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Original Research Article

Knowledge, attitude, implementation and satisfaction levels regarding availability of resources for airborne infection control among the nursing staff of a medical college in central India during the COVID-19 pandemic

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ABSTRACT

Background: Implementing airborne infection control measures as per guidelines are very important in preventing the spread of airborne infections. Therefore the purpose of this study was to evaluate the gaps in knowledge, attitude, implementation and satisfaction levels regarding the availability of resources for airborne infection control among the nursing staff of a medical college in central India during the COVID-19 pandemic.

Materials and Methods: A cross-sectional survey was done in which 109 nurses participated. This self-administrable questionnaire contained five parts (General information, knowledge, attitude, implementation and satisfaction regarding available resources) and was distributed to the participants. The correct responses as per the National airborne infection control guideline, Ministry of Health and family Welfare, Government of India, 2010 (NAIC) were scored and assessed.

Results: The mean age of the participants was 28.9 + 3.02 years. The mean scores out of total score of 10 were 5.48 + 1.2 for knowledge, 6.78 +1.0 for attitude, 5.21 + 1.1 for implementation, and 4.28 + 0.9 for satisfaction of available resources. The knowledge was adequate in 46.8%, the attitude was positive in 89.9 %, the guideline implementation was adequate in 45.9% and the resource satisfaction was only in 9.2% of study participants.

Conclusion: Although the nurses had a positive attitude to airborne infection control practices, the overall knowledge and implementation of NAIC were barely adequate and the majority of subjects felt gaps in the availability of resources in implementations of these guidelines. Therefore, it is recommended to enforce their training, ensuring better availability of resources and strict monitoring from hospital administrations for better implementation of NAIC.

1. Introduction

Some of the common diseases with serious consequences that spread through an airborne route are drug-sensitive Tuberculosis, drug resistance Tuberculosis, Influenza H1N1, H5N1 and, COVID-19. Their spread could probably, be effectively controlled by strictly implementing the airborne infection control measure. The risk of airborne infections is more in healthcare personal when airborne infection control measures are not properly applied.[1–3] Keeping in mind the high burden of these airborne diseases specifically and preparedness for the pandemic in general by having infection control activities already in place, the national "Guidelines on Airborne Infection Control in Healthcare and Other Settings "were developed by

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government of India in the year 2010.[4] While much of the guideline focuses on TB as the prototypic disease of airborne transmission, they may apply well to other respiratory infections also. It was felt during the guideline development stage itself that, effective implementation of the recommended measures as per the guidelines will greatly improve the response of health care professionals (HCP) during any respiratory virus pandemics. In the present scenario, we can say that these guidelines could foresee the future in relation to the recent COVID-19 pandemic that started in the year 2020 in India.

These National airborne infection control guidelines (NAIC) were designed to provide up-to-date information about methods of reducing the risk of airborne infections in health care facilities. These guidelines provide technical and operational guidance on recommended precautions to reduce the risk of transmission of airborne pathogens.[4]

It is an absolute necessity to follow infection control measures in the healthcare setting by all HCP, including doctors, nurses, and paramedical staff to prevent the spread of nosocomial infections. Therefore, in this study, we wish to evaluate the gaps in available resources, knowledge, attitude, and implementation of national airborne infection control guidelines in the post-COVID era by the nursing staff practicing in various super specialty departments of a tertiary care hospital of one of the oldest government-owned medical college of central India.

2. Materials and Methods

This cross-sectional study was conducted among the nursing staff working in the super-specialty departments of a medical college & hospital, located at central India, to obtain information regarding knowledge, attitude, implementation, and satisfaction levels of availability of the airborne infection control resources as per NAIC.[4] In Indian medical education system, there are two levels defined at post graduate level, i.e. Broad speciality level subjects in which the departments may run MD/MS level courses and Super speciality levels departments which may run DM and MCh. Courses, by the medical education regulating bodies such as erstwhile Medical Council of India and presently National Medical Commission. These DM and MCh. courses are academically considered similar to post doctoral fellowship courses in content in European or American countries.

A Pre-tested self administrable questionnaire was distributed in person, as well as, using an online data collection platform (Google forms) after obtaining an informed consent prior to answering of its items. In this survey study, no personally identifiable information was captured; hence the responses that were collected could not be traced back to specific respondents. The study was of non-interventional intent and the data collected was also kept anonymous. All the survey participants consented to participate further in the study provided over the first part of the questionnaire itself, before proceeding to answer the other parts of it. This type of survey is exempted from approval by the institutional ethics committee in India. This agrees to the ethical review procedures of the National Ethical Guidelines for Biomedical and Health Research involving human participants, as per 2017 guidelines of the Indian Council of Medical Research.[5]

The survey questionnaire included 5 parts. The first part contained the socio-demographic profile of each study participant such as the participant age, sex, information regarding their highest academic qualification like Midwifery & Nursing course i.e. ANM & GNM, Bachelor's Degree holders (BSc. in Nursing) or Master's Degree in Nursing (MSc. in Nursing), years of work experience of the study participants after attaining their basic qualification and duration in days for which the study participants were posted in COVID wards on duty and were involved in taking care of COVID-19 positive patients, which involved direct contact with these patients.

The remaining 4 parts contained a total of 40 questions. Each part contained 10 questions from 4 different domains such as knowledge, attitude, and implementation of NAIC and satisfaction level of essential resource materials provided by the hospital.

The second part of the questionnaire was related to the assessment of knowledge on NAIC. Knowledge of the participant about N-95 mask use, regarding control measures for reducing the risk of transmission of respiratory pathogens, regarding adequate air exchange and minimum air change per hour, seating arrangements for patient and health care worker, the role of ultraviolet germicidal irradiation and sterilization of solid waste was assessed in this session.

The third part of the questionnaire was aimed at assessing the attitude of the participant on NAIC. The assessment was made regarding the attitude of the participant on educating patients with symptoms of cough, about cough etiquette and proper disposal of sputum according to the guideline, follow up of patients to identify persons with respiratory ailments by screening, segregation of respiratory symptomatic at out-patient(OPD), usage of airborne precaution room for respiratory infection suspect patients, facility of fast-tracking of a respiratory suspect, educating about airborne infection control among family members and friends of patients, mode of spread of respiratory infection, a protocol of screening patients with a respiratory infection such as more than two weeks of cough for Tuberculosis suspect patient.

The fourth part of the questionnaire was used to assess participant practice on NAIC. Participants hand wash technique and hand wash hygiene before and after patient care, disposal of biomedical waste as per correct color-coded bins, usage of N-95 respirators in high-risk wards

and personal protective equipment(PPE) suitable as per various settings, regular monitoring of natural ventilation in the wards and adequate cleaning and disinfection of patients bed at periodic intervals and implementing adequate display sign board, requesting patient and family members with acute febrile illness to maintain respiratory hygiene and participant involvement on implementing cough hygiene practice among patients and disposal of respiratory secretions in the in-patient(IPD) setting was assessed in this part.

The last part of the questionnaire was to assess satisfaction level on essential resource materials available in the institution. The study participants were assessed for their satisfaction level based on their satisfaction regarding ventilation in all areas including OPD, waiting area, availability of PPEs, soap or hand wash facility, availability of hand sanitizers with at least 70% of alcohol content in their respective wards, proper facility to dispose off surgical masks, details about the presence of adequate isolation room for patients with suspect or confirmed highly infectious disease, presence of ultraviolet germicidal irradiation and N-95 respirators provided in high-risk areas , provision of the mask to patients suffering from a respiratory infection ,implementation or training on airborne infection control program in hospital and passive surveillance of TB/ other nosocomial infection screening among health care providers by the authorities.

The responses were then scored for their correctness as per recommendations provided in the NAIC. Each correct answer was given one mark and no mark was given for a wrong answer or an unanswered question. No negative marking was given for wrong answers. The total score secured in each domain was then calculated and assessed for its adequacy by assessing, if the score in each domain was above or below 5.

All the data was tabulated as a master chart in excel format, and then statistical analysis of the data was done using the software IBMSPSS version 23.0 for Windows. Range, frequencies, percentage, mean, standard deviation, and p-value were calculated. Descriptive statistics were used for categorical variables that were expressed as frequencies and percentages, while the continuous variables were expressed as Mean and Standard deviation. The student's t-test was used to compute the means and standard deviation of continuous variables such as age. The Inter-group variation of the scores of various domains of the study was assessed by applying the ANOVA test. A p-value of < 0.05 was taken as statistically significant.

3. Results

This study was performed to assess the knowledge, attitude, implementation (practice), and satisfaction about the adequacy of resources available in the hospital, in following the recommendations of NAIC. In this study, a total of 109 nurses working in various super specialty departments responded to the questionnaire.

The mean age of the participants was 28.9 + 3.02 years. All the nursing staffs in these departments are females, and the maximum 62(56.9%) of the study participants belonged to the age group 26-30 years. The age binning was done for the purpose of statistical analysis.

The educational qualification of these nursing staff was as follows: Midwifery & Nursing course, i.e. ANM & GNM were 36(33%), Bachelor's Degree holders 64 (58.7) and Master's Degree in nursing 09(8.3%). The working area (department) of these nursing staff is shown in Table 1.

The total mean scores of various domains of questionnaire out of a total score of 10 were 5.48 + 1.2 for knowledge, 6.78 +1.0 for attitude, 5.21 + 1.1 for implementation, and 4.28 + 0.99 for satisfaction of available resources domain. The adequacy levels of these domains for the NAIC have been show in Table 2.

The study results show that those with higher educational qualifications had significantly better knowledge scores (p-value = 0.04), and those nursing staff who had a work experience of more than 5 years had better scores in the practice domain of the questionnaire (p-value= 0.05). There was no significant difference in the scores of various domains with respect to them having worked in COVID wards. The Intergroup variation of the scores of various domains of the study by applying the ANOVA test is shown in Table 3. The mean scores did not statistically differ in nursing staff working in various clinical departments as show in the Table 4.

Table 1: Frequency distribution of department of study participants (n=109)

Department	Frequency (%)
Cardiology	18(16.5)
Cardiothoracic Surgery	08 (7.3)
Nephrology	12(11)
Neurology	17(15.6)
Neurosurgery	07(6.4)
Respiratory/Pulmonary Medicine	39 (35.8)
Urology	08 (7.3)

4. Discussion

The present study is a hospital-based study conducted to assess the gaps in available resources, knowledge, attitude, and implementation of national Airborne Infection Control guidelines by nursing staff working at various super-specialty departments of a tertiary level hospital. Airborne infections are common in all health care settings. It is necessary to follow a proper protocol to control the rate of transmission of airborne infections. Ministry of Health and family welfare, Government of India recommends that all the health care settings should adhere to the

Table 2: Showing mean scores and score levels of various domains

Domain	Score Levels	Number	% age	Mean + SD
Knowledge	Adequate (>5 score)	51	46.8	5.48 + 1.2
	Inadequate (< 5 score)	58	53.2	
Attitude	Positive (>5 score)	98	89.9	6.78 + 1.0
	Negative (< 5 score)	11	10.1	
Implementation (practices)	Adequate (>5 score)	50	45.9	5.21 + 1.1
	Inadequate (< 5 score)	59	54.1	
Resources	Satisfied by availability (>5 score)	10	9.2	4.28 + 0.99
	Not Satisfied by availability (< 5 score)	99	90.8	

SD = Standard deviation, % age= Percentage

Table 3: Showing differences in scores of all the four domains in different groups

Variable		Knowledge domain				Attitude				Implementation				Resources			
		Mean + SD	P Value	Adequacy		Mean + SD	P Value	Adequacy		Mean + SD	P Value	Adequacy		Mean + SD	P Value	Adequacy	
				Score <5	Score >5			Score <5	Score >5			Score <5	Score >5			Score <5	Score >5
Qualification	Diploma (n=36)	4.89+0.96	**0.04***	19	17	7.08 +1.02	0.08	3	33	5.14+1.22	0.84	19	17	4.17+1.0	0.56	33	3
	Bachelors (n= 64)	5.26+1.02		34	30	6.64+0.94		6	58	5.27+1.14		35	29	4.3+1.01		58	6
	Masters (n=9)	6.82+1.1		5	4	6.56+1.23		2	7	5.11+1.4		5	4	4.56+0.88		8	1
Experience	< 5 Years (n = 78)	5.32+1.21	**0.03***	43	35	6.81+0.99	0.65	6	72	4.78+1.17	**0.05***	42	36	4.24+0.96	0.60	71	7
	> 5 Years (n=31)	5.87+1.14		15	16	6.71+1.07		5	26	6.42+1.23		17	14	4.35+1.08		28	3
Covid Duty Duration	< 45 Days (n=34)	5.59+1.13	0.522	15	19	6.79+1.22	0.92	5	29	5.32+1.19	0.50	17	17	4.18+0.86	0.49	33	1
	> 45 Days (n=75)	5.43+1.25		43	32	6.77+0.96		6	69	5.16+1.18		42	33	4.32+1.05		66	9

Table 4: Shows the comparison of the score of various domains with the departments of work

Department	Knowledge score (Out of 10) as Mean + SD	Attitude score (Out of 10) as Mean + SD	Implementation score (Out of 10) as Mean + SD	Adequacy of resources score score (Out of 10) as Mean + SD
Respiratory/ Pulmonary Medicine	5.54 + 1.21	6.74 + 1.04	4.54 +2.28	5.13 +1.174
Cardiology	5.44 +1.04	6.78 +1.06	4.06 +1.92	5.06 +1.34
Neurology	5.29 +1.35	6.88 +0.99	4.24 +1.98	5.24 +1.14
Neurosurgery	6.00 +1.41	6.57 +1.13	3.71 +2.3	5.00 +1.63
Cardiothoracic surgery	5.63 +1.30	7.00 +0.92	4.50 +1.69	5.88 +0.99
Nephrology	5.08+1.08	6.83+1.15	4.42+1.88	5.42+0.79
Urology	5.63+1.4	6.63+0.91	4.00+1.30	5.13+1.35
p-value (Obtained by applying ANOVA test)	**0.780**	**0.982**	**0.947**	**0.736**

SD = Standard Deviation, ANOVA =Analysis of variance

National Airborne Infection Control guidelines.[4] Various studies conducted in different categories of health care professionals regarding their Knowledge, attitude, and implementation of infection control measures, assessed the infection control norms broadly and were not specific to airborne infection control.[6–10] After a sincere literature search we could find only a few studies assessing airborne infection control measures in India,[11] and could not find any specific study that had assessed the Knowledge, attitude, and implementation of NAIC in Indian healthcare professionals.

All the HCP in health care settings should be trained to get adequate knowledge on airborne infection control guidelines. The present study assessed the knowledge on personal protective measures, environmental measures including air exchange rate, arrangements of seating, display of signboards, and education to the patients. Overall, we observed that around 46.8% of the study participants have adequate knowledge of NAIC, whereas 53.2% had inadequate knowledge. Wide variations have been observed in various studies done over different times in different parts of the world, where some studies have reported adequate knowledge, whereas others have reported less than 40% of HCP had adequate knowledge on infection control.[12–17] These variations may be due to geographical variations and varied periodic training conducted in the health care settings. But most of the studies were done for assessing infection control norms in general and only some studies specifically focused on airborne infection control,[18,19] which is most relevant in the present COVID pandemic time even in areas caring for non-COVID illness patients in the hospital.

The attitude of the study participants were assessed based on screening and segregation of respiratory suspects, personal protective measures, and their responsibilities in airborne infection control. The present study reported that 89.9% of the study participants were having a positive attitude towards guidelines. Similar findings were reported in the study conducted in past also in which attitude of subjects towards infection control measures was assessed.[12–14,18,19] This shows HCP have a positive attitude towards airborne infection control at their workplace irrespective of the geographical differences.

Airborne infections pose a greater risk for the HCP and also patients. Most of the time it may be difficult to eliminate the reservoirs and susceptible hosts in the health care settings, in such conditions, proper implementation of measures to eliminate the mode of transmission of airborne infection plays a pivotal role. In the present study, only 45.9% of the study participants had reported that their department had adequately implemented the guidelines. The remaining 54.1 % of study participants had reported inadequate implementation of guidelines at their work setting. Contrary to our study findings, other studies conducted in India showed good practice

in implementing the infection control guidelines in their workplace settings.[18,19] Hospital associated infections magnitude was alarmingly high in developing countries, where the basic infection control measures are not feasible due to limited resources in the health sectors. Resources being available play a vital role in the implementation of airborne infection control in any health care settings. In the present study, the satisfaction level of study participants on resources was measured by infrastructure provided for effective control of airborne diseases and only around 10% of the study participants reported satisfactory level on essential resources provided in their working area.

Our study showed that those with higher educational qualifications had significantly better knowledge scores (p-value = 0.04), and those nursing staff who had a work experience of more than 5 years had better scores in the practice domain of the questionnaire (p-value = 0.05). Neither there was any significant difference in the scores of various domains with respect to the department of work, nor was any difference noted with respect to duration of work in COVID wards.

The mean score assessing the knowledge domain was high for participants with master's degrees than compared to those with a bachelor's degree and diploma, whereas no significant differences were found in terms of qualification for the attitude and practice domains. Regarding years of experience, participants with more experience had good knowledge and practice whereas attitude does not have any significant differences. This shows that nursing staff who have higher educational qualifications and increasing years of experience have better in-depth knowledge on airborne infection control measures, but the healthcare professional starts practicing airborne infection control measures more efficiently, as one gain work experience in the profession. The reason behind this can be the periodic training they might receive on airborne infection control measures so that they become better versed in practicing these measures in their daily clinical practice.

Our study could identify gaps in knowledge, practices, and availability of resources. Only 46.8% of study participants had adequate knowledge. There was poor knowledge regarding the appropriate use of N-95 mask, regarding control measures for reducing the risk of transmission of respiratory pathogens, seating arrangements for patient and health care workers, ultraviolet germicidal irradiation, and sterilization of solid hospital waste material. Similarly, only 45.9% of study participants reported that they were actually practicing the airborne infection control measures as per guidelines. There was poor implementation of measures such as, hand wash technique, disposal of biomedical waste in correct color-coded bins, proper usage of N-95 mask in high-risk wards, cough hygiene practice among patients, and disposal of respiratory secretions in the ICU setting. Only 9.2% of the study participants were satisfied with the availability of resources such as availability of masks, gloves, and gowns, and soap or hand washing facilities in the hospital, for following the NAIC. Participants were unsatisfied regarding proper facility to dispose off surgical masks, presence of adequate isolation room for patients with suspected or confirmed highly infectious disease, presence of ultraviolet germicidal irradiation, N-95 respirators provided in high-risk areas, and provision of the mask to patients suffering from a respiratory infection

A high percentage (89.9%) of study participants exhibited a positive attitude towards following these airborne infection control measures, but when actually implementing these norms the number significantly reduced, and most of the nursing staff was implementing only the personal protective measures part of the airborne infection control measures. The infection control measures during COVID pandemic made mandatory for all at community level, such as use of face mask at work place and public places is seen not to be followed by everyone. If such an attitude occurs in HCP, then it may have catastrophic effect in spread of infection through hospitals. Therefore, it seems necessary that hospital administration makes it mandatory to follow infection control measures in HCP. Hospitals may adopt steps such as, taking Regular feedbacks and incentivize those HCPs who follow AIC measures in best ways and as per the norms.

The study highlights the need for improving knowledge and practice of the airborne infection control guidelines in nursing staff, which in turn can be achieved with measures focusing on the repeated and widespread training of the HCPs and wider dissemination of these guidelines at every level of health care. When the HCPs will have a thorough knowledge of airborne infection control measures, with having a positive attitude towards the airborne infection control, there is every likelihood that they may implement it better in their day to day practice, and may perform much better even in settings where extensive resources may not be available. Strict monitoring in turn done by the hospital management to implement the guidelines in a full-fledged manner and utilizing the available resources, as well as ensuring the better availability of resources to implement the NAIC, may lead to effective control of airborne infections.

5. Conflict of Interest

There are no conflicts of interest in this article.

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None.

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