis, in view of their shift duties so as to cover the entire ICU staff. Out of 83, two were excluded as the duration of their interaction with COVID -19 disease patients was less than 1 month. Questionnaire was circulated to 81 health care workers, and completed questionnaire was collected after ensuring completeness of the responses. Questionnaire consisted of 4 sections (A,B,C,D). Components of Section A were demographic characteristics, work experience, vaccination status and IPC training and facilities. Components of section B were knowledge on IPC measures, which had 18 items on general awareness (3 items), isolation precautions (2 items), hand hygiene (2 item), respiratory hygiene (2 items), needle stick injury (2 item), appropriate use of PPE (3 items), biomedical waste management (2 items), and patient care equipment (2 item) as recommended by WHO. Items are either true/false statements or multiple choice questions (MCQs). Section C included items which evaluate their attitude towards existing IPC measures in the institute, which has 14 items on PPE (2 items), hand hygiene (2 itlems), respiratory hygiene (1 item), needle stick injury (3 items), injection safety (4 items) and asepsis (2 items). Items are either true or false or MCQs. Section D includes 2 parts (1 and 2) with 13 items on adherence towards IPC procedures during health care interactions (part-1, 7 items) and aerosol generating procedures (part-2, 6 items) on COVID-19 disease patients. It was rated on a 4 point likert scale with, always (as recommended), most of the time, occasionally and rarely scored as 1, 2, 3 and 4. Score 1 and 2 were considered as correct practices and 3 and 4 as wrong practices. Of the 81 health care workers, thirty six (18 doctors and 18 ICU nurses) of them performed or assisted AGP. Compliance with IPC measures when performing AGP was therefore assessed for only 36 of the study participants. Correct responses were scored 1 and wrong responses as zero. Final knowledge, attitude, practice scores ranges from 0-18, 0-14 and 0-7/13 (part1/part1and part2). Cumulative KAP scores were categorised as, below average (KAP <80%), Good (KAP 81–90%) and Very good (KAP > 90%). Data analysis: Data entered in Microsoft excel 2007. Data represented in frequencies and proportions and analysed using statistical software SPSS 22 version. Chi-square statistic was used for statistical analysis and  $p < 0.05$  was considered as statistically significant.

## RESULTS

Data collected from 81 health care workers (HCWs) of Intensive care unit (ICU) staff. Majority belongs to age group 18-40 years (58.1%). Males (56.8%) were more compared to females (43.2%). With respect to marital status married, single and divorced/ widowed were 67.9%, 28.4% and 3.7% respectively. Majority of the HCWs highest educational status was bachelors (69.1%) followed by masters (24.7%). Out of 81 HCWs nurses, cleaners, medical doctor, laboratory personnel, pharmacist and clerk were 42(51.8%), 2(2.5%), 24(29.6%), 6(7.4%), 3(3.7%) and 4 (4.9%) respectively. HCWs with work experience for < 5 years, 5-10 years, 11+ years were 24.7%, 53.1% and 22.2% respectively. HCWs who were vaccinated were 65(80.2%). IPC training received by HCWs in the past 6 months was 59(72.8%). Only 9.9% of HCWs responded that IPC facilities were adequate( table 1)

Knowledge was assessed by 18 items. Mean and standard deviation of knowledge score of all the health care workers was 13.5±2.1 with median and Inter-quartile range as 13(11-14). Above average knowledge was present in 59 (72.8%) health care workers. Attitude assessment has 14 items. Mean and standard deviation of attitude score of all the health care workers was 11.7±0.9, median and Inter-quartile range was 11(10-13). Attitude score was above average in 68 (84%) health care workers. Mean and standard deviation of practice score during health care interactions was 5.9±0.4 with median and Inter-quartile range as 5(4-6). Compliance towards IPC practices while HCI was above average in 75 (92.6%) health care workers. Out of 36 HCWs performing or assisting AGP, mean and standard deviation of practice score during aerosol generating procedures was 5.5±0.43 with median and Inter-quartile range as 5.5(4-6) and 34

Health care worker characteristics	Groups	Frequency (n=81)	Percentage (%)
Age	18-40 years	47	58.1%
	40-63 years	34	41.9%
Gender	Male	46	56.8%
	Female	35	43.2%
Marital status	Single	23	28.4%
	Married	55	67.9%
	Divorced/Widowed	3	3.7%
Highest Qualification	Schooling	2	2.5%
	Diploma	3	3.7%
	Bachelor	56	69.1%
	Masters	20	24.7%
Type of health professional	Nurse	42	51.8%
	Cleaner	2	2.5%
	Laboratory personnel	6	7.4%
	Medical doctor	24	29.6%
	Pharmacist	3	3.7%
	Clerk	4	4.9%
Work experience	< 5years	20	24.7%
	5-10 years	43	53.1%
	11+ years	18	22.2%
Vaccination status	Vaccinated	65	80.2%
	Unvaccinated	16	19.8%
IPC training in the past 6 months	Received	59	72.8%
	Not received	22	27.2%
IPC facilities	Adequate	8	9.9%
	Inadequate	73	90.1%

**Table-1:** Distribution of health care workers by sociodemography, vaccination status and IPC training.

Variables/Frequency (n)	Range	Mean ± Standard deviation	Median (Q1-Q3)	HCWS with score more than 80% of maximum score
Knowledge score (81)	0-18	13.5±2.1	13 (11-14)	59 (72.8%)
Attitude score (81)	0-14	11.7± 0.9	11(10-13)	68(84%)
Practice score during HCI* (81)	0-7	5.9±0.4	5(4-6)	75 (92.6%)
Practice score during AGP# (36)	0-6	5.5±0.43	5.5(4-6)	34(94.4%)
Total KAP scores	only HCI (45)	0-39	30(28-35)	66(81.5%)
	HCI and AGP (36)	0-45	35(32-39)	67(82.7%)

\*Health care interactions (HCI); #Aerosol generating procedures(AGP)

**Table-2:** Knowledge, attitude, practice and Total KAP scores during HCI and AGP.

Variables	Groups	KAP score >80% of maximum score (n=64/79%)	KAP scores <80% of maximum scores (n=17/21%)	Total n=81/100%	Chi-square statistic / p value
Age	18-40 years	40 (85.1%)	7 (14.9%)	47 (58.1%)	2.2838/ 0.130734.
	40-63 years	24(70.6%)	10(29.4%)	34 (41.9%)	
Gender	Female	42(91.3%)	4(8.7%)	46 (56.8%)	9.6998/ 0.001843
	Male	22(63.9%)	13(37.1%)	35(43.2%)	
Marital Status	Single	17(73.9%)	6(26.1%)	23(28.4%)	0.8975/ 0.638425
	Married	45(81.8%)	10(18.2%)	55(67.9%)	
	Divorced/Widowed	2(66.7%)	1(33.7%)	3(3.7%)	
Highest qualification	Schooling and Diploma	2(40%)	3(60%)	5(6.2%)	6.0516/ 0.048519.
	Under graduate	44(78.6%)	12(21.4%)	56 (69.1%)	
	Post graduate	18(90%)	2(10%)	20(24.7%)	
Type of health professional	Medical	62(82.7%)	13(17.3%)	75(92.6%)	8.1536/ 0.004298
	Non Medical	2(33.3%)	4(66.7%)	6(7.4%)	
Work experience	< 5years	16(80%)	4(20%)	20(24.7%)	0.6595/ 0.719112.
	5-10 years	35(81.4%)	8(18.6%)	43(53.1%)	
	11+ years	13(72.2%)	5(27.8%)	18(22.2%)	
Vaccination status	Vaccinated	52(80%)	13(20%)	65(80.2%)	0.1936/ 0.659965
	Unvaccinated	12(75%)	4(25%)	16(19.8%)	
IPC training	Received	53(89.8%)	6(11.2%)	59(72.8%)	15.3307/ 0.00009.
	Not received	11(50%)	11(50%)	22(27.2%)	
IPC facilities	Adequate	6(66.7%)	2(33.3%)	8(9.9%)	0.0862/ 0.769095.
	Inadequate	58(79.5%)	15(20.5%)	73(90.1%)	

**Table-3:** Determinants of KAP (above average/ >80% of maximum score) on IPC measures during Health Care Interactions and Aerosol Generating Procedures

(94.4%) health care workers have above average compliance with IPC practices. Mean and Standard deviation of total KAP scores during HCI and during both HCI and AGP was 31.2±2.4 and 36.3±3.1 respectively. ( table 2)

KAP scores were more than 80% of maximum scores in, more proportion of females (91.3%) compared to males (63.9%) and who were postgraduates (90%) by qualification followed by undergraduates (78.6%), only 40% of HCWS whose qualification was diploma which was statistically significant. More proportion of medical health professionals(82.7%) compared with nonmedical(33.3%) have above average KAP scores, also HCWs who received IPC training (89.8%) in the past 6 months have above average KAP scores compared to those who were not trained (50%) which was statistically significant. (table 3)

Though more proportion of HCWs in age group 18-40 years (85.1%) compared to 40-63 years (70.6%) have above average scores it was not statistically significant. More HCWs who were married (81.8%) whose work experience was 5 -10 years (81.4%) were slightly more compared with single and divorced/widowed and whose experience was <5 years and 11+ years have above average KAP scores which was not statistically significant. Less proportion of HCWs who feel that the IPC facilities were adequate (66.7%) have above average KAP scores compared with those who feel IPC facilities were inadequate (79.5%) which was not statistically significant.

## DISCUSSION

Exposure to infectious diseases is one of the most frequently

identified occupational hazards faced by HCWs in general. In the current pandemic of Corona virus disease, the greatest risk is to healthcare workers (HCWs) who are exposed to infected patients or by procedures such as intubation, aerosolized medication, handling human secretions, doffing of PPE, handling biomedical waste, and cross-infection among HCWs. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has very high infectivity; therefore, we need to implement infection control practices vigorously in the intensive care unit (ICU), where confirmed as well as suspected coronavirus disease-2019 (COVID-19) patients are treated.<sup>17</sup> The incidence of healthcare-related cross-transmission of SARS-CoV-2 is high up to the tune of 40%.<sup>18</sup>

The current study aimed to understand the KAP of IPC practices amongst ICU staff. Mean and Standard deviation of total KAP scores during HCI and during both HCI and AGP was 31.2±2.4 and 36.3±3.1 respectively in this study. Proportion of HCWS with score more than 80% of maximum score with respect to Knowledge, attitude practice scores during HCI and Both HCI and AGPs were 72.8%, 84% and 92.6% and 94.4% respectively. In study by Ashinyo et al; Compliance with IPC during healthcare interactions was (80.8%) and highest (95%) compliance with IPC was when performing AGPs. <sup>19</sup>In study by Geberemariam et al. there was a strong linear correlation between HCWs IPC knowledge score and the practice score (Pearson correlation coefficient=0.703,  $p<0.001$ ).<sup>20</sup>

In this study score was better in attitude as compared to knowledge, but still unacceptable as nearly one-third of

the ICU staff scored poor in minimal requirements for IPC. Previous research from India and outside have shown KAP scores varying from as low as 10% to as high as 90% depending on different study tools used, intensity of training and available infrastructure.<sup>21,22,23</sup>

In this study though health care workers with average knowledge score was less compared to attitude and practices, it clearly shows that knowledge of infection control guidelines and a positive attitude toward infection control measures alone does not influence compliance with the approved infection control guidelines.

In the current study KAP scores were more than 80% of maximum scores in, more proportion of females (91.3%) compared to males (63.9%) similar to study by Hamid Ali Hamid et al where, females were found to be more knowledgeable than males (females 83.2%) and males (46.2%).<sup>24</sup>

In the current study More proportion of medical health professionals(82.7%) compared with nonmedical(33.3%) have above average KAP scores. In study by Ogoina et al, Nigeria Compliance of laboratory scientists (46.2%), house officers (49.2%), and staff nurses (49.2%) were lower than those of consultants (53%), resident doctors (56.9%) and principal nursing officers (50.7%).<sup>25</sup>

In this study less HCWs who feel that the IPC facilities were inadequate and who did not receive IPC training have above average KAP scores. In study by Ogoina et al. lack of enough facilities and resources to practice IPC (66.1%), absence of training on IPC (52.4%), lack of IPC committee (38.9%) and excess workload (34.8%) were main challenges to prevent HCWs from practice of standard precautions.<sup>25</sup> In study by Geberemariam BS et al, HCWs who have ever taken training on IPC were about 5.31 times more likely to practice safe infection prevention than those who have not received training.<sup>20</sup> In study by Assefa et al. in Ethiopia The odds of safe practice were higher in participants who received IPC training and IPC compliance was lower among HCWs who are working in the facility which has no continuous water supply.<sup>26</sup>

In study by Michel-Kabamba, Democratic Republic of the Congo Practices scores were relatively low. About 55% of HCWs complied with good practices; 49.4% wore masks consistently and, only 54.9% used PPE during contact with patients.<sup>27</sup>

A change of culture and training in relation to IPC is needed, so that good IPC practices are modelled by seniors to cultivate and sustain such practices amongst other staff.<sup>28</sup> Study in the People's Republic of China, demonstrated that a one-time intervention program had no effect on knowledge.<sup>29</sup> A UK study demonstrated that structured teaching programs are effective.<sup>30,31</sup> scenario-based learning, assessment, both summative and formative, reflections, and online teaching in conjunction with face-to-face learning (blended learning) are all suggested examples of effective methods of teaching IPC practices.<sup>32, 33,34,35,36</sup>

Initiatives like Swatch Bharat Abhiyan (Clean India mission)

and Kayakalp Award Scheme (Ministry of Health and Family Welfare, 2015) have raised interest among hospital administrators to strengthen IPC by setting up of systems and policies and dedicating funds resulting in some improvement in cleanliness, hygiene and documentation.<sup>37</sup> However, sustained improvement in IPC requires rigorous efforts towards implementation of policies and guidelines through capacity building and behavioural modification of healthcare staff.<sup>38</sup>

## CONCLUSIONS

Proportion of HCWS with score more than 80% of maximum score with respect to Knowledge, attitude practice scores during HCI and Both HCI and AGPs were 72.8%, 84% and 92.6% and 94.4% respectively. A change of culture and training in relation to IPC is needed, so that good IPC practices are modelled by seniors to cultivate and sustain such practices amongst other staff. KAP scores were more than 80% of maximum scores in, more females (91.3%), who were postgraduates (90%) by qualification, medical health professionals(82.7%), HCWs who received IPC training (89.8%) in the past 6 months have above average KAP scores compared to those who were not trained (50%) which was statistically significant.

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