Research Article

Patterns Among Healthcare Workers of Bangalore About Face Mask Usage: A Single-Center Observational Study

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ABSTRACT

Introduction: Face masks prevent acute respiratory infections. Healthcare workers are prone to infections owing to their direct and constant exposure to infected patients. This pioneering study in Bangalore city, analyzed the awareness and attitude of healthcare staff toward using a face mask. **Methods**: This observational study was conducted among 290 subjects (mean age, 33.89 ± 7.88 years; male:female ratio, 1:2.67). The study included all the healthcare workers from various departments. Data on basic demographic characteristics, attitude, awareness, and observations on the use of face mask were collected. **Results**: A large proportion of the sample were from the nursing department ($n = 161$, 55.51%). Most of the healthcare workers believed that making wearing a mask mandatory in public was very effective (80%) and 79% believed that wearing a mask could prevent the spread of coronavirus. Most of the healthcare workers said they would wear masks even when not mandatory. Most of them used an N95 mask or an N95 mask along with a surgical mask. Almost all were conscious of wearing the mask above the nose, covering the mouth and chin (289, 99.65%). A significantly higher number of doctors (medical postgraduates) (17, 45.95%, $p = 0.01$) used two masks when compared with others. Significantly fewer doctors (4, 10.81%) and other healthcare staff (8, 22.22%) reused masks ($p = 0.002$). Most of them used the mask only once, and those who reused it, cleaned it on alternate days (< 0.001). Sun-drying or air-drying, preceded by washing with detergent or soap, were the cleaning methods used, and most used paper or plastic bags to store the masks when not in use. Most of them did not use hand sanitizer before wearing the mask but followed all other precautions and measures to prevent infection. **Conclusions**: Most of the healthcare workers believed the use of masks could prevent virus transmission. A significantly higher number of doctors used two masks when compared with other healthcare staff. Significantly fewer doctors and other healthcare staff reused masks when compared with nurses and technicians.

Keywords: COVID-19, healthcare personnel, masks, respiratory tract infections

INTRODUCTION

Acute respiratory infections (ARIs) lead to significant morbidity and mortality, globally.[1] Worldwide, an estimated 3.9 million deaths in young children occur due to ARIs. In India it is estimated that at least 300 million episodes of ARI occur every year.[2] Many respiratory viruses contribute to ARIs, such as influenza virus, rhinovirus, and coronavirus.[1] Transmission can occur by air through aerosolization, respiratory secretions as droplets, or by inoculation after exposure to or touching contaminated surfaces. Depending on the type of virus, the entry and manifestation of disease symptoms is different.[3] Face masks and respirators are known to prevent respiratory infections.[4] Types of masks used are N95 and surgical masks, which are regulated in the United States by the Food and Drug Administration (FDA).[5] However, even a simple cloth mask presents a pragmatic solution.[6]

Healthcare workers are crucial to any healthcare system.[7] There are approximately 59 million healthcare workers worldwide.[8] The Centers for Disease Control and Prevention (CDC) reports at least 11% of healthcare workers are diagnosed with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections.[9] In India, the predominance of healthcare workers with coronavirus disease-2019 (COVID-19) was 413 of 3711 workers, with 87% of doctors (medical postgraduates) and nurses and 84% of other healthcare workers being symptomatic.[10] Thus, using face masks and respirators is strongly recommended by the World Health Organization (WHO) and the CDC as a measure to prevent virus

transmission.[11] Because there is very little literature analyzing the effective usage of masks among healthcare professionals, this study focused on assessing the awareness and attitude among healthcare workers in Bangalore toward usage of masks.

METHODS

The observational study was conducted at Ramiah Memorial Hospital, Bangalore, Karnata, India, from November 1–30, 2020 (30 days). The study was approved by the institutional review board. Informed written consent was obtained.

In this study, the healthcare workers were administered a self-structured questionnaire. The questionnaire was developed based on literature search, and opinions of related subject experts.

Study Population

All doctors, nurses, paramedical staff, and administration staff consenting to participate were included. This study recruited 290 healthcare workers.

The hospital-associated medical, paramedical, and technical staff who were working during the study period in the pandemic were included in the study. The senior doctors, professors who are teleconsulting or not visiting on a regular basis were excluded.

Estimation of Sample Size

The following formula was used for sample size calculation: [12]

$$n = \frac{p(1-p)Z^2}{d^2} \; ,$$

where n = required sample size, p = percentage occurrence of a state or condition (proportion or prevalence), d = percentage maximum error required, and z = value corresponding to the level of confidence required.

Prevalence of correct practice of using face masks in healthcare workers was assumed as 25% with a 95% confidence level and 5% error. Thus, the minimum sample size required for the study was $n = 289$.

Data Collection

A paper and pen–based, self-assessment questionnaire to assess the attitude and awareness toward wearing of masks was developed by the investigators. The assessment contained 3 questions testing attitude and 10 questions testing awareness; all of them were closed-ended questions.

Statistical Analyses

Data were analyzed using statistical software R version 4.0.3. Continuous variables were presented as mean ± SD and categorical variables as frequency tables. The χ^2 test was used to analyze the relationship between two categorical variables. Alpha for statistical significance was set at $p \leq 0.05$.

Table 1. Demographic characteristics of the study sample

Variable	Value
Age, y	
Mean (SD)	33.89 (7.88)
Median (IQR)	33 (28, 38)
Sex	
Female	211 (72.75)
Male	79 (27.24)
Department	
Billing	2 (0.68)
GDA	3 (1.03)
Laundry	1 (0.34)
MRD	28 (9.65)
Nursing	161 (55.51)
OT technician	3 (1.03)
Doctors	37 (12.75)
RSO	1 (0.34)
Security	1 (0.34)
Technician	53 (18.27)
How many people live in your household?	
Alone	20 (6.94))
2	49 (16.89)
3	66 (22.75)
4	62 (21.37)
5	90 (31.03)
5 and above	3 (1.02)
Subjects older than 65 y	
Yes	81 (27.93)
No	209 (72.06)
Children younger than 15 y	
Yes	146 (50.34)
No	144 (49.66)
Pregnant women	
Yes	8 (2.75)
No	282 (97.25)
Differently abled	
Yes	6 (2.06)
No	284 (97.94)
Person with chronic medical conditions, such as respiratory system illness, diabetes, cardiovascular diseases, or cancer	
Yes	62 (21.39)
No	228 (78.61)

Data are n (%) unless otherwise noted.
GDA: general duty assistant; MRD: medical records department; OT: occupational therapy; RSO: radiation safety officer.

RESULTS

This study recruited 290 healthcare workers belonging to various departments, such as front office department–billing staff, housekeeping department–general duty assistant, housekeeping department–laundry staff, nursing department–staff nurses, operation theater technicians, doctors, radiology safety officer, security department–security staff, and medical records department technicians The mean age of participants was 33.89 ± 7.88 years. Approximately 72.75% of the study cohort were women and 55.51% were from the nursing department (Table 1).

Most of the healthcare workers believed that making wearing a mask mandatory in public was very effective (80%) and 79% believed that wearing a mask can prevent

Table 2. Data on attitude toward wearing a mask among healthcare workers

Attitude Questions	Department				Total	*p*
	Nursing	Others[a]	Doctor	Technician[b]		
How do you feel about making mask wearing mandatory in all public places?						0.23
Very effective	130 (80.75)	31 (86.11)	29 (78.38)	234 (80.68)	234 (80.68)	
Somewhat effective	31 (19.25)	4 (11.11)	7 (18.92)	54 (18.62)	54 (18.62)	
I do not know	0	1 (2.78)	1 (2.70)	0	1 (0.68)	
To what extent do you think wearing a face mask will reduce the spread of coronavirus?						0.77
Very effective	125 (77.64)	29 (80.56)	28 (75.68)	48 (85.71)	230 (79.31)	
Somewhat effective	34 (21.12)	6 (16.67)	8 (21.62)	8 (14.29)	56 (19.31)	
Not effective at all	1 (0.62)	0	0	0	1 (0.34)	
I do not know	1 (0.62)	1 (2.78)	1 (2.70)	0	3 (1.03)	
Would you wear a mask even if it is not mandatory?						0.005
Yes	102 (63.35)	29 (80.56)	30 (81.08)	30 (53.57)	191 (65.86)	
Maybe	39 (24.22)	4 (11.11)	7 (18.92)	12 (21.43)	62 (21.37)	
No	20 (12.42)	3 (8.33)	0	14 (25)	37 (12.75)	

Data are presented as *n* (%).
[a]Others include the general duty assistant and personnel in medical records, billing, maintenance, public relations, laundry, and security.
[b]Technicians include the occupational therapy, radiation safety officers, security, and technician personnel.

the spread of coronavirus. When asked if they would wear a mask if it was not mandatory, most of the healthcare workers said they would wear a mask, whereas 24.22% (39) of nurses said they would maybe wear a mask (Table 2).

No significant difference was observed on the mask type used between healthcare workers, with most of them using an N95 mask followed by wearing a surgical mask along with an N95 mask. Almost all were conscious of wearing the mask with the right technique, that is, above the nose covering their mouth and chin ($n = 289$, 99.65%). A significantly higher number of doctors (17, 45.95%, $p = 0.01$) used two masks when compared with nurses, technicians, and other healthcare staff (maintenance and public relation staff [PR]). Significantly fewer doctors (4, 10.81%) and other healthcare staff (8, 22.22%) reused masks when compared with nurses and technicians ($p = 0.002$). The frequency of cleaning was different between healthcare workers, with most of them using the mask only once, and those who reused the mask, cleaned it on alternate days ($p < 0.001$). The most frequently used method to clean was sun-drying or air-drying, preceded by washing with detergent or soap. A higher percentage of doctors used antiseptic agent (12, 32.43%). Most of them used paper or plastic bags to store the masks when not in use (Table 3).

Most of them did not use hand sanitizer before wearing a mask (211, 72.75%); inspected the mask for damage (258, 88.96%); ensured the mask covered their nose, mouth, and chin (287 (98.96); ensured the mask fit snugly (280, 96.55%); secured strings behind the ear (168, 57.93%); avoided touching the face while the mask was on (160, 55.17%); used hand sanitizer to adjust the mask (282, 97.24%); did not keep the mask on the neck or under the nose (264, 91.03%); did not remove mask to talk (247, 85.17%); removed the mask using the straps (199, 68.62%); washed hands immediately after removing the mask (258, 88.96%); and disposed of the mask in the designated bin (289, 99.65%). None of them wore a soiled, torn, or wet mask (Table 4).

There was a significant association between department and compliance ($p = 0.02$).

There was no significant association between department and attitude toward wearing a mask ($p = 0.82$) (Table 5).

DISCUSSION

Using a face mask will avert the spread of infection and prevent individuals from contracting any airborne infections such as COVID-19.[4] Determining the attitude and awareness of healthcare staff regarding the mask is crucial to understand if there are any measures to be taken to address the lack of awareness. Therefore, the present study aimed to analyze the effective usage of masks among healthcare workers in Bangalore, Karnataka, India.

COVID-19, which was declared a pandemic in 2020, is transmitted primarily via respiratory droplets. Therefore, governments across the world made usage of a mask mandatory, especially in public places.[13] Surgical masks and N95 respirators are used the most. Some individuals prefer cloth masks.[5,6] The Bacterial Filtration Efficiency and the Particle Filtration Efficiency masks are known to provide 95% protection against COVID-19.[14] Disposable masks have a colored outer layer, which is a hydrophobic or fluid-repelling layer to prevent germs from adhering to it. An inner hydrophilic layer absorbs moisture from the air we exhale. The middle layer filters the microorganisms.[15] The other ways to minimize transmission are possibly enhanced by particle filtration, effective ventilation, and air disinfection.[16] Hospitals rely on masks for

Table 3. Data on awareness among healthcare workers

Awareness Questions	Department				Total	p
	Nursing	Others[a]	Doctor	Technicians[b]		
Which type of mask do you use?						0.10
Cloth	0	1 (2.78)	0	0	1 (0.34)	
Cloth, surgical	0	0	0	1 (1.79)	1 (0.34)	
Cloth, N95	7 (4.35)	1 (2.78)	4 (10.81)	2 (3.57)	14 (4.82)	
N95	114 (70.81)	28 (77.78)	26 (70.27)	40 (71.43)	208 (71.72)	
Surgical mask	5 (3.11)	3 (8.33)	0	1 (1.79)	9 (3.1)	
Surgical mask, N95	35 (21.74)	3 (8.33)	7 (18.92)	12 (21.43)	57 (19.65)	
How do you wear the mask						0.11
Above nose covering mouth and chin	161 (100)	35 (97.22)	37 (100)	56 (100)	289 (99.65)	
Below your nose covering mouth only	0	1 (2.78)	0	0	1 (0.34)	
How many masks do you use in a day?						0.01
1	108 (67.08)	28 (77.78)	20 (54.05)	42 (75)	198 (68.28)	
2	42 (26.09)	6 (16.67)	17 (45.95)	11 (19.64)	76 (26.21)	
3	10 (6.21)	0	0	3 (5.36)	13 (4.48)	
3 and more	1 (0.62)	2 (5.55)	0	0	3 (1.02)	
Do you share a mask among your family members?						0.30
Yes	3 (1.86)	1 (2.78)	0	3 (5.36)	7 (2.41)	
No	158 (98.14)	35 (97.22)	37 (100)	53 (94.64)	283 (97.57)	
Do you reuse the mask?						0.002
Yes	95 (59.01)	28 (77.78)	33 (89.19)	37 (66.07)	193 (66.55)	
No	66 (40.99)	8 (22.22)	4 (10.81)	19 (33.93)	97 (33.45)	
How many times do you reuse?						0.02
Alternate days	71 (44.10)	22 (61.11)	20 (54.05)	34 (60.71)	147 (50.7)	
Every day	10 (6.21)	3 (8.33)	3 (8.11)	1 (1.79)	17 (5.86)	
Monthly	0	0	1 (2.70)	0	1 (0.34)	
Single use	56 (34.78)	7 (19.44)	5 (13.51)	18 (32.14)	86 (29.65)	
Weekly	24 (14.91)	4 (11.11)	8 (21.62)	3 (5.36)	39 (13.45)	
How often do you clean your mask?						< 0.001
Alternate days	53 (32.92)	5 (13.89)	14 (37.84)	15 (26.79)	87 (30)	
Every day	27 (16.77)	13 (13.89)	6 (16.22)	18 (32.14)	64 (22.07)	
Others	0	0	1 (2.70)	0	1 (0.34)	
Single use	64 (39.75)	17 (47.22)	10 (27.03)	23 (41.07)	114 (39.31)	
Weekly	17 (10.56)	1 (2.78)	6 (16.22)	0	24 (8.28)	
How do you clean the mask?						0.001
Antiseptic solution	20 (12.42)	3 (8.33)	12 (32.43)	7 (12.50)	42 (14.48)	
Antiseptic solution, sun-drying or air-drying	6 (3.73)	0	3 (8.11)	0	9 (3.1)	
Never wash	27 (16.77)	2 (5.56)	0	7 (12.50)	36 (12.41)	
Plain water	0	0	0	1 (1.79)	1 (0.34)	
Soap or detergent, sun-drying or air-drying	1 (0.62)	0	0	0	1 (0.34)	
Soap or detergent	40 (24.84)	17 (47.22)	6 (16.22)	21 (37.50)	84 (28.97)	
Sun-drying or air-drying	67 (41.61)	14 (38.89)	16 (43.24)	20 (35.71)	117 (40.34)	
How do you store your mask when not in use?						0.006
Hanger	22 (13.66)	11 (30.56)	9 (24.32)	6 (10.71)	43 (14.83)	
Leave it lying anywhere	0	1 (2.78)	1 (2.70)	1 (1.79)	3 (1.03)	
Others	6 (3.73)	3 (8.33)	3 (8.11)	0	12 (4.14)	
Paper bag	58 (36.02)	12 (33.33)	15 (40.54)	15 (26.79)	100 (34.49)	
Plastic bag	75 (46.58)	9 (25.00)	9 (24.32)	34 (60.71)	127 (43.79)	
How do you dispose of the mask?						0.07
Burn it	13 (8.07)	0	0	4 (7.14)	17 (5.86)	
Dust bin	140 (86.96)	36 (100)	37 (100)	51 (91.07)	264 (91.03)	
Treat with bleaching solution and bury it deeply or burn it	8 (4.97)	0	0	1 (1.79)	9 (3.1)	

Data are presented as *n* (%).
[a]Others include the general duty assistant and personnel in medical records, billing, maintenance, public relations, laundry, and security.
[b]Technicians include the occupational therapy, radiation safety officers, security, and technician personnel.

protecting healthcare professionals. As per WHO, incorrect use of masks increases the rate of transmission.[15] Prolonged usage of medical masks, that is, for more than 6 hours, increases the risk in healthcare workers through contaminated personal protective equipment.[16,17] WHO recommends storing masks in a clean plastic bag, and every day either wash it if it is a fabric mask, or dispose of a medical mask in a trash bin.[18]

Table 4. Data on observations made while wearing a mask

Variable	*n* (%)
Before wearing mask	
Using hand rub before wearing mask	
Yes	79 (27.24)
No	211 (72.75)
Removing the new mask by the straps from the package	
Yes	140 (48.27)
No	150 (51.72)
Inspecting mask for any damage	
Yes	258 (88.96)
No	32 (11.03)
While wearing mask	
Covering mouth, nose, chin with mask and making sure there are no gaps between face and the mask	
Yes	287 (98.96)
No	3 (1.03)
Ensuring the mask fits snugly but comfortable against the face by placing the metal piece or stiff edge over the nose	
Yes	280 (96.55)
No	10 (3.44)
Securing strings behind the ears and head	
Yes	168 (57.93)
No	122 (42.06)
Touching front of mask, eyes, nose, and mouth while wearing it	
Yes	130 (44.82)
No	160 (55.17)
Use of hand sanitizer when adjusting the mask while wearing it	
Yes	8 (2.75)
No	282 (97.24)
While using mask	
Wearing mask around the neck and under the nose	
Yes	26 (8.96)
No	264 (91.03)
Wearing dirty, torn, or wet mask	
Yes	0
No	290 (100)
Removing mask while talking	
Yes	43 (14.82)
No	247 (85.17)
While removing mask	
Removing the mask by straps behind the ears and head	
Yes	199 (68.62)
No	91 (31.37)
Washing hands immediately before and after use of mask	
Yes	258 (88.96)
No	32 (11.03)
Dispose of mask in a designated bin	
Yes	289 (99.65)
No	1 (0.34)

In general, most healthcare workers are from the nursing department (55.51%). Among all healthcare workers, nurses are frequently in contact with patients, so they adhere to stringent precautions as compared with other healthcare workers.[19]

In the current study, approximately 80% of subjects were of the opinion that wearing mask is supposed to be mandatory in all public locations and 79.31% of healthcare workers believed that wearing a mask reduces the spread of virus. Jemal et al[20] reported that 86.4% of respondents had good knowledge about hospital-acquired infection prevention. No significant difference was observed on the mask type used among healthcare workers, with most of them using an N95 mask followed by wearing a surgical mask along with an N95 mask. Asadi et al[21] showed that both surgical masks and unvented KN95 respirators without fit-testing, reduced the outward particle emission rates by 90% and 74% on average during speaking and coughing, respectively.

In this research, several questions were framed to test the awareness and observations among healthcare workers. A significantly higher number of doctors (17, 45.95%, $p = 0.01$) used two masks when compared with nurses, technicians, and other healthcare staff. Significantly fewer doctors (4, 10.81%) and other healthcare staff (8, 22.22%) reused masks when compared with nurses and technicians ($p = 0.002$). The frequency of cleaning was different among healthcare workers, with most of them using a mask only once and those who reused the mask, cleaned it on alternate days ($p < 0.001$). The most used method to clean was sun-drying or air-drying, preceded by washing with detergent or soap. A higher percentage of doctors used an antiseptic agent (12, 32.43%). Most of them used paper or plastic bags to store them when not in use (Table 3).

Most of them did not do the following: use hand sanitizer before wearing the mask (211, 72.75%); inspect the mask for damage (258, 88.96%); ensure the mask covered the nose, mouth, and chin (287 (98.96); ensure the mask fit snugly (280, 96.55%); secure strings behind the ear (168, 57.93%); avoid touching the face while the mask was on (160, 55.17%); use hand sanitizer before adjusting the mask (282, 97.24%); keep the mask on the neck or under the nose (264, 91.03%); remove the mask to talk (247, 85.17%); remove the mask using the straps (199, 68.62%); wash hands immediately after removing the mask (258, 88.96%); or dispose of the mask in the designated bin (289, 99.65%). None of them wore a dirty, torn, or wet mask (Table 4). However, in the study by

Table 5. Comparison among departments on their attitude toward wearing a mask

Attitude	Nursing	Others[a]	Doctors	Technicians[b]	*p*
Negative attitude	1 (0.62)	1 (2.78)	1 (2.7)	0 (0)	0.82
Neutral attitude	9 (5.59)	2 (5.56)	2 (5.41)	4 (7.14)	
Positive attiude	151 (93.79)	33 (91.67)	34 (91.89)	52 (92.86)	

Data are presented as *n* (%).
[a]Others include the general duty assistant and personnel in medical records, billing, maintenance, public relations, laundry, and security.
[b]Technicians include the occupational therapy, radiation safety officers, security, and technician personnel.

Tadesse et al,[4] the proportion of poor face mask use was higher among midwives (30.1%) and health officers (19.10%). Sahiledengle et al[22] showed that 57.9% of healthcare workers wore a mask.[13,14,21] Abdulraheem et al[23] revealed that only 55.5% of health workers used a mask.[22] These variations were attributed to awareness, resource availability, clinical test performed, difference in public health polices, socioeconomic variations, and cultural differences.[5,24]

Review of the literature is proof of the fact that the authors of the current study have carried out pioneering observational research on the knowledge, attitudes, and usage of face masks among healthcare staff. The outcome of this analysis has added meaningful knowledge with respect to the Indian context. The study by Li et al showed that during COVID time, countries or regions where individuals did not wear a mask reported increased cases compared with countries where individuals used a mask ($p < 0.001$).[24]

Limitations of the research include small sample size and single study center, and therefore the results cannot be generalized. Future studies should aim to examine other geographic regions, as it is crucial to analyze the knowledge of healthcare workers on usage of masks to understand the safety standards applied during a crucial time such as a pandemic.

CONCLUSIONS

Most of the healthcare workers believed that mandatory wearing of a mask in public was a very effective measure that can prevent the spread of coronavirus. Most of them used N95 masks and wore it above the nose, covering their mouth and chin. A significantly higher number of doctors used two masks when compared with nurses, technicians, and other healthcare staff. Significantly fewer doctors and other healthcare staff reused masks when compared with nurses and technicians. The frequency of cleaning was different among healthcare workers, with most of them using a mask only once, and those who reused the mask, cleaned it on alternate days.

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