

**Assessment of Airborne Infection Control Practices and Adherence to National Airborne Infection Control Guidelines: An Observational Study**AlokKumar Binod Kumar Singh<sup>1</sup>, Rupesh Shinde<sup>2</sup><sup>1</sup>Assistant Professor, Department of Community Medicine Government Medical College and Hospital, Miraj, Maharashtra, India,<sup>2</sup>Assistant Professor, Department of Community Medicine Government Medical College and Hospital, Miraj, Maharashtra, India

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Conflict of interest: Nil

**Abstract****Aim:** The objective of the current study was to assess the health facilities for airborne infection control practices and adherence to the National airborne infection control guidelines.**Methods:** A cross-sectional study was conducted in Department of Community Medicine, 100 health-care facilities. A checklist was developed based on the NAIC guidelines, which dealt with three main domains of infection control-administrative control, environmental control, and personal respiratory protection measures.**Results:** Most of the facilities had infection control committees 72 (72%). Annual infection control trainings were held for staff in 38 (38%) facilities, but 40 (40%) of facilities were familiar with NAIC guidelines. Counselling on cough etiquette/hygiene practices in registration/ waiting areas was practiced in 10 (10%) institutions. Cross ventilation was present in OPDs in 55 (55%) institutions. Fast-tracking of respiratory symptomatic in OPD was practiced in 18 (18%) institutions. Segregation of respiratory symptomatic was practiced in 18 (18%) of the facilities. The provision of providing masks to respiratory symptomatic was present in 28 (28%) of institutions. Sputum was disposed of properly in 87 (87%) institutions. N95 masks were available in high-risk settings in 14 (14%) health facilities.**Conclusion:** There exist deficiencies in adherence to all components of NAIC guidelines including administrative, environmental, and use of personal protective equipment in both government and private hospitals in the state.**Keywords:** Airborne infection control, nosocomial infections, tuberculosisThis is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Airborne transmission of infectious disease is a major public health concern. [1] Evidence shows that tuberculosis (TB) is a significant occupational problem among health-care workers (HCWs), especially in hospitals with no TB control measures in place. Nosocomial outbreaks of airborne infections such as influenza H1N1, H5N1, drug-susceptible, multidrug-resistant TB, and extensively drug-resistant TB have been reported, and high rates of morbidity and mortality have been linked to the absence or limited application of airborne infection control strategies. [2-4] The airborne infection control (AIC) precautions and practice in health-care institutions are important to prevent the cross-contamination and transmission of infectious diseases not only to the health-care personnel but also to the general population. [5] The airborne transmission becomes even more

prevalent in health-care settings because of overburdened and overcrowded hospitals and the presence of patients with immunosuppression. [6-8]

Globally healthcare-acquired infections (HCAIs) have become a significant cause of morbidity as well as mortality among the hospitalized patients. Exposure of human beings to different airborne pathogens has resulted in the emergence of epidemics of respiratory infections. [9] The infectious patient can infect the other individuals who have had no direct contact with the primary source through droplet infection. Airborne transmission in the health care settings through droplet nuclei becomes more important because of overburdened hospitals and the presence of immunosuppressed patients like those who had undergone surgery, cancer patients, people who are

living with HIV/AIDS (PLHIV), those who are having diabetes, chronic renal disease etc.

Hospital acquired respiratory infection poses a greater risk for the health care workers, as they come in contact with patients early in the course of disease when they are highly infectious. This can lead to widespread epidemics of the respiratory infections because of two reasons. Firstly, one infected health care worker attends a large number of patients on any given day in developing countries like India and secondly, the infection to health care workers reduces the number of skilled workforce available for treating the patients and preventing the spread of infection during an outbreak. [10-14]

National AIC (NAIC) guidelines were formulated in India in 2010. These guidelines included specific policies for TB prevention and control in health-care settings. The objective of the current study was to assess the health facilities for airborne infection control practices and adherence to the National airborne infection control guidelines.

#### Materials and Methods

A cross-sectional study was conducted in Department of Community Medicine Government Medical College and Hospital, Miraj, Maharashtra, India for nine months. 100 health-care facilities. A checklist was developed based on the NAIC guidelines, which dealt with three main domains of infection control-administrative control, environmental control, and personal respiratory protection measures.

Major components in checklist were administrative control measures include education and training of staff; out-patient department (OPD) measures such as screening of patients for respiratory complaints, education for cough etiquette, segregation of respiratory symptomatic in a ventilated waiting area, fast-tracking of respiratory symptomatic; inpatient department measures including educating patients and attendants about cough hygiene, routine segregation of patients to separate infectious wards or separate areas in same ward, maintain spacing between beds, safe sputum collection practices; environmental control measures including ensuring effective ventilation.

Principal investigator visited all the institutions after obtaining necessary permissions interview was conducted with medical and nursing superintendents. Relevant data and information were collected and recorded by observing general OPD, pulmonology OPD, in patient general wards, medical intensive care units, causality, and laboratory of each facility.

Statistical analysis was performed using the IBM Statistical Package for Social Sciences version 20 (IBM). Frequencies, percentages, and mean with standard deviation were used to summarize facility assessment and compliance. The study had been approved by the ethical review committees of the Institutional Review Board.

#### Results

**Table 1: Details of administrative airborne infection control practices**

Indicator	Public, n (%)	Private, n (%)	Total, n (%)
Facilities with IC committees in place	41 (82)	31 (62)	72 (72)
IC committee meetings held in the last 3 months	30 (60)	30 (60)	60 (60)
Health facility IC plan available in written form	18 (36)	20 (40)	38 (38)
Facility risk assessment for airborne infections conducted	0	18 (36)	18 (18)
Routine surveillance for nosocomial infections performed	16 (32)	24 (48)	40 (40)
Periodic IC training for the hospital staffs	36 (72)	32 (64)	68 (68)
Periodic assessment on infection prevention practices	21 (42)	25 (50)	46 (46)
Hospital familiar with the Ministry of Health and Family Welfare AIC guidelines	16 (32)	24 (48)	40 (40)
Policy for screening and restricting family/visitors with illnesses	22 (44)	23 (45)	45 (45)
Reassessment of infection prevention policies and procedures (annual)	31 (62)	32 (64)	63 (63)

Most of the facilities had infection control committees 72 (72%). Annual infection control trainings were held for staff in 38 (38%) facilities, but 40 (40%) of facilities were familiar with NAIC guidelines.

**Table 2: Airborne infection control practices at outpatient departments**

Indicator	Public, n (%)	Private, n (%)	Total, n (%)
Counseling on cough etiquette/hygiene practices in registration/waiting areas	6 (12)	4 (8)	10 (10)
IEC material on cough hygiene displayed/handed over to patients	20 (40)	18 (36)	38 (38)
Provided masks to respiratory symptomatic at the reception area	14 (28)	14 (28)	28 (28)
Separated well-ventilated waiting area for respiratory symptomatic	25 (50)	2 (4)	27 (27)
Fast tracking of respiratory symptomatic	10 (20)	8 (16)	18 (18)
Segregation of respiratory symptomatic	8 (16)	10 (20)	18 (18)
Adequate cross ventilation available	35 (70)	20 (40)	55 (55)

Counseling on cough etiquette/hygiene practices in registration/ waiting areas was practiced in 10 (10%) institutions. Cross ventilation was present in OPDs in 55 (55%) institutions. Fast-tracking of respiratory symptomatic in OPD was practiced in

18 (18%) institutions. Segregation of respiratory symptomatic was practiced in 18 (18%) of the facilities. The provision of providing masks to respiratory symptomatic was present in 28 (28%) of institutions.

**Table 3: Details of practice of using personal protective equipment**

Indicator Practices and behaviors	Public, n (%)	Private, n (%)	Total, n (%)
Practice of hand hygiene among health workers	48 (96)	38 (76)	86 (86)
Availability of PPE's and use among health workers	38 (76)	42 (84)	80 (80)
Provided N95 respirators at high-risk settings	0	14 (28)	14 (14)
Usage of N95 respirators at high-risk settings	0	10 (20)	10 (10)
Sputum disposal as per the BMW management plan	40 (80)	47 (94)	87 (87)
Proper disposal facilities for used surgical masks	48 (96)	50 (100)	98 (98)
Preemployment medical examination among staffs for respiratory conditions	0	10 (20)	10 (10)

Sputum was disposed of properly in 87 (87%) institutions. N95 masks were available in high-risk settings in 14 (14%) health facilities.

### Discussion

Globally airborne infections remain an occupational risk for healthcare workers. [15-17] Reports of infectious outbreaks such as influenza, H1N1, drug-susceptible and multidrug-resistant tuberculosis among healthcare workers are alarming. Even though there are guidelines available at national and state level to curb airborne infections in hospitals, there is no mechanism at present to ensure its adherence.

In general, the airborne infection controls in the hospitals are implemented through a three pronged approach namely administrative, environmental, and personal protection measures. [18] Administrative control measures mainly aims to reduce potential opportunities of exposure of susceptible individuals to infectious patients. The present study identified several gaps in the implementation of administrative control measures. Even though the hospitals had infection control plan and policies, most of them were not complete and up to date. It appears that the administrators do not consider this as a priority among their innumerable day to day activities. The importance

of infection control in the hospitals as part of overall quality improvement has to be highlighted through regular training of all category staff including housekeeping staff, administrators and security. Adherence to NAIC guidelines by the healthcare workers can be ensured by routine monitoring and supervision. The infection control committee need to take some precautions and alert the staff to take safety measures if a patient with any of the infectious disease gets admitted in the hospital. This is possible only when there is a policy decision in this regard and a system in place. None of the hospitals had such a mechanism unless in the case of an outbreak or epidemic. As per the information shared by the Superintendents in the selected institutions, some of the employees were infected with airborne infections out of which pulmonary tuberculosis was frequent. Similar to some of the earlier studies, more cases of TB was reported among nurses who work in close contact with the patients. [19,20]

Most of the facilities had infection control committees 72 (72%). Annual infection control trainings were held for staff in 38 (38%) facilities, but 40 (40%) of facilities were familiar with NAIC guidelines. Counseling on cough etiquette/hygiene practices in registration/ waiting areas was practiced in 10 (10%) institutions. Cross ventilation

was present in OPDs in 55 (55%) institutions. Fast-tracking of respiratory symptomatic in OPD was practiced in 18 (18%) institutions. Segregation of respiratory symptomatic was practiced in 18 (18%) of the facilities. The provision of providing masks to respiratory symptomatic was present in 28 (28%) of institutions. Sputum was disposed of properly in 87 (87%) institutions. N95 masks were available in high-risk settings in 14 (14%) health facilities. The study found that administrative measures specific to AIC were negligible. Routine N95 respirators use was observed in only 2 of the 21 high-risk settings. [21] Most environments could be effectively ventilated with natural ventilation, but nonusage of available ventilation (i.e., shut windows) or layered modifications, such as deliberate blocking of windows, had reduced the potential ventilation. [22,23] Natural ventilation is particularly suited to limited-resource settings and tropical climates, where the burden of TB and institutional TB transmission is the highest. Use of personal protective measures by HCWs was found to be negligible even in high-risk settings. [24,25] This challenge might be overcome through proper training, education, and monitoring mechanisms. Integrating AIC principles into existing general infection control training and education modules was recommended. Hospital reports and records were trusted for data as direct verification or counterchecking were not feasible. Statistical analysis of predictors of good practices was not attempted because of the small sample size and wide heterogeneity of sample due to stratification. Facilitators and barriers for ensuring adherence to the NAIC guidelines need to be explored qualitatively. The study also did not assess the impact of the interventions on reduction of nosocomial transmission, neither by surveillance among HCWs as this was beyond the scope of the study objectives.

Simple administrative interventions for providing counseling on cough etiquette/ hygiene practices in registration/waiting areas, displaying information, education, and communication material on cough hygiene, providing masks to respiratory symptomatic at the reception area, fast-tracking or respiratory symptomatics and segregation of respiratory symptomatic need to be ensured in all hospitals. Provision for and usage of N95 respirators need to be ensured at high-risk settings. [26] AIC need to find a place in quality improvement process in health care such as accreditation of hospitals. The findings also suggest the need to establish routine surveillance for nosocomial infections and capture data regarding the incidence of airborne infections among HCWs. [27]

## Conclusion

There exist deficiencies in adherence to all components of NAIC guidelines including administrative, environmental, and use of personal protective equipment in both government and private hospitals in the state. The systematic scale-up of AIC measures across all health-care facilities in the state can serve as preparedness plan for preventing airborne infections of pandemic potentials. This can also accelerate TB elimination in the state.

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