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Gap in protective behaviors between Han and minority ethnicities during COVID-19 pandemic in rural western China: A decomposition analysis

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ABSTRACT

Understanding the ethnic gap in protective behavior and its explanatory factors is a promising step for reducing pandemic-induced disparities. However, no studies have endeavored to identify the factors contributing to a gap in protective behaviors between Han and minority ethnicities during COVID-19 pandemic in rural China. We aimed to analyze the gap in protective behaviors between Han and minority residents in rural China. We conducted cross-sectional studies in multi-ethnic rural China in 2020. A total of 1640 participants from Han and minority groups were invited to participate. The decomposition method was applied to analyze the gap in protective behaviors and its associated factors between the Han and minority groups. Participants in the Han group had a higher protective behavioral score (9.26 ± 1.20) than the minority group (8.97 ± 1.50), yielding a significant gap in protective behaviors between Han and minority ethnicities of 0.29. Socio-demographic characteristics, health status, the degree of knowledge held about COVID-19, and psychological responses to COVID-19 explained 79.3 % (0.23/0.29) of the behavioral gap between the Han and minority groups. The difference in household asset levels was the largest explained contributor to the behavioral gap (52.17 %) (0.12/0.23), followed by fear felt for COVID-19 (−21.74 %) (−0.05/0.23). Differences in educational attainment, degree of knowledge held about COVID-19, and self-efficacy in response to COVID-19 each explained 17.4 % (0.04/0.23) of the behavioral gap. In conclusion, Han group show greater protective behaviors than minority ethnic groups. To drive better protective behavior in the most vulnerable communities, targeted, group-specific COVID-19 preventative messages deployed in public health communication strategies is suggested to enhance individual confidence in coping with the pandemic while creating a healthy amount of fear for public health crisis.

1. Introduction

The novel coronavirus disease 2019 (COVID-19) has become not only a public health crisis but also a serious threat to social and economic development worldwide (Bank, 2021; Organization, 2021a). The COVID-19 pandemic has triggered the deepest global recession in decades, prompting a 5.2 percent contraction in the global economy that has left lasting scars on productivity rates around the world (Bank, 2021). In China, although nationwide disease control measures have continued to keep case numbers low, China's disease control policies have cost hundreds of billions of dollars in its domestic productivity (Jin et al., 2021).

COVID-19 virus can spread from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak, sing or breathe. Another person can then contract the virus when infectious particles that pass through the air are inhaled at short range, this is often called short-range airborne transmission (Organization, 2021c). Since the start of the COVID-19 pandemic, the World Health Organization (WHO) has recommended the practice of protective behaviors by all individuals to guard themselves from infection (Organization, 2021b). Encouraging and motivating people to comply with specific behaviors regarding social distancing and hygiene has previously proven effective in mitigating

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other infectious disease outbreaks (Fong et al., 2020; Fung and Cairncross, 2006; Low, 2010; Vardavas et al., 2020).

Recent data has revealed ethnicity and race as factors influencing COVID-19 protective behavior adoption, though the findings are mixed (Afolabi et al., 2022; Alsan et al., 2020; Breakwell et al., 2021; Dickinson et al., 2021; Gross et al., 2020; Hearne and Niño, 2021; Renee Luthra and Holford, 2021). In the USA, two studies found that Black Americans were more likely to practice protective behaviors than White Americans (Dickinson et al., 2021; Hearne and Niño, 2021). Similarly, in the UK, participants belonging to non-White minority groups—or Blacks, Asians, and minority ethnic British—reported a greater likelihood of adopting protective behaviors than White British participants (Breakwell et al., 2021). However, another United Kingdom study reported mixed findings — Black, Asian, and White Non-British participants were found to be more likely to report always practicing handwashing and wearing masks than their White British counterparts, while White British participants were found to be more likely to practice social distancing than Black and Asian British participants yet were less likely to do so than White non-British participants (Renee Luthra and Holford, 2021).

Preliminary data gathered in low- and middle-income countries (LMICs) have revealed similar ethnic and racial protective behavior disparities. A study in Nigeria with participants from several minority ethnic groups concluded that a higher level of adherence to COVID-19 protective behaviors was significantly associated with the ethnicity of the participant (Afolabi et al., 2022). Additionally, a study that sampled from the general population in China found that participants belonging to minority ethnic groups were less likely to wear face masks and wash their hands than Han participants during the pandemic (Lv et al., 2021; Wang et al., 2020). Han population is the largest ethnic group in China, comprising more than 90 % of the population. Han population had a relatively higher level of social economic status than minority population (China, 2021). Evidence also showed health disparities between Han and minority ethnic groups in China, which is mainly due to inequalities in endowments (Liu and Zhang, 2019; Ouyang and Pinstrup-Andersen, 2012). During COVID-19 pandemic, owing to the differences of SES, health belief, and accessing to the medical services, health disparities were also found between Han and minority ethnic group in China (Gallifant et al., 2023). More importantly, racial and ethnic disparities in COVID-19 protective behavior adoption in LMIC settings have been identified in the literature as potentially contributing to widening the gap in risk of infection between different racial and ethnic groups (Alsan et al., 2020; Gross et al., 2020).

However, to the best of our knowledge, research in LMIC settings has not adequately explained the ethnic gap in protective behavior adoption and its contributors in rural, more resource-poor populations. The primary objective is to estimate the overall gap of protective behaviors adopted in response to COVID-19 between Han participants and minority participants from rural China. Our secondary objective is to assess how significantly each factor contributes to the gap in protective behaviors.

2. Methods

2.1. Study design and participants

The data presented in this study come from two cross-sectional studies conducted in 2020 in Sichuan Province, a province in western China. In the first study's survey done in May 2020, we used a multistage cluster sampling method to select the study sample. For this sample, 829 participants from 80 townships across four counties were enrolled. In the second study's survey done in August 2020, a multistage cluster sampling approach was also used to select the study sample, which enrolled 823 participants from 36 townships across six counties. Both the 80 townships in the first survey and the 36 townships in the second survey were selected from the list of national poverty-stricken counties in Sichuan Province (China, 2011). In total, the research team surveyed 1652 participants across both studies, 12 participants failed to answer the questions on risk perception and protective behavior, the response rate was 99.2 % (1640/1652), our final analytical sample includes 1640 participants.

Although the survey questionnaires used in both study's surveys were identical, the approach to data collection varied between them. The data of the first survey were collected by trained enumerators through telephone interviews during China's first wave of COVID-19 lockdowns in early 2020. The data of the second survey were collected by trained enumerators through face-to-face interviews. All telephone interviewees were from the Han group and all face-to-face interviewees were from the minority group.

2.2. Measures

2.2.1. Outcome variable

Self-protective behaviors in response to COVID-19, the outcome variables of this study, were defined as behavioral responses of the participants to the COVID-19 pandemic. This definition was based on the guidelines from the WHO for healthy people in response to COVID-19 and previous studies (Bruine de Bruin and Bennett, 2020; Nivette et al., 2021; Organization, 2021b). Self-protective behaviors in our study included mask-wearing and handwashing, which was measured two questions: (a) "During the lockdown, did you wear masks when going outside?" and (b) "During the lockdown, did you wash your hands with soap or detergent after returning home?" Responses to both questions were rated on a 5-point Likert scale. The score of protective behaviors therefore ranged from 2 to 10, with higher scores indicating better protective behaviors adopted during the pandemic.

2.2.2. Explanatory variables

Socio-demographic characteristics. The first block of explanatory variables in our study collected the socio-demographic characteristics of the participants, including age, gender, educational attainment, occupation, and the level of household assets.

Health status. The second block of explanatory variables measured the self-reported health status of participants. Participants were asked the question, "How would you rate your health status?" and were asked to report their opinion on a 5-point Likert scale.

Knowledge of COVID-19. The third block of explanatory variables measured the participants' degree of knowledge held about COVID-19. To measure the degree of COVID-19 knowledge held, participants were asked, "Do you know how to prevent COVID-19?" They then provided a response that was rated by survey enumerators on a 5-point Likert scale.

Psychological responses to COVID-19. The fourth block of explanatory variables measured the psychological responses of the participants to COVID-19, which we defined as a multi-dimensional construct based on empirical evidence (Li, 2018; Maloney et al., 2011; Popova, 2011; Rosenstock, 1974; Witte, 1992; Witte, 1996) that included three variables: self-efficacy, perceived risk, and fear. We defined self-efficacy as the belief in one's ability to perform a recommended response in order to avert a threat (Maloney et al., 2011; Witte, 1996). To measure the degree of self-efficacy, participants were asked, "When taking precautionary measures for COVID-19, if you encountered a problem, to what extent do you believe you could address it?" Their response was then rated by survey enumerators on a 5-point Likert scale.

We defined perceived risk as the subjective evaluation of the risk contained in a health threat (Popova, 2011) as well as a cognitive construct comprised of two quantifiable dimensions: perceived susceptibility and perceived severity (Li, 2018; Popova, 2011; Rosenstock, 1974). Perceived susceptibility referred to the perceived likelihood that a risk will directly affect an individual (Li, 2018; Popova, 2011; Rosenstock, 1974), participants were asked, "What was the probability of becoming infected with COVID-19 to you?". Perceived severity

measured the participant's perceived seriousness of a risk (Li, 2018; Popova, 2011; Rosenstock, 1974). It was assessed by the question, "If you were infected with COVID-19, would you think of it as fatal?". Their responses were rated on a 5-point Likert scale.

We defined fear as a negative emotional reaction to a perceived threat (Popova, 2011; Witte, 1992). To assess the scared and anxious emotion items, participants were asked, "Does COVID-19 make you feel scared?" and "Does COVID-19 make you feel anxious?" respectively. Responses to both questions were rated on a 5-point Likert scale.

2.2.3. Statistical analysis

Our descriptive analyses assessed the statistical values of the variables that measured our study's outcomes of interest and explanatory variables. Continuous variables were expressed as means and SDs, and categorical variables as numbers and percentages.

We used the Blinder-Oaxaca type decomposition method to decompose the gap in protective behaviors between Han and minority groups. The Blinder -Oaxaca decomposition method was applied to study labor market wage discrimination in gender and race (Nielsen, 1998). Nielsen (1998) concludes that discrimination accounted for 26 % of the gender difference in formal sector employment in Zambia, while qualification only accounted for 4.5 % (Nielsen, 1998). The Blinder-Oaxaca decomposition method has been used to wider areas to detect the roots of differences, which provide ideal method for this study (Anyamele et al., 2022; Dang and Viet Nguyen, 2021; Walsh and Grey, 2019). We decomposed the gap into two components. The first component was explained by differences in socio-demographics, health status, knowledge of COVID-19, self-efficacy in response to COVID-19, perceived risk, and fear of COVID-19. In the rest of the analysis, we referred to this component as that due to "differences in characteristics." The second component was due to between-group differences in returns to characteristics. The gap in protective behaviors between Han and minority ethnicities (or the difference in behavior scores) was therefore expressed as:

$$(Y_H^* - Y_M^*) = (X_H^* - X_M^*)\beta_H + X_M^*(\beta_H - \beta_M) \quad (2)$$

where Y_H^* and Y_M^* were the predicted mean scores of protective behaviors among Han and minority groups, X_H^* and X_M^* were the mean characteristics of Han and minority groups (including $S_{ib}H_{ib}K_{ib}E_{ib}R_{ib}F_{ib}$), and β_H and β_M were the returns to characteristics for Han and minority groups as estimated using equation (1) above. Thus we decomposed the overall difference in protective behaviors into two portions. The first portion was attributable to differences in the quantity of characteristics, evaluated using Han returns, $(X_H^* - X_M^*)\beta_H$, which became the "explained gap." The second portion, $X_M^*(\beta_H - \beta_M)$, was that attributable to differences in returns to the characteristics of the Han and minority groups, which became the "unexplained gap." All analyses were conducted in STATA 14.1. P-values less than 0.05 were considered statistically significant.

Ethical approval

This study was approved by the Sichuan University Ethical Review Board (approval number: KS2020246). All methods were carried out in accordance with relevant guidelines and regulations. Participants in both studies provided written informed consent for their involvement.

3. Results

3.1. Summary statistics by ethnicity

Table 1 highlights several significant differences between the Han and non-Han minority group subsamples. Out of the total sample, 499 participants (499/1640, 30.43 %) identified themselves as belonging to a minority ethnic group (Yi or Tibetan). Compared to participants in the Han group, the minority group had participants that were significantly older and with significantly fewer women. Additionally, the minority group had participants with significantly lower levels of education, a significantly lower proportion of stay-at-home caretakers, and households with lower asset levels (all P <.001). When it came to health status, more participants in the minority group reported a health status

Table 1
Summary statistics between Han and minority residents in rural western China in 2020.

Characteristics	Han (n=1141)		Minority (n=499)		*P* value of difference
	n/ mean	%/*sd*	n/ mean	%/*sd*	
Age	32.6	11.2	35.5	13.2	<0.001
Gender (Female=yes)	1126	98.7	398	79.8	<0.001
Educational attainment (High school or higher=yes)	394	34.5	44	8.8	<0.001
Occupation					<0.001
Stay-at-home caregiver	835	73.2	171	34.3	
Other	306	26.8	328	65.7	
Household assets level					<0.001
Lower level	315	27.6	429	86.0	
Higher level	826	72.4	70	14.0	
Health status [a]					<0.001
Very bad	2	0.2	2	0.4	
Bad	31	2.7	26	5.2	
Moderate	275	24.1	74	14.8	
Good	615	53.9	134	26.9	
Very good	218	19.1	263	52.7	
Knowledge of COVID-19					<0.001
Not at all	33	2.9	54	10.8	
A little	84	7.4	79	15.8	
Somewhat	372	32.6	93	18.6	
Moderately well	540	47.3	201	40.3	
Very well	112	9.8	72	14.4	
Self-efficacy					<0.001
Very unsure	11	1.0	31	6.2	
Moderately unsure	48	4.2	51	10.2	
Moderately confident	236	20.7	114	22.8	
Confident	529	46.4	171	34.3	
Very confident	317	27.8	132	26.5	
Susceptibility					<0.001
Not at all	417	36.5	234	46.9	
Probably not	489	42.9	140	28.1	
Moderate	131	11.5	55	11.0	
Probably	90	7.9	49	9.8	
Definitely	14	1.2	21	4.2	
Severity					<0.001
Not at all	42	3.7	21	4.2	
Probably not	194	17.0	59	11.8	
Moderate	187	16.4	81	16.2	
Probably	457	40.1	176	35.3	
Definitely	261	22.9	162	32.5	
Scared emotion					<0.001
Never	171	15.0	74	14.8	
Rarely	167	14.6	30	6.0	
Sometimes	244	21.4	37	7.4	
Very often	421	36.9	146	29.3	
Always	138	12.1	212	42.5	
Anxious emotion					<0.001
Never	269	23.6	131	26.3	
Rarely	210	18.4	40	8.0	
Sometimes	288	25.2	70	14.0	
Very often	289	25.3	136	27.3	
Always	85	7.4	122	24.4	
Score of protective behaviors adopted in response to COVID-19 [a]	9.26	1.20	8.97	1.50	<0.001

[a] The score of protective behaviors adopted in response to COVID-19 was developed based on the combination of the mask-wearing and handwashing scores. Thus the score of protective behaviors ranged from 2 to 10, with higher scores indicating better protective behaviors adopted during the pandemic.

of "very good" compared to those in the Han group (P <.001). For knowledge of COVID-19 and psychological responses to COVID-19, participants in the Han group had relatively higher levels of knowledge as well as higher levels of self-efficacy in response to COVID-19 compared to minority participants (all P <.001). However, we observed the opposite result when it came to participants' perceived severity and overall emotional response to the pandemic, as participants in the minority group had higher levels of perceived risk, fear of COVID-19, and the anxious emotion item compared to participants in the Han group (all P <.001). For the overall protective behavior score, those in the Han group had a higher score (9.26 ± 1.20) than the mean level of the total sample (9.12 ± 1.31), while those in the minority group had a lower score than the mean level of the total sample (8.97 ± 1.50). The Han group's protective behavioral score significantly higher than the minority group's protective behavioral score (P <.001).

3.2. Decomposition results

Table 2 presents the results of the Blinder-Oaxaca decomposition. The first and second rows provide the respective mean scores of protective behaviors among the Han and minority groups. The third row shows the estimated total gap in protective behaviors between the Han and minority groups. The fourth row gives the total gap estimated due to differences between the Han and minority groups' characteristics. Finally, estimated subtotals for each category of included characteristics (socio-demographics, health status, degree of knowledge held about COVID-19, and psychological responses to COVID-19) are summed up in the fourth row.

Table 2
Detailed decomposition with protective behaviors adopted in response to COVID-19 among rural residents in western China in 2020.

Elements	Mean/ β	95 % CI		P value	Explained change (%)
Protective behavior score among Han residents	**9.26**	**9.19**	**9.33**	<00.001	–
Protective behavior score among minority residents	**8.97**	**8.83**	**9.10**	<00.001	–
Total gap in protective behaviors between Han and minority	**0.29**	**0.14**	**0.44**	<00.001	–
Gap explained by differences between all included variables	**0.23**	**0.11**	**0.35**	<00.001	79.31
Unexplained gap	0.06	−0.11	0.23	0.48	20.69
Contribution of explained variables to gap					
Age	**−0.02**	**−0.04**	**−0.00**	0.049	−8.70
Gender	0.04	−0.03	0.10	0.27	17.39
Educational attainment	**0.04**	**0.00**	**0.08**	0.03	17.39
Occupation	0.04	−0.01	0.09	0.14	17.39
Household assets level	**0.12**	**0.04**	**0.20**	0.005	52.17
Health status [a]	−0.03	−0.06	0.01	0.10	−13.04
Knowledge on COVID-19 [a]	**0.04**	**0.01**	**0.06**	0.005	17.39
Self-efficacy [a]	**0.04**	**0.02**	**0.07**	0.003	17.39
Perceived susceptibility [a]	0.01	−0.00	0.00	0.77	4.35
Perceived severity [a]	0.01	−0.01	0.01	0.63	−4.35
Scared emotion [a]	**−0.05**	**−0.09**	**−0.01**	0.02	−21.74
Anxious emotion [a]	0.01	−0.01	0.03	0.40	4.35

[a] The factors of health status, knowledge of COVID-19, self-efficacy, susceptibility, severity, and the scared and anxious emotion items were all measured through a participant's response to a corresponding survey question that was then rated by enumerators on a 5-point Likert scale. CI confidence interval. The bold fonts indicate the significant variables.

When examining the findings of the decomposition analysis, Table 2 reveals that the mean score of protective behaviors is 9.26 for the Han group and 8.97 for the minority group, yielding a significant behavior gap of 0.29. That is the gap in protective behavior scores is 0.29 and favors the Han (Han 9.26; minority 8.97; overall mean 9.12). According to the results of the analysis, if the minority group had the same characteristics as the Han group (including socio-demographics, health status, degree of knowledge held about COVID-19, and psychological responses to COVID-19), then the mean score of the protective behavioral scale for the minority group would increase by 0.23 (shown in row 4). Therefore, the Han-minority gap between socio-demographic characteristics, health status, degree of knowledge held about COVID-19, and psychological responses to COVID-19 explained 79.3 % (0.23/0.29) of the gap in protective behaviors between the Han and minority groups. In addition, following this set of findings in row 4, the decomposition analysis implied that differences in characteristics were unable to explain 20.7 % (0.06/0.29) of the gap in protective behaviors between the Han and minority groups (shown in row 5).

Our decomposition analysis also identified key specific variables accounting for differences between those in the Han and minority groups. First, the results of the decomposition analysis revealed that the difference in household asset levels was the largest explained contributor to the gap in protective behaviors between Han and minority ethnicities, as differences in household assets between those in the Han and minority groups accounted for 52.2 % (0.12/0.23) of the gap. The second largest explained contributor to the gap was the scared emotion item (−21.7 %, −0.05/0.23). Finally, differences in educational attainment, degree of knowledge held about COVID-19, and self-efficacy in response to COVID-19 each explained 17.4 % (0.04/0.23) of the gap.

4. Discussion

Although China's government announced nationwide mask mandates and suggested for its citizens to practice proper handwashing (Deng and Peng, 2020; Peng et al., 2020), our analysis demonstrated that there indeed existed a significant difference in the adoption of protective behaviors between the Han and minority groups, most of the identified gap in protective behaviors between Han and minority ethnicities can be explained by differences in socio-demographic characteristics, knowledge of COVID-19, and psychological responses to COVID-19.

We found that the influence SES factors played on protective behavior engagement in our study is consistent with previous studies finding that an individual's engagement in protective behaviors varies according to their SES. In Mexico, Korea, and the USA, people with lower SES were found to report practicing fewer protective behaviors than people with higher SES (Irigoyen-Camacho et al., 2020; Lee et al., 2022; Papageorge et al., 2021). This could be explained by the differences of resources and cognitions among people with different level of SES. For example, people with lower levels of SES usually reside in areas with limited resources, hard to access to personal protective materials, such as masks and soap (Wang et al., 2020). Another side, people with higher levels of SES had better access to public health information and understand better the government-recommended precautious measures (Ali et al., 2021). These are important individual and environmental determinants of self-protective behavior in response to COVID-19. Although outside of these studies there has been only a limited attempt made to explain how SES differences contribute to protective behavior adoption, we nonetheless consider it highly plausible that because SES differences are at the root of all health disparities (Carter-Pokras and Baquet, 2002; Kennedy et al., 2007; Miao and Wu, 2016), that SES's effect has simply been exacerbated by the COVID-19 pandemic.

We now turn to our finding that higher fear responses to COVID-19 were more likely to be found in the minority group than in the Han group. Evidence indicated that fear of infection is significantly

associated with vaccine hesitance (Willis et al., 2021). Although we did not measure the practices of vaccines, we assumed that the association of the difference of fear of infection between could be explained by their difference of vaccine hesitancy. More importantly, the difference in fear levels between the Han and minority groups explained a considerable part of the gap in protective behaviors between Han and minority ethnicities. According to the data, the higher levels of fear experienced by those in the minority group may have actually decreased the Han-minority behavior gap. This finding is in line with previous evidence suggesting that a participant belonging to a minority group who experienced more fear of COVID-19 would, in general, be better at practicing protective behaviors (Liu and Zhang, 2019; Wang et al., 2020). A possible explanation for this finding is that those belonging to more vulnerable populations, such as the participants in our study's minority group, often find it harder to access accurate COVID-19 information due to lower educational attainment and higher barriers to accessing quality healthcare and accurate health information (Liu and Zhang, 2019; Wang et al., 2020). As a result, individuals with less accurate COVID-19 knowledge may feel higher levels of fear, pay more attention to the pandemic, or take the health risks of COVID-19 infection more seriously, which could lead to them practicing protective behaviors (Roberts and David, 2021).

In our efforts to examine the importance of knowledge of COVID-19, we sought to determine whether there existed ethnic differences in knowledge levels about COVID-19. According to our findings, knowledge gaps indeed persisted between those in the Han and minority groups. The literature supports such findings. A study from the USA showed that knowledge of COVID-19 tended to be lower among Black and Hispanic participants compared to White participants (Reiter and Katz, 2021). Another study revealed that White and Asian participants were more likely to have better COVID-19 knowledge compared to Hispanic and Black participants (Jones et al., 2020). According to the literature, racial and ethnic knowledge gaps are likely attributable to language problems and barriers to access of accurate health information, which are circumstances and environments often experienced much more acutely by minority groups (Sonoda et al., 2020; Wang, 2019; Wang et al., 2020). Thus in China, a country with large populations of non-Mandarin-speaking minority ethnic groups, the same reasons may contribute to the existence of a COVID-19 knowledge gap between ethnic majority and minority populations, contributing to the observed gap in protective behaviors between Han and minority ethnicities. We believe that identify culturally appropriate methods of improving up-to-date knowledge of the disease, risk factors for contracting it and risk factors for adverse outcomes (such as refuse to wear mask or wash hand, non-vaccination), may actually help to improve narrow the protective behaviors gaps.

Another notable finding from our study was that the observed gap in protective behaviors between Han and minority ethnicities was also explainable by differences in self-efficacy. Differences in self-efficacy in response to COVID-19 among ethnic groups has been examined in a USA study finding African Americans to be in possession of more self-efficacy for engaging in protective behaviors against COVID-19 than White Americans (Roberts and David, 2021). They found that African Americans were more likely than White Americans to have friends that practiced protective behaviors, with those friends more inclined to share information on how to prevent COVID-19 infection. Thus the African American participants' higher levels of exposure to COVID-19 information explained why they felt more self-efficacy in performing protective behaviors than other participants (Roberts and David, 2021). In our study, however, the minority participants reported lower self-efficacy for practicing protective behaviors. Although several explanations for these results are possible, we believe a likely one is that differences in SES and access to knowledge of COVID-19 may impact an individual's self-efficacy for getting through the pandemic (Downey and Moen, 1987; Roberts and David, 2021). This would then exacerbate the gap in protective behaviors between Han and minority ethnicities (Bandura and Walters, 1977; Glanz et al., 2008).

Our study was subject to several limitations. First, although our sample contains sufficient numbers of minority participants to conduct our analyses, the non-representativeness issues could be raised since the studies were about infant nutrition and different modes of collection were used for the Han and minority groups, and 70/30 split between Han and minority groups could not represent the characteristics of western China. A study involving a larger sample of minority participants from a greater number of regions in China would provide further insight into the protective behavior gap. We also found the significant difference between telephone interviews and face-to-face interviews, which may affect representativeness of our sample. Second, data for the study were collected after China's first lockdown period was over. We did not collect any data at the beginning of COVID-19 in China, and were thus unable to rule out the possibility of recall bias. However, we emphasized in our survey questions that we were asking about the experience of the participants "during the initial lockdown" and trained our enumerators to follow a standard survey manual when asking these questions. Third, we did not ask about the extent to which sample members were able to reduce social contacts and therefore whether they needed to use these measures at all, vaccine hesitancy also was not measured which is the most effective method of prevention of severe outcomes of COVID-19 infection. The factors mentioned above maybe relevant to the protective behaviors.

5. Conclusion

Our results suggested that differences in SES appeared to contribute the most to explaining the gap in protective behaviors, followed by fearfulness levels, knowledge of COVID-19 levels, and self-efficacy levels. More importantly, policy recommendations should take account of the different attitudes to protective behaviors response to COVID-19 between Han and minority ethnicities. We believe that targeted, group-specific COVID-19 prevention messages deployed in public health communication strategies may help to enhance individual confidence in getting through the pandemic, while creating a healthy amount of fear for COVID-19 that would in turn drive better protective behavior adoption.

CRediT authorship contribution statement

Ruixue Ye: Writing – original draft, Software, Methodology, Investigation, Formal analysis, Conceptualization. **Yuju Wu:** Validation, Project administration, Investigation, Formal analysis. **Chang Sun:** Investigation, Data curation. **Qingzhi Wang:** Visualization, Investigation. **Yue Ma:** Validation, Formal analysis. **Yunwei Chen:** Validation, Formal analysis. **Lucy Pappas:** Writing – review & editing. **Cindy Feng:** Writing – review & editing. **Scott Rozelle:** Writing – review & editing, Validation. **Huan Zhou:** Validation, Supervision, Project administration, Funding acquisition.

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.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2024.102617.

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