TBM

Face mask wearing during the COVID-19 pandemic: comparing perceptions in China and three European countries

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Abstract

Face mask recommendations are conflicting across the world during the coronavirus disease 2019 (COVID-19) pandemic. While universal face mask wearing is a useful non-pharmaceutical preventive strategy, little is known about the perception of mask wearing during a pandemic. This study aimed to examine people's face mask use in China and Europe. An online survey was conducted among residents in China, Austria, Germany, and Switzerland from the 1st to 10th of April 2020. With a convenience sampling approach, 655 valid answers were received including 267 Chinese and 388 European residents (261 from Austria, 101 from Germany, 26 from Switzerland). Self-reported face mask wearing status and related perceptions were assessed. Compared with the Europeans, Chinese participants showed a stronger pro-masking tendency. Subjective norm was an important predictor of face mask wearing in public. Wearing of face masks in the Chinese sample was also associated with risk perception as well as obedience to advice from local health authority. Discrepancies in face mask wearing suggest that targeted measures to promote face mask wearing are needed in Europe. Globally coordinated guidelines on pandemics are also warranted to face the next waves of COVID-19 and other infectious respiratory diseases.

Keywords

COVID-19, Face mask, Mass masking, China, Europe, Perception

INTRODUCTION

Universal wearing of face masks is an important preventive measure in the coronavirus disease 2019 (COVID-19) pandemic. However, recommendations of face mask wearing conflict across countries [1]. As the first epicenter of this pandemic, China provided specific guidelines on face mask wearing in early February [1]. In contrast, European countries showed different policies regarding face mask use. Even in Austria, Germany, and Switzerland, three neighboring German-speaking countries, discrepant versions of mask wearing guidelines exist. On March 30, 2020, Austria announced that face masks are mandatory in public. As for Germany and Switzerland, universal face mask wearing was voluntary until mid-April 2020. While there are still concerns about the inappropriate use of face masks [1],

Implications

Practice: Face mask wearing perceptions are different between Chinese and Europeans, with Chinese showing higher adherence to mask wearing rules.

Policy: Stricter face mask wearing rules relate to pro-masking actions and cognitions. Message and social campaigns may shift the narrative, shaping the social acceptance of universal wearing of face masks.

Research: Perceived social pressure to wear face masks is important for community-wide mask wearing. Further research focusing on trust and social marketing is needed.

function of cotton and surgical masks [2], and supply shortage [1, 3], medical professionals generally believe that community-wide face mask wearing could prevent the transmission of COVID-19 [1, 3–7].

So far, research has targeted the biochemical and clinic aspects of COVID-19. With a dramatic paucity of health behavior research during pandemics [3], little is known about the status of face mask use and related perceptions especially when regional discrepancies exist in policies. Face mask wearing in a community depends on everyone's action. From a social psychological perspective, wearing face masks in public can be regarded as a specific behavior resulting from one's cognitive decision-making processes.

As a framework that has been widely applied in behavioral medicine and health psychology, the Theory of Planned Behavior (TPB; [8]) is an ideal theoretical lens to understanding face mask wearing because the TPB is more theoretically parsimonious and has more operationalized constructs compared to other health behavior change models [9]. Specific to behavior, the TPB suggests that the volitional nature of face mask wearing (i.e., unlike a habit or an autonomous action) is influenced by the information

one possesses, such as preferences to and control over face mask wearing.

Following the theoretical framework of the TPB [8], this process could be determined by one's attitude (i.e., evaluation of face mask wearing), subjective norm (i.e., perceived social pressure to wear face masks), and perceived behavioral control (i.e., one's perceived ability to wear face masks). Risk perception appears to be another important construct as shown in previous TPB-based studies (e.g., [10]). As effective treatments for COVID-19 are thus far lacking, one's risk perception of being infected with COVID-19 and the severity of outcomes may also relate to face mask use. Moreover, how strictly individuals obey the advice from their local authorities may have an impact on their actual mask use. Investigation is needed to determine whether the constructs of risk-susceptibility, risk severity, and obedience to advice would further explain face mask wearing.

China's assiduous intervention work against COVID-19 has yielded positive outcomes for global public health [11]. Previous investigations using disease models, nevertheless, overlooked the agency of individuals in active prevention. As universal wearing of face masks in a pandemic could avoid asymptomatic and pre-symptomatic transmission [1, 3, 6], people's perceptions and the use of face masks in a community play a preventive role. This study aimed to compare face mask wearing in China and three European countries to investigate face mask wearing behavior and perceptions using the TPB. We compared China (with established pro-masking policy), Austria (with emerging pro-masking policy), and Germany (absence of pro-masking policy) due to their distinct face mask policies. Given the three different conditions in community, it was hypothesized that stricter pro-masking policy would result in individuals' pro-masking actions and perceptions.

METHODS

Participants and procedure

Prior power calculation suggested that 80 participants in each country (i.e., China, Austria, Germany) were required to achieve a power of 0.81 in a block-wise regression (blocks 1 and 2 both having three predictors) with a medium effect size (f^2 = 0.15). Online survey links were circulated in various educational institutes in China, Austria, Germany, and Switzerland via email or other social media (e.g., WeChat in China). Participants were encouraged to share the survey with people they know. The survey started on April 1, 2020 just after Austria stipulated its national face mask wearing rule. Data collection ceased on 10 April when the minimal number of valid cases was reached. During this period, people in the four countries were very unlikely

to travel across borders therefore each country's mask wearing guidelines served as a public health condition for its residents.

A sample of 655 valid cases was received (respondent rate = 91.1%). Convenience samples were deemed appropriate in the four countries as each population had a national face mask use policy. Participation in this study was voluntary. All participants read and consented to their participation before answering questions. This study was approved by the University's Ethics Committee.

Measures

The self-report online survey questionnaire was developed based on the guidelines of the TPB [12], as well as previous TPB-based research on health and safety behaviors [13]. The finalized English version was translated into Chinese and German; translation was then read by a few native speakers for wording suggestions.

The main outcome variable is the frequency of face mask wearing in public since the COVID-19; assessed with a 5-point Likert scale ([1] *never* to [5] *always*). Six psychological variables were measured using a 7-point Likert scale (see Appendix); namely, positive attitude, subjective norm, perceived behavioral control, risk-susceptibility, risk-severity, and obedience to advice. The scales of the three TPB constructs showed satisfactory internal consistency indices: positive attitude (α = 0.93), subjective norm (α = 0.95), perceived behavioral control (α = 0.74). Demographic and background information was also assessed (see Table 1).

Analyses

Between-group comparisons were analyzed using *F*-test for continuous variables and Fisher's exact test for categorical variables. To examine the correlational relationships between face mask wearing behavior and psychological variables, Pearson's correlation was calculated, followed by multiple regression with a block-wise approach using the TPB and extended TPB constructs. Block 1 was composed of attitude, subjective norm, and perceived behavioral control as per the TPB, while risk perception (i.e., risk-susceptibility, risk-severity) and obedience to advice were added to Block 2 as an extended TPB block. To explore the different patterns across countries, regression analyses were performed separately, and model estimates and coefficients in determination (i.e., R^2) were compared. Data from Switzerland was only analyzed as part of the combined European pool due to the small sample size. Data were managed and analyzed with IBM SPSS 25.

RESULTS

Sample characteristics

As shown in Table 1, the sample included 267 Chinese (from 20 provinces/municipalities; 81.3%

Table 1 | Descriptive results of demographic and face mask wearing variables by region

Variable	Total ($n = 655$)	Chinese residents ($n = 267$)	European residents ($n = 388$)	p-value[a]
Gender				.456
Female	532 (81.2%)	291 (82.0%)	311 (80.7%)	
Male	120 (18.3%)	48 (18.0%)	72 (18.6%)	
Others	3 (0.5%)	0	3 (0.8%)	
Mean age (range) – year	25.54 (16–80)	22.46 (17–65)	27.53 (16–80)	<.001
Highest education level				<.001
Primary education	9 (1.4%)	0	9 (2.3%)	
Secondary education	228 (34.8%)	24 (9%)	204 (52.6%)	
Tertiary education	418 (63.8%)	243 (91%)	175 (45.1%)	
Marital status				<.001
Single	346 (52.8%)	189 (70.8%)	157 (40.5%)	
In a relationship	241 (36.8%)	53 (19.9%)	188 (48.5%)	
Married	61 (9.3%)	24 (9.0%)	37 (9.5%)	
Divorced	7 (1.1%)	1 (0.4%)	6 (1.5%)	
Had underlying diseases such as pulmonary or cardiovascular diseases	18 (2.8%)	1 (0.4%)	17 (4.4%)	<.001
People around (e.g., friends, family members, neighbors) had been confirmed positive with COVID-19	59 (9.0%)	4 (1.5%)	55 (14.3%)	.001
Frequency of face mask wearing in public since the COVID-19 outbreak – M (SD)	3.16 (1.68)	4.65 (0.80)	2.08 (1.28)	<.001
Positive attitude towards face mask wearing in public – M (SD)	5.13 (1.39)	6.23 (0.96)	4.27 (1.03)	<.001
Subjective norm of wearing face mask in public – M (SD)	4.66 (1.97)	6.06 (1.27)	3.56 (1.72)	<.001
Perceived behavioral control over face mask wearing in public – M (SD)	5.12 (1.45)	5.48 (1.33)	4.83 (1.48)	<.001
Risk-susceptibility for COVID-19 if not wearing face mask in public – M (SD)	4.27 (2.09)	5.97 (1.22)	2.92 (1.60)	<.001
Risk-severity of being infected with COVID-19 – M (SD)	5.18 (2.01)	6.64 (0.82)	4.01 (1.91)	<.001
Obedience to advice provided by local health authorities since the outbreak – M (SD)	6.50 (0.83)	6.61 (0.75)	6.40 (0.87)	.002

[a] p-values comparing scores for Chinese and European participants.

Yunnan residents) and 388 European residents (261 Austrians, 101 Germans, 26 Swiss). All Chinese participants were born in China, but the European participants were born in 18 different countries (predominantly, Germany [43.9%] and Austria [42.9%]). Participants were young (M_{age} = 25.54 years) and mostly women (81.2%). While the gender distribution was similar between Chinese and Europeans, Fisher's exact test indicated that the European sample was significantly older ($p < .001$), with more underlying diseases ($p < .001$), and more acquaintances infected with COVID-19 ($p < .001$). While the distribution of highest education level showed difference ($p < .001$) across samples, most European undergraduates categorized themselves as secondary rather than tertiary educated. The percentage of single participants in the Chinese sample was significantly larger ($p < .001$).

Behavioral and psychological variable comparisons

As Table 1 illustrates, the Chinese sample reported a significantly higher frequency of wearing face masks in public ($p < .001$), more positive attitude toward face mask wearing in public ($p < .001$), more perceived social pressure to wear face masks in public ($p < .001$), higher perceived ability to wear face masks in public ($p < .001$), and stronger risk perceptions ($p < .001$). Further, while participants showed high obedience to local health authorities' advice, the Chinese sample still showed a significantly higher level ($p = .002$).

Significant contrasts among Austrian, German, and Swiss residents are shown in Appendix Table A2. Except for obedience to advice provided by local health authorities ($p = .349$), all other variables were significantly different between Austria and the other two German-speaking countries, indicating a stronger pro-masking tendency reported in Austria.

Associates of face mask wearing

On a univariate level, all psychological variables showed significant correlations with face mask wearing (see Appendix Table A3). However, in

the multivariate analyses shown in Table 2, subjective norm was the only predictor of face mask wearing across countries. In the overall European sample, and within the Austrian and German samples, stronger positive attitude to mask wearing were related to higher frequencies of face mask wearing.

The additional variables added in Block 2 did not show a significant model improvement for the European sample, but further explained 5.7% of variance in face mask wearing in the Chinese sample. Subjective norm, risk-susceptibility, risk-severity, and obedience to advice all showed significant associations with face mask wearing among Chinese participants. Of note, the direction of risk-severity in predicting reported mask wearing was negative in the Chinese model.

DISCUSSION

As the first study specifically focusing on face mask behavior and its psychological associates in a pandemic, our report provides a rapid cross-national understanding by comparing Chinese and European residents. As hypothesized, Chinese residents showed a significantly higher level on all behavioral and perceptional variables regarding mask wearing, even though the European sample reported more cases with underlying diseases and more participants knew people with COVID-19. This contrast between these countries is consistent with cross-national mask wearing status based on naturalistic observations [14]. Since face mask wearing is crucial for vulnerable populations [1], such cross-national discrepancies highlight the necessity of stronger community-wide mask wearing promotion in Europe. A coordinated and consistent face mask guidance in Europe is urgently needed. For European participants, the higher average scores for Austrians could be an immediate effect of their emerging face mask legislations compared with voluntary mask wearing in Germany and Switzerland.

The patterns in psychological associates of face mask wearing further support the use of policy to promote community-wide wearing of face masks. Although the Chinese sample showed an extremely high average frequency in face mask wearing (scoring on average 4.65 out of 5), their behavior could not be well explained by the TPB. This suggests that mask wearing in China is less related to whether one likes face masks or whether one experiences difficulties wearing face masks. By contrast, attitude was a significant predictor among European participants, indicating that their personal preferences about face masks influence their actions.

Existing literature has noted that people with migration backgrounds may be more disadvantaged in the face of COVID-19 [15]. Language and communication differences might influence how minority groups access and interpret health information

[16]. It is also important to note that general face coverings have been used in Asian societies long before the COVID-19 pandemic as face coverings can be culturally interpreted as a boundary between clean self and contaminated outside [17]. Like other socially-grounded health behaviors—such as smoking in China [18]—using facial and nasal coverings as a socially accepted practice may further explain the salient role of subjective norm in the Chinese model. To better unpack the disposition of these social constructs, further qualitative studies among an at-risk population are needed to elicit the specific beliefs underlying mask wearing behavior.

The additional constructs used in this study revealed some unexpected findings. As China used an intensive health education since early February, the protective effect of face masks might be well believed [1, 11]. In contrast, such health communication in all three European countries we surveyed was still emerging. These differences in health information may explain why risk perception and obedience to advice were only found significant in the Chinese sample. Given China's assiduous administrative environment, the punitive consequences of people's disobedience may have reinforced community-wide mask wearing.

Interestingly, when other variables were adjusted, the direction of the relationship between risk-severity and mask wearing was negative, meaning that Chinese who estimated the outcomes of being infected with COVID-19 as more serious tended to wear face masks in public less frequently. In contrast, risk-susceptibility showed a positive relationship with mask wearing. These findings suggest that ideal health communication in China would highlight the link between COVID-19 infection and not wearing face masks, rather than emphasizing the detrimental outcomes of the COVID-19.

From a social psychological perspective, individual obedience to health advice has also been associated with trust in the government and health systems [19]. Further investigations are needed to examine whether the institutional trust levels undermine one's obedience to advice. Social desirability should also be taken into account as China may have distinct cultural understanding from the three European countries. Future studies may consider the contributing factor of social sanctions across countries [20].

The sample characteristics of younger, educated people and the self-report design are the main limitations of this study. Furthermore, as a TPB-based study, our study may have unintentionally overlooked constructs from other health behavior change models. Future studies may include culture-related constructs as the behavioral differences in mask wearing appear to be culturally embedded [21]. However, our findings are timely as they revealed differences in face mask wearing in China and Europe from a psychological perspective.

Table 2 | Regression results of the face mask wearing behavior by region

Variable	Chinese residents (n = 267)			European residents (n = 323)			Austrian residents (n = 219)			German residents (n = 82)		
	B	95% CI	R^2	B	95% CI	R^2	B	95% CI	R^2	B	95% CI	R^2
Block 1			6.6%***			41.9%***			37.8%***			35.7%***
Positive attitude	0.05	[−0.06, 0.14]		0.19**	[0.10, 0.36]		0.17*	[0.04, 0.36]		0.32**	[0.14, 0.71]	
Subjective norm	0.22**	[0.06, 0.22]		0.50***	[0.29, 0.45]		0.46***	[0.26, 0.46]		0.37**	[0.13, 0.48]	
Perceived behavioral control	0.04	[−0.05, 0.10]		0.07	[−0.01, 0.14]		0.10	[−0.01, 0.20]		0.02	[−0.12, 0.14]	
Block 2			12.3%**			42.0%			38.4%			36.7%
Positive attitude	0.03	[−0.08, 0.12]		0.18**	[0.09, 0.36]		0.15*	[0.02, 0.34]		0.31**	[0.12, 0.70]	
Subjective norm	0.21**	[0.05, 0.21]		0.49***	[0.28, 0.45]		0.43***	[0.22, 0.45]		0.39**	[0.14, 0.51]	
Perceived behavioral control	0.02	[−0.06, 0.09]		0.07	[−0.01, 0.14]		0.09	[−0.02, 0.19]		0.02	[−0.12, 0.15]	
Risk-susceptibility	0.14*	[0.01, 0.18]		0.03	[−0.05, 0.10]		0.07	[−0.04, 0.16]		−0.01	[−0.14, 0.13]	
Risk-severity	−0.18**	[−0.30, −0.05]		−0.01	[−0.07, 0.06]		0.00	[−0.08, 0.07]		−0.04	[−0.14, 0.09]	
Obedience to advice	0.17*	[0.04, 0.31]		0.00	[−0.12, 0.13]		0.05	[−0.09, 0.23]		−0.10	[−0.38, 0.11]	

B = standardized coefficient. * $p < .05$. ** $p < .01$. *** $p < .001$. The demographic variables (age, education level, marital status, underlying health condition, acquaintances infected with COVID-19) that were significantly different between the Chinese and European samples in Table 1 were entered as the initial block for the Chinese model and European model, respectively; no demographic variable was a significant predictor of face mask wearing behavior thus the final regression analyses did not include demographic variables.

The significantly higher pro-masking tendency in the Chinese sample may suggest the positive effect of local policies [4, 10]. As subjective norm was identified as a significant predictor of face mask wearing across countries, future health communication and policymaking should focus on how to enhance the individual's perceived social pressure to wear face masks in public. As discussed [21], a drastic narrative shift may result in a successful cultural and social change in face mask use. For instance, public messaging may emphasize the population benefits at a community level rather than focusing on individual risk reduction. As attitude was a significant predictor of Europeans' mask wearing, strategies used in social marketing may be useful. For example, rather than merely focusing on mask functionality, face mask designs that consider aesthetics (i.e., pleasure) and symbolism (i.e., social meaning) might increase people's positive attitude towards the product [22].

By the end of March 2020, Austria, Germany, Switzerland, and China had remarkably different numbers of cumulative cases of infection [23]. Of concern, Germany and Switzerland had more cases than Austria, and our study had revealed less pro-masking perceptions compared with Austria. Even though face mask rules could immediately shape pro-masking action and perception, as suggested in the Austrian sample, further cross-national transmissions are unavoidable with the re-opening of borders within Europe. A more coordinated universal mask wearing rule is thus needed across countries to strengthen the effect of face mask use.

Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards: All authors declare that they have no conflicts of interest.

Human Rights: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Ethical Statement: The study was approved by the ethics committee of University of Klagenfurt.

Author Contributions: Both authors developed the research and collected data. XZ conducted data analysis and drafted the initial report. Both authors revised and improved the draft.

Transparency Statement: This study was not formally registered. The analysis plan was not formally pre-registered.

Data Availability: De-identified data from this study are not available in a public archive. De-identified data from this study will be made available (as allowable according to institutional IRB standards) by emailing the

corresponding author. There is not analytic code associated with this study. The survey questions are presented in the Appendix.

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