

BMJ Open Surgical mask wearing behaviour in COVID-19 pandemic and influenza seasons: a cross-sectional study on healthcare professional students and staff's perspective in Southern California

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ABSTRACT

Objective To investigate healthcare professional staff and students' perception of wearing surgical masks before and after their experience with the COVID-19 pandemic, and to evaluate the impact on mask wearing behaviour in future influenza seasons.

Design Cross-sectional study using anonymous survey.

Setting and participants Healthcare students and staff from a healthcare academic institution in Southern California participated in the mask survey study. Survey results were collected from June to November 2021. A total of 305 respondents responded to the survey, with 173 being healthcare students and 132 being working healthcare staff.

Outcomes The study examined respondents' perceptions and hospital mask wearing behaviour before and after their COVID-19 pandemic experience, as well as during previous and future influenza seasons.

Results Two hundred and sixty-four (86.6%) respondents agreed that wearing a surgical mask reduces infection and limits transmission of infectious disease, yet prior to the pandemic, only a small proportion wore a mask in the hospital or during patient care. After experiencing the COVID-19 pandemic, more respondents indicated that they would continue to wear a mask when they are in a hospital in general (n=145, 47.5%), during patient care (n=262, 85.9%), during influenza seasons throughout the hospital (n=205, 67.2%) and during influenza seasons during patient care (n=270, 88.5%).

Conclusion The pandemic experience has greatly influenced the health prevention behaviours of healthcare students and staff. After the pandemic, many respondents will continue to practice surgical mask wearing behaviour in the hospital, especially during face-to-face patient care. This demonstrates a significant change in health prevention perceptions among the current and the future generation of healthcare professionals.

BACKGROUND

The COVID-19 pandemic highlighted healthcare professionals' awareness regarding their

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Responses to this cross-sectional study was anonymous among three different professions.
- ⇒ Recruitment was limited to a single large academic institution of one geographic area where generalisability might be challenged.
- ⇒ Respondents were limited to three professions: respiratory therapy, nursing and medical professions.
- ⇒ Subjects may have experienced recall bias.
- ⇒ Majority of subjects who responded to the study completed each section and question of the survey in full.

vulnerability to respiratory infections.¹ The medical use of masks was designed to limit respiratory droplet transmission from and to the user. With various improvements made to the design and the introduction of the 'total disposable system' in 1969, different grades and types of masks are now designed for different functions.²⁻⁴ N95 respirators and surgical masks are most commonly used by healthcare workers. At the same time, the use of home-made face coverings has also increased among the professions and general population during the COVID-19 pandemic.^{5,6}

Over the past few decades, an increase in the prevalence of infectious disease outbreaks has been observed.⁷ Other than the coronavirus family that has caused a number of recent severe outbreaks including severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and COVID-19, seasonal influenza or influenza outbreaks continue to create significant burden on society and the healthcare

system due to high-risk individuals requiring hospital admissions.⁸ With increased number of people seeking medical attention and needing hospitalisation, working healthcare staff have the highest risk of exposure to infectious diseases due to direct patient contact, along with an increased risk of secondary transmission to their family members.^{9–15} In addition, influenza is known to be contagious through droplet transmission, in which large amounts of the virus are often found in the respiratory secretion of patients with influenza and can spread through sneezing or coughing.¹⁶

There are recommendations for US healthcare workers to take extra precautions against disease transmission when taking care of patients with influenza; however, mask wearing is not strictly enforced.⁹ In Asian cultures and countries, a mask wearing culture that predates 21st century infectious disease outbreaks played a huge role during SARS and swine influenza pandemics.¹⁷ A high level of self-efficacy of self-protection among the general Asian population was observed when a widespread outbreak occurs.¹⁸ Countries such as Taiwan, which has practised a rigorous public health policy since early 2020, have far lower COVID-19 cases than other countries, even though being geographically closer to China.¹⁹

Other than achieving control in community transmission of COVID-19, the policy of wearing face masks has also led to an unintended effect on lowering severe influenza cases.²⁰ Even though mask wearing was not socially accepted in western cultures prior to COVID-19, it has become an integral part of US daily life since the better half of 2020.^{21 22} According to FluView, observations of seasonal influenza cases have been much lower for the 2020 and 2021 influenza season compared with data from 2018 and 2019.²³

Before COVID-19, surgical mask wearing practices were not mandated for healthcare students and staff alike in a hospital. They were only required when performing certain procedures, providing care to specific patient groups or when exposed to certain hazards.²⁴ As the pandemic emerged, surgical mask wearing and other health prevention practices have been vigorously promoted, and the public health culture has changed.²⁵ This meant that both trained staff and students who were still going through professional training held the same responsibility to comply with surgical mask mandates to reduce disease transmission and protect themselves and others.²⁶

The objectives of this study were: (1) to investigate healthcare professional staff and students' perception of wearing surgical masks before and after their experience with the COVID-19 pandemic, and (2) to evaluate the impact on surgical mask wearing behaviour in future influenza seasons.

METHODS

The study was designed as a cross-sectional study where healthcare professionals from a large academic healthcare

institution in Southern California, USA, were recruited to participate. An email with an anonymous survey link was sent out to each programme and department director for distribution to their students and staff at their own discretion. There was no financial incentive provided to the participants. Responding and participation was completely voluntary. Programme and department directors had no access to the survey data nor who completed and participated as it was anonymous. The following professions were selected: medicine, respiratory therapy and nursing. The survey was designed using the Qualtrics survey platform by the authors. The content was validated by experts in respiratory care, pulmonary medicine and public health.

Survey responses were collected between June and November 2021 using a survey that took about 8 min to be completed. Subjects were asked to answer a series of questions regarding their surgical mask wearing perceptions and behaviours in various time frames, before, during and after the respondents' COVID-19 pandemic experience. Perception questions inquired about subjects' beliefs about the efficacy of wearing a surgical mask within the hospital setting. The behavioural questions evolved their surgical mask wearing habits in the patient care setting. In addition, respondents reported their experience as healthcare students during the pandemic and were asked to describe their surgical mask wearing behaviour after their pandemic experience and during future influenza seasons.

Patient and public involvement

Patients and the public were not involved in this research.

Data analysis

Data were summarised using frequencies and percentages for qualitative variables and mean±SD for continuous variables. To compare the proportion of respondents' mask wearing behaviour before versus after their COVID-19 experience, Pearson's χ^2 test of independence was used. Fisher's exact test was used when the expected counts were less than 5. All analyses were conducted with SPSS V.28.0. The level of significance was set at $p \leq 0.05$.

RESULTS

A total of 305 subjects with a mean age of 29.9±9.1 years responded to the survey. Respondents included healthcare students and healthcare staff in respiratory care (n=80, 26.2%), nursing (n=31, 10.2%) and medicine (n=194, 63.6%) programmes and departments. Among those, 174 (57.1%) were healthcare students (respiratory therapy, nursing and medical students) and 131 (42.9%) were healthcare staff (respiratory therapists, registered nurses and medical residents). One hundred and sixty-seven respondents were females (54.7%). The frequency distribution of the demographics and characteristics of the respondents is shown in [table 1](#).

Table 1 Frequency (%) of demographics and characteristics of the respondents (N=305)

Variables	Students (n=173)	Staff (n=132)	Total
Gender			
Male	80 (46.0)	54 (41.2)	134 (43.9)
Female	91 (56.3)	76 (58)	167 (54.8)
Non-binary	1 (0.6)	0 (0)	1 (0)
Prefer not to say	2 (1.2)	1 (0.8)	3 (0.1)
Age* (years)			
	25.1±3.5	36.3±10.3	29.9±9.1
Race			
Asian	32 (18.4)	28 (21.4)	60 (19.7)
Black	19 (10.9)	5 (3.8)	24 (7.9)
Latino	18 (10.3)	25 (19.1)	43 (14.1)
Multiracial	23 (13.2)	8 (6.1)	31 (10.2)
Native American	1 (0.6)	0 (0)	1 (0.3)
White	68 (39.1)	53 (40.5)	121 (39.7)
Other, not specified	5 (2.9)	3 (2.3)	8 (2.6)
Prefer not to say	8 (4.6)	9 (6.9)	17 (5.6)
Ethnicity			
Hispanic	27 (15.6)	34 (26)	61 (20.1)
Non-Hispanic	137 (79.2)	92 (70.2)	229 (75.3)
Prefer not to say	9 (5.2)	5 (3.8)	14 (4.6)
Highest level of education			
Some college credit, no degree	6 (3.5)	1 (0.8)	7 (2.3)
Associate degree	5 (2.9)	30 (22.9)	35 (11.5)
Bachelor's degree	140 (80.5)	45 (32.4)	185 (60.7)
Master's degree	16 (9.2)	11 (8.4)	27 (8.9)
Doctorate (PhD, MD or equivalent)	7 (4.0)	44 (33.6)	51 (16.7)
Programme or profession			
Respiratory therapy	13 (7.5)	67 (51.2)	80 (26.2)
Nursing	7 (4.0)	24 (18.3)	31 (10.2)
Medicine	154 (88.5)	40 (30.6)	194 (63.6)
Chronic conditions that increase risk of severe illness (COPD, asthma, hypertension, heart conditions, type 2 diabetes, etc)			
Yes	18 (10.4)	30 (22.9)	48 (15.8)
No	155 (89.6)	101 (77.1)	256 (84.2)

*Mean±SD.
COPD, chronic obstructive pulmonary disease.

Most of the student respondents had patient care clinical experience during their programme (n=142, 81.6%), and some reported additional clinical experience practising face-to-face patient care during past influenza seasons (n=70, 40.2%). Furthermore, the majority of respondents

had clinical experience at a hospital during the COVID-19 pandemic (n=137, 78.7%), but only a limited number had experience performing direct patient care in a COVID-19 unit (n=20, 11.5%). The median working experience of the staff was 6 (0, 45) years. Most of the staff respondents provided patient care during previous influenza seasons (n=128, 97.7%), 122 provided patient care during the COVID-19 pandemic (93.1%) and 97 (74.0%) worked in a patient with COVID-19 unit.

Most respondents believed that wearing a surgical mask reduces infection and limits transmission of infectious diseases (n=264, 86.6%). Additionally, the majority of respondents reported that they receive influenza shots annually according to provider recommendation (n=231, 74.3%). Subsequently, some reported that receiving the influenza shot changed their mask wearing behaviour (n=47, 15.1%). Yet, prior to the pandemic, 174 (57%) respondents indicated that they wore a face mask in the hospital during patient care and during influenza seasons. Respondents contributed their behaviour to mask wearing to not being part of the protocol (55.5%), exposure or infection risk was minimal (33.5%) and no one else did it in the work setting (20.3%).

However, through their experiences during the COVID-19 pandemic, future health risk prevention choices were greatly influenced among students (n=140, 80.4%) and staff (n=90, 68.7%). A higher proportion of the respondents predicted that they would continue wearing a mask in a hospital when mask mandates are dropped compared with those who did not wear it prior to the pandemic (figure 1A). More respondents will wear a mask throughout the hospital (n=145, 47.5%, $\chi^2=12.8$, $p<0.001$), during patient care (n=262, 85.9%, $\chi^2=37.9$, $p<0.001$), during influenza seasons throughout the hospital (n=205, 67.2%, $\chi^2=5.5$, $p=0.019$) and during influenza seasons during patient care (n=270, 88.5%, $\chi^2=26.1$, $p<0.001$).

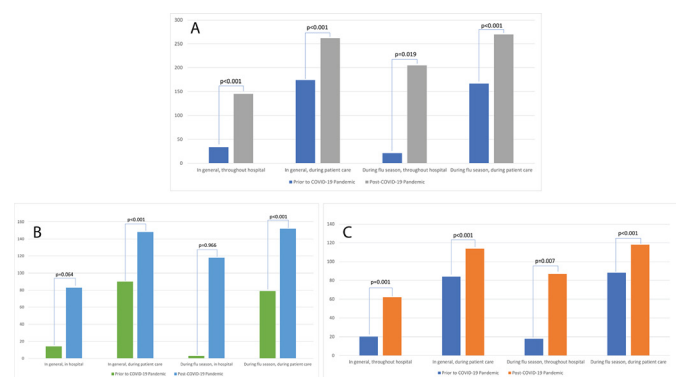


Figure 1 (A) Changes in mask wearing behaviour for healthcare students and staff prior to and post-COVID-19 pandemic experience in different clinical situations. (B) Changes in mask wearing behaviour for healthcare students prior to and post-COVID-19 pandemic experience during patient care. (C) Changes in mask wearing behaviour for healthcare staff prior to and post-COVID-19 pandemic experience in different clinical situations.

Significant changes in mask wearing behaviour for healthcare students prior to versus post-COVID-19 pandemic experience during patient care are shown in [figure 1B](#). Among healthcare students, this was observed especially during face-to-face patient care in general (n=148, 85%, $\chi^2=23.7$, $p<0.001$). Due to their pandemic experiences, a large proportion of students reported that they will wear a mask during future influenza seasons when performing face-to-face patient care (n=152, 87.4%, $\chi^2=13.4$, $p<0.001$).

In addition, more staff members reported that they would wear a mask when in the hospital (n=62, 47.3%, $\chi^2=10.1$, $p=0.001$), when performing face-to-face patient care (n=114, 87.0%, $\chi^2=14.0$, $p<0.001$) in general, in hospital during influenza season (n=87, 66.4%, $\chi^2=7.4$, $p=0.007$) and during patient care (n=118, 90.1%, $\chi^2=12.7$, $p<0.001$) in influenza season ([figure 1C](#)).

Additionally, when asked to respond regarding future influenza season health prevention behaviours, many respondents who did not always receive influenza shots now consider taking them annually when they become available (n=50, 67.6%). Notably, over one-third of the respondents reported that they will consider wearing a mask outside of the hospital during future influenza seasons (n=113, 37.0%), with a slight difference between the student group (n=51, 45.1%) and the staff group (n=62, 54.9%).

DISCUSSION

The objective of this study was to evaluate and predict surgical mask wearing behaviours among healthcare professional students and staff. Compared with mask wearing behaviour prior to the COVID-19 pandemic, interestingly, more healthcare students indicated that they will continue to wear a surgical mask while performing face-to-face patient care, a 28.7% increase after experiencing the pandemic. Among staff, a significant increase in predicted mask wearing behaviour within the hospital and during face-to-face patient care was observed. The findings of this study showed that a large proportion of respondents reported that they would continue to wear a mask during patient care, even when mask mandates are lifted and things return to prepandemic levels. Furthermore, an even greater proportion of students and staff indicated that they will wear masks during future influenza seasons. Some even opted to practise other preventive health strategies to prevent and reduce the risk of transmission, such as receiving the annual influenza shot, wearing a mask in the hospital when not interacting with patients and even wearing it outside the clinical setting.

Most notably, when comparing healthcare students and staff, a heightened sense of vigilance in practising health preventive measures was observed among staff. The working staff significantly increased their mask wearing behaviour within hospital grounds in general and during influenza seasons. Initially, we expected students would be more likely to change their mask wearing perceptions

and predicted behaviour than staff, as students' exposure to education opportunities could be a great contributor to their increased receptibility to new concepts and practices.²⁷ However, through an examination of this association, currently working healthcare professionals have demonstrated a greater change in mask wearing behaviour and perception, and recognised its importance in non-patient care situations, even outside of the clinical setting. Both students and staff should value learning opportunities to continue improving and expanding their medical expertise and practices.²⁸ In addition, we believe that our findings provide great insights to clinical educators and programme directors on how future students' perceptions are about surgical mask wearing behaviour in their clinical rotations. This might influence medical education curriculum design for students such as discussing the importance of surgical mask wearing during rounds.

A prominent mask wearing culture has been witnessed in Asia even before the pandemic. The SARS outbreak in 2003 shifted Asian public health systems.^{29 30} Since then, health perceptions evolved rapidly and a high adherence to personal hygiene behaviours was observed among the population.³¹ Even during subsequent outbreaks and influenza seasons, vigilant mask wearing behaviour was observed without government mandating or direct enforcement.³²

Due to previous outbreak experiences, Asian cultures have been at the forefront of promoting mask wearing behaviour as part of their principal health prevention efforts. Mask wearing became an Asian social norm to prevent spread of disease in the public when an individual feels ill.³³ Because of the cultures' inherent collectivism and community responsibility, enforcing governmental health prevention policies in Asian countries did not generate as many negative criticisms as other parts of the world.³⁴ In one way, wearing a mask was seen as a social responsibility. Based on the findings of this study, it would be interesting to see if western mask wearing culture shifts similarly to Asia.

Prior to COVID-19, most healthcare students and staff in the USA had already agreed that surgical masks provide protection against certain transmittable diseases and can reduce infection risks. However, they did not practise a rigorous mask wearing routine due to certain limitations in their clinical setting. Even though outbreaks such as SARS, swine influenza and MERS created waves of 'pandemic fear' in the past,³⁵ many current healthcare students never experienced a pandemic through a clinical perspective.³⁶

Based on our observations, students who had clinical experience as part of their programme during the COVID-19 pandemic had a unique and valuable experience. Also, healthcare staff working during the pandemic experienced the whole ordeal firsthand, significantly influencing their health prevention perception and mask wearing practices. This firsthand exposure to an outbreak during their professional training and career made these

healthcare professionals play a vital role in public health improvement.³⁷ Their experiences could influence health preventive perceptions and behaviours that might define the future of healthcare.

Furthermore, interesting new data regarding influenza cases during this pandemic were observed. According to FluView, a US influenza case monitoring report illustrates that seasonal influenza cases have been much lower during the 2020 and 2021 influenza seasons.²³ This was also observed in Australia, Chile and South Africa. According to a report issued by Centers for Disease Control and Prevention, widespread community health prevention measures against COVID-19 played a role in significantly reducing influenza cases, especially during influenza seasons, where expected peaks of influenza cases occurred.³⁸ In Taiwan, despite its proximity to the epicentre of the pandemic, COVID-19 cases remained significantly lower than the rest of the world due to immediate action of the government and health agency.^{39 40} With a rigorous public health programme and population compliance to mask wearing policies, Taiwan also observed significantly lower numbers of severe influenza cases amid the pandemic.²⁰ Therefore, the findings of this study and with an increased possibility of mask wearing behaviour changes during current and future influenza seasons, healthcare professionals' efforts may contribute to lower number of future influenza cases.

This study had some limitations. First, this was a single-centre study where subjects were recruited from one large academic institution in one geographical area. Second, the study's subjects were limited to three professions (respiratory therapy, nursing and medical) due to the nature of their profession and involvement in consistent face-to-face patient care interactions. Third, since the study was conducted using a survey, subjects may have experienced some degree of recall bias due to mask wearing becoming a part of a daily routine. Future studies that examine a similar topic would benefit from having access to a wider range of healthcare professionals at various locations and countries for generalisability purposes. Additionally, studies that measure and evaluate surgical mask wearing behaviour that is practised in future outbreaks are needed to further validate the findings of this study.

CONCLUSIONS

With the COVID-19 pandemic experience, a shift among healthcare professionals' mask wearing perception and behaviour was observed. As their learning and working environment became more dangerous, students and staff took on the responsibility as part of a team, and practised health preventive behaviours to protect each other and reduce risk of transmission. While only some respondents had access to COVID-19 unit clinical experience, many recognised the importance of mask wearing. This can be demonstrated by the change in perception and increased predicted mask wearing behaviour, while performing face-to-face patient care.

Furthermore, results showed a relationship between the current COVID-19 pandemic and future outbreak risks such as influenza seasons. Many recognised that the potential risk of influenza transmission warrants an increased mask wearing practice, and especially during face-to-face patient care. This was also further supported by an increased number of respondents employing other health preventive measures such as receiving the influenza vaccine.

In a post-COVID-19 pandemic era, the world will seek stronger healthcare leaders that promote public health and practise evidence-based medicine. The future healthcare workforce will play a crucial role in influencing and realising public health reforms and changes. Understanding and educating healthcare professionals' mask wearing perceptions and behaviours can help reduce cases during influenza season as well as other outbreaks.

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Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. All data relevant to the study are included in the article.

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