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Cross-sectional survey of changes in knowledge, attitudes and practice of mask use in Sydney and Melbourne during the 2020 COVID-19 pandemic

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ABSTRACT

Objectives Since mask uptake and the timing of mask use has the potential to influence the control of the COVID-19 pandemic, this study aimed to assess the changes in knowledge toward mask use in Sydney and Melbourne, Australia, during the 2020 COVID-19 pandemic.

Design An observational study, using a cross-sectional survey, was distributed to adults in Sydney and Melbourne, Australia, during July–August 2020 (survey 1) and September 2020 (survey 2), during the COVID-19 pandemic in Australia.

Setting and participants Participants aged 18 years or older and living in either Sydney or Melbourne.

Primary and secondary outcome measures Demographics, risk measures, COVID-19 severity and perception, mask attitude and uptake were determined in this study.

Results A total of 700 participants completed the survey. In both Sydney and Melbourne, a consistent decrease was reported in almost all risk-mitigation behaviours between March 2020 and July 2020 and again between March 2020 and September 2020. However, mask use and personal protective equipment use increased in both Sydney and Melbourne from March 2020 to September 2020. There was no significant difference in mask use during the pandemic between the two cities across both timepoints (1.24 (95% CI 0.99 to 1.22; p=0.072)). Perceived severity and perceived susceptibility of COVID-19 infection were significantly associated with mask uptake. Trust in information on COVID-19 from both national (1.77 (95% CI 1.29 to 2.44); p<0.000)) and state (1.62 (95% CI 1.19 to 2.22); p=0.003)) government was a predictor of mask use across both surveys.

Conclusion Sydney and Melbourne both had high levels of reported mask wearing during July 2020 and September 2020, consistent with the second wave and mask mandates in Victoria, and cluster outbreaks in Sydney at the time. High rates of mask compliance may be explained by high trust levels in information from national and state government, mask mandates, risk perceptions, current outbreaks and the perceived level of risk of COVID-19 infection at the time.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Mask uptake and the timing of mask use have the potential to influence the control of the COVID-19 pandemic.
⇒ Widespread behaviour modification and mask use for COVID-19 risk prevention in Australia were seen during the study periods.
⇒ Sydney and Melbourne both had high levels of reported mask wearing during July 2020 and September 2020.
⇒ A potential limitation of this study is that the survey was only administered in English, and thus there may be bias for English speakers and non-English speakers or people with limited access to the internet may have been excluded.
⇒ Recall bias may have been introduced, as this survey provided a cross-sectional description of mask use only, which was dependent on recall for reporting behaviours early in the pandemic period.

INTRODUCTION

The first wave of COVID-19 in Australia occurred during January–April 2020 and a nationwide lockdown was enforced; however, mask use was not mandated. The second wave, starting in June 2020, though largely localised to Melbourne (Victoria), featured much more widespread community transmission, with the highest death rate and at its peak, the state had 6767 active cases.[1] It was during this second wave that mask use was mandated by the Victorian state government on 19 July 2020, together with a state-wide lockdown.[2] At the same time, smaller epidemics occurred in Sydney with 109 cases associated with the Thai Rock restaurant cluster and 58 cases associated with the Crossroads Hotel cluster.[3 4]

During the early stages of the pandemic, amid shortages of N95 respirators and face masks for healthcare workers (HCWs), the WHO, Centers for Disease Control and Prevention (CDC) and other health organisations

actively discouraged mask use by the general public unless symptomatic.[5] However, it became evident that asymptomatic persons are potential sources of COVID-19 infection and around 40%–45% of COVID-19 cases were asymptomatic.[6–9] In symptomatic infections, 44% of transmission occurred in 48 hours prior to showing symptoms, and a further proportion on the first day of showing symptoms.[10] This, plus recognition of airborne transmission, led to a change in recommendation for mask use as a non-pharmaceutical intervention for COVID-19 prevention by the WHO, CDC and other agencies.[11 12] There is now evidence that universal mask use during periods of high transmission of SARS-CoV-2 may contribute to epidemic control.[13–15]

Mask use by healthy people in closed community settings provides protection against respiratory infections[16] and is also a well-established method of source control.[17] Mask type varies and observational studies among HCWs and the general public during the SARS outbreak in China found cotton masks to be effective at preventing infections.[18] In Victoria, Australia, use of all types of masks during the mask mandate, accounting for poor quality cloth coverings, is estimated to have been 22%–33% effective and averted a much larger epidemic.[13 15]

However, the role of mask uptake, perceived effectiveness and the timing when community members use their masks during the pandemic is unknown. A Norwegian study on the people's reflections on the consequences of a potential influenza pandemic found that substantial proportions of the population actually considered the mortality risk during a pandemic to be lower than estimates from health authorities, and thus would implement only minimally disruptive precautions to protect themselves against the causative agent.[19] Other studies have demonstrated that the necessity of wearing masks by the public during the COVID-19 pandemic has been underemphasised by governments.[20] However, despite the public demonstrating a moderate to high level of knowledge of the COVID-19 infection and adequate knowledge about its preventive aspects,[21] the overall practice of face mask use was low in some settings, guidelines conflicting and changing, and was influenced by education, literacy and age in some countries.[22 23] It is, therefore, important to gather evidence about community understanding and practices around the use of face masks during the COVID-19 pandemic, in settings with different disease incidence and different policies. We sought to determine that widespread behaviour modification and mask use for COVID-19 risk prevention in Australia is affected by knowledge, attitude and practice toward mask use. This study, therefore, aimed to assess changes in the knowledge, attitudes and practices toward mask use during the COVID-19 pandemic in the Australian population at two time points of the epidemic.

METHODS

Study design and recruitment

This study was part of a larger study (MacIntyre *et al*,[24] where multiple cities were included. A cross-sectional survey was conducted in two Australian cities: Sydney, and Melbourne, at two time points. The initial survey was conducted during July–August,[24] while the second survey was conducted in September 2020 using the same survey questions, corresponding with the peak of the Victorian second wave and the period shortly afterward. To recruit participants for the survey, a market research company, Dynata,[25] was employed to randomly distribute the survey link among a geographically targeted sample of their panel members[26] aged 18 years or older and living in either Sydney or Melbourne. Panel members that logged onto the platform had the option to open the survey link. A random sample was used for the second time point, which may not have included all those surveyed in the first time point. Once participants opened the link, they were redirected to the survey page, where data were collected using an anonymous web-based survey platform, REDCap.[27 28] It took 10–15 min to complete the survey. To determine a 20% difference in the rate of mask use between cities with and without mandated mask policies, the study was powered a priori with 95% confidence and 80% power. In Sydney (without a mask mandate), a mask use prevalence of 60% was assumed and in Melbourne (with a mask mandate), a mask use prevalence of 80% was assumed,[29 30] together with a sampling ratio of 0.8 and 0.6, respectively, yielding a minimum required sample size of 194.

Patient and public involvement

No patients were involved in this study.

Variables of interest

A survey of 123 questions were administered to participants'. For the purposes of this paper, only Australian cities and questions pertaining to mask use, attitude and changes in behaviour relating to mask use were compared for analysis. To determine changes in knowledge, attitudes and practice of mask use among Sydney and Melbourne participants were asked to indicate their perception of the severity of COVID-19, together with the perceived level of risk of a COVID-19 infection (online supplemental appendix frame 1). Participants were asked which of several risk mitigation measures were used during the pandemic, both at the start of the pandemic and at the time of the survey. To determine mask uptake during the pandemic, participants were asked to indicate if they had ever worn a mask and to specify the type of mask used, whether it had been worn correctly over both the nose and mouth and the reason for mask use, whether it was specifically due to the pandemic. A Likert scale[31] was used to assess participant attitudes towards both the national and state government during the COVID-19 pandemic.

Data analysis

Descriptive statistics were performed for variables relating to health status, mask use, attitude of participants towards mask use, and other behaviours and perceptions during the COVID-19 pandemic. Continuous variables were displayed as mean±one SD, and range. Categorical variables were presented as an absolute count and percentage. A Pearson Chi Squared test was used to calculate significance levels for categorical data and a logistic regression was used to determine predictors of mask uptake during the pandemic. These relationships were expressed at a 95% CI. A p value ≤0.05 was considered significant. The percentage change of responses to the use of risk measures in July–August and September 2020 were calculated and graphed. A comparison of the percentage change of prepandemic risk measures between the two surveys was performed to provide an internal validation to determine how well the results among the study participants represent true findings among similar individuals across the second survey (online supplemental appendix table 1). Analysis was completed using Stata V.16.[32]

RESULTS

A total of 700 participants in Sydney (n=402) and Melbourne (n=298) completed the survey, with sampling proportionate to population size, with no losses. In Sydney, 200 and 202 participants were sampled in July 2020 and September 2020, respectively. In Melbourne, 148 participants were sampled in July 2020 and 150 participants in September 2020. The mean age of all participants was 45.71±16.8 years with 49.7% of participants male, while 47.71% of participants indicated that they had underlying comorbidities such as cancer, diabetes and pre-existing heart conditions (online supplemental appendix table 2).

Participants were asked to indicate infection risk measures previously and currently used for reducing the risk of COVID-19 transmission across both surveys. Figure 1 shows the frequency of COVID-19 risk-control measures used early in the pandemic during March–April 2020 and percentage changes of these measures from March 2020 to July 2020 (figure 2) and from March 2020 to September 2020 (figure 3), where March 2020 was the baseline value for comparative purposes. Participants reported adopting a wide range of infection risk measures. In the early stages of the pandemic, the most common measures used were avoiding crowded areas, public transport and shops (69.8% in Sydney and 84.8% in Melbourne); physical distancing (66% in Sydney and 76.4% in Melbourne); practicing hand hygiene, that is, washing hands frequently, using hand sanitizers and avoiding touching your face (57% in Sydney and 69.1% in Melbourne); restricting visitors (56.5% in Sydney

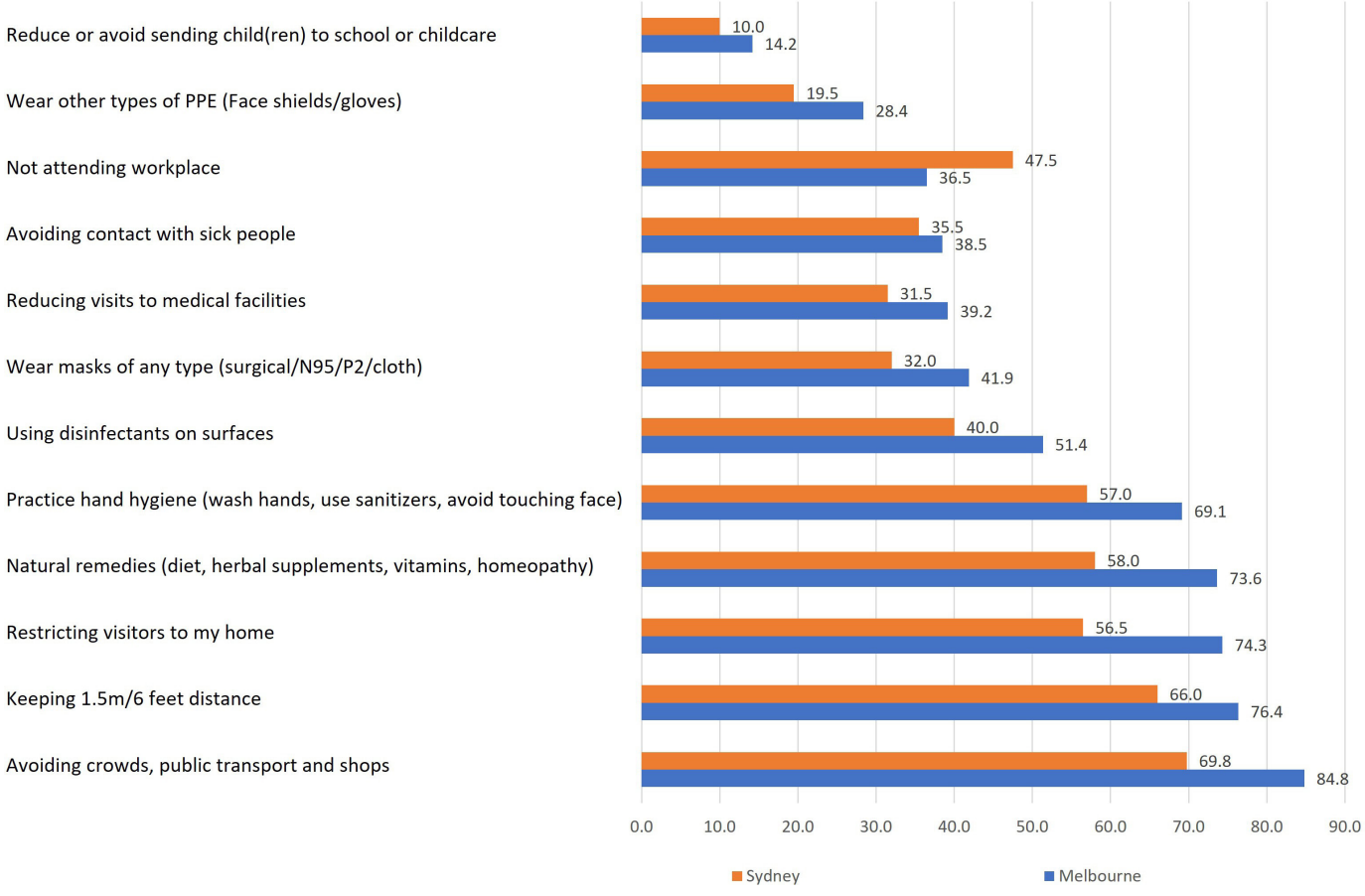

Figure 1 Frequency percentage of COVID-19 risk-control measures from March 2020 to April 2020.

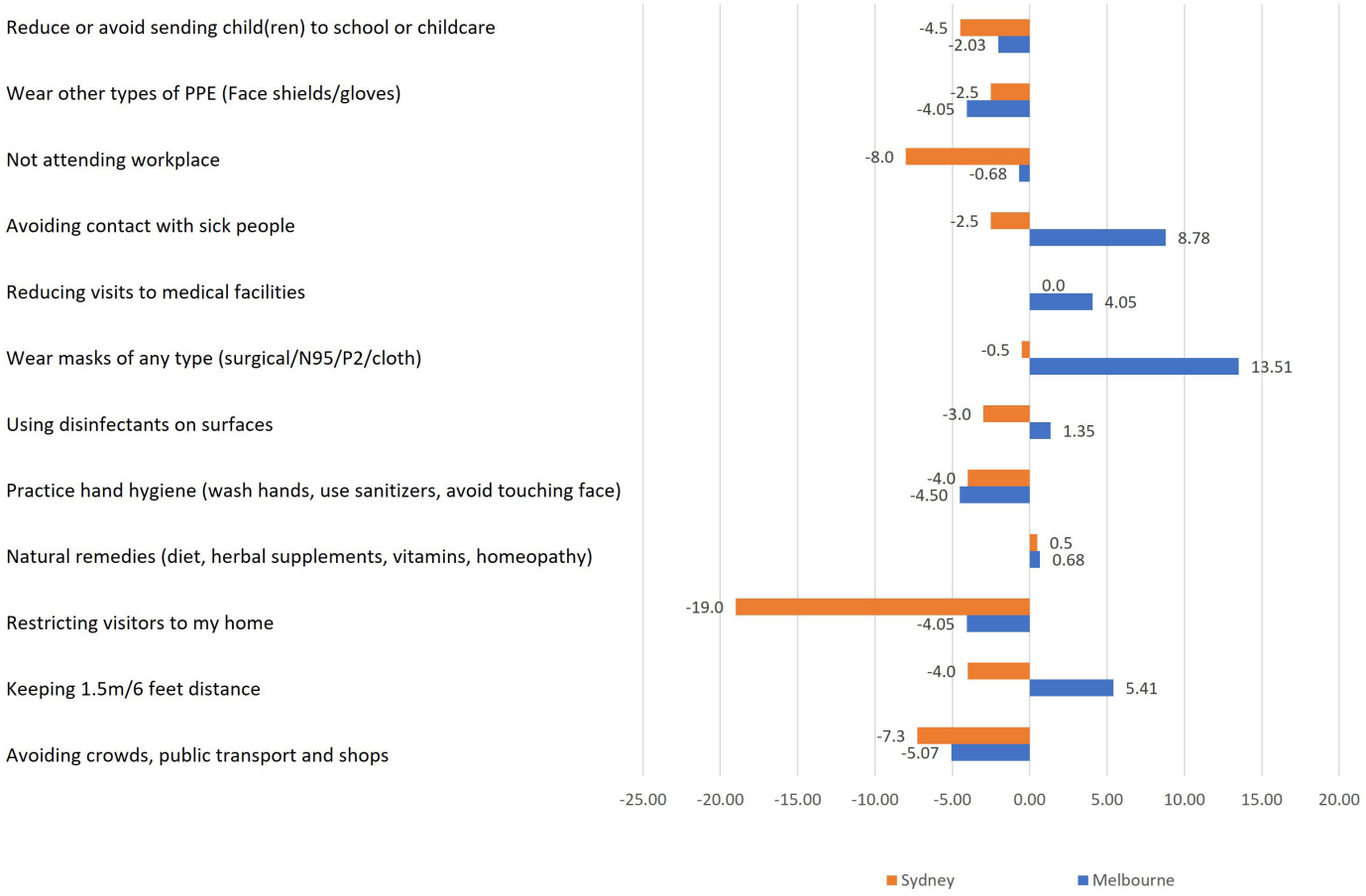

Figure 2 Percentage changes of the COVID-19 risk-control measures from March 2020 to July 2020.

and 74.3% in Melbourne); using disinfectants to clean surfaces (40% in Sydney and 51.4% in Melbourne); not attending the workplace (47.5% in Sydney and 36.5% in Melbourne); avoiding contact with sick people (35.5% in Sydney and 38.5% in Melbourne); reducing visits to medical facilities (31.5% in Sydney and 39.2% in Melbourne) and wearing masks of any type, that is, N95, P2, surgical and cloth (32% in Sydney and 41.9% in Melbourne). In both Sydney and Melbourne, a consistent decrease was reported in almost all risk-mitigation behaviours between March 2020 and July 2020 (figure 2). However, mask use, social distancing, reducing visits to medical facilities and avoiding contact with sick people increased in Melbourne, which was amid a second wave at the time of the survey, where mask use and lockdowns were mandated. A consistent decrease was again reported in almost all risk-mitigation behaviours between March 2020 and September 2020 (figure 3). However, mask use and personal protective equipment (PPE) use increased in both Sydney and Melbourne. An increase in not sending children to daycare and adults not attending the workplace was also seen in Melbourne between March 2020 and September 2020. Participants also indicated the following qualitative responses of additional risk measures, which were used: 'exercise', 'only going out for shopping and medical', 'staying home more' and 'keeping fit'.

Participants who used a mask during the pandemic were assessed for a variety of predictors of mask uptake during the pandemic. The unadjusted ORs are given in table 1. Across both surveys, there was a significant association between age (<45.711 years) and mask uptake (0.67 (95% CI 0.50 to 0.91; p=0.011)), with younger people more likely to wear a mask, but no association between gender (1.00; (95% CI 0.74 to 1.35; p=1.000)) or city of residence (1.24 (95% CI 0.99 to 1.22; p=0.072)) on mask uptake during the pandemic. Embarrassment when wearing a mask (0.24 (95% CI 0.10 to 0.54; p=001)) was a predictor of lower mask uptake. A small number of participants indicated issues such as people staring (5.86%), receiving negative comments (3.71%), receiving racist comments and being perceived as an infected person (3.57%) as barriers when wearing a mask, none of which were associated with mask uptake during the pandemic. Qualitative responses included 'breathing and talking', 'cannot breathe properly', 'fogs up my glasses', 'difficulty to breath', 'discomfort especially on physical exercise', 'mask too close to eyes', 'itching', 'uncomfortable', 'hyperventilating', 'people found it hard to hear me', 'breathless when walking uphill', 'too sweaty', 'it affected my ability to look down' and 'was uncomfortable to wear'.

Of the factors which participants believed influenced mask uptake, 45% of participants reported significant influence on the public from a recommendation by the

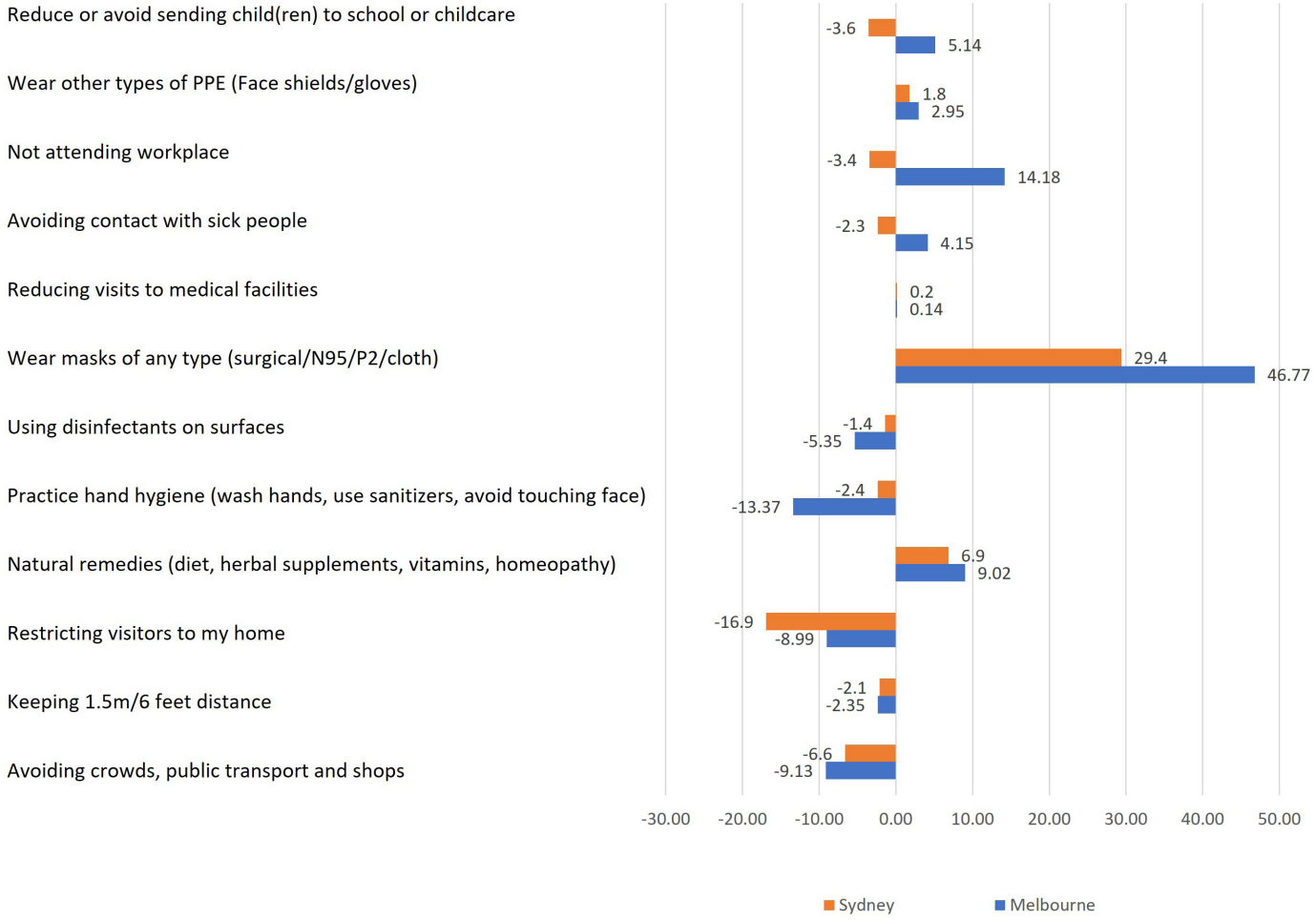

Figure 3 Percentage changes of the COVID-19 risk-control measures from March 2020 to September 2020.

government or health departments in their decision to wear a mask (1.83 (95% CI 1.32 to 2.53; p<0.000)), how much infection was around at the time (1.45 (95% CI 1.00 to 2.09; p=0.049)) and experience with using masks (2.32 (95% CI 1.35 to 4.00; p=0.002)). Information from social media platforms (9.3%), media sources such as news, TV, radio and the internet (20.6%) had a high level of indication from participants but were not significantly associated with mask uptake.

Participants were asked how severe they believed a COVID-19 infection would be and their perceived level of risk of contracting COVID-19 (table 1). On a sliding scale, the perceived severity of COVID-19 infection was 62.5±24.3 (1.96 (95% CI 1.44 to 2.66; p<0.000)), while the perceived level of risk of contracting COVID-19 was 52.7±24.2 (1.98 (95% CI 1.43 to 2.74; p<0.000)), both were significantly associated with mask uptake. When asked to indicate the level of trust in both state and national governments regarding information on the COVID-19 pandemic, participants expressed a high level of trust in both their state government (63.7%) and national (67.1%) government. Trust in information on COVID-19 from both national (1.77 (95% CI 1.29 to 2.44); p<0.000)) and state government (1.62 (95% CI 1.19 to 2.22); p=0.003)) was significantly associated with mask uptake across both surveys.

Overall, participants indicated that N95 or P2 masks were perceived to be the most effective for COVID-19 prevention (62.2±22.2), followed by surgical masks (57.3±22.3) and cloth masks (50.0±23.5) (online supplemental appendix table 2). However, only 18.9% of participants indicated that they had worn their masks over both their nose and mouth, with 39.6% unsure and 41.6% indicating they had worn their mask under their nose and only covering their mouth.

DISCUSSION

Despite established guidelines of PPE use to manage the pandemic in many countries, mask hesitancy remains a cultural issue.[20] In Western countries, many view PPE and physical barriers, including wearing the mask, as contrary to freedom and individualism and a recent study on mask uptake during the COVID-19 pandemic found that negative issues experienced while wearing masks reduced the likelihood of people wearing them.[24] In this study, stigma or negativity associated with mask use was a predictor of mask uptake. Both Sydney and Melbourne participants

Table 1 Predictors of mask uptake during the pandemic in Sydney and Melbourne in 2020

	N (%)	OR (95% CI)	P value
Age (<45.711 years)*	384 (54.86)	0.67 (0.50 to 0.91)	0.011†
Gender (male)	348 (49.71)	1.00 (0.74 to 1.35)	1.000
City of residence (Sydney, reference)	402 (57.43)	–	–
Melbourne	298 (42.57)	1.24 (0.99 to 1.22)	0.072
Barriers to wearing a mask			
Felt embarrassed to wear it	59 (8.43)	0.24 (0.10 to 0.54)	0.001†
People stared at me	41 (5.86)	0.48 (0.15 to 1.52)	0.212
I received negative comments	26 (3.71)	0.87 (0.29 to 2.64)	0.804
I received racist comments	25 (3.57)	0.43 (0.05 to 3.98)	0.458
People thought I was infected	25 (3.57)	0.46 (0.18 to 1.20)	0.114
People laughed at me	13 (1.86)	0.39 (0.11 to 1.40)	0.148
Factors which influenced mask wearing			
A recommendation from government or health department	315 (45.0)	1.83 (1.32 to 2.53)	<0.000†
How much infection is around at the time	203 (29.0)	1.45 (1.00 to 2.09)	0.049†
Media information (TV, radio, internet and print)	144 (20.57)	0.83 (0.54 to 1.29)	0.405
A recommendation from friends or family members	124 (17.71)	1.22 (0.76 to 1.95)	0.405
A recommendation from my doctor	118 (16.86)	1.45 (0.92 to 2.29)	0.106
Experience with using these products	86 (12.29)	2.32 (1.35 to 4.00)	0.002†
Social media (Facebook, Twitter, Instagram, etc)	65 (9.29)	0.86 (0.44 to 1.65)	0.644
Perceived COVID-19 severity >average*	348 (49.71)	1.96 (1.44 to 2.66)	<0.000†
Perceived risk of getting COVID-19 >average*	442 (63.14)	1.98 (1.43 to 2.74)	<0.000†
High trust in state government‡	446 (63.71)	1.62 (1.19 to 2.22)	0.003†
High trust in national government‡	470 (67.14)	1.77 (1.29 to 2.44)	<0.000†

*Average refers to the population mean of each variable. Variables were coded as '1' if their values were larger than the population mean and coded as '0' if smaller than the population mean.
†Indicates statistical significance at p≤0.05 (logistic regression used for analysis).
‡On a scale of 0–5, where '5' represents highest level of trust/confidence. Variables were coded as '1'(high) if their values were larger than 3 and coded as '0' if smaller than or equal to 3.

expressed a high level of trust in information from both their state and national government during the COVID-19 pandemic. Participants also reported a significant influence on the public from government or health departments in their decision to wear a mask together with COVID-19 risk perception.

In Sydney and Melbourne, a significant increase in mask uptake during the COVID-19 pandemic was seen in July 2020 and September 2020, while other mitigation methods or behaviours, like avoiding medical facilities, no longer using public transport and practicing hand hygiene, were not reported to have changed over the period. This increase in mask use in Melbourne coincides with the resurgence of COVID-19 from June 2020 to August 2020, where a mask mandate from the Victorian government from 23 July 2020 onward (close to the peak of the second wave), along with a 6-week stage three lockdown which commenced on 9 July 2020, was issued. Demographic differences and the rate of the outbreaks' growth make it difficult to directly compare the two states' responses to the pandemic; however, it is important to stress that early mask use prevents more cases than mask usage, which is only implemented closer to the peak of a pandemic.[13] While mask mandates have a strong effect on mask use,[24] research which has shown that in countries where communities were 'socially obliged' to wear masks, the public are more likely to engage in mask wearing in response to a pandemic.[33] In this study, factors associated with mask use included an underlying comorbidity, a requirement of work, embarrassment, perception of being COVID-19 positive, how much infection was present at the time, perceived COVID-19 severity of infection and perceived risk of infection. Gender and city of residence were not predictors of mask uptake in Sydney and Melbourne, while age was associated with mask uptake. The most significant influence on mask use was a recommendation from the government or health department. State governments need to address these issues with the public when advising or mandating mask use and target campaigns breaking through the stigma of mask wearing should be considered.

A recently published study on the effect of masks during the second wave in Victoria showed that the effect of masks increases with the increasing uptake and increased effectiveness of the masks.[13] It also demonstrated that moderately effective masks with uptake levels of 50% or greater can have a significant effect on epidemic control.[13] N95 or P2 masks were perceived to be the most effective for COVID-19 prevention. However, the use of any mask type should be encouraged as studies have shown that even when poor quality face masks were used, wearing masks significantly reduced the spread SARS-CoV-2.[34 35] Furthermore, 18.9% of participants indicated that they had worn their masks over both their nose and mouth, with 39.6% unsure and 41.6% indicating they had worn their mask under their nose and only covering their mouth. It is therefore essential to educate the public on correct mask wearing for mask use to be effective. Some of the qualitative responses from participants in survey 2, after the first wave, indicated that masks were now being worn not only to protect themselves from getting sick but also from transmitting COVID-19. This highlights the need for continued community education on mask use.

This study was not without limitations. The survey was powered to detect a difference between Sydney and Melbourne with 95% confidence and 80% power but may not have had enough statistical power to compare each time point by city. The survey was only administered in English, and thus there may be bias for English speakers and non-English speakers or people with limited access to the internet may have been excluded. Online panels provide a simple, cost-effective means of conducting survey research but may be biased depending on the method used by the market research company for panel member recruitment.[26 36] Data on participants' ethnicity and socioeconomic status were not collected. This study surveyed a simple, random sample of panel members and was not stratified to be representative of the population, so mask uptake rates in this survey may not reflect true uptake. Recall bias may have been introduced, as this survey provided a cross-sectional description of mask use only, which was dependent on recall for reporting behaviours early in the pandemic period. This study highlighted the fact that mask uptake and the timing of mask use has the potential to influence the control of the COVID-19 pandemic. By assessing the changes in knowledge, attitudes, and practices towards mask use in Sydney and Melbourne, Australia, during the 2020 COVID-19 pandemic, widespread behaviour modification and mask use for COVID-19 risk prevention in Australia was seen with high levels of reported mask wearing during the study periods.

Despite a now highly vaccinated Australian population, there is still the need to maintain the correct use of masks to prevent the spread of the virus. Future research and estimates pertaining to new variants of concern (VOCs) are necessary and community understanding and practices around the use of face masks for COVID-19, particularly in light of the emergence of the highly transmissible delta and omicron strains, are essential. With the emergence of these VOCs, mask wearing must become the 'new normal' and should remain mandated in public spaces and large gatherings in future.

Conclusion

There had been widespread behaviour modification and mask use for COVID-19 risk prevention in Australia during the study periods. Some behaviours, like avoiding medical facilities, did not change over the period. While social distancing measures were the most commonly used mitigation, mask use changed the most over the study period. Sydney and Melbourne both had high levels of reported mask wearing during September 2020, consistent with the second wave and mask mandates in Victoria and cluster outbreaks in Sydney at that time. Following the large second wave in Melbourne and smaller outbreaks in Sydney, the perceived level of risk of COVID-19 infection was high. High rates of mask compliance may be explained by high trust in both national and state governments, mask mandates at the time, risk perceptions and current outbreaks. Considering the presymptomatic and asymptomatic transmission of SARS-CoV-2, mask use is an essential measure for COVID-19 risk mitigation. It is, therefore, essential to continue to encourage mask use, together with ongoing community education with an emphasis on the route of COVID-19 transmission and correct face mask use, while considering evidence about community understanding and practices around the use of face masks for COVID-19, particularly in light of the emergence of the of highly transmissible delta and omicron strains.

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Contributors ALQ: writing original draft, project administration, conceptualisation, methodology and formal analysis, guarantor. MT and HS: writing and editing. AAC: supervision, writing and editing. CRM: conceptualisation, supervision, writing and editing. All authors read and approved the final manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval The University of New South Wales Human Research Ethics Committee approved (approval number: HC #200460) the survey instrument and study protocol prior to data collection. Completion of the survey was taken as consent.

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