Knowledge, practice, and barriers of optimal mask usage among general public – A cross-sectional study from Kerala, South India

Aditya Ashok[1], Akhilesh Kunoor[2], Midhun Rajeev[3], Soumya Melepurakkal[4], Aravind Mohankumar Syamala[5], Sarath Venugopal[6], Vishnu Gopalakrishnan[7], Tajik Mohammed Shafi[8]

[1]Post Graduate Resident, [2]Professor, [8]Assistant Professor, Department of Respiratory Medicine, Amrita Institute of Medical Sciences and Research Centre, Amrita Viswavidyapeetham, Kollam, Kerala, [3]Project Coordinator, Department of Thalassemia and Sickle Cell Disease, Centre for Stem Cell Research, CMC, Vellore, Tamil Nadu, [4]General Practitioner, Swastha Ayurveda Clinic, Mekkad, [5]City Project Officer, City Officer, Project Joint Effort for Elimination of TB, CHRI, Kochi, Kerala, [6]Senior Register, Department of Anesthesiology, Vijaya Hospital, Chennai, Tamil Nadu, [7]Consultant, Department of Interventional Pulmonology, Aster MIMS Hospital, Kannur, Kerala, India

ABSTRACT

Background: Social distancing, mask, and sanitizers are advised to cut the chain of transmission of the droplet and airborne infection since the first case of COVID-19 was reported from Wuhan. Universal mask usage is advised by the center for disease control. Despite this, it is assumed that there is no adequate mask practice. **Aims and Objectives:** The objectives of the study are as follows: (1) To assess the knowledge and practice regarding optimal mask usage in a different setting by the general community. (2) To identify the barriers for optimal mask usage as experienced by users. **Materials and Methods:** We did a cross-sectional study in Kerala using self-made validated questionnaire translated to Malayalam, the regional language distributed by web based Google form. The sample size was calculated as 200 with an assumption of awareness regarding mask usage among the general public to be at least 60% with a confidence interval of 95 and allowable error of 10% Knowledge was considered as high if 80–100%, moderate if 60–79% and low if 0–59%. The practice was considered as good if >75, 74–50 satisfactory and if <50, it is termed as unsatisfactory. **Results:** Overall knowledge regarding masks and their usage was 52. 88% which is low. Only 38% were doing satisfactory practice. There were lacunae in knowledge regarding mask reusage (39.9%), ideal masks in hospital settings (43.3%). Only 26.4% practiced optimal method of mask removal and 38.4% safe mask disposal. Major barriers for mask usage were suffocation (49.3%) and exertional dyspnea (46.9%). **Conclusion:** More awareness needs to be created among the public for COVID appropriate behavior with a focus on mask usage. There is a need to address the commonly observed barriers for adhering to mask practice.

Key words: Mask; Barriers; Knowledge; COVID-19; Airborne infections; Droplet

INTRODUCTION

Optimal mask usage is one of the most important strategies in the prevention of airborne infections. Awareness regarding infection control strategies such as hand hygiene and mask usage is increasing among the general public. National airborne infection control (AIC) guidelines developed by the Central TB Division strongly urge strict adherence to various infection control strategies.[1] Cough corners and free distribution of AIC Kit were important strategies in preventing airborne infections such as tuberculosis and H1N1. Amid the current COVID-19 pandemic universal masking is advised by the Centre for Disease Control and Prevention (CDC) and Indian Council for Medical Research.[2] Improper mask usage is usually observed and studies have shown that there is a lacuna in

Address for Correspondence:
Dr. Akhilesh Kunoor, Professor, Department of Respiratory Medicine, Amrita Institute of Medical Sciences and Research Centre, Amrita Viswavidyapeetham, Kollam, Kerala, India. **Mobile:** 8547258738. **E-mail:** akhileshkunoor@gmail.com

awareness regarding infection control strategies among the general public.[3] There are some observed practices such as lowering of masks while talking and stigma associated with mask usage. There are not many studies available that have assessed the awareness and barriers to proper mask usage. In this study, we assessed the knowledge, practice, and barriers for optimal mask usage in the current scenario. This observation might help to adopt positive strategies regarding optimal mask usage.

Aims and objectives

Aim of the study: To find out the knowledge, practice and barriers of mask usage among general population.
The objectives of the study are as follows:
1. To assess the knowledge and practice regarding optimal mask usage in a different setting by the general community.
2. To identify the barriers for optimal mask usage as experienced by users.

MATERIALS AND METHODS

We conducted this study across 14 districts in Kerala as a cross-sectional study. Institutional ethical clearance was taken for the study. The study tool was a self-made validated questionnaire containing 30 questions. The questions were translated to Malayalam, the regional language. Expert validity of the content of the questionnaire was done by two pulmonologists and two public health specialists with community medicine affiliation. The questionnaire was distributed through a web-based platform (Google form). The total study duration was 3 months. Baseline demography including name, age, occupation, and educational qualifications were collected. The questions were mainly focused on knowledge regarding various masks, guidelines regarding mask usage, current practices of the public regarding mask usage, and the barriers for optimal mask usage. The questions were divided into five domains which included nine questions in knowledge, eight in practice, two in attitude, two in communication, and one in perception. There were eight questions for collecting baseline demographic data. The sample size was calculated as 200 with an assumption of awareness regarding mask usage among the general public to be at least 60% with a confidence interval of 95 and allowable error of 10%. Responses were summarized in frequencies and percentages.

The knowledge was considered as high if 80–100%, moderate if 60–79% and low if 0–59%.

The practice was considered as good if >75, 74–50 satisfactory and if <50, it is termed as unsatisfactory.

RESULTS

There were 208 respondents for the study. Major age groups were from 30 to 49 years of age (50.5%). There were 52.9% males and most of the respondents were graduates and above. (43.8% and 32.7%). About 42.3% of respondents were working in the private sector and 15.9% in government sector jobs. About 34.8% of the respondents were healthcare workers. Baseline demographics are depicted in (Table 1).

About 31.3% were from Ernakulam district which is the business capital of the state. Overall knowledge regarding masks and their usage was 52. About 88% of which is low as per modified Bloom's criteria. Most of the respondents were aware of different types of masks, optimization of mask usage while dining or talking, and regarding maximum hours of mask usage. However, there were lacunae in knowledge regarding mask reusage (39.9%), ideal masks in hospital settings (43.3%), and thread count of cloth mask (20.7%) (Figure 1). About 52.7% have acquired information regarding mask usage from different media and 33.2% were from educational and workplace.

Only 38% were doing satisfactory practice which is very low as per the defined criteria. Correct practices regarding mask usage were found as, 98.6% in public space, 91.3% during dining, 98.6% while talking to others, 86% when mask got soiled, etc. Only 26.4% practiced optimal method of mask removal and 38.4% safe mask disposal and 46.2% while visitors are at home (Figure 2).

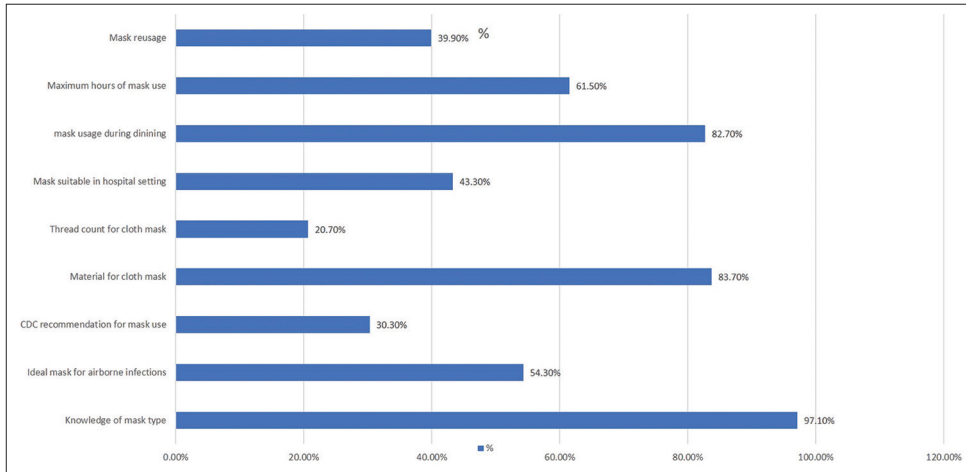| Table 1: Baseline demographics of study population	
Category	**Percentage**
Age	
15–29	31.3
30–49	50.5
50–69	17.3
>70	1
Sex	
Male	52.9
Female	47.1
Education	
Primary	0
High school	1.4
Plus two	4.3
Technical education	15.4
Degree (graduation)	43.8
Postgraduation	32.7
Others	2.4
Occupation	
Private sector	42.3
Government sector	15.9
Public sector	7.7
Self-employed	8.2
Others	26

Figure 1: Awareness among public regarding mask usage
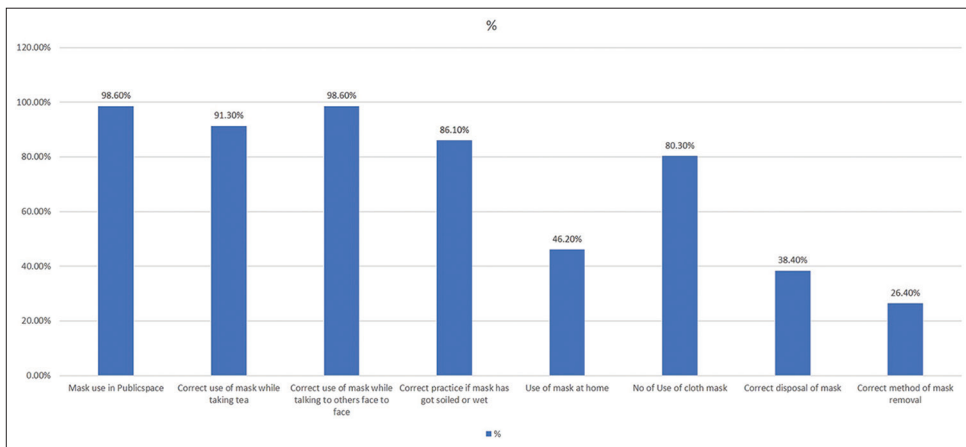

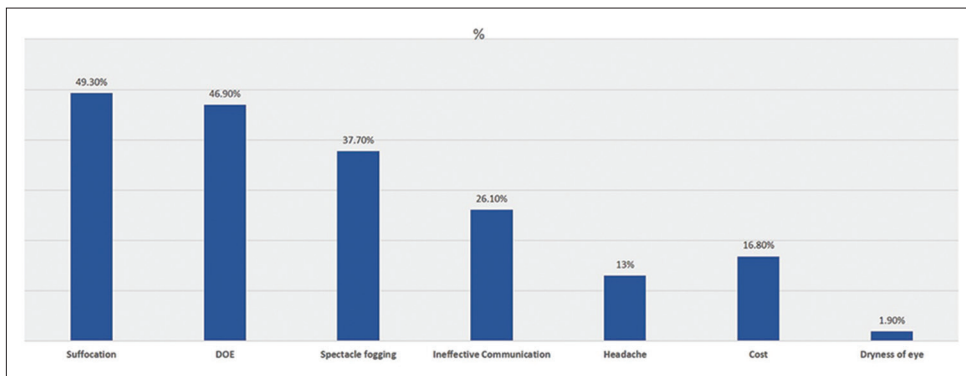**Figure 2:** Practice of public regarding mask usage

Figure 3: Barriers of optimal mask usage

There were some barriers as perceived by the respondents while using masks. These include suffocation (49.3%), exertional dyspnea (46.9%), spectacle fogging (37.7%), headache (13%) etc. (Figure 3).

DISCUSSION

The first case of the SARS-CoV-2 pandemic was reported in Wuhan in November 2020. Till now, no effective curative

strategy has been found for the same. It is believed that the transmission of the virus occurs through droplets and fomites. Social distancing, hand hygiene, and mask usage are believed to be the most effective strategy to prevent the spread of the disease. The CDC has published guidelines regarding for optimal use of masks in different settings which include both public and healthcare workers.[2] Although hand hygiene, cough etiquette, and mask usage were promoted as effective strategies for several airborne and droplet infections, awareness and practices of the same were found to be inadequate. This applies to both public and healthcare workers. In the study conducted by James et al., it was shown that general awareness about infection control such as handwashing, sputum disposal was less known to the general public.[3]

In a systematic review of 19 randomized controlled trials conducted by MacIntyre and Chughtai, it was found out that in the community, mask usage with or without handwashing is beneficial in the prevention of the spread of infections.[4] This highlights the fact that mask use is the most important strategy in airborne and droplet infections. About 97% of the study respondents were aware of different types of masks such as N 95, three-layer surgical mask, Cloth mask, and N95 with expiratory valves. Medical masks were intended for use in health-care settings and found to reduce infections among them. Cloth masks, though inferior, are found to reduce aerosol exposure.[5,6] CDC recommends N95 and three-layer masks in hospital settings and cloth mask is not advisable there. In this study, only 39% of respondents were aware of CDC recommendations for mask usage. Only 43% were aware of types of masks suitable in hospital settings which shows the lacunae in awareness.

54% received information regarding mask usage through different media which include printed and social media and only 23% used government agencies and official sites for proper knowledge. This may be the issue for reduced awareness about CDC recommendations on masks. This emphasizes the importance of fact-checking and relying on authentic sources for proper information. Mask reusage is very common in both communities and hospital settings. The ideal reuse methods have been described for the N95 mask by Juang and Tsai, which include periodic rotation, heating at 70° for 60 min, and boiling for 5 min.[7] Reuse methods for cloth masks were described by CDC.[8] Only 39.9% were aware of the proper method of reuse of masks.

Only 54% were aware of ideal masks useful in AIC. As airborne infections such as varicella, H1N1, and tuberculosis are very common, this area needs to be emphasized in awareness sessions.

The practice of wearing masks was not common in non-COVID time, even when caring for infectious patients at home. The study conducted by Lee et al., showed that the practice and technique were unsatisfactory.[9] In this study, 46.2% were using masks at home. In a study by Alrasheedy et al., the knowledge regarding COVID-19 preventive measures was good and 66% of patients were wearing masks at home.[10] It is to be noted that in the latter study, the participants were pharmacy students who have constant reinforcement and background knowledge about medical diseases compared to lay men. A previous observational study from the United States showed that 77% of all people appropriately used face masks, covering their nose and mouth, while 23% were either incorrectly masked or not masked at all.[11] About 80–90% of the respondents were following good practices in various situations like as in public space, dining, and on soiling the mask in this study.

A very few research articles were found to have assessed the barriers to mask usage during this pandemic. In this study, the major barrier in mask usage was found to be suffocation. Kyung et al., reported that the study samples who are COPD patients were experiencing desaturation, dyspnea, and increase in end tidal carbon dioxide during 6 min walk test.[12]

It is a known fact that mask usage can cause a physical barrier for effective communication.[13] Goldin et al., found that medical masks act as low pass acoustic filter for speech and also attenuate high frequencies by 3–4 dB on using the surgical mask and upto12 dB on respirator mask use.[14] In this study, 26.10% of the respondents experienced ineffective communication. This is causing another challenge as the persons might come closer for a proper hearing to tackle ineffective communication but may violate the physical distancing and chance of contracting the infections from others.

Lazzarino et al., commented that face masks can cause fogging, compromise effective communication and cause dyspnea.[15] In this study, 49.3% opined suffocation, 46.9% exertional dyspnea, and 37.7% spectacle fogging. Exhaled air and ineffective sealing is being attributed to the causation of spectacle fogging. Beder et al., studied the variation in oxygen saturation on wearing the mask by a surgeon during the procedure and found out that there was a reduction in arterial oxygen saturation and an increase in pulse rate after 1 h.[16] A cross-sectional study conducted in Spain among healthcare workers showed that 51.6% had *de novo* headache and it varies with the type of mask. The causes may include mechanical factors, inappropriate wearing, stress, duration of mask-wearing, hypoxia, or possible hypercarbia.[17] The possible solutions include ensuring optimal fitting of the mask, the optimal

duration of wearing the mask by making the duty hours comfortable, and removal of mask whenever the person is alone and in a well-ventilated space. Cost of the masks was another serious concern which had an impact on improper re use and disposal behavior.

Limitations of the study

As the study was done in COVID 19 pandemic period, personal interviews could not be done .The responses were recorded via google forms which might have affected the participant responses.

CONCLUSION

Awareness regarding COVID appropriate behavior needs to be improved. Optimal mask use is the most important strategy and proper knowledge and practice to be ensured by education, reemphasize, and administrative control. Behavioral changes may need time especially with barriers but measures for alleviating those to be found out and apply for proper prevention of the airborne and droplet infections by cutting the chain of transmission. This may include the selection of mask with proper fitting, changes in duty hours, etc.

ACKNOWLEDGMENT

REFERENCES

1. Directorate General of Health Services-Ministry of Health and Family Welfare. Guidelines on Airborne Infection Control in Health Care and Other Setting-in the context of Tuberculosis and other airborne infections. New Delhi: Nirmal Bhawan, Directorate General of Health Services-Ministry of Health; 2010.

2. Centre for Disease Control and Prevention. Guidance for Wearing Mask. United States: Centre for Disease Control and Prevention; 2021. Available from: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html [Last accessed on 2021 May 19].

3. James PT, Kunoor A and Rakesh PS. Awareness of health care workers, patients and visitors regarding air borne infection control-a descriptive study from a tertiary care centre in Kerala, Southern India. Indian J Tuberc. 2018;65(2):168-171.
   https://doi.org/10.1016/j.ijtb.2017.08.028

4. MacIntyre CR and Chughtai AA. A rapid systematic review of the efficacy of face masks and respirators against coronaviruses and other respiratory transmissible viruses for the community, healthcare workers and sick patients. Int J Nurs Stud. 2020;108:103629.
   https://doi.org/10.1016/j.ijnurstu.2020.103629

5. Chughtai AA, Seale H and Macintyre CR. Effectiveness of cloth masks for protection against severe acute respiratory syndrome coronavirus 2. Emerg Infect Dis. 2020;26(10):e200948.
   https://doi.org/10.3201/eid2610.200948

6. Van der Sande M, Teunis P and Sabel R. Professional and home-made face masks reduce exposure to respiratory infections among the general population. PLoS One. 2008;3(7):e2618.
   https://doi.org/10.1371/journal.pone.0002618

7. Juang PS and Tsai P. N95 respirator cleaning and reuse methods proposed by the inventor of the N95 mask material. J Emerg Med. 2020;58(5):817-820.
   https://doi.org/10.1016/j.jemermed.2020.04.036

8. Centers for Disease Control and Prevention. Use and Care of Masks. United States: Centers for Disease Control and Prevention; 2022. Available from: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html [Last accessed on 2022 Oct 01].

9. Lee LY, Lam EP, Chan CK, Chan SY, Chiu MK, Chong WH, et al. Practice and technique of using face mask amongst adults in the community: A cross-sectional descriptive study. BMC Public Health. 2020;20(1):948.
   https://doi.org/10.1186/s12889-020-09087-5

10. Alrasheedy AA, Abdulsalim S, Farooqui M, Alsahali S and Godman B. Knowledge, attitude and practice about coronavirus disease (COVID-19) pandemic and its psychological impact on students and their studies: A cross-sectional study among pharmacy students in Saudi Arabia. Risk Manag Healthc Policy. 2021;14:729-741.
    https://doi.org/10.2147/RMHP.S292354

11. Tamamoto KA, Rousslang ND, Ahn HJ, Better HE and Hong RA. Public compliance with face mask use in Honolulu and regional variation. Hawaii J Health Soc Welf. 2020;79(9):268-271.

12. Kyung YS, Kim Y, Hwang HH, Park JW and Jeomg SH. Risks of N95 face mask use in subjects with COPD. Respir Care. 2020;65(5):658-664.
    https://doi.org/10.4187/respcare.06713

13. Marler H and Ditton A. "I'm smiling back at you": Exploring the impact of mask wearing on communication in health care. Int J Lang Commun Disord. 2021;56(1):205-214.
    https://doi.org/10.1111/1460-6984.12578

14. Goldin A, Weinstein B and Shiman N. How do medical masks degrade speech reception? *Hear Rev*. 2020;27(5):8-9.

15. Lazzarino AV, Steptoe A, Hamer M and Michie S. Covid-19: Important potential side effects of wearing face masks that we should bear in mind. BMJ. 2020;369:m2003.
    https://doi.org/10.1136/bmj.m2003

16. Beder A, Büyükkoçak U, Sabuncuoğlu H, Keskil ZA and Keskil S. Preliminary report on surgical mask induced deoxygenation during major surgery. Neurocirugia (Astur). 2008;19(2):121-126.
    https://doi.org/10.1016/s1130-1473(08)70235-5

17. Ramirez-Moreno JM, Ceberino D, Plata AG, Belen R, Sedas PM, Hariramani R, et al. Mask-associated '*de novo*' headache in healthcare workers during the COVID-19 pandemic. Occup Environ Med. 2020;78(8):548-554.
   https://doi.org/10.1136/oemed-2020-106956

Authors' Contributions:
AA- Interpreted the result, Manuscript preparation, and Coordination; **AK-** Concept, Design, Manuscript preparation, and Coordination; **MR-** Design, Statistical analysis, and Revision of the manuscript; **SM-** Interpreted the result, Statistical analysis, and Revision of the manuscript; **AMS-** Statistical analysis; **SV-** Review of the literature; **VG-** Review of the literature; and **TMS-** Statistical analysis.

Work attributed to:
Amrita Institute of Medical Sciences and Research Centre, Amrita Viswvidyapeetham, Kochi, Kerala, India.

Orcid ID:
Aditya Ashok - https://orcid.org/0000-0002-9293-5983
Akhilesh Kunoor - https://orcid.org/0000-0001-9653-8697
Soumya Melepurakkal - https://orcid.org/0000-0002-3878-618X
Sarath Venugopal - https://orcid.org/0000-0002-5528-1132
Vishnu Gopalakrishnan - https://orcid.org/0000-0002-6857-5391
Tajik Mohammed Shafi - https://orcid.org/0000-0001-6145-7686