Research paper

Effects of mask wearing on anxiety of teachers affected by COVID-19: A large cross-sectional study in China

Quanman Li [a], Clifford Silver Tarimo [a,c], Yudong Miao [b], Xin Zeng [a], Cuiping Wu [a], Jian Wu [a,*]

[a] Department of Epidemiology and Health Statistics, College of Public Health, Zhengzhou University, 100, Science Avenue, Gaoxin District, Zhengzhou, Henan 450001, PR China
[b] Henan Provincial People's Hospital, People's Hospital of Zhengzhou University, Henan, PR China
[c] Department of Science and Laboratory Technology, Dar es salaam Institute of Technology, P.O. Box 2958, Dar es Salaam, Tanzania

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ABSTRACT

Objective: There is a limited information on mask wearing in relation to anxiety. The aim of this study was to evaluate the association between mask wearing practice and the risk of anxiety during the COVID-19 epidemic among teachers in Henan province, China.
Methods: We enrolled 88,611 teachers in an online cross-sectional survey across three cities of Henan Province in China. A total of 94.75% of study participants completed an online questionnaire between February 4, 2020 and February 12, 2020. Mask wearing practice was defined according to its type, how it is worn, and the behavior exhibited in relation to wearing a mask. We used the Generalized Anxiety Disorder tool (GAD-7) to assess anxiety levels among study participants. Odds ratios (OR) with 95% confidence intervals (CI) were used to estimate the association between mask wearing practice and anxiety by using multivariable logistic regression models.
Results: A total of 67,357 registered teachers (25.91% men) were included in this study. After adjusting for potential confounders, participants who knew the wrong type of mask had 17% increased odds of having anxiety compared to those who knew the proper type (Aor = 1.17; 95%CI: 1.11–1.24). Odds for anxiety were higher for teachers who did not know the proper way of wearing mask compared to those who knew it properly (aOR = 1.18; 95%CI: 1.07–1.30). Not adhering to proper behavior of mask wearing was associated with 39% increased odds for anxiety (aOR = 1.39; 95%CI: 1.18–1.64). The odds for anxiety for teachers who did not adhere to all the three parameters of proper mask wearing was about 2.55 times as much compared to those who reported full compliance to the parameters (aOR = 2.55; 95%CI: 1.22–5.35). We observed similar ORs on stratified analyses across gender and age groups.
Conclusion: Our findings suggest that improper mask wearing is another important attribute that play a significant role in increasing the risk of anxiety during the COVID-19 epidemic situation. However, these results should be considered as exploratory and hence interpreted with caution.

1. Introduction

Human-to-human transmission of the Coronavirus disease 2019 (COVID-19) has posed a major global health threat (Wang et al., 2020). Since the World Health Organization declared the COVID-19 as a pandemic and hence a public health emergence of international concern, the rate of new infections and deaths has been ever-accelerating in many parts of the world (WHO, 2020). As of August 17, 2020, at least 21,549,706 confirmed cases of COVID-19, including 767,158 deaths, had been reported in 216 countries around the world (WHO, 2020). This pandemic has brought a significant change in life style as well as working environment. Such sudden changes to daily life may have adversely impact peoples' mental health (Dong and Bouey, 2020). Some epidemiological surveys have described that, over 20% of respondents reported to have suffered from anxiety during the pandemic (Gao et al., 2020; Wang, 2020). Likewise, the COVID-19 pandemic has caused unprecedented damage to the educational system worldwide. As a result, most countries, including China, which is seen as a credible global health actor (Zhang et al., 2020; Wu et al., 2020), have been implementing strict controls over social gatherings including schools that would anyhow be regarded as a superspreading event (Abdollahi et al., 2020; Auger, 2020; Koo et al., 2020; Stein-Zamir, 2020). However,

* Corresponding author.
  E-mail address: jianwu17@163.com (J. Wu).

with the school closed, a study reported about 13.67% of teachers that had suffered from anxiety during the COVID-19 epidemic in the face of the significant shifts from normal learning and teaching habits (Li, Q., et al., 2020).

To control COVID-19, proper use of masks, hand hygiene and social distancing have proved extremely useful in most countries (Chu et al., 2020; Patel and Jernigan, 2020). Among other practices, mask wearing is considered the most recommended practice for infection control and breaking the transmission chain of COVID-19 (Goh et al., 2020). However, A cross-sectional study that investigated Chinese residents from January 27 to February 1, found only 73.9% of residents chose the proper type of mask (Zhong et al., 2020) while nearly 56.4% of healthcare workers have either reported having difficulty or little knowledge on effective way of wearing a mask during COVID-19 outbreak in Pakistan (Kumar et al., 2020). Another cross-sectional study among primary school students in Wuhan, China which included 9145 students showed only 51.60% of students practiced appropriate mask wearing behavior (Chen, 2020). In addition, about 19.6% of study participants frequently reported to experience itchy sensations when they wore the mask for an extended time (Szepietowski et al., 2020). An observational study involving 1738 respondents from 190 Chinese cities revealed that high frequency of mask wearing regardless of the presence or absence of symptoms was significantly associated with lower scores of anxiety (Wang et al., 2020).

Based on above evidences, we designed a cross-sectional survey that included primary, junior, high school and university teachers in china during the COVID-19 epidemic to explore the relationship between mask wearing practice and the risk of anxiety. Considering the fact that different psychological interventions are formulated according to sex and age (Liu et al., 2020), we stratified our analysis accordingly so as to further disclose the existing associations. This may provide evidence-based clues for government and public health authorities to plan proper healthcare strategies to face anxiety during the COVID-19 era, considering the history of disease outbreak re-currency in China.

2. Methods

2.1. Study setting and participants

We designed a cross-sectional survey through an online survey platform ("SurveyStar", Changsha Ranxing Science and Technology, Shanghai, China) and developed an anonymous online questionnaire link which was sent to respondents through social media ("WeChat", Tencent, Shenzhen, China) between February 4, 2020 and February 12, 2020 among registered teachers from Zhengzhou, Xinyang, Xinxiang city of Henan province, China. 93,518 registered teachers were recruited by using a cluster sampling method. For quality control, we excluded the participants aged less than 18 years or aged above 100 years. We also excluded participants who took less than 100 s to fully respond to the questions ($n = 4,907$) plus the non-outgoing participants ($n = 21,254$). We eventually remained with 67,357 participants who were included in the current study.

The study protocol was approved by the Ethics Committee of the Zhengzhou University. All participants consented for participation in this study.

2.2. Data collection

A standard questionnaire used covered different aspects including socio-demographic characteristics, the level of attention to COVID-19 epidemic, information source, knowledge, attitude and behavior with respect to COVID-19 and psychological status. Socio-demographic characteristics included sex, age, marital status, and education level, residence, teachers' category, school location and many others. The levels of attention to COVID-19 epidemic was divided into high, moderate and low categories. Information sources were categorized as

independent, structured and mixed learning. The knowledge, attitude and behavior about COVID-19 included questions about the mask wearing, hand hygiene and social distancing. Questions on psychological state covered several attributes including worried condition, fear and anxiety. Other details of this questionnaire are provided elsewhere (Li et al., 2020).

This study defined the proper type of mask as surgical mask or N95/KN95 respirator. The proper way of wearing mask was defined as wearing a mask while the side of the mask which has a stiff bendable edge on the top and which is meant to mold to the shape of your nose. Furthermore, the colored side of the mask should always face outwards while the white side touches the face and should fully cover the mouth, nose and chin. We defined proper behavior of mask wearing as wearing a mask whenever go out, or in crowded areas or when taking public transportation.

Generalized Anxiety Disorder (GAD-7) tool was used to assess anxiety (sensitivity: 89%; specificity: 82%). A score of 10 or above was considered a reasonable cut point for identifying cases (Spitzer et al., 2006).

2.3. Statistical analysis

Categorical data were presented as frequency (%) while continuous data were displayed using means and standard deviations (SD). The bivariate associations between the levels of anxiety among teachers stratified by sex was compared using Pearson chi-square test or Student's t test when appropriate. Crude odds ratios (cORs) and adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were estimated using multivariable logistic regression models. In adjusted model, we controlled our analyses with potential confounders including age, sex, education status, marital status, type of teachers, school location, information source, attention level, worried level and fear level. Interaction effect were detected by including multiplicative interactions terms in the multivariable logistic regression models. We applied joint tests to assess the overall differences between the individual categories of the corresponding variable in the final model. Stratified analyses were conducted to examine the associations of mask wearing with anxiety in different sex and age group. All analyses were performed by using SAS v9.4 (SAS Inst., Cary, NC) and Stata 12.1 (Stata Corp, College Station, TX). All statistical tests were two-tailed, with $P < 0.05$ considered statistically significant for both univariate and multivariable analyses.

3. Results

3.1. Demographic characteristics of the study participants

A total of 67,357 registered teachers (25.91% men) were included in this study. The overall prevalence of anxiety was 13.51%, 12.66% for male teachers and 13.80% for female teachers. The mean age of study participants was 41.33 (SD = ±9.67) years for male participants and 34.69 (SD = ±8.23) years for females. We found that anxiety in both sexes was significantly associated with education status, type of teachers, source of information regarding the epidemic situation, type of mask, way of wearing mask, behavior of mask wearing, level of attention, level of worry, and level of fear (all $P < 0.05$). The detailed characteristics of study participants stratified by sex and anxiety status are summarized in Table 1.

The association between mask wearing and anxiety for study participants.

In total, 15.81% of teachers who did not know the proper type of mask to wear and 16.7% who did not know to the proper way of wearing mask were found to suffer from anxiety. Similarly, 17.10% of teachers did not adhere to the proper behavior of mask wearing suffered from anxiety as well. In the adjusted model, teachers who knew the improper type of mask during the epidemic had 17% increased odds of anxiety (aOR = 1.17; 95%CI: 1.11–1.24) compared to the teachers who knew it

Table 1
Characteristics of study participants by anxiety status.

Characteristics	Male teachers (n = 17,450)		P_{value}	Female teachers (n = 49,907)		P_{value}
	Without anxiety (n = 15,240)	With anxiety (n = 2210)		Without anxiety (n = 43,018)	With anxiety (n = 6889)	
Age (years)	41.95 ± 9.37	42.12 ± 9.65	0.4319	35.40 ± 8.32	35.53 ± 8.40	0.2447
Education status (%)			<0.0001			<0.0001
College	3830 (25.13)	629 (28.46)		9382 (21.81)	1638 (23.78)	
Bachelor	10,018 (65.73)	1306 (59.10)		28,539 (66.34)	4225 (61.33)	
Master	843 (5.53)	134 (6.06)		2888 (6.71)	433 (6.29)	
Others	549 (3.60)	141 (6.38)		2209 (5.14)	593 (8.61)	
Married (%)	13,621 (89.38)	1973 (89.28)	0.8860	33,809 (78.59)	5567 (80.81)	<0.0001
Type of teachers (%)			0.0045			<0.0001
Primary school teacher	5449 (35.75)	874 (39.55)		26,589 (61.81)	4462 (64.77)	
Junior school teacher	5408 (35.49)	753 (34.07)		10,641 (24.74)	1648 (23.92)	
High school teacher	3943 (25.87)	530 (23.98)		5204 (12.10)	679 (9.86)	
University teacher	440 (2.89)	53 (2.40)		584 (1.36)	100 (1.45)	
School location (%)			0.1819			<0.0001
City	5438 (35.68)	822 (37.19)		17,601 (40.92)	2929 (42.52)	
Country-level city	6025 (39.53)	877 (39.68)		13,749 (31.96)	2282 (33.13)	
Rural	3777 (24.78)	511 (23.12)		11,668 (27.12)	1678 (24.36)	
Information source (%)			<0.0001			<0.0001
Independent learning	671 (4.43)	144 (6.55)		2692 (6.27)	603 (8.78)	
Structured learning	236 (1.56)	46 (2.09)		428 (1.00)	99 (1.44)	
Mixed learning	14,251 (94.02)	2008 (91.36)		39,797 (92.73)	6163 (89.77)	
Type of mask wearing (%)			<0.0001			<0.0001
Proper	10,584 (69.45)	1406 (63.62)		33,551 (77.99)	5041 (73.17)	
Improper	4656 (30.55)	804 (36.38)		9467 (22.01)	1848 (26.83)	
Way of mask wearing (%)			0.0068			<0.0001
Proper	14,179 (93.04)	2021 (91.45)		41,039 (95.40)	6468 (93.89)	
Improper	1061 (6.96)	189 (8.55)		1979 (4.60)	421 (6.11)	
Behavior of mask wearing (%)			0.0001			0.0400
Proper	14,856 (97.48)	2123 (96.06)		42,350 (98.45)	6759 (98.11)	
Improper	384 (2.52)	87 (3.94)		668 (1.55)	130 (1.89)	
Attention level (%)			0.0019			0.5100
High	15,160 (99.48)	2192 (99.19)		42,798 (99.49)	6860 (99.58)	
Moderate	70 (0.46)	11 (0.50)		185 (0.43)	23 (0.33)	
Low	10 (0.07)	7 (0.32)		35 (0.08)	6 (0.09)	
Worried level (%)			<0.0001			<0.0001
High	12,956 (85.01)	2163 (97.87)		39,314 (91.39)	6818 (98.97)	
Moderate	1624 (10.66)	30 (1.36)		2975 (6.92)	56 (0.81)	
Low/none	660 (4.33)	17 (0.77)		729 (1.69)	15 (0.22)	
Fear level (%)			<0.0001			<0.0001
High	2141 (14.37)	1190 (54.07)		8263 (19.37)	4310 (62.65)	
Moderate	5862 (39.35)	786 (35.71)		20,652 (48.42)	2235 (32.49)	
Low/none	6894 (46.28)	225 (10.22)		13,734 (32.20)	335 (4.87)	

Data are mean (standard deviation) or number (percentage).
P value is from Student's t test or chi-square test for continuous variables and categorical variables.

properly. Odds for anxiety were higher for teachers who did not know the proper way of mask wearing compared to those with such knowledge (aOR = 1.18; 95%CI: 1.07–1.30). Teachers who did not exhibit the proper behavior of mask wearing had higher odds for anxiety than those who executed the proper behavior (aOR = 1.39; 95%CI: 1.18–1.64). There were significant differences in aORs for anxiety by different responses as shown in Table 2. We found a significant interaction between sex and all the three mask wearing practices (*P* < 0.001). Moreover, the interaction effects were also observed between participants' age group, the type of mask, and the behavior of mask wearing (*P* = 0.0021; *P* = 0.0062). The adjusted model showed that teachers who did not adhere to all the three parameters had 2.55 (95%CI: 1.22–5.35; P_{trend} < 0.0001) times more risk of anxiety compared to their counterparts who observed all the measured parameters. Detailed information is displayed in Table 3.

The association between mask wearing and anxiety stratified by sex.

Overall, among the participants who did not know the proper type of mask, study found that 804 (14.73%) male teachers and 1848 (16.33%) female teachers were experiencing anxiety. Male teachers who did not know the proper type of mask to wear were at more risk of anxiety (aOR = 1.19 (95%CI: 1.08–1.32) compared to male teachers who had that knowledge. Similar result was found among female teachers (aOR = 1.16; 95%CI: 1.09–1.24). We also found that male teachers who did not know the proper way of wearing mask were more likely to suffer from

anxiety compared to male teachers who practiced it in a proper way (aOR = 1.08; 95%CI: 0.91–1.29). The current study revealed an elevated risk of anxiety among female teachers that were not practicing the proper way of wearing mask compared to their counterparts who practiced in a proper way (aOR = 1.23; 95%CI: 1.09–1.39). Multivariable regression models showed that male teachers who did not exhibit the proper behavior of mask wearing had higher odds of anxiety compared to those with the proper behavior (aOR = 1.79; 95%CI: 1.37–2.35). However, this association was not statistically significant in female teachers (aOR = 1.20; 95%CI: 0.97–1.48) (Table 2). Female teachers who did not adhere to all the three practices were more likely to have anxiety compared to teachers who adhered well to all the practices (aOR = 6.64; 95%CI: 2.05–21.50; P_{trend} < 0.0001). In contrast, we did not find a significant association between adhering well to all the practices and risk of anxiety among male teachers (aOR = 1.32; 95%CI: 0.46–3.81; P_{trend} = 0.0136). Detailed information was showed in Fig. 1 and Table 1.

The association between mask wearing and anxiety stratified by age.

We found that among teachers aged < 45 years, 1986 (15.85%) teachers did not know the proper type of mask to wear, 449 (16.42%) teachers did not know the proper way of mask wearing and 160 (16.51%) teachers did not exhibit proper behavior towards mask wearing. For teachers aged ≥ 45 years, 666 (15.70%) teachers did not know the proper type of mask wearing, 161 (17.60%) teachers did not

Table 2
Association between mask wearing practice and anxiety.

Mask wearing practice	Type of mask wearing		P_{value}	Way of mask wearing		P_{value}	Behavior of mask wearing		P_{value}
	Proper	Improper		Proper	Improper		Proper	Improper	
Total									
Cases/participants	6447/ 50,582	2652/16,775		8489/ 63,707	610/3650		8882/ 66,088	217/1269	
cOR (95% CI)	1.00 (ref)	1.29 (1.22–1.35)	<0.0001[a]	1.00 (ref)	1.31 (1.19–1.43)	<0.0001[a]	1.00 (ref)	1.33 (1.15–1.54)	0.0007[a]
aOR (95% CI)	1.00 (ref)	1.17 (1.11–1.24)	<0.0001[a]	1.00 (ref)	1.18 (1.07–1.30)	0.0035[a]	1.00 (ref)	1.39 (1.18–1.64)	0.0002[a]
Sex			<0.0001[b]			<0.0001[b]			<0.0001[b]
Men									
Cases/participants	1406/ 11,990	804/5460		2021/ 16,200	189/1250		2123/ 16,979	87/471	
cOR (95% CI)	1.00 (ref)	1.30 (1.18–1.43)	<0.0001[a] [a]	1.00 (ref)	1.25 (1.06–1.47)	0.0274[a]	1.00 (ref)	1.59 (1.25–2.01)	0.0004[a]
aOR (95% CI)	1.00 (ref)	1.19 (1.08–1.32)	0.0012[a]	1.00 (ref)	1.08 (0.91-1.29)	0.5591[a]	1.00 (ref)	1.79 (1.37–2.35)	<0.0001[a]
Women									
Cases/participants	5041/ 38,592	1848/11,315		6468/ 47,507	421/2400		6759/ 49,109	130/798	
cOR (95% CI)	1.00 (ref)	1.30 (1.23–1.38)	<0.0001[a]	1.00 (ref)	1.35 (1.21–1.51)	<0.0001[a]	1.00 (ref)	1.22 (1.01–1.47)	0.0726[a]
aOR (95% CI)	1.00 (ref)	1.16 (1.09–1.24)	<0.0001[a]	1.00 (ref)	1.23 (1.09–1.39)	0.0013[a]	1.00 (ref)	1.20 (0.97–1.48)	0.1257[a]
Age			0.0021[b]			0.1460[b]			0.0062[b]
Age < 45 years									
Cases/participants	5024/ 39,635	1986/12,532		6561/ 49,432	449/2735		6850/ 51,198	160/969	
cOR (95% CI)	1.00 (ref)	1.30 (1.23–1.37)	<0.0001[a]	1.00 (ref)	1.28 (1.16–1.43)	<0.0001[a]	1.00 (ref)	1.28 (1.08–1.52)	0.0137[a]
aOR (95% CI)	1.00 (ref)	1.16 (1.09–1.24)	<0.0001[a]	1.00 (ref)	1.13 (1.01–1.26)	0.0699[a]	1.00 (ref)	1.30 (1.07–1.57)	0.0108[a]
Age ≥ 45 years									
Cases/participants	1423/ 10,947	666/4243		1928/ 14,275	161/915		2032/ 14,890	57/300	
cOR (95% CI)	1.00 (ref)	1.25 (1.13–1.38)	0.0001[a]	1.00 (ref)	1.37 (1.15–1.63)	0.0016[a]	1.00 (ref)	1.49 (1.11–1.99)	0.0133[a]
aOR (95% CI)	1.00 (ref)	1.20 (1.08–1.34)	0.0023[a]	1.00 (ref)	1.33 (1.10–1.62)	0.0067[a]	1.00 (ref)	1.68 (1.22–2.33)	0.0018[a]

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; cOR, crude odds ratio; ref, reference.
cOR: Unadjusted.
aOR: Adjusted for age, sex, education status, married status, type of teachers, school location, information source, attention level, worried level, fear level.
[a] *P* value is based on joint tests.
[b] *P* value is based on the interaction effect.

know the proper way of mask wearing and 57 (19.00%) teachers did not adhere to the proper behavior of mask wearing. Teachers aged < 45 years who could not adhere to the proper type of mask, the proper way of wearing mask and adherence to the proper behavior of mask wearing were at an increased risk of anxiety compare to those who adhered (aOR = 1.16; aOR = 1.13; aOR = 1.30 respectively). However, the association was only statistically significant for teachers aged ≥ 45 years (aOR = 1.20; aOR = 1.33; aOR = 1.60) (Table 2). Compared to teachers who adhered to all the three mask wearing practices, the aOR for anxiety in teachers who did not adhere at all the practices were 2.34 times more likely for teachers aged < 45 years (95%CI: 0.98–5.62; P_{trend} < 0.0001) and 2.93 for teachers aged ≥ 45 years (95%CI: 0.73–11.75; P_{trend} = 0.0052). Fig. 2 and **Supplementary Table 2** showed the details.

4. Discussion

This cross-sectional survey involved 67,357 teachers during the COVID-19 epidemic period and it provides the best available evidence that the improper mask wearing practice were found to be associated with the risk of anxiety. These data also suggest that the improper mask wearing practice increases the risk of anxiety between sex and age categories among teachers. After adjusted the potential confounders, teachers who did not adhere to all the mask wearing practice had 2.55 times more likely to suffer from anxiety compared to those who

completely adhered to the practice.

For all teachers, our results suggest that responses with improper behavior of mask wearing is associated with the increased risk of anxiety after adjusting for potential confounders, which was consistent to studies conducted elsewhere (Wang et al., 2020). Therefore, mask wearing practice may play a crucial role in reducing the risk of anxiety during the COVID-19 epidemic and hence the study may recommend community sensitization on proper practice of wearing face masks. In addition, Further, we also disclosed that the participants who knew the improper type or knew the mask wearing in an improper way were also subjected into a risk of anxiety. Although some studies have found that mask wearing could create a false sense of security among some individuals (Goh et al., 2020), public health education also needs to put more emphasis on these aspects to effectively fight anxiety during the COVID-19 pandemic among Chinese population. Another previous study found higher anxiety being associated with an increased use of preventive measures against COVID-19 through a cross-sectional population survey involved 3555 residents of Taiwan aged between 20 to 70 years (Wong et al., 2020). We also think that the shortages of supplies, rising prices and increasingly frantic quests for surgical masks during the COVID-19 epidemic (Choi et al., 2020) may confound the association between mask wearing and the risk of anxiety.

We discussed that the association between the type, the way and behavior of mask wearing, and risk of anxiety by sex and found the

Table 3

Association between mask wearing practices and the risk of anxiety.

Mask wearing practices	Cases/ participants	cOR (95% CI)	aOR (95% CI)
Type & Way & Behavior			
P & P & P	5934/47,247	1.00 (ref)	1.00 (ref)
P & P & I	116/804	1.17 (0.96–1.43)	1.26 (1.01–1.56)
P & I & P	387/2464	1.30 (1.16–1.45)	1.20 (1.06–1.35)
I & P & P	2364/15,316	1.27 (1.21–1.34)	1.16 (1.10–1.23)
P & I & I	10/67	1.22 (0.62–2.39)	1.12 (0.53–2.40)
I & P & I	75/340	1.97 (1.52–2.55)	1.91 (1.43–2.55)
I & I & P	197/1061	1.59 (1.36–1.86)	1.29 (1.08–1.53)
I & I & I	16/58	2.65 (1.49–4.72)	2.55 (1.22–5.35)
P_{trend}		<0.0001	<0.0001

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; cOR, crude odds ratio; I & I & I, improper type & improper way & improper behavior; I & I & P, improper type & improper way & proper behavior; I & P & I, improper type & proper way & improper behavior; I & P & P, improper type & proper way & proper behavior; P & I & I, proper type & improper way & improper behavior; P & I & P, proper type & improper way & proper behavior; P & P & I, proper type & proper way & improper behavior; P & P & P, proper type & proper way & proper behavior; ref, reference.

cOR: Unadjusted.

aOR: Adjusted for age, sex, education status, married status, type of teachers, school location, information source, attention level, worried level, fear level.

essentially similar results with the main results. This may prompt that mask wearing may contribute to the control of anxiety in the population and hence support the policy of mask wearing practice. However, for male teachers, the non-significant association between anxiety and the way of wearing mask was found in the adjusted model. We think that health tips and directives provided my authorities regarding mask wearing practice are somehow ignored, a situation which may further lead to more disease incidences and poor health outcomes (Wong et al., 2020). The association between the behavior of mask wearing and anxiety was non-significant for female teachers. We think that, the masks may affect one's untoward side effects such as itchy feeling and
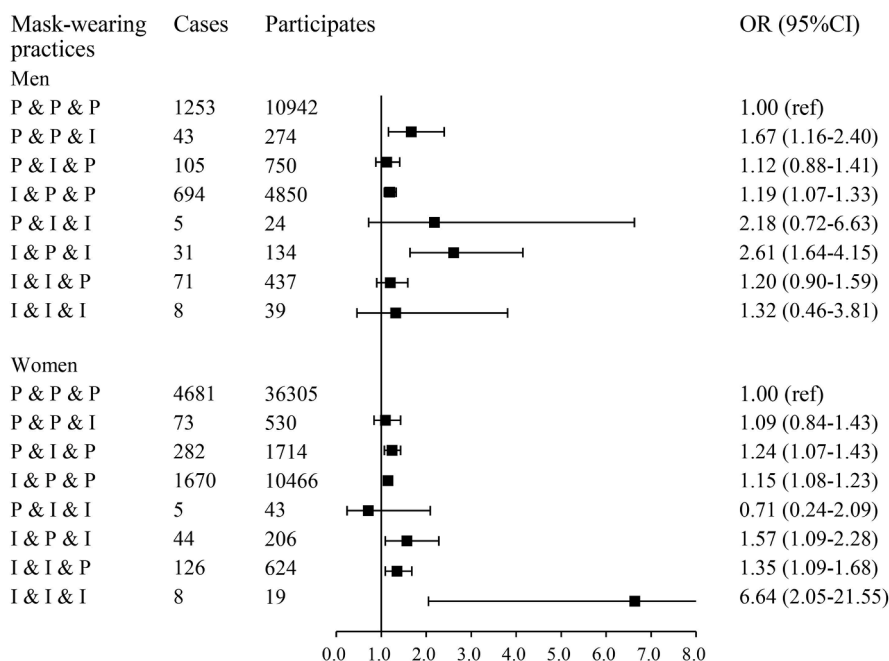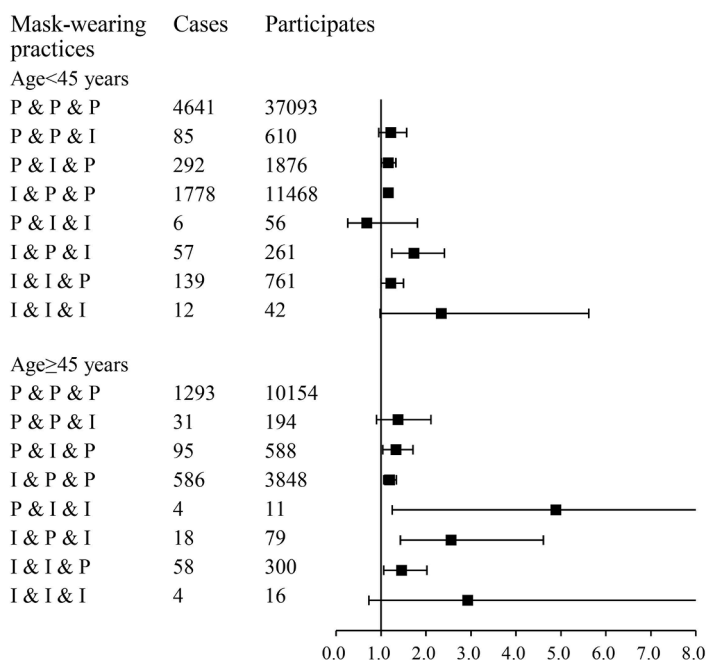
normal respiration (Scarano et al., 2020), which may lead the non-significant association. Future studies should be designed to assess further the relationship between mask wearing practice and risk of anxiety among females taking into consideration more variables in the predictive model.

The association between the type, the way and behavior of mask wearing, and risk of anxiety by age group showed the similar results with the main results, too. So, our results were essentially robust. However, with all improper mask wearing is non-significant associated with increased risk for anxiety in teachers younger than 45 years and in teachers aged 45 years or older. However, the type of mask, way of wearing and behavior of mask wearing are independent risk factors for anxiety at all ages. The inconsistencies may be due to the small sample sizes between the selected age groups which in turn affected the statistical power.

Adopting correct COVID-19 prevention measures such as proper use of masks is influenced by the health risk perception related to the probability of contracting the virus (Commodari et al., 2020). Health risk perception plays an important role in acting the mental health of people in a public health crisis (Ding et al., 2020). Therefore, health policies aiming to improve the psychological wellbeing of the people in a public health crisis should take risk perception into consideration, what decision-makers, health authorities, and health care professionals need to know.

Strengths of our study include timely execution which enabled us to capture the effects when the pandemic was still ongoing in China. The study also made use of the standardized questionnaire (GAD-7) to diagnose anxiety, which has been previously validated and used in Chinese populations. To our knowledge, this survey was the first to examine the association between mask wearing and anxiety in a large, representative sample of teachers in China, and has a potential to inform public health policy in other regions with the similar health systems.

This study has several limitations. the multivariable-adjusted logistic regression models were performed to estimate the association between mask-wearing and anxiety. However, the usual deficiency of observational studies exists, such as the inability to include all relevant confounders, especially those unmeasured, causing bias that cannot be adjusted. Secondly, our study was designed as a cross-sectional survey, which does not establish causality. Thirdly, the data were self-reported, and hence a chance of being subject to social desirability bias. Fourthly,

Mask-wearing practices	Cases	Participates		OR (95%CI)
Men				
P & P & P	1253	10942		1.00 (ref)
P & P & I	43	274		1.67 (1.16-2.40)
P & I & P	105	750		1.12 (0.88-1.41)
I & P & P	694	4850		1.19 (1.07-1.33)
P & I & I	5	24		2.18 (0.72-6.63)
I & P & I	31	134		2.61 (1.64-4.15)
I & I & P	71	437		1.20 (0.90-1.59)
I & I & I	8	39		1.32 (0.46-3.81)
Women				
P & P & P	4681	36305		1.00 (ref)
P & P & I	73	530		1.09 (0.84-1.43)
P & I & P	282	1714		1.24 (1.07-1.43)
I & P & P	1670	10466		1.15 (1.08-1.23)
P & I & I	5	43		0.71 (0.24-2.09)
I & P & I	44	206		1.57 (1.09-2.28)
I & I & P	126	624		1.35 (1.09-1.68)
I & I & I	8	19		6.64 (2.05-21.55)

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0

Fig. 1. Association between mask wearing practices and anxiety by sex.

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; I & I & I, improper type & improper way & improper behavior; I & I & P, improper type & improper way & proper behavior; I & P & I, improper type & proper way & improper behavior; I & P & P, improper type & proper way & proper behavior; P & I & I, proper type & improper way & improper behavior; P & I & P, proper type & improper way & proper behavior; P & P & I, proper type & proper way & improper behavior; P & P & P, proper type & proper way & proper behavior.

Adjusted for age, sex, education status, married status, type of teachers, school location, information source, attention level, worried level, fear level.

Mask-wearing practices	Cases	Participates		OR (95%CI)
Age<45 years				
P & P & P	4641	37093		1.00 (ref)
P & P & I	85	610		1.22 (0.95-1.57)
P & I & P	292	1876		1.16 (1.01-1.33)
I & P & P	1778	11468		1.16 (1.08-1.23)
P & I & I	6	56		0.68 (0.26-1.81)
I & P & I	57	261		1.73 (1.24-2.41)
I & I & P	139	761		1.22 (1.00-1.50)
I & I & I	12	42		2.34 (0.98-5.62)
Age≥45 years				
P & P & P	1293	10154		1.00 (ref)
P & P & I	31	194		1.38 (0.90-2.11)
P & I & P	95	588		1.33 (1.04-1.71)
I & P & P	586	3848		1.19 (1.06-1.34)
P & I & I	4	11		4.89 (1.25-19.12)
I & P & I	18	79		2.56 (1.43-4.61)
I & I & P	58	300		1.46 (1.06-2.02)
I & I & I	4	16		2.93 (0.73-11.75)

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0

Fig. 2. Association between mask wearing practices and anxiety by age group.
Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; I & I & I, improper type & improper way & improper behavior; I & I & P, improper type & improper way & proper behavior; I & P & I, improper type & proper way & improper behavior; I & P & P, improper type & proper way & proper behavior; P & I & I, proper type & improper way & improper behavior; P & I & P, proper type & improper way & proper behavior; P & P & I, proper type & proper way & improper behavior; P & P & P, proper type & proper way & proper behavior.
Adjusted for age, sex, education status, married status, type of teachers, school location, information source, attention level, worried level, fear level.

participants of this study were all teachers, which may limit the generalizability of our findings to other professional population. Finally, we failed to explore the association between mask wearing practices and the risk of anxiety among students during COVID-19 pandemic. However, Chen X, et al. and Commodari E, et al. have provided an up-to-date insights and practical advice on the same (Chen, 2020; Commodari et al., 2020).

5. Conclusion

It indicates that mask wearing may be an intervention indicator to reduce the anxiety during COVID-19 epidemic among teachers. Early intervention in mask wearing practice could be helpful for the primary prevention of anxiety, which should draw specific attention for international and national decision-makers.

Data Availability

The data that support the findings of this study are available from the corresponding author on reasonable request.

CRediT authorship contribution statement

Quanman Li: Formal analysis, Writing - original draft, Writing - review & editing. **Clifford Silver Tarimo:** Validation, Writing - review & editing. **Yudong Miao:** Project administration, Writing - review & editing. **Xin Zeng:** Validation, Writing - review & editing. **Cuiping Wu:** Data curation, Methodology, Writing - review & editing. **Jian Wu:** Funding acquisition, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2020.11.113.

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