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# COVID-appropriate facemask use: A study among patients attending outpatient Departments of a Public Health Institute in West Bengal

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## Abstract:

**BACKGROUND:** In the ongoing COVID-19 pandemic, facemask use has been the most feasible public health measure in preventing transmission of SARS-CoV2 with the dual benefit of controlling the source of infection and decreasing the risk of acquiring infection from infected people. Therefore, COVID-appropriate behavior regarding facemask use is imperative for controlling the pandemic. This study aimed to assess COVID-appropriate mask behavior and factors associated with it among the patients attending outpatient departments of a public health institute in West Bengal.

**MATERIALS AND METHODS:** This cross-sectional study was done among 298 patients attending outpatient departments of Rural and Urban Health Units of a public health institute of Kolkata, during October 2020–February 2021. A pretested questionnaire and an observational checklist based on the World Health Organization guidelines were used to collect data. COVID-appropriate mask behavior was assessed by a five-point domain-wise scale, where good practice regarding facemask usage was considered when the score was three or more. Statistical analyses were done in SPSS 16.0.

**RESULTS:** Good practices regarding COVID-19 appropriate mask-related activities were recorded among 30.2% of the study participants. No difficulties faced during or on wearing a mask (adjusted odds ratio [AOR] = 1.86, 95% confidence interval CI: 1.1–3.33) and higher socioeconomic status (AOR = 2.25, 95% CI: 1.22–4.15) were significantly associated with good practice regarding COVID-19 appropriate facemask usage.

**CONCLUSION:** The magnitude of poor practice regarding COVID-appropriate mask-related behaviors is quite high among the study participants. Awareness regarding correct mask handling, storage, hygiene, disposal, and place of wearing from a reliable source would go a long way to curb the myths and misinformation surrounding mask usage and encourage COVID-appropriate mask behaviors among the general population.

## Keywords:

COVID-19 pandemic, disposal, facemask, health practices, mask storage, N-95 respirators

## Introduction

The novel SARS-CoV-2 virus was first reported in the Wuhan province of China in December 2019. The World Health Organization (WHO) declared this respiratory outbreak as a Public Health Emergency of International Concern on

January 30, 2020, and subsequently as a pandemic on March 11, 2020.<sup>[1]</sup> Droplet transmission from close contact with infected persons while coughing, sneezing, or even talking is the most common route of transmission for COVID-19. Some experimental studies documented airborne transmission risk of SARS-CoV-2, but the

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mere presence of viral RNA in environmental samples is not sufficient to comment on the transmissibility, except in medical treatment or dental settings where aerosol-generating procedures are undergone.<sup>[2]</sup> Facemask uses, frequent handwashing with soap and water, using alcohol-based hand sanitizer in the absence of a hand-washing facility, and physical distancing have been identified as effective public health control measures to prevent transmission of COVID-19. Initially, many experts across the world were against the routine usage of facemasks by the general population, as it was postulated that self-contamination outweighs the benefits of mask usage.<sup>[3-5]</sup> However, numerous randomized control trials, experimental studies, and mathematical models have documented the benefits and impact of facemask usage by the general population.<sup>[6-11]</sup> Facemask usage by symptomatic and asymptomatic infected individuals can control the source and on the other hand, usage by healthy and susceptible persons can decrease the risk of acquiring the infection from infected people.<sup>[12]</sup> Facemask usage can decrease the number of newly infected cases, hospital admission rate, morbidity, and mortality. In addition, it can decrease the contact of unwashed hands with mouth, nose, and faces and thereby reducing the chance of infection.<sup>[13-15]</sup> Most countries around the world have already adopted the policy of universal mask usage considering the benefits of face mask usage on the transmission of infection.<sup>[16]</sup>

India is one of the worst-hit countries across the globe by the COVID-19 pandemic. The Government of India revised its mask usage guidelines and made universal mask usage mandatory in public places from April 2020 onward.<sup>[17,18]</sup> Despite that, COVID-19 cases in India were increasing rapidly. While exploring the reasons for this rapid spread and growing caseload, public health experts opined that the effectiveness of mask usage in preventing transmission depended on multiple factors such as the type of masks used, seal and fit of the worn mask, the epidemiology of the local area, places or settings where the mask is worn, comorbid conditions, occupation of the individual, adherence to other nonpharmaceutical measures, cleaning and disposal of the used mask, the experience of facemask use, acceptability, and affordability.<sup>[19]</sup> Mildly symptomatic patients treated in home and their household contacts are generating infected wastes daily.<sup>[20,21]</sup> In the absence of an organized waste management system in the community, the sanitation workers, scavengers, and even the general people are continuously exposed to these infected wastes. Used medical masks are also detrimental to the environment and ecosystem as they are made of Polymeric Nanofibers, a potential source of microplastic pollution.<sup>[22]</sup>

Most of the surveys around the world estimated the correct facemask usage and disposal in health care

settings. Till now, very limited studies have been documented the correct facemask usage among general population focussing on the adherence to all necessary measures to comply while wearing masks, the cleaning and storage for reuse, and disposal at community level. Proper facemask usage is one of the most important parts of comprehensive strategies to reduce transmission risk, especially after the withdrawal of lockdown, resumption of public transports, reopening of many institutions, and relaxation of movement of the general population in a highly populous country, like India.<sup>[23,24]</sup>

With this backdrop, this study aimed to assess COVID-appropriate mask behaviors among the sociodemographically and culturally diverse population of outdoor patients attending Rural and Urban Health Units of All India Institute of Hygiene and Public Health during the COVID-19 pandemic. Our study also intended to identify the important factors associated with good practices regarding COVID-appropriate facemask use among the study participants.

## Materials and Methods

### Study design and setting

This study was an observational study with a cross-sectional design. It has been conducted in outpatient departments of four health centers under the rural unit and one health center under the urban unit of a public health institute of Kolkata. This study was conducted over 4 months (October 2020 to February 2021).

### Study participants and sampling

This study was conducted among all the patients aged more than 5 years and who have attended the aforesaid OPDs during the data collection period. Those who did not give informed written consent have been excluded from the study. In the case of the participant being not an adult, an assent form was obtained from the guardian who accompanied the minor. The sample size was calculated using the formula,  $N = Z_{\alpha/2}^2 PQ / L^2$ . The prevalence of proper face mask usage during the pandemic has been taken as 50%, as there is no such study previously conducted in India. Considering allowable error like 15% of  $p$ , design effect as 1.5, and nonresponse as 15%, the minimum sample size estimated was 298. On average, fifty patients attend those OPDs per day. Weekly 2 days were allotted for general OPD services in the health centers. Each day ten patients were selected from those OPDs by systematic random sampling method. The first patient had been selected randomly and then every 5<sup>th</sup> patient had been chosen for data collection. Every patient recruited for the study was provided with a unique ID, and thus data duplication was prevented by cross-checking the IDs each time before collecting data from a new patient.

### Data collection tool and technique

Data were collected by face-to-face interview using a predesigned and pretested structured questionnaire and one observational checklist. Strict privacy was maintained during data collection to elicit correct responses from the interviewee. The observational checklist had 7-items to assess the correct mask-wearing techniques and behavior during wearing a face mask<sup>[23]</sup> [Figure 1]. This had been developed on the guidelines of the WHO for the usage of medical and nonmedical masks for the general population. For each item, "Yes" implies correct practice and scored 1, whereas "No" denotes incorrect practice and scored 0. The maximum attainable score was 7, incorrect practice in any of these 7-items was considered as incorrect practice as all 7-items were mandatory to be followed for the effectiveness of the worn mask.

### Ethical consideration

The study was commenced after getting approval from Institutional Ethical Committee. During the outdoor visit, rapport was built and patients were initiated about the nature of the study and ensured on the confidentiality of their identity. Patients were informed that the information would only be used for academic purposes

and they were only included in the study after obtaining written informed consent.

### Operational definition

#### Proper/improper use for each domain

Five domains were identified for the COVID-appropriate mask behaviors [detailed description is given in Figure 1 in flowchart form]. Proper and improper use for each of the domains is described as follows: (i) Mask-handling domain: A score of 7 in the abovementioned WHO-observational checklist is considered as proper use. (ii) Mask reuse and disposal domain: A 3-ply surgical mask and FFP-1, FFP-2, N95, and N99 masks were considered as medical masks. These medical masks, if reused, were considered improper use. The fabric masks were reusable. Any face masks, if disposed of in closed bins provided by the Municipal Corporation or Panchayat for safe disposal or using bleach solution (5%) or sodium hypochlorite solution (1%) and then burnt or disposed of in dug holes underground were regarded as proper disposal. (iii) Mask hygiene domain: If washed after each use and not shared with others, were considered as proper use. (iv) Mask storage domain: Regarding storage of fabric masks, the proper use was to store them in a resealable or closed clean container

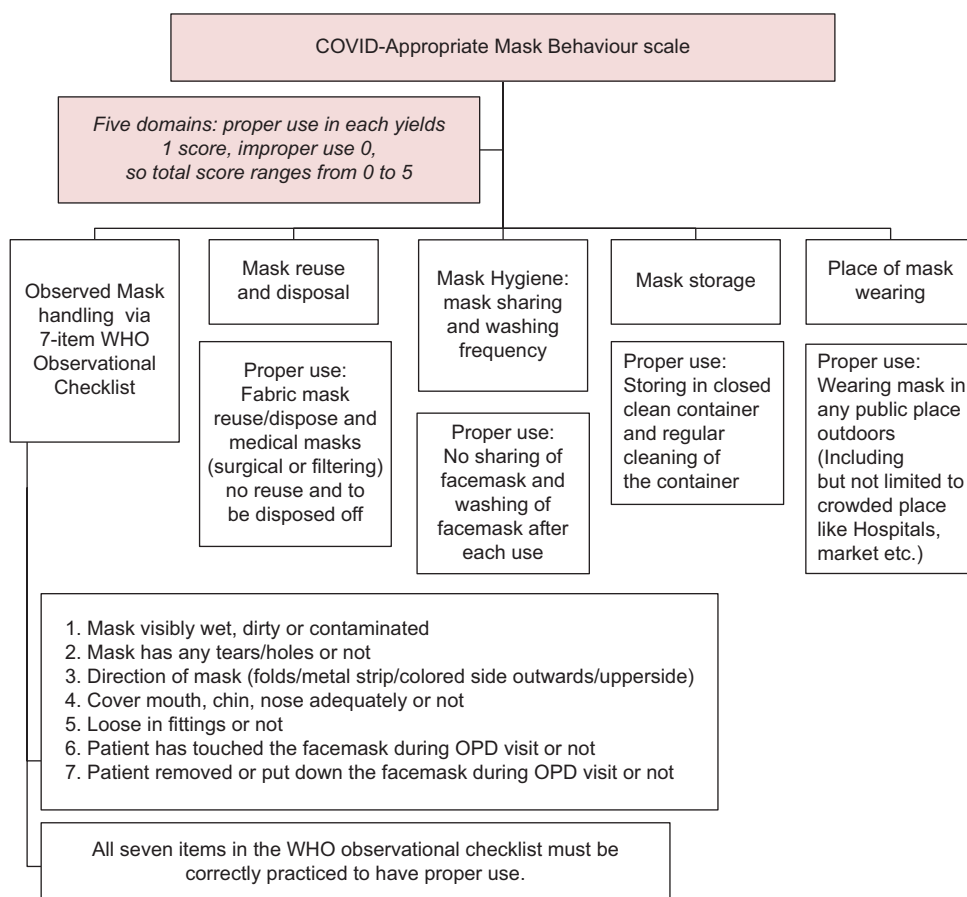


Figure 1: Flowchart of COVID-appropriate mask behaviour scale: Domains and scoring

or bag after properly cleaning after each use. (v) Place of mask-wearing: According to MoHFW guidelines, mask-wearing in any public place is considered a proper use.<sup>[25-27]</sup>

### COVID-19 appropriate mask behavior scale

A five-point scale (each point was given for the proper use in each of the domains of COVID-19 appropriate mask behaviors) was developed with the help of literature review to assess mask-related COVID-appropriate behaviors among study participants [Figure 1]. The scale was face and content validated by experts of public health and a 75-percentile score (which came as three) in the COVID-appropriate mask behavior scale was taken as the cut-off value for good practice. Hence, any participants scoring 3 or more on the scale were categorized as “good practice” for COVID-appropriate mask-related behaviors. Scores of 2 or less were interpreted as “poor practice” regarding mask use.

### Statistical analysis

Data analysis was done using Microsoft Excel 2016 and Statistical Package for the Social Sciences (SPSS for Windows, version 16.0) IBM, Chicago, IL, USA. Data were analyzed by descriptive and inferential statistics. Biologically plausible covariates, which came significant in univariate logistic regression with  $P \leq 0.05$ , were included for analysis in multivariable logistic regression.

## Results

Among the total of 298 participants, females were 167 (56%) and males 131 (44%). The mean (standard deviation) age of study participants was 45.5 ( $\pm 15.5$ ) years. Most of them were Hindu (263, 88.3%). There were 79 participants (26.2%) who were illiterate or below primary, whereas 22 participants were educated graduates and above. Among them, 201 (66.5%) resided in an urban area and 97 (33.5%) resided in a rural area. Most of the participants (67.6%) belonged to socioeconomic Class III and IV according to Modified Prasad Scale (March 2020). Almost 40% ( $n = 118$ ) were homemakers. A total of 137 participants (45.2%) had at least one comorbid condition. Hypertension (85, 62%) and diabetes (60, 43.8%) were the two most common comorbidities among them while 42 people (14.2%) had multiple morbidities.

On the days of data collection at OPDs, 187 (62.8%) wore fabric masks, 73 people (24.5%) wore surgical masks, 23 (7.7%) wore N95 masks, while the rest of the 15 people wore home-made face cover (like scarf and handkerchief). 298 participants were assessed for correct techniques of facemask handling by direct observation using the WHO checklist and we found that only 40 individuals (14.1%) adhered to all correct

measures of wearing masks. Most common (177, 62.5%) observed incorrect behavior was to touch the front of the mask frequently, followed by using loose-fitting masks (121, 42.7%) and wearing masks not covering the nostrils, mouth, and sides of the face properly (117, 41.3%). Besides, 75 (26.5%) of them removed the mask during communication with the doctors. Most of the participants (92.6%) reported that they had never shared their masks with others. Around 30.2% of the study participants showed good practice in mask-related activities under COVID-appropriate behaviors. Table 1 depicts the prevalence of COVID-appropriate mask behaviors among study participants overall and for each domain.

Among the fabric mask users ( $n = 262$ ), the most commonly adopted method of cleaning used mask was washing with soap or detergent and normal water (225, 86.9%), followed by using only disinfectant spray or liquid (24, 9.3%). While only 15 (5.8%) individuals were practicing the correct method, i.e., washing with soap/detergent and hot water and drying in the hot sun. When asked about the most common method of disposal of their used masks, it was found that the most common method of fabric mask disposal was indiscriminate throwing at any place (32, 86.5%), for surgical mask and N95 masks were also indiscriminate throwing that

**Table 1: Distribution of study participants according to COVID appropriate mask behaviors: Overall and each domain ( $n=298$ )**

	<i>n</i> (%)
Mask-related COVID-19 appropriate behaviors	
Good practice ( $\geq 3$ proper use out of 5 domains)	90 (30.2)
Poor practice ( $< 3$ proper use out of 5 domains)	208 (69.8)
Domains	
Mask handling (according to WHO observational checklist)	
Proper use*	42 (14.1)
Improper use	256 (85.9)
Mask reuse and disposal	
Proper use†	136 (45.6)
Improper use	162 (54.4)
Mask hygiene	
Proper use‡	193 (64.8)
Improper use	105 (35.2)
Mask storage	
Proper use§	28 (9.4)
Improper use	270 (90.6)
Places for wearing the mask	
Proper¶	191 (64.1)
Improper	107 (35.9)

\*All seven items in the WHO observational checklist must be correctly practiced, †For fabric mask, it should be reused and medical masks (3-ply and filtering masks) should not be reused and disposed of, ‡Proper use is when a person correctly practices both mask sharing (no sharing) and mask washing frequency (wash after each use), §Store in a closed container and clean the container/bag regularly, ¶Any public places outdoors (including crowded places such as hospitals and markets). WHO=World Health Organization



is 80.7% and 100%, respectively. Others burned (8.1%–12%), buried underground (4.9%–5.4%) their used masks. Hence, only 13.5% ( $n = 5$ ) disposed of their used fabric mask correctly and 19.3% ( $n = 16$ ) disposed of their surgical masks correctly [Table 2].

170 (57%) study participants stated the reason for wearing masks as fear of acquiring COVID-19 infection from others, whereas 30 (10.1%) wore a mask as they stated it also protected others and 18 (6.9%) reported that they were afraid of acquiring COVID 19 and worsening of their condition due to preexisting comorbid conditions. 130 study participants (43.6%) experienced any form of difficulty while wearing masks such as breathing difficulty and problems in communication.

The participants who belonged to SES III and above had more chance of following good mask-related practice than those who were from SES IV and below (adjusted odds ratio [AOR] = 2.25, 95% confidence interval [CI]: 1.22–4.15). People, who had studied middle school and above, also adhered to good practice regarding COVID-appropriate mask behaviors than their counterparts. Participants who had no difficulties during/in mask-wearing were found to be significantly associated with good mask-related COVID appropriate practices after adjusting for all other confounders in multiple logistic regression analysis (AOR = 1.86, 95% CI: 1.04–3.33). This model was fit to use as Hosmer and Lemeshow test came insignificant. Approximately 14%–19% variability of the dependent variable can be explained by this model [Table 3].

## Discussion

The Government of India launched the vaccination program against COVID 19 on 16<sup>th</sup> January 2021.

**Table 2: Distribution of study participants according to facemask cleaning and disposal practices**

	<i>n</i> (%)
Washing/cleaning methods of fabric facemask for reuse ( $n=262$ )	
Correct*	15 (5.8)
Incorrect	244 (94.2)
Predominant methods of facemask disposal	
Fabric mask ( $n=37$ )	
Proper method <sup>†</sup>	5 (13.5)
Improper method	32 (86.5)
Surgical mask ( $n=83$ )	
Proper method <sup>†</sup>	16 (19.3)
Improper method	67 (80.7)
N-95 and filtering masks ( $n=7$ )	
Proper method	0
Improper method	7 (100)

\*Hot water and soap, <sup>†</sup>For fabric mask, burning and burying underground and for surgical mask: Burning, burying underground, and throwing in Municipality dustbins

However, even after receiving the full course of the COVID-19 vaccine, it is mandatory to follow and strictly adhere to all precautions such as using facemask correctly, maintain physical distancing, and adherence to hand hygiene measures.<sup>[28-30]</sup> Though the number of new cases was low from October 2020 to mid-February, the COVID-19 cases have been increasing steeply from March 2021, forecasting the impending second wave of the pandemic in India.<sup>[31]</sup> Under such circumstances, the Ministry of Home Affairs gave an order to enforce the Test-Track-Treat strategy along with a major emphasis on COVID-appropriate preventive public health measures and enforcement of monetary fines, even if necessary.<sup>[32]</sup>

In the current study, all the 298 study participants were found to wear face covers during their outdoor clinic visits. In other studies, conducted in Italy by Scalvenzi *et al.*,<sup>[33]</sup> in China by Tan *et al.*,<sup>[34]</sup> in Brazil by Cotrin P. *et al.*,<sup>[35]</sup> and in Japan by Machida *et al.*,<sup>[36]</sup> the prevalence of facemask use was found to be 98.2%, 99%, 99.1%, and 80.2%, respectively. In another study conducted in Malaysia among the hospital visitors, Gunasekaran GH *et al.*<sup>[37]</sup> found the prevalence of facemask use was 96.9%. Ganczak M. *et al.*<sup>[38]</sup> found the prevalence of facemask use in selected public places as 65.7%–73.6%. While Rahimi *et al.*<sup>[39]</sup> observed the facemask usage prevalence to be 45.6% among pedestrians in Southwest Iran, among the pedestrians in Hong Kong the prevalence was around 94.8% as found by Tam *et al.*<sup>[40]</sup> Elachola H. *et al.* observed the face cover usage prevalence in different public places in Asian and African countries and found it as in Lima, Peru (86%), in Kerala, India (41%), in Cuernavaca, Mexico (25%), Atlanta, USA (21%), Kinshasa, DRC (4%), Phnom Penh, and Cambodia (97%).<sup>[41]</sup>

In the current study, observed mask handling practices were found to be very poor among study participants in comparison to other web-based surveys, where the participants' self-reported responses might have been influenced by social desirability bias,<sup>[34]</sup> and on the other hand, only direct observation-based studies while assessing the correct behavior did not use all the domains, particularly the storage and disposal methods.<sup>[37-39]</sup> Lee *et al.* reported that none of the participants followed all the steps of wearing a facemask correctly.<sup>[42]</sup> This has correctly overcome the "Know-to-Do" gap as well as social desirability bias.

On the days of data collection at OPDs, we found 62.8% of participants wearing fabric masks, followed by surgical masks (24.5%) and N95 masks (7.7%). This finding differs from other studies,<sup>[33,34,37,39,40]</sup> where the most commonly used mask was surgical masks. In the current study, only 5.8% of the study participants followed the correct method of cleaning used masks as recommended by GOI.<sup>[43]</sup> Around 43.6% of people reported discomfort while

**Table 3: Multivariable logistic regression analysis model of factors associated with good COVID appropriate mask behaviors (n=298)**

Factors	Total	n (%) among persons with good mask-related COVID appropriate behavior (n=90)	Multivariable model <sup>‡</sup>	
			AOR (95% CI)	P
↓Age*	298	39.7±14.7 <sup>†</sup>	1.02 (0.99-1.04)	0.144
Religion				
Hindu	263	74 (28.1)	1 (reference)	
Muslim	35	16 (45.7)	2.19 (0.99-4.84)	0.053
Educational level				
Above middle school	107	49 (45.8)	1.67 (0.91-3.1)	0.1
Middle school and below	191	41 (21.5)	1 (reference)	
SES				
Class III and above	168	65 (38.7)	2.25 (1.22-4.15)	0.01
Below Class III	130	25 (19.2)	1 (reference)	
Problems in/during mask-wearing				
Absent	170	66 (38.8)	1.86 (1.04-3.33)	0.03
Present	128	24 (18.8)	1 (reference)	
Comorbidities				
Absent	163	62 (38)	1.39 (0.73-2.66)	0.32
Present	135	28 (20.7)	1 (reference)	

\*Continuous variable, <sup>†</sup>Mean±SD of the continuous variable in the particular group, <sup>‡</sup>The multivariable model was fit to use, as seen from the insignificant P value in Hosmer and Lemeshow test (0.878). Variables in the model correctly predicted 71.8% of the variability in mask-related COVID-appropriate behaviors. Cox and Snell's R<sup>2</sup>=0.135 and Nagelkerke R<sup>2</sup>=0.191. SD=Standard deviation, SES=Socioeconomic status, CI=Confidence interval, AOR=Adjusted odds ratios

wearing masks such as breathing difficulty, difficulty in communication, earache, skin irritation, and fogging of glasses in the present study. These findings have also been reported in other studies.<sup>[35,44]</sup> Fifty-seven percent of people depicted the reason for wearing masks as fear of getting infected by SARS-CoV-2 in our study. Perceived risk and severity and cues to action were also described as important predictors of mask compliance by others.<sup>[45,46]</sup> Furthermore, higher socioeconomic status and higher were found to be associated with good covid-appropriate mask-related activities in this study. A study by Tan M *et al.*<sup>[34]</sup> and Alam K *et al.*<sup>[47]</sup> also depicted that people with lower educational status showed lower compliance to correct mask use, while Machida M *et al.*<sup>[36]</sup> found women with a high household income had better compliance. More than 80% of study participants in this study, disposed of their used facemasks by indiscriminately throwing them. In the COVID-19 pandemic scenario, the amount of generated potential infectious waste has been increased hugely and, in some places, it exceeds the capacity of local waste management.<sup>[21]</sup> Although in some urban localities, dustbins are being provided by local authorities, they are not sufficient, and also rural areas lack the organized waste collection system and general people are not aware of correct methods of disposing of the used masks.

### Limitations and recommendation

This study observed the mask-wearing techniques and behavior by direct observation with an observational checklist. This method is more reliable than other questionnaires-or web-based surveys. The information regarding other domains such as the cleaning, storage,

and disposal of used masks was collected by asking the participants as it is not possible to observe directly. On the other hand, a bias could arise out of the study setting as people are expected to follow all COVID-19 appropriate behaviors more stringently along with face mask use in health care settings as health-care settings are considered as a potential source of COVID-19 infection. Other limitations of our study are as follows: relatively smaller sample size and lack of generalizability due to non-probabilistic sampling.

### Conclusion and Recommendations

From the month of March 2021, India is battling the second wave of this disease, and in this scenario, the nonpharmacological preventive measures such as using face masks in public places, maintain cough etiquette, following hand hygiene, and maintaining physical distancing are undoubtedly still our potential weapons. Therefore, frequent awareness campaigns should be arranged by grassroots health workers in a war footing manner emphasizing the importance of COVID appropriate facemask use. People need to know that mere face mask-wearing is not enough. Correct steps of wearing a mask, along with proper mask handling steps should be equally emphasized. People should be educated on storage, washing, and safe disposal in community settings and its importance. This specific information regarding correct COVID-Appropriate mask behaviors, if dispersed from a reliable source, preferably through a digital platform, would be highly efficacious in curbing the myths and misinformation. In the current study, quite a few study participants had queries about

the apparent failure of masks to prevent COVID-19 and the necessity of young people to wear a mask, while some other had doubts about the duration and interval of mask use. Future research work could be done focusing primarily on addressing these misconceptions and queries of the general population.

### Ethical code

This research work underwent complying with the ethical code/principles, namely: (a) Principle of confidentiality, (b) principle of consent, (c) principle of nonmaleficence, (d) principle of justice, (e) principle of autonomy, and (f) principle of beneficence. Interviewers had strictly followed all covid appropriate behaviors during face-to-face interviews. After collection of the data, persons who were found to have wrong facemask handling practices were demonstrated with the correct facemask wearing methods and informed about all other covid appropriate behaviors.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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