

University students' adherence to mask wear and handling protocols during the COVID-19 pandemic

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Abstract

Background/Aim In Alberta, mask wear in public continues to be mandatory to limit the spread of COVID-19. Public health guidelines on correct wear and handling of masks is established to ensure effectivity. However, with COVID-19 incidence increasing in adults in their 20s and 30s, questions are raised on whether young adults follow these mitigation strategies. The aim was to investigate university students' adherence to mask wear and handling protocols.

Methods University of Alberta students (N=454) completed an online survey about mask handling. It evaluated socio-demographic, psychological factors and face mask perception (FMP) related to proper mask wear, avoidance of touching and hand hygiene. A 3-step hierarchical

linear regression was used, with socio-demographics measured at step 1, psychological factors at step 2, and FMP at step 3.

Results For mask wear, positive FMP explained 21% of variance. Positive FMP of efficacy ($p < .001$) and inconvenience ($p < .001$) associated with better mask wear. Positive FMP also explained 13% of variance in mask touch. For mask hand hygiene, 20% of variance was affected by psychological factors. Fear of COVID-19 ($p < .001$), not willing to take risks ($p < .05$) and altruism ($p < .001$) associated with better hand hygiene. Fear of COVID-19 had minimal impact on correct mask wearing protocols but influenced both mask touch and hand hygiene.

Conclusions Many mask protocols are hidden practices. Factors associated with fear of COVID-19 or altruism are likely to predict private practices of mask handling, but less so the public displays of mask wearing. These findings can aid in finding strategies that may influence university students' behaviours to improve mask wear and handling protocols.

Keywords Face mask, COVID-19, health anxiety, face mask perception

Résumé

Contexte / Objectif En Alberta, le port du masque en public continue d'être obligatoire pour limiter la propagation de la COVID-19. Les directives de santé publique sur le port et la manipulation correcte des masques sont établies pour garantir leur efficacité. Cependant, avec l'augmentation de l'incidence de la COVID-19 chez les adultes dans la vingtaine et la trentaine, des questions se posent quant à savoir si les jeunes adultes suivent ces stratégies d'atténuation. L'objectif était de faire une enquête sur le respect des protocoles de port et de manipulation des masques par les étudiants universitaires.

Méthodes Des étudiants de l'Université de l'Alberta ($N = 454$) ont répondu à un sondage en ligne sur la manipulation des masques. Il a évalué les facteurs sociodémographiques, psychologiques et la perception du masque facial (FMP) liés au port approprié du masque, à l'évitement du toucher et à l'hygiène des mains. Une régression linéaire hiérarchique en 3 étapes a été utilisée, avec des données sociodémographiques mesurées à l'étape 1, des facteurs psychologiques à l'étape 2 et FMP à l'étape 3.

Résultats Pour le port du masque, une FMP positive explique 21% de la variance. FMP positive d'efficacité ($p < .001$) et l'inconvénient ($p < .001$) associé à un meilleur port du masque. La FMP positive explique également 13% de la variance au niveau du toucher du masque. Pour l'hygiène des mains aux masques, 20% de la variance était affectée par des facteurs psychologiques. Peur de la COVID-19 ($p < .001$), refus de prendre des risques ($p < .05$) et altruisme ($p < .001$) associé à une meilleure hygiène des mains. La peur de la COVID-19 a eu un impact minimal sur les protocoles de port corrects du masque, mais a influencé à la fois le toucher du masque et l'hygiène des mains.

Conclusions De nombreux protocoles de masques sont des pratiques cachées. Les facteurs associés à la peur de la COVID-19 ou à l'altruisme sont susceptibles de prédire les pratiques privées de manipulation des masques, mais moins les manifestations publiques de port de masques. Ces résultats peuvent aider à trouver des stratégies susceptibles d'influencer les comportements des étudiants universitaires afin d'améliorer le port des masques et les protocoles de manipulation.

Mots-clés masque facial, COVID-19, anxiété liée à la santé, perception du masque facial

Introduction

Due to the emergence of the novel SARS-CoV-2 (COVID-19), masks and face coverings have attracted a lot of public attention. COVID-19 is transmitted via respiratory droplets expelled during talking, coughing or sneezing. It can be spread by asymptomatic, pre-symptomatic and symptomatic carriers (Wiersinga et al., 2020; World Health Organization, 2020b). However, infection from the virus can be preventable via public health action and personal protective behaviours such as physical distancing, personal hygiene and the use of protective equipment. Regulatory actions include governmental limits on size gatherings, stay-at-home orders, and mandatory mask wear (World Health Organization, 2020a).

Early in the pandemic, the COVID-19 incidence was highest among older adults, however during June – August of 2020, the median age of those in the U.S decreased to persons aged 20-29 years. It was also found that people aged 18 to 22 have increased in incidence by 55% (Boehmer et al., 2020). The changes in age distribution were also representative worldwide, including in Canada. As of May 2021, the age group with the highest incidence rate is from 20-29 years old (Berry et al., 2020). This suggests that younger adults are contributing to community transmission. The younger population are more likely to have mild or no symptoms which could lead to asymptomatic transmission. Thus, it is important that younger adults adhere to community mitigation strategies and personal preventative behaviours. However, with the decrease in age for COVID-19 incidence, questions were raised on whether young adults are following these mitigation strategies.

Mandatory mask wear continues to be advised by local public health authorities in Canada. However, with the number of vaccinations increasing and COVID-19 cases decreasing in the

United States, mask restrictions are being reduced (Centers for Disease Control and Prevention, 2021b, 2021a). Masks must be worn when in a shared space with people outside the immediate household. This includes outdoor and indoor spaces such as parks, homes, backyards, workplaces and retail setting (Government of Canada, 2021b). Mask wearing is an effective way to prevent transmission, however evidence points that many are wearing them incorrectly, which may contribute to the spread instead (Kumar et al., 2020; Machida et al., 2020).

Recommendations for masks from WHO (2020b) include ensuring mouth and nose coverage, avoidance of touching the mask, performing hand hygiene before and after mask usage, and proper replacement or discard of masks when soiled. In two separate cross-sectional studies across the world, it was found that not only does the regular population wear masks incorrectly, but also health care workers. Both studies focused on improper mask wear, however, they did not measure factors that caused them to do so (Kumar et al., 2020; Machida et al., 2020).

Several studies looked at correlations between behaviours surrounding pandemic protocols and individual personality and beliefs (Bir & Widmar, 2021; Nikolov et al., 2020; Sheth & Wright, 2020). Nikolov et al (2020) found that females, increased age, higher education and risk aversion were strong predictors for social distancing and mask wearing. Bir and Widmar (2021) also discovered that those who were altruistic and attended college believed that masks had a role in preventing infection. Thus, emphasizing the need to study how University students and their beliefs can predict proper mask usage.

Fear is another factor that can affect one's behaviour. With high levels of fear, individuals may not think rationally when reacting to COVID-19 (Ahorsu et al., 2020). Studies have shown that having intense COVID-19 fears is an important driver in social distancing outcomes (Nikolov et

al., 2020). Additionally, females and university student were reported to have higher levels of COVID-19 fears (Reznik et al., 2020). Therefore, analyzing fear can be a valuable instrument in providing information about adherence to mask protocols.

With many people being resistant to face mask wearing, little is known on how to encourage face mask wear. Howard (2020) developed a Face Mask Perception (FMP) scale that can gain an understanding on how people perceive masks. It questions 8 dimensions of masks: comfort, efficacy doubts, access, compensation, inconvenience, appearance, attention and independence. Using this on university students can identify specific perceptions that can be targeted in interventions to increase mask wear, and consequently decrease transmission (Howard, 2020).

Purpose

The purpose of this study was to investigate characteristics that can influence university students' adherence to mask protocols such as adherence to mask wear, hand hygiene, and avoidance of touching masks. Specifically, it questioned how socio-demographics, psychological factor such as fear of COVID-19, willingness to take risks and altruism, and face mask perceptions predicted adherence to mask wearing and handling protocols.

Methods

Participants and study design

Using convenience sampling, 527 participants who attended the University of Alberta completed an online survey about mask perceptions and handling from January 22 to April 5, 2021.

Eligibility criteria consisted of a minimum age of 18 and those who attended the university. The self-administered survey, hosted through Google forms, was distributed to students through email list servers, courses and the university's online weekly education magazine. Selected

responses were then limited to ages 18 to 34 years old due the highest incidence of COVID-19 being within these age groups (Government of Canada, 2021a). After selection for age (35 years or older) and deletion of invalid responses, 454 responses were used in the analysis. This study was approved by the University of Alberta institutional ethics review board.

Measures

Mask wear and handling behaviours: Mask wear and handling behaviours were rated according to the extent they followed guidelines presented by the World Health Organization (WHO) and Alberta Health. An exploratory factor analysis (EFA) was applied to 16 items related to face mask wear and handling protocols in order to extract mask wear and handling constructs. Four constructs were extracted accounting for 51.5% of the variance. First, mask wear comprised of four items, after excluding one item that exhibited poor inter-item correlation (Cronbach's alpha = .76). Mask wear related to proper coverage of the mouth, nose and chin. The second construct related to mask touching behaviour and was made up of four items (Cronbach's alpha = .77). Mask touching included avoidance of touching the front of the mask and usage of ear loops to apply the mask. The third construct was also made up of four items and related to mask related hand hygiene (Cronbach's alpha=0.85). Mask hand hygiene included sanitization and/or hand washing before and after donning and doffing of a mask. The final construct was made up of only two items, and related to changing of soiled masks. The Cronbach's alpha for changing soiled masks was .67 which was below the recommended .70 for internal validity (Hair et al., 2006). Therefore, changing of soiled masks construct was not used in further analysis. Each item was assessed using a 5-point Likert scale consisting of: 1 = never; 2 = only on a few occasions; 3 = about half of the time; 4 = most of the time; and 5 = always. The final three constructs used in this study are shown in Appendix 1.

Socio-demographic characteristics: Demographic factors such as gender and age were included. Similar to the Gouin et al., (2021) household composition was assessed as to whether participants lived alone or with others, and whether they lived with high risk individuals (e.g. over 60 years of age, heart disease, respiratory disease, kidney disease, diabetes, immunocompromised). Participant's assessment of their own health risk status, and whether they had friends or family members who had tested positive for COVID-19 were also included.

Psychological factors: Participants completed two items assessing their willingness to take risks and to do good deeds. A 10-item scale ranging from 1 (not willing at all) to 10 (very willing) was used for both items. The risk perception question came from a qualitative self-assessment previously used to determine risk taking behaviour but adapted to a 10-item scale (Dohmen et al., 2011). The altruistic scale was adapted from a question used to assess altruistic cognitive attitudes from a validated instrument that was found to be predictive for a wide range of individual choices (Falk et al., 2016). The question was adapted to "how willing are you to do good deeds without expecting anything in return?". The Fear of COVID-19 scale (FCV-19S) was taken from Ahorsu et al., (2020), where participants responded to seven items to assess their fear and anxiety towards COVID-19 infection and coming into contact with the virus (Cronbach's alpha = 0.87). Participants indicated their level of agreement with the statements using a 5-item Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Perception of face masks: Participants completed a shortened version of the validated Face Mask Perceptions (FMP) Scale (Howard, 2020). Participants were asked how much they agreed or disagreed with a series of statements on face masks. Using 5 dimensions of the scale, statements focused on comfort of masks (e.g., "Face masks get too hot") (Cronbach's alpha = .85); efficacy

doubts (e.g., “Face masks are ineffective”) (Cronbach’s alpha = .80); inconvenience (e.g., “Wearing a face mask is too much of a hassle”) (Cronbach’s alpha = .82); appearance (e.g., “Face masks look weird”) (Cronbach’s alpha = .93); and attention (e.g., “Face masks make people seem untrustworthy”) (Cronbach’s alpha=0.86). Assessment followed a 5-item Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Statistical analysis

Data was downloaded onto an excel file and coded for analysis on SPSS. Measures of central tendency (means and standard deviations) were used to describe socio-demographics and health. An EFA was used to extract factors from dependent variables of related to mask wear and handling protocols. Three hierarchical linear regression models were used to test the associations of socio-demographics, psychological factors and perception of face masks with the three dimensions of recommended mask wear and handling protocols (mask wear, mask touch, mask hand hygiene). In step 1, associations of socio-demographic factors to the adherence of mask protocols were tested. Step 2 was the addition of psychological factors, beyond effects of socio-demographics. Step 3 was the addition of perception of masks with socio-demographics and psychological factors held constant.

Results

Descriptive statistics for socio-demographics and health characteristics are presented in Table 1. Most participants were aged 18 to 24 years old (82.6%) and over half of all participants knew friends or family who have tested positive for COVID-19 (55.9%). Correlation coefficients and mean results for the dependent variables of mask adherence protocols with the independent variables (i.e., socio-demographics factors, psychological factors and FMP) are presented in

Table 2. Mask wear was found to have highest level of adherence, with less variability, compared to the other two mask handling procedures (i.e. 19.36 ± 1.54 compared with 16.08 ± 2.84 [mask touch] and 11.92 ± 4.26 [mask hand hygiene]).

Table 1: Socio-demographic and health characteristics (N = 454)

		N	%
Gender	Male	206	45.4
	Female	248	54.6
Age	18-24	375	82.6
	25-29	50	11.0
	30-34	29	6.4
Health risk status	Low risk	406	89.4
	High risk	48	10.6
	Total	454	100.0
Friends/Family with Covid-19	No	200	44.1
	Yes	254	55.9
Household composition	Lives alone	32	7.0
	Lives with other(s)	422	93.0
Living with someone at risk	No	297	65.4
	Yes	157	34.6

Table 2. Descriptive statistics and Spearman's rho correlations between mask wearing/handling and sociodemographic characteristics, fear of COVID-19 and perception of face masks

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Mask Wear	19.36	1.54																
2 Mask Touch	16.08	2.84	.314**															
3 Mask Hand Hygiene	11.92	4.26	.291**	.450**														
4 Gender	0.55	0.50	.105*	.179**	.176**													
5 Age	1.24	0.56	-.074	.069	.105*	.010												
6 Health risk	0.11	0.31	.031	-.001	.087	-.018	.085											
7 Friends/family been COVID-19 positive	0.56	0.50	-.076	-.022	-.071	-.060	.047	.031										
8 Live with others	0.93	0.26	.065	.059	.097*	.026	-.098*	.039	.016									
9 Live with an at-risk person	0.35	0.48	.064	.062	.093*	.039	-.108*	.202**	-.017	.200**								
10 Fear of COVID-19	15.82	5.95	.160**	.214**	.470**	.326**	.025	.117*	-.104*	.050	.139**							
11 Risk taker	5.41	2.03	-.068	-.108*	-.198**	-.196**	.004	.049	.046	-.028	-.060	-.210**						
12 Altruistic	8.33	1.25	.082	.123**	.198**	.179**	-.011	.061	.049	-.039	.037	.037	.070					
13 Comfort	9.17	3.86	-.202**	-.219**	-.193**	.071	.066	-.014	.005	-.066	-.152**	-.040	.041	-.133**				
14 Efficacy	7.09	3.13	-.238**	-.283**	-.302**	-.124**	-.004	-.017	.099*	-.006	-.094*	-.225**	.117*	-.167**	.380**			
15 Inconvenience	6.41	2.69	-.333**	-.321**	-.335**	-.180**	.026	-.083	.027	-.013	-.127**	-.203**	.126**	-.221**	.437**	.460**		
16 Appearance	7.53	3.76	-.232**	-.306**	-.242**	-.216**	.066	.007	-.015	-.034	-.074	-.157**	.097*	-.184**	.467**	.499**	.583**	
17 Attention	7.25	3.20	-.224**	-.221**	-.188**	-.116*	.011	-.001	.019	-.039	-.106*	-.118*	.032	-.141**	.422**	.474**	.467**	.553**

* $p < 0.05$; ** $p < 0.01$

Adherence to mask wear

Results from hierarchical linear regression models testing the independent associations between socio-demographics and health, psychological factors and FMP with adherence to mask wear is summarized in Table 3. Socio-demographics and health factors, tested in step 1, explained only 2.6% of the variance in adherence to mask wear, with participants' female gender ($\beta = .13, p < .01$) being associated with better adherence to mask wear protocols. Psychological factors related to Fear of COVID-19, willingness to take risks and do good deeds tested in step 2 explained an additional 3.7% in adherence to mask wear beyond effects of socio-demographics. Fear of COVID-19 ($\beta = .16, p < .01$) and willingness to take risks ($\beta = -.10, p < .05$) predicted better adherence to mask wear when controlling for socio-demographics and health. In step 3, when FMP was included to the model, an additional 21.4% of variance was explained. Positive perceptions of efficacy ($\beta = -.25, p < .001$), and inconvenience ($\beta = -.27, p < .001$) predicted better mask wear adherence. In this final model including all socio-demographics and health, psychological factors, and FMP, only the FMP factors remained independently related to better adherence to mask wear. The final model explained 27.2% of variance in adherence to face mask wear.

Table 3. Hierarchical Regression Analysis of Predictor variables for Mask wearing and handing

	Mask Wear			Mask Touch			Mask Hand Hygiene		
	<i>Regression 1</i>	<i>Regression 2</i>	<i>Regression 3</i>	<i>Regression 1</i>	<i>Regression 2</i>	<i>Regression 3</i>	<i>Regression 1</i>	<i>Regression 2</i>	<i>Regression 3</i>
Gender	0.13 **	0.05	0.03	0.17 ***	0.09	0.06	0.17 ***	-0.02	-0.03
Age	0.01	0.00	0.02	0.08	0.07	0.09 *	0.08	0.07	0.08 *
Health risk	0.05	0.03	0.03	0.00	-0.02	-0.02	0.07	0.02	0.02
Friends/family been COVID-19 positive	-0.08	-0.06	-0.03	-0.02	-0.01	0.01	-0.07	-0.05	-0.03
Live with others	0.03	0.03	0.05	0.06	0.06	0.07	0.09 *	0.10 *	0.11 **
Live with an at-risk person	0.01	-0.02	-0.07	0.06	0.03	0.00	0.06	0.01	-0.02
Fear of COVID-19		0.16 **	0.07		0.18 ***	0.12 *		0.42 ***	0.38 ***
Risk taker		-0.10 *	-0.04		-0.06	-0.02		-0.12 **	-0.09 *
Altruistic		0.06	-0.04		0.07	-0.01		0.19 ***	0.14 ***
Comfort			-0.09			-0.06			-0.07
Efficacy			-0.25 ***			-0.14 *			-0.11
Inconvenience			-0.27 ***			-0.18 **			-0.17
Appearance			-0.01			-0.13 *			-0.02
Attention			0.04			0.05			0.06
R ²	0.026	0.064	0.277	0.044	0.081	0.211	0.065	0.277	0.344
R ² change	0.026	0.037	0.214	0.044	0.038	0.130	0.065	0.213	0.067
F change	2.03	5.85	25.98	3.39	6.08	14.44	5.16	43.54	8.96

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Touching of masks

Results from hierarchical linear regression models testing the independent associations with adherence to touching of masks are summarized in Table 3. Socio-demographic factors, tested in step 1, explained 4.4% of variance in the mask touch dependent variable. Females ($\beta = .17, p < .001$) was associated with being more likely to avoid touching of masks. Psychological factors, tested in step 2, explained an additional 3.8% of variance in touching of masks beyond effects of socio-demographics. Of the three factors, only fear of COVID-19 ($\beta = .18, p < .001$) was associated with less touching of masks when socio-demographics factors were held constant. The effect of gender was not significant when psychological factors were included in the model. FMP, tested in step 3, explained an additional 13.0% of variance in touching of masks beyond effects of socio-demographics and personality traits. Positive perceptions of efficiency ($\beta = -.14, p < .05$), convenience ($\beta = -.18, p < .01$), and appearance ($\beta = -.13, p < .05$) was associated with less touching of masks when controlling for socio-demographics and psychological factors. In this final model including all socio-demographics, psychological factors and FMP, age ($\beta = -.09, p < .05$) and fear of COVID-19 ($\beta = .12, p < .05$) were also significant. This final model explained 21.1% of variance of avoidance of touching masks.

Adherence to hand hygiene

Results from hierarchical linear regression models testing the independent associations with adherence to mask hand hygiene are also summarized in Table 3. Socio-demographics, tested in step 1, explained 6.5% of variance in mask hand hygiene. Females ($\beta = .17, p < .001$) and living with others ($\beta = .09, p < .05$) were associated with better hand hygiene related to mask use. Psychological factors, tested in step 2 accounted for the bulk of the variance explaining an

additional 21.3% in mask hand hygiene. Fear of COVID-19 ($\beta = .42, p < .001$), willingness to take risks ($\beta = -.12, p < .01$) and willingness to do good deeds ($\beta = .19, p < .001$) were all associated with better hand hygiene when controlling for socio-demographics. FMP, tested in step 3, explained an additional 6.7% of variance in mask hand hygiene. In this final model including all socio-demographics, psychological factors and FMP, older ages ($\beta = .08, p < .05$), living with others ($\beta = .11, p < .01$), fear of COVID-19 ($\beta = .38, p < .001$), willingness to take risks ($\beta = -.08, p < .05$) and willingness to do good deeds ($\beta = .12, p < .05$) remained independently related to better adherence to mask hand hygiene. The final model explained 34.4% of variance in adherence overall.

Discussion

The goal of the study was to examine post-secondary students' independent socio-demographics, health, psychological factors and face mask perceptions correlates of adherence to mask wear and handling protocols during the COVID-19 pandemic. Overall, adherence to mask wear was reported higher than adherence to mask handling protocols (Table 2). Therefore, it was clear from the results that students were highly likely to wear a mask properly, such as ensuring proper fit over the nose, mouth and chin and ensure a good fit. However, people were less likely to follow proper mask handling recommendations such as avoiding touching the front of the mask, and mask hand hygiene such as sanitizing and/or washing hands prior to and following donning and doffing. This finding supports previous research on mask wearing and handling protocols (Machida et al., 2020). The reason for greater mask wear adherence may be due to private versus public practices. As mask wear became mandatory in all public indoor areas and public transport since August 1, 2020 in Calgary and Edmonton, and in all of Alberta in December 8, 2020, (Government of Alberta, 2021) then improper mask wear such as wearing masks beneath the

nose or under the chin is visually noticeable by others. People are more likely to criticize obvious incorrect wear, making individuals more likely to follow this directive. In a study examining the social consequences of wearing masks during the pandemic, Betsch et al., (2020) found that people who were compliant to wearing masks perceived each other more positively, and those who were non-compliant were socially punished (Betsch et al., 2020). How individuals handle masks such as washing or sanitizing hands or even changing them when they are wet or soiled is harder to discern when public health recommendations are not followed correctly. Thus, less social pressure or judgment may occur, making one less inclined to follow these protocols. Therefore, it was perhaps not surprising that sociodemographic and psychological factors did not have a major impact on reported adherence to mask wear protocols in a community where mask wearing mandates had been in place for months. The finding of greater compliance with mask wear over other handling protocols suggests that intervention designs should also promote correct mask handling protocols rather than just promoting mask wear.

Psychological factors, particularly as it pertained to experiencing anxiety related to COVID-19 were among the strongest predictors of adherence to the other two mask handling protocols. Specifically, higher fear of COVID-19 predicted strong adherence to mask hand hygiene, and to a lesser extent touching of masks. A possible explanation for fear causing increased adherence is due to “fear appeals.” Fear appeals was previously used to change health behaviours to threatening diseases such as lung cancer from smoking and sunscreen usage for melanoma (Pakpour & Griffiths, 2020). This correlates with prior literature, where it was also found that the threat and fear of COVID-19 caused individuals to engage in public health behaviours such as social distancing and hand hygiene (Harper et al., 2020). Therefore, the perceived threat of COVID-19 could be a motivation factor in preventative behaviours. Evidence of altruism in

another study was also found to promote mask wear. Individuals who believed that masks protected others from COVID-19 were more likely to voluntarily wear them (Bir & Widmar, 2021). Although altruism, as measured by the willingness to do good deeds scale, showed better adherence to mask wear and handling in our study, in other literature altruism was not predictive to other mitigation strategies such as stay-at-home orders or social distancing (Nikolov et al., 2020; Sheth & Wright, 2020). Instead, higher risk aversion was found to be a strong predictor for social distancing and mask wearing (Nikolov et al., 2020). For our study, lower willingness to take risks predicted better adherence to hand hygiene, but was not one of the main predictors. Therefore, given the positivity associated with altruism and fear of COVID-19, it may be a potential strategy to improve adherence to mask handling protocols. Encouraging the idea that correct wear and handling of masks not only help yourself but protects the vulnerable public may cause others to see the altruistic value of proper mask adherence. Demonstrating that improper wear and handling of masks can cause self-contamination may elicit more anxiety in individuals and thus cause them to be more aware of how they use their masks.

Face mask perception was another main predictor for adherence to mask protocols. Specifically, perceptions related to doubts of the efficacy of face masks and their inconvenience showed lower adherence to mask wear and more touching of masks during wear. In another study that focused on FMPs, it was found that the top two reasons for not wearing masks were due to negative perceptions of comfort and efficacy doubts (Howard, 2020). In another study by the same researcher, it was found that women were more likely to perceive face masks as uncomfortable (Howard, 2021). Interestingly, comfort was not a predictor in our study. However, Howard's (2021) factors were not assessed on mask wear or handling protocols. Further research on different perceptions should be used to predict resistance in mask wear and proper handling. Yet,

the current results can pose as a potential target for the promotion of increased correct mask handling interventions. Greater adherence to proper use of masks may be established if there was increased publicity about the effectiveness and health benefits of masks against COVID-19 and the convenience of wearing them. Other face mask perceptions, such as comfort, appearance and attention may be less relevant for approaches.

Socio-demographics and health were not as strong independent factors associated with correct mask wear and handling. While not associated with explaining as much of the variance in results as psychological factors or FMP, gender did show some influence in all three dependent variables of mask wear and handling protocols. Results showed that females were more likely to adhere to mask protocols compared to males. More females than males were also shown to follow mitigation strategies such as social distancing and limiting social gatherings along with voluntary mask wear in various studies (Bir & Widmar, 2021; Brankston et al., 2021; Chuang & Liu, 2020; Howard, 2021; Machida et al., 2020; Nikolov et al., 2020; Ying Fan, Orhun, & Turjeman, 2020). Contrasting to our study, a longitudinal study found demographic characteristics to have the largest influence on social distancing and mask wearing over psychological characteristics such as risk taking. Specifically, females and age showed a positive affect to mask wear (Nikolov et al. 2020). The gender difference may be due to women being more precautionous and worried about their health than males (Ying Fan et al., 2020) . It may also be that women are less risk tolerant and therefore comply to most mitigation strategies (Sheth & Wright, 2020). Understanding what demographics are prone to improper mask wear, such as males, can aid in creating interventions for target groups.

One limitation of this study was the use of convenience sampling. With sampling bias, the findings do not represent or generalize to other age populations, or to the university population as a whole. The study also used a self-reported measure of adherence to mask recommendations. When interpreting results, response bias should be noted as participants could have inflated practices to adherence.

Further studies should seek to replicate the four dependent variables of mask adherence. It can aid in predicting other age populations. However, the variable of changing soiled masks contained only two items and loaded lower than the others. Modifications may be needed for higher correlation. Additionally, the fear of COVID-19 and face mask perception scale can be used to predict behaviours towards other mitigation strategies during the pandemic, such as social distancing and limiting social gatherings.

Conclusion

This study's finding indicates that an individual's psychological factors such as their level of fear of COVID-19, altruism and wiliness to take risks, along with perceptions of face masks were independently associated with adherence to mask protocols, many of which are hidden practices. These results can improve understandings on what influences university students to follow recommended mitigation strategies during the pandemic. These findings can aid in targeting strategies that may influence university students' behaviours to improve mask wear and handling protocols.

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Appendix 1.

Mask wear and handling constructs

Construct	Items
Mask Wear	I ensure my mask covers my mouth, nose and chin when I am wearing a mask. When I wear a mask, I ensure the mask covers both my mouth and my nose. I wear my mask underneath my nose. I make sure my mask fits securely against my face.
Mask Touch	When I am wearing a mask, I avoid touching it. I tend to touch my mask often when I am wearing it. (R) I remove my mask without touching the front of the mask. I remove my mask by using the ear-loops/ties.
Mask Hand Hygiene	I sanitize or wash my hands before putting on my face mask. I sanitize or wash my hands before I remove my face mask. I sanitize or wash my hands after I remove my face mask. If I inadvertently touch my mask during wear, I will sanitize or wash my hands.

R = Reverse coded