Article

Gendered Factors Associated with Preventive Behaviors and Mental Health among Chinese Adults during the COVID-19 Pandemic Home Quarantine

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Abstract: The outbreak of the coronavirus disease in 2019 (COVID-19) has greatly impacted the life and mental health of many people globally. The objective of this study was to investigate the factors associated with preventive behaviors and mental health among Chinese adults during their home quarantine in the COVID-19 period. An online questionnaire survey was administered in March 2020. The study participants were adults aged between 18 and 70 years old from 31 provinces in China. Of the 3878 participants, 1314 reported moderate levels of anxiety, and the remaining participants reported moderate to severe levels of anxiety. Findings revealed that females aged between 18 and 30 years old who had higher educational qualifications, greater levels of preventive knowledge, trust in the government, and resided in urban and medium-risk areas ($R^2 = 0.100$, F = 27.97, $p < 0.001$) were more likely to exhibit preventive behaviors. In contrast, a higher negative emotional response was generally seen in males who had low levels of preventive knowledge and behaviors, higher risk perception of infection, lower trust in the government, and unhealthy lifestyles ($R^2 = 0.127$, F = 32.33, $p < 0.001$). In addition, the high-risk perception of infection was positively associated with high odds of anxiety (AOR = 1.17, 95% CI: 1.10–1.24), whereas a greater level of preventive knowledge (AOR = 0.36, 95% CI: 0.19–0.70) and behaviors (AOR = 0.69, 95% CI: 0.57–0.84), higher trust in the government's COVID-19 pandemic mitigation measures (AOR = 0.77, 95% CI: 0.71–0.83), and a healthier lifestyle (AOR = 0.89, 95% CI: 0.79–0.99) were negatively associated with high odds of anxiety. Results showed that a lower level of anxiety and negative emotional response were associated with better preventive behaviors against COVID-19, which were influenced by preventive knowledge, risk perception, trust in the government's COVID-19 pandemic mitigation measures, and healthy lifestyle. Findings in this study could help formulate health interventions for vulnerable groups related to gendered vulnerabilities in the COVID-19 environment to improve their mental health and preventive behaviors, especially during the period of a pandemic.

Keywords: gender balance; gendered impact; mental health; preventive behaviors; risk perception

1. Introduction

The coronavirus disease of 2019 (COVID-19) has become a worldwide pandemic that has significantly affected millions of businesses and individuals. Governments across the globe have taken numerous unprecedent actions and measures to prevent further spreading of the disease. Although medical treatments and hospital isolation are typically put in place to manage individuals who have been tested positive for COVID-19 [1], home quarantine of the general population and social distancing are also considered critical means to help minimize the transmission of COVID-19 in several countries, including China [2,3]. In China, the government has adopted strict measures since January 23, 2020, which included the initiation of a first-level response to major public health emergencies [4]; lockdown of the Hubei area, the epicenter of the outbreak; and the implementation of travel restrictions across China [5]. In addition, home quarantine and preventive behaviors are commonly applied to the general population during the period of the COVID-19 outbreak. All these measures undertaken have greatly affected people's lives, leading to a significant impact on their mental health.

Several studies have revealed that a wide range of mental health issues has emerged as a result of the COVID-19 outbreak, and they include anxiety and depression [6–11], behavioral problems [12], and distress [7,12]. These studies have mainly focused on the prevalence of mental illnesses and the identification of susceptible populations. Given the lessons learned from previous outbreaks of SARS, Middle East respiratory syndrome, Zika virus, and H1N1 [13–16], it is acknowledged that preventive behaviors associated with health knowledge, risk perception, public trust in government, and healthy lifestyle can also play a critical role in the control of epidemics. Although there are increasing studies conducted globally to investigate the impact of COVID-19 on general mental health, there needs to be further exploration and understanding in this constantly changing COVID-19 situation, especially in areas where it is still under-researched. This is the case in China, where very few studies have been conducted and where one study examined the mental health status of children who were confined at home during the COVID-19 outbreak in Hubei Province [17]. China is the most populous country in the world, with approximately 723 million males and 688 million females in 2020 [18]. The age group of 16 to 59 years old made up the largest proportion (63.35%), with 60 years and older accounted for approximately 32%, and the remaining aged 0 to 15 years old [18]. As of 9 March 2020, there was a total of 80,754 confirmed COVID-19 cases and 3136 deaths in China [19]. This lack of adequate understanding of the mental health of the adults in China during this period of COVID-19 has prompted the need for further research. This study aims to fill this gap and extend the existing knowledge by investigating the relationships between preventive behaviors and mental health. Specifically, this study will focus on factors associated with preventive behaviors such as public knowledge, risk perception, trust in the government's mitigation measures to the COVID-19 pandemic, and heathy lifestyles and determine how they can potentially affect the mental health of the adults in China who have experienced the COVID-19 home quarantine.

2. Materials and Methods

2.1. Design and Participants

This cross-sectional online survey was administered from 2 March to 9 March 2020, when COVID-19 cases started to increase globally. The online survey was anonymous, and a snowballing sampling technique was used to recruit participants. According to the Protection of Minors Law in China, the legal age of adulthood is 18 years old. Therefore, people who are aged 18 and above were invited to participate in this study. The Wen Juanxing online platform (https://www.wjx.cn/, from 2 March to 9 March 2020) was used to create the online survey and its link was sent through WeChat, the most popular social networking app, especially for the adult population in China. The survey link was initially disseminated through the researchers' social network and was subsequently expanded beyond this to include others across the country. It was explicitly specified that those who

received the shared survey link through WeChat had to be aged 18 or over, and participants gave implicit consent to begin the survey. The participants were informed about their rights to withdraw at any time prior to the questionnaire being submitted. Although a total of 4148 participants took part in the survey, only 3878 (from 31 provinces in China) were included in the analysis due to invalid responses (e.g., identified as younger than 18 years old, location revealed as Hong Kong, Macau, Taiwan). This study was approved by the Research Ethics Committee of Institutes of Psychological Sciences, Hangzhou Normal University (No. 20200301).

2.2. Measurements

Six experts in the fields of health behaviors and mental health who were external to the research team and institution were invited to review the questionnaire, and as a result some minor revisions were undertaken to enhance the content validity. A revised version of the questionnaire was pre-tested by 30 adults from both the urban (13 male, 17 female) and rural (16 male, 14 female) areas, to determine the suitability of the questions as well as their internal consistency. Results of the pre-tested survey found that internal consistency of the overall questionnaire items was within an acceptable limit (Cronbach'$\alpha > 0.7$). Questionnaire items that had a lower internal consistency were revised accordingly to ensure clearer expression and comprehension. Consequently, some minor changes were made to the questionnaire and subsequently used in the actual survey. The online questionnaire took approximately 10 to 15 min to complete.

The questionnaire survey was designed to be self-administered, which consisted of eight sections, namely, (1) Preventive knowledge, (2) Risk perception of infection, (3) Trust in government's COVID-19 pandemic mitigation measures, (4) Preventive behaviors, (5) Healthy lifestyle, (6) Anxiety symptoms, (7) Emotional response to home quarantine, and (8) Socio-demographic background (please see Appendix A.1. Survey Questionnaire (No. 20200301VER2)). Each of these will be briefly discussed in turn as follows.

Preventive knowledge: Participants' knowledge about preventing COVID-19 (e.g., susceptible people, ways of wearing a facemask, routes of transmission, and other recommendations for preventing transmission) was measured with four items. These items included (1) "People with low immune function and normal immune function can be infected by the COVID-19 virus," (2) "You can wear a mask on both sides to save money," (3) "Windows should be sealed at home to prevent the spread of the COVID-19 virus," and (4) "You should avoid direct contact with the eyes, mouth, and nose after touching public objects or facilities during COVID-19." Participants were to answer "Yes," "No," or "I don't know" to the above statements. For statements (1) and (4), the correct answers were "Yes," whereas the answers for statements (2) and (3) were "No." For every correct answer provided, one point would be allocated and tallied to the total. For every wrong answer provided or a response of "I don't know," zero point is awarded. A higher score (maximum of four points) indicated that the participants had a greater level of preventive knowledge regarding COVID-19.

Risk perception: Participants' risk perception was measured by three items related to their concerns of themselves, their family, or other people around them being infected with COVID-19. Participants were asked the following questions: (1) "Do you think you may be infected with COVID-19?," (2) "Do you think your family may be infected with COVID-19?," and (3) "Do you think people around you may be infected with COVID-19?" These items were assessed with a six-point Likert scale (i.e., 1 = Strongly disagree, 2 = Disagree, 3 = Slightly disagree, 4 = Slightly Agree, 5 = Agree, to 6 = Strongly agree). A higher score indicated that the participants perceived a greater risk of COVID-19 infection. The Cronbach's alpha for risk perception was 0.80, which was acceptable for internal consistency.

Trust in the government's mitigation measures to the COVID-19 pandemic: Four items were used to assess the public's trust in the Chinese government's response to the COVID-19 pandemic. Participants were asked the following using a six-point Likert scale (i.e.,

1 = Strongly disagree, 2 = Disagree, 3 = Slightly disagree, 4 = Slightly Agree, 5 = Agree, to 6 = Strongly agree): (1) "The government's policy on preventive measures against COVID-19 is credible," (2) "The government's policy on preventive measures against COVID-19 is correct," (3) "The government should develop a long-term plan to address the problem of COVID-19," and (4) "The government has the ability to resolve the problem of COVID-19." A higher score suggested that participants perceived a higher degree of trust in the Chinese government against COVID-19. The Cronbach's alpha for trust in government's pandemic mitigation measures achieved a good internal consistency, with a value of 0.95.

Preventive behaviors: Questions and variables related to preventive behaviors were based on the instrument developed by Wong et al. [20] and government sources in China, which included a total of 18 items categorized in five sections, namely, (1) Personal protection (seven items, e.g., wear a mask; eye protection; wash hands frequently with soap; avoid touching your eyes, nose, and mouth; use serving chopsticks; keep the windows and doors open for ventilation; and improve cleaning and disinfection), (2) Cough etiquette (four items, e.g., cover mouth and nose when coughing and sneezing; wash hands immediately after coughing, sneezing, or runny nose; wash hands after touching contaminated objects or people with coughing, sneezing, or runny nose), (3) Contact precautions (five items, e.g., avoid proximity (closeness) with other people, avoid group gathering, avoid taking public transportation, avoid the act of shopping in stores instead of online shopping, and avoid unnecessary outings), (4) Voluntary quarantine (one item, if I am feeling unwell I distance myself from others), and (5) Prompt reporting (one item, if I am feeling unwell I will immediately declare my symptoms to the authorities/healthcare providers). These items were assessed using a four-point Likert scale (i.e., 1 = Rarely, 2 = Occasionally, 3 = Often, 4 = Always). Participants were asked to answer each question about the preventive behaviors they had implemented during the COVID-19 outbreak. A higher score showed that participants displayed better preventive behaviors. The Cronbach's alpha for the preventive behaviors attained a good internal consistency with a value of 0.83.

Healthy lifestyle: Participants' healthy lifestyle was measured by assessing the frequency of performing five health-related activities, namely, (1) regular physical exercise, (2) paying attention to nutrition, (3) going to sleep on time/getting adequate sleep, (4) focusing on positive emotions, and (5) taking the initiative to drink water) in the past month since the outbreak of COVID-19. Response options for each item included the following: 1 = Less than before, 2 = The same as before, 3 = A little more than before, and 4 = Much more than before. The Cronbach's alpha for healthy lifestyle was 0.83, which indicated good internal consistency.

Anxiety symptoms: Anxiety symptoms were measured using the six-item state version of the State–Trait Anxiety Inventory (STAI-6) [21]. The STAI-6 has demonstrated acceptable reliability and validity compared to those obtained using the full-form version of the STAI [21,22]. This study adopted the Chinese version of the STAI-6 that was used to understand the relationship between different measures of psychological wellbeing [23]. The STAI-6 has been previously used in research related to Chinese populations as well as SARS, and had good internal consistency (Cronbach's alpha = 0.90) [24,25]. In this study, participants were asked specifically how they felt in relation to the current COVID-19 outbreak in the context of statements that included six items related to feeling calm, tense, upset, relaxed, content, and worried. Response options for each item included the following: 1 = Not at all, 2 = Somewhat, 3 = Moderately, and 4 = Very much. This study adopted the measurements proposed by previous studies [26,27], but instead reversed the coding for positively worded items (calm, relaxed, content), and summed all six scores and multiplied the total score by 20/6 (range from 20 to 80). Those participants who had a score between 20 and 43 were regarded as having moderate symptoms, whereas anyone with a score of 44 and above were considered to have moderate to severe symptoms. The Cronbach's alpha of 0.80 for the six-item State-Trait Anxiety Inventory scale was regarded as indicating acceptable internal consistency.

Emotional response to home quarantine: Participants' emotional response to home quarantine was measured by 10 items related to boredom, quarantine, frustration, loneliness, melancholy, helplessness, anger, distress, depression, and stress. To address these 10 items, the following question was asked: "How did you feel when you were confined at home during the COVID-19 outbreak?" These items were assessed using a six-point Likert scale (i.e., 1 = Extremely disagree, 2 = Very much disagree, 3 = Somewhat disagree, 4 = Somewhat agree, 5 = Very agree, to 6 = Extremely agree). A higher score indicated the participant's emotional responses to home quarantine to be more negative. The Cronbach's alpha for the emotional response was 0.96, which indicated good internal consistency.

Socio-demographic variables (basic information): The socio-demographic information collected in the survey included (1) gender (male, female), (2) age (18~30, 31~50, 51 and above), (3) educational qualification (high school or below, college or undergraduate, postgraduate), (4) personal income (less than RMB 4000/month, RMB 4001~10,000/month, more than RMB 10,001/month), (5) occupation (students, employees, health care workers, migrant workers/peasants/jobless), (6) current residential area (urban, rural), and (6) cumulative risk area of infection (high-risk area, medium-risk area, low-risk area). The risk areas were categorized according to the cumulative number of confirmed cases in the country during the period of investigation.

2.3. Ethical Considerations

Anonymity and informed consent were assured. This study protocol was approved by the Research Ethics Committee of Hangzhou Normal University (No. 20200301). Participants were deemed to have agreed and provided consent to participate in the survey when they successfully completed and submitted the online questionnaire (please see Appendix A.1. A. Questionnaire introduction and informed consent for study participants).

2.4. Statistical Analysis

SPSS software 25.0 was used to perform the statistical analysis. Statistical significance was defined as $p < 0.05$. Descriptive statistics were used for all variables. Multiple linear regression analysis was used to identify the factors associated with participants' preventive behaviors and emotional response to home quarantine while controlling for socio-demographic variables. Multinomial logistic regression model was conducted to identify the factors influencing participants' anxiety symptoms during the COVID-19 outbreak while controlling for socio-demographic variables.

3. Results

3.1. Descriptive Statistics

As shown in Table 1, there were significantly more females (72.2%) than males (27.8%) who participated in this study. More than half of the participants were aged between 18 and 30 years old (53.4%), with the remaining age groups of 31–50 years old and 51 years old and above accounting for 38.4% and 8.2%, respectively. Most of the participants had attained college or undergraduate (62.1%) educational qualifications, and this was followed by postgraduate (20.2%) and high school or below (17.7%) qualifications. In terms of personal income, 55.5% of the participants earned less than RMB 4000/month, and this was followed by those earning between RMB 4001 and 10,000/month (35.9%) and more than RMB 10,001/month (8.6%). Most of the participants' were employees (50.7%), with the remainder being students (33.2%), migrant workers/peasants/jobless and others (12.6%), and health care workers (3.5%). There were more participants residing in urban areas (63.6%) than in rural areas (36.4%), and the majority of them were considered to be living in medium-risk (61.6%) areas of infection, whereas others were in low-risk (35.0%) and high-risk (3.4%) areas.

Table 1. Socio-demographic variables of participants (N = 3878).

	Participants		Population [1]
Variables	*n*	%	%
Gender			
Male	1079	27.8	51.2
Female	2799	72.2	48.8
Age			
18~30	2071	53.4	21.7
31~50	1490	38.4	33.1
51 and above	317	8.2	24.3
Educational qualification			
High school or below	687	17.7	88.8 (18 years and above)
College or undergraduate	2408	62.1	10.8 (18 years and above)
Postgraduate	783	20.2	0.3 (18 years and above)
Personal income			N/A
Less than RMB 4000/month	2152	55.5	
RMB 4001~10,000/month	1394	35.9	
More than RMB 10,001/month	332	8.6	
Occupation			N/A
Students	1288	33.2	
Employees	1966	50.7	
Health care workers	136	3.5	
Migrant workers/peasants/jobless and others	488	12.6	
Residing area			
Urban	2466	63.6	30.3% (cities)
Rural	1412	36.4	69.7% (villages and rural areas)
Cumulative risk area of infection [1]			
High-risk area	131	3.4	3.4
Medium-risk area	2391	61.6	61.7
Low-risk area	1356	35.0	35

[1] The official demographic statistics were retrieved from the latest version published by the National Bureau of Statistics, China. http://www.stats.gov.cn/tjsj/pcsj/rkpc/6rp/indexch.htm (accessed on 9 September 2021). N/A indicates data not available in the official database. Cumulative risk area of infection was categorized according to the cumulative number of infections in the 31 provinces across the country as of 10 March 2020. Provinces with more than 10,000 cumulative infections were classified as high-risk areas. Provinces with between 500 and ~10000 cumulative infections were classified as medium-risk areas. Provinces with less than 500 cumulative infections were classified as low-risk areas.

The findings revealed that the participants had a high level of preventive knowledge against COVID-19 (mean: 0.96, score 0~1). However, the result represents a coefficient of questionable reliability (Cronbach'α = 0.6) for consistency in the participants' preventive knowledge against COVID-19. The reason the Cronbach's α was not very high (less than 0.7) is because the value of Cronbach's α is most valuable in relation to single-construct scales; it is less informative when reported for instruments measuring several constructs of items of knowledge at once [25]. This question set comprised several discrete questions, and such items may not have correlated well with some other items.

The participants' level of public trust in the government's mitigation measures to the COVID-19 pandemic was high (mean: 5.09, score 1~6), but their risk perception was only at a moderate level (mean: 3.01, score 1~6). The participants indicated that they

displayed good preventive behaviors to prevent transmission of COVID-19 (mean: 3.58, score 1~4). In terms of healthy lifestyle behaviors, the findings were only at a reasonable level (mean: 2.06, score 1~4). The results revealed that the participants had a moderate to severe level of anxiety symptoms (mean: 48.2, score 20~80). As for emotional response to home quarantine, the findings showed that participants had a high level of negative emotion during the COVID-19 pandemic with a sample mean score of 3.34 (score 1~6). Table 2 below presents a summary of the key findings.

Table 2. Descriptive statistics of preventive knowledge, risk perception, public trust in government, preventive behaviors, healthy lifestyle, anxiety symptoms, emotional response to home quarantine (N = 3878).

Variables	Number of Items	Possible Range	Mean	SD	Cronbach'sAlpha
Preventive knowledge	4	0–1	0.96	0.12	0.60
Risk perception	3	1–6	3.01	1.20	0.96
Public trust in government	4	1–6	5.09	0.90	0.95
Preventive behaviors	18	1–4	3.58	0.39	0.84
Healthy lifestyle	5	1–4	2.06	0.63	0.83
Anxiety symptoms	6	20–80	48.20	11.30	0.80
Emotional response to home quarantine	10	1–6	3.34	1.08	0.96

3.2. Factors Associated with Preventive Behaviors

As shown in Figure 1, results from the multiple linear regression analysis indicated that factors associated with participants' preventive behaviors included their gender, age, educational qualification, residential area, cumulative risk area of infection, preventive knowledge, and public trust in the government (R^2 = 0.100, F = 27.97, $p < 0.001$). The findings indicated that female participants aged between 18 and ~30 years old who had educational qualifications of college and above, greater levels of preventive knowledge and higher public trust in the government, and resided in urban and medium-risk areas were more likely to display preventive behaviors during the pandemic (please refer to Table 3).

Table 3. Factors associated with preventive behaviors (N = 3878).

Variables	β	t	Adj. R^2	F
Constant		43.71 ***		
Gender (Reference: Female)				
Male	−0.13	−8.03 ***		
Age (Reference: 18–30)				
31–50	−0.05	−2.19 *		
51–70	−0.08	−4.31 ***		
Educational qualification (Reference: High school or below)				
College or undergraduate	0.07	2.54 *		
Postgraduate	0.06	2.47 *		

Table 3. *Cont.*

Variables	β	t	Adj. R²	F
Personal income (Reference: Less than RMB 4000/month)				
RMB 4000~10,000/month	0.03	1.55		
More than RMB 10,000/month	0.02	0.96		
Occupation (Reference: Students)				
Employees	0.04	1.52		
Health care workers	0.02	0.89		
Migrant workers/peasants/jobless and others	0.04	1.95		
Residing area (Reference: Rural)				
Urban	0.08	4.88 ***		
Risk area (Reference: Low-risk area)				
High-risk area	0.02	0.96		
Medium-risk area	0.05	3.35 **		
Preventive knowledge (4 items)	0.03	1.99 *		
Risk perception (3 items)	0.02	1.54		
Trust in the government's mitigation measures to the COVID-19 pandemic (4 items)	0.26	16.98 ***		
			0.100	27.97 ***

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

3.3. Factors Associated with Emotional Response to Home Quarantine

According to Figure 2, the results from the multiple linear regression analysis revealed that factors associated with participants' emotional response to home quarantine included their gender, preventive knowledge, risk perception, public trust in the government, preventive behaviors, and healthy lifestyle ($R^2 = 0.127$, F = 32.33, $p < 0.001$). As shown in Table 4, the findings suggested that males with a high level of risk perception of being infected with COVID-19 but a low level of preventive knowledge, trust in the government, and preventive behaviors and healthy lifestyles were more likely to have a negative emotional response to home quarantine.

3.4. Factors Associated with Anxiety during the COVID-19 Outbreak

With controlled socio-demographic variables, the multinomial logistic regression analyses indicated that factors associated with participants' anxiety were preventive knowledge (AOR = 0.36, 95% CI:0.19–0.70), risk perception (AOR = 1.17, 95% CI:1.10–1.24), trust in the government's response to the COVID-19 pandemic (AOR = 0.77, 95% CI:0.71–0.83), preventive behaviors (AOR = 0.69, 95% CI:0.57–0.84), and healthy lifestyle (AOR = 0.89, 95% CI:0.79–0.99). The findings suggested that female participants were more likely to have moderate to high levels of anxiety than males (AOR = 0.66, 95% CI:0.57–0.78). In addition, participants aged between 20 and ~30 years old were associated with a higher risk for moderate to high levels of anxiety than those aged 31 years and older (AOR = 0.61, 95% CI:0.50–0.74; AOR = 0.46, 95% CI:0.34–0.61). In comparison to participants who lived in urban areas, those who lived in rural areas were more likely to display moderate to high levels of anxiety (AOR = 0.81, 95% CI: 0.69–0.95) (please refer to Table 5).
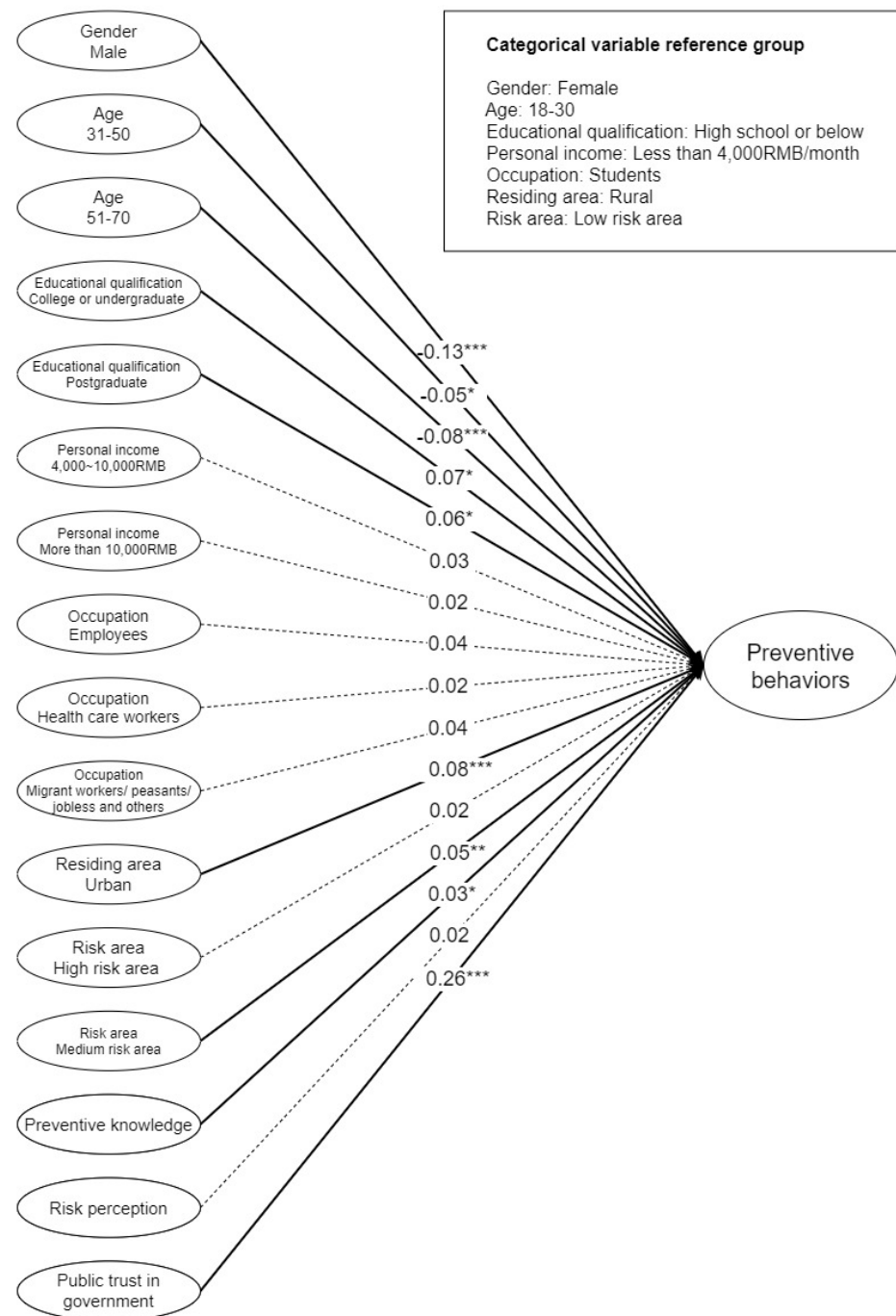
Figure 1. Multiple linear regression results of preventive behaviors and related factors. Notes: * *p* < 0.05, ** *p* < 0.01, *** *p* < 0.001.
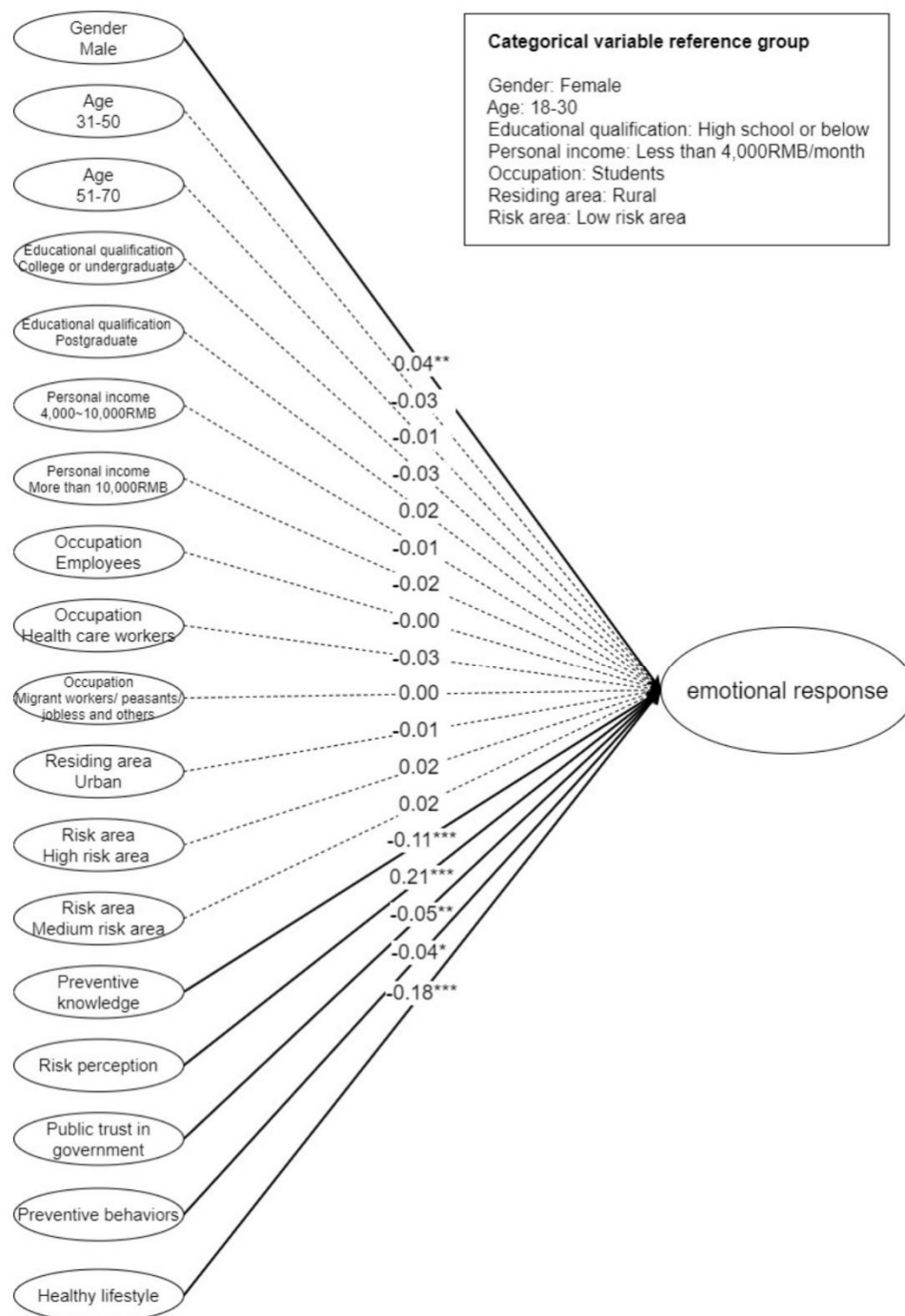
Figure 2. Multiple linear regression results of emotional response to home quarantine during the COVID-19 outbreak and related factors. Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4. Factors associated with emotional response to home quarantine during the COVID-19 outbreak (N = 3878).

Variables	β	t	Adj. R^2	F
Constant		23.63 ***		
Gender (Reference: Female)				
Male	0.04	2.76 **		
Age (Reference: 18–30)				
31–50	−0.03	−1.49		
51–70	−0.01	−0.57		
Educational qualification (Reference:				
High school or below)				

Table 4. *Cont.*

Variables	β	t	Adj. R²	F
College or undergraduate	−0.03	−1.15		
Postgraduate	0.02	−0.80		
Personal income (Reference: Less than RMB 4000/month)				
RMB 4000~10,000	−0.01	−0.48		
More than RMB 10,000/month	−0.02	−1.16		
Occupation (Reference: Students)				
Employees	−0.00	−0.18		
Health care workers	−0.03	−1.73		
Migrant workers/peasants/jobless	0.00	0.12		
Residing area (Reference: Rural)				
Urban	−0.01	−0.71		
Risk area (Reference: Low-risk area)				
High-risk area	0.02	0.99		
Medium-risk area	0.02	−1.39		
Preventive knowledge (4 items)	−0.11	−7.21 ***		
Risk perception (3 items)	0.21	13.46 ***		
Trust in the government's mitigation measures to the COVID-19 pandemic (4 items)	−0.05	−3.37 **		
Preventive behaviors (18 items)	−0.04	−2.30 *		
Healthy lifestyle (5 items)	−0.18	−12.04 ***		
			0.127	32.33 ***

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5. Factors associated with anxiety during the COVID-19 pandemic (N = 3878).

Variables	Moderate to Severe Anxiety vs. Moderate Anxiety		
	Adj. OR	**95%CI**	
Gender (Reference: Female)			
Male	0.66 ***	0.57	0.78
Age (Reference: 18–30)			
31–50	0.61 ***	0.50	0.74
51–70	0.46 ***	0.34	0.61
Educational qualification (Reference: High school or below)			
College or undergraduate	0.96	0.76	1.21
Postgraduate	1.13	0.86	1.50
Personal income (Reference: Less than RMB 4000/month)			
RMB 4000~10,000/month	1.07	0.88	1.31
More than RMB 10,000/month	0.94	0.70	1.28
Occupation (Reference: Students)			
Employees	1.03	0.80	1.31
Health care workers	0.75	0.49	1.14
Migrant workers/peasants/jobless	1.05	0.77	1.43
Residing area (Reference: Rural)			
Urban	0.81 **	0.69	0.95
Risk area (Reference: Low-risk area)			
High-risk area	1.44	0.94	2.21
Medium-risk area	1.02	0.88	1.18
Preventive knowledge (4 items)	0.36 **	0.19	0.70
Risk perception (3 items)	1.17 ***	1.10	1.24
Trust in the government's mitigation measures to the COVID-19 pandemic (4 items)	0.77 ***	0.71	0.83
Preventive behaviors (18 items)	0.69 ***	0.57	0.84
Healthy lifestyle (5 items)	0.89 *	0.79	0.99

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4. Discussion

This study investigated the factors associated with mental health among China's adults in home quarantine during the COVID-19 pandemic. The findings showed that anxiety was a general emotional response to the COVID-19 pandemic. Individuals' preventive behaviors and mental health varied with gender, age, educational background, and areas in which they resided. Furthermore, the results showed that there was a significant association between preventive behaviors and mental health for this group of study participants.

4.1. Preventive Behaviors and Healthy Lifestyle during the Outbreak of COVID-19

Although the findings revealed that participants had a relatively high level of preventive behaviors in general, their behavior of using public chopsticks and spoons was lower than the overall mean score. This was somewhat unexpected despite most participants reporting that they followed and practiced the guidelines (e.g., washing hands with soap after touching contaminated objects, avoiding touching their eyes, mouth, or nose) stipulated by the government. This could be explained by participants' high adherence to the stay-at-home order, and other measures such as showing their health status code and checking their body temperature when going out, or preventive guidance from the government to maintain hygiene and personal health habits [6]. However, participants might not have been aware that eating together or sharing tableware in public were also regarded as close contact approaches that could spread COVID-19, and this might have occurred unconsciously. Previous studies suggested that younger females who had higher educational qualifications and resided in urban and medium-risk areas were more likely to display better preventive behaviors [6,28]. Although some of these were supported by the findings in this study, positive associations between younger age and preventive behaviors were found. This could possibly be explained by young people and urban residents who had better skills, knowledge, and infrastructure to access preventive health information from the media or Internet [29,30]. Furthermore, people who resided in a medium-risk area would be more concerned about their health conditions and infection risk, and therefore more likely to exhibit preventive behaviors. The findings in this study prompted the government to pay more attention to older males with lower educational qualifications who lived in rural and high-risk areas. Although the participants did not indicate significant changes in their lifestyle, there was less physical outdoor exercise during the outbreak, and this could be attributed to the adherence to home quarantine [31,32].

4.2. Emotional Response to Home Quarantine and Anxiety during the COVID-19 Outbreak

The findings in this study revealed serious negative emotions regarding home quarantine, and this was evident by more than half of the participants reporting moderate to high levels of anxiety during the COVID-19 pandemic, which was higher than the prevalence in other surveys [8,33,34]. According to the results, males and those living in rural areas were more likely to have a negative emotional response to home quarantine. A possible explanation to this might be that males in China have traditionally been the primary breadwinners in the household and had to be out working to support the family; thus, they may have found it emotionally challenging to be quarantined at home, especially for an extended period [35]. On the other hand, females aged between 18 and 30 years old were found to display a higher prevalence of moderate to high levels of anxiety, and this aligned with previous research where anxiety was more likely to occur in young females [7,8,36]. A possible reason for this might be that women tended to seek COVID-19-related information via social media channels and were more likely to be excessively exposed to the risk of non-authoritative and distrustful information [37–39]. Other studies also found that females were more likely to experience reduced social interactions during the pandemic, which could have led to increased anxiety and depression [40,41].

4.3. The Role of Public Preventive Knowledge, Risk Perception, Trust in the Government's Mitigation Measures to the COVID-19 Pandemic, and Healthy Lifestyle in Behavioral and Psychological Response

During the COVID-19 outbreak, the Chinese government implemented stringent prevention and control measures, including nationwide social distancing, public health education, home quarantine, and travel restrictions [6]. This could be a key reason as to why participants showed a high level of preventive knowledge against COVID-19 and public trust in the government.

The findings also revealed that participants had a medium level of risk perception about the risk of infection with COVID-19. As of March 3, 2020, the cumulative number of diagnosed patients and confirmed cases had seen a progressive reduction, whereas the number of diagnosed people who had recovered from the disease had increased [37]. Such a positive development of the circumstance could have contributed to reducing people's perception of risk of infection.

The results in this study also suggested that participants had high levels of preventive knowledge and public trust in the government, which could have contributed to enhancing their preventive behaviors [6,42]. Although the findings indicated that a high-level perception of the risk of infection was positively associated with psychological problems, preventive knowledge, public trust in the government, healthy lifestyle, and preventive behaviors were found to have a negative association instead. This suggests the need for increase health education and awareness about preventive knowledge, mental health programs, and promotional campaigns for public trust in the government, which could be considered actions to be undertaken to minimize psychological problems during the outbreak of infectious diseases.

5. Limitations and Future Research

This study had several limitations. Firstly, like other previous studies [3,29] conducted during the COVID-19 pandemic, this study used an online questionnaire survey to collect data that aimed to avoid physical contact and possible infection. Participants were only those who had online access and could not be regarded as representative of the population at large; therefore, generalization of the findings was not possible. Future research might consider the use of traditional methods (e.g., mail, face-to-face) for the questionnaire survey to enhance the sample representation.

Secondly, this study used the convenience sampling technique, which might have resulted in an unbalanced and underrepresented sample size from the geographical areas. There were more samples gathered from the developed regions of eastern China than those from the central, western, and northeastern parts of China. An area-based stratified random sampling technique could be adopted for future studies to ensure a better geographical representation and sample size.

Thirdly, this study was conducted in China and thus limited to this context only. Future studies could be replicated in other countries [43] to examine and compare the key similarities and differences that contribute toward extending the literature.

Lastly, this study mainly focused on male and female gendered factors associated with preventive behaviors and mental health. Future research could be extended to examine the mental health issues of transgender individuals during the COVID-19 pandemic [44,45].

6. Conclusions

This study investigated the factors associated with preventive behaviors and psychological problems among adults in China during the outbreak of COVID-19. Participants who were more likely to self-report mental health problems were characterized as being a young female adult living in a rural area who had a lower level of preventive knowledge, had public trust in the government, led a healthy lifestyle, and had a higher perception of risk of infection. On the other hand, participants who were more knowledgeable about preventing infection with the COVID-19 virus and had a higher level of trust in the government

were more likely to exhibit preventive behaviors and less likely to encounter psychological problems. For China and other understudied countries in similar regions/conditions, the findings in this study could help formulate targeted health interventions and mental health programs for vulnerable groups related to gendered vulnerabilities. In addition, promotional campaigns could aim to better manage and minimize mental health problems and improve preventive behaviors, especially during the period of a pandemic [46].

Appendix A

Appendix A.1 Survey Questionnaire No. 20200301VER2

A. Questionnaire introduction and informed consent for study participants

To whom it may concern:

This is a survey questionnaire on preventive behaviors subsidized by the Cultivation Project of Zhejiang Provincial Advantageous and Characteristic Disciplines in the Jing Hengyi College of Education of Hangzhou Normal University (No. 19JYXK005), the Zhejiang Provincial Educational Science Planning Research Subject (No. 2020SCG012), subsidized by the research funds of Hangzhou Normal University (No. RWSK20200406), PR China. The main objective of this questionnaire is to gain a better understanding on the protective behaviors among adults during the COVID-19 pandemic in China. Participants are deemed to have agreed and provided consent to participate in the survey when they have successfully completed and submitted the online questionnaire. Please note that each questionnaire can take approximately 15 min to complete. Thank you for taking the time to complete it.

This questionnaire has been designed to be completed anonymously and will not identify any individual participant. The research team will take all reasonable steps to maintain your privacy and the confidentiality of the data collected. The research results will be published in academic journals with the findings reported as a summary where no individuals will be identified. There are no commercial benefits derived from this study.

Please do not feel obliged to participate in this study; however, once you have started and submitted your answers, you are deemed to have agreed to participate. Since this questionnaire is not pre-coded for any identification purpose, the research team will not be able to delete the questionnaire and its contents once it has been filled out and submitted.

If you wish to inquire about the content of this questionnaire or are interested in knowing the results of the research, you are welcome to request a summary of the research results by contacting project team member Wei-Ta Fang, Tel.: +886-939859399, email: wtfang@ntnu.edu.tw. Graduate Institute of Environmental Education, National Taiwan Normal University (NTNU).

<div align="right">
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</div>

B. Basic information

1. Gender: ☐Male ☐Female
2. Age _____
3. Education qualification: ☐ High school or below ☐ College or undergraduate ☐ Post-graduate
4. Personal income: ☐ Less than RMB 4000/month ☐ RMB 4000/month RMB ~10,000/month ☐ More than RMB 10,000/month
5. Occupation: ☐ Student ☐ Employee ☐ Health care worker ☐ Migrant worker/peasant/jobless and other
6. Do you reside in an urban or rural area? ☐ Urban ☐ Rural
7. Place (Where you live): _____ (City/town/village, Province)

C. Questions

Question set 1 (4 items):

Please fill in the level of agreement to the best of your understanding of the following statements.	Yes (1)	No (2)	I don't know (3)
(1) People with low immune function and normal immune function can be infected by the COVID-19 virus.	☐	☐	☐
(2) You can wear a mask on both sides to save money.	☐	☐	☐
(3) Windows should be sealed at home to prevent the spread of the COVID-19 virus.	☐	☐	☐
(4) You should avoid direct contact with the eyes, mouth, and nose after touching public objects or facilities during COVID-19.	☐	☐	☐

Question set 2 (8 items):

Please fill in the level of agreement to the best of your understanding of the following statements.	Strongly disagree (1)	Disagree (2)	Slightly disagree (3)	Slightly Agree (4)	Agree (5)	Strongly agree (6)
(1) Do you think you may be infected with COVID-19?	☐	☐	☐	☐	☐	☐
(2) Do you think your family may be infected with COVID-19?	☐	☐	☐	☐	☐	☐
(3) Do you think people around you may be infected with COVID-19?	☐	☐	☐	☐	☐	☐
(4) The government's policy on preventive measures against COVID-19 is credible.	☐	☐	☐	☐	☐	☐
(5) The government's policy on preventive measures against COVID-19 is correct.	☐	☐	☐	☐	☐	☐

(6) The government should develop a long-term plan to address the problem of COVID-19.	☐	☐	☐	☐	☐	☐
(7) The government has the ability to resolve the problem of COVID-19.	☐	☐	☐	☐	☐	☐
(8) How did you feel when you were confined at home during the COVID-19 outbreak?						
Boredom	☐	☐	☐	☐	☐	☐
Quarantine	☐	☐	☐	☐	☐	☐
Frustration	☐	☐	☐	☐	☐	☐
Loneliness	☐	☐	☐	☐	☐	☐
Melancholy	☐	☐	☐	☐	☐	☐
Helplessness	☐	☐	☐	☐	☐	☐
Anger	☐	☐	☐	☐	☐	☐
Distress	☐	☐	☐	☐	☐	☐
Depression	☐	☐	☐	☐	☐	☐
Stress	☐	☐	☐	☐	☐	☐

Question set 3 (18 items):

Please fill in the level of frequency to the best of your understanding of the following statements.	Rarely (1)	Occasionally (2)	Often (3)	Always (4)
(1) Do you use some personal protection?				
Wear a mask.	☐	☐	☐	☐
Eye protection.	☐	☐	☐	☐
Wash your hands frequently with soap.	☐	☐	☐	☐
Avoid touching your eyes, nose, and mouth.	☐	☐	☐	☐
To stop the spread of the virus, I had better use serving chopsticks.	☐	☐	☐	☐
Keep the windows and doors open for ventilation.	☐	☐	☐	☐
Improve cleaning and disinfection.	☐	☐	☐	☐
(2) Do you use some respiratory etiquette/cough etiquette?				
Cover your mouth and nose with a tissue when you cough or sneeze.	☐	☐	☐	☐
Dispose tissue paper immediately after coughing or sneezing.	☐	☐	☐	☐
Wash your hands immediately after coughing or sneezing.	☐	☐	☐	☐
Perform hand hygiene (e.g., hand washing with soap or antiseptic handwash) after having contact with respiratory secretions or contaminated objects.	☐	☐	☐	☐
(3) Do you use any contact precautions?				
Avoid proximity (closeness) with other people.	☐	☐	☐	☐
Avoid group gathering.	☐	☐	☐	☐
Avoid taking public transportation.	☐	☐	☐	☐
Avoid the act of shopping in stores instead of online shopping.	☐	☐	☐	☐
Avoid unnecessary outings.	☐	☐	☐	☐
(4) Do you do any voluntary quarantine?				
If I am feeling unwell, I distance myself from others.	☐	☐	☐	☐

(5) Prompt reporting				
If I am feeling unwell, I will immediately declare my symptoms to the authority/healthcare providers.	☐	☐	☐	☐

<div align="center">Question set 4 (5 items):</div>

Please fill in the level of frequency to the best of your understanding of the following statements.	Less than before (1)	The same as before (2)	A little more than before (3)	Much more than before(4)
(1) Do you do any regular physical exercise during the COVID-19 outbreak?	☐	☐	☐	☐
(2) Do you pay attention to nutrition during the COVID-19 outbreak?	☐	☐	☐	☐
(3) Do you go to sleep on time and get adequate sleep during the COVID-19 outbreak?	☐	☐	☐	☐
(4) Do you focus on positive emotions during the COVID-19 outbreak?	☐	☐	☐	☐
(5) Do you take the initiative to drink water during the COVID-19 outbreak?	☐	☐	☐	☐

<div align="center">Question sets 5 (6 items):</div>

Please fill in the level of your feeling to the best of your understanding of the following statements.	Not at all (1)	Somewhat (2)	Moderately (3)	Very much (4)
How are you feeling during the COVID-19 outbreak?				
Calm	☐	☐	☐	☐
Tense	☐	☐	☐	☐
Upset	☐	☐	☐	☐
Relaxed	☐	☐	☐	☐
Content	☐	☐	☐	☐
Worried	☐	☐	☐	☐

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