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# Risk communication on behavioral responses during COVID-19 among general population in China: A rapid national study

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SUMMARY

*Objectives:* To describe the risk perception and behavioral responses among Chinese adults and to assess the associations of risk communication, risk perception, and behavioral adherence during the COVID-19 epidemic.
*Methods:* A national cross-sectional survey was conducted in 31 provinces in China with a total number of 5039 effective questionnaires collected. The questionnaire included sociodemographic characteristics, COVID-19 risk communication factors, mask and soap supply, and engagement in preventive behaviors during the epidemic. Multivariable Logistic regression was used.
*Results:* An overwhelmingly high prevalence of Chinese people was exposed to COVID-19 related risk communication messages (86.5%) and an overwhelming majority of respondents reported engagement in preventive behaviors (88.3%). Exposed to risk communication messages were positively associated with engaging in preventive behaviors, whereas, believing in misinformation were negatively associated with wearing masks when in public ($p < 0.01$). Respondents encountered an inadequate supplies of personal protection materials were negatively associated with their outdoor hygiene behaviors. People who were male, in an older age group, minorities, with lower education, with lower income, and lived in rural area showed lower exposures to risk communication messages.
*Conclusions:* Future risk communication practices are recommended to better monitor population risk perceptions and pay attention to socio-demographically disadvantaged people.


## Introduction

In December 2019, a novel coronavirus (COVID-19) was first reported in Wuhan, China, which rapidly spread across the country and was later reported in the rest of the world. To contain the outbreak, the Chinese government locked down the city of Wuhan on Jan 23 during the spring festival, a time when there are typically large population movements, and implemented large-scale social distancing policies, including quarantine, isolation, and travel restrictions, to limit cross-regional population movements, and other social distancing measures to reduce the disease spread.[1] It is estimated that the response to the crisis in China delayed the spread and limited the size of the outbreak, as well as averting hundreds of thousands of potential cases of COVID-19.[2]

There is general consensus that risk communication is essential during a disease epidemic. Risk communication is defined by the World Health Organization (WHO) as “the real-time exchange of information, advice, and opinions between experts or officials and people who face threat to their survival, health or economic or social well-being.”[3] Risk communication can guide public sentiment and promote adherence to recommended behavior change.[4] However, the public’s risk perception, which is influenced by various factors and is key for the public to make health-related decisions in the face of contradictory information, is one of the most important determinants of a successful risk communication strategy.[5] It was suggested that perceived risk perception regarding a newly emerging infectious disease is usually high, especially at the early stage of the epidemic.[6] However, the role of risk perception played in the adoption of preventive behaviors among the respondents was found to be inconsistent (e.g., positive, weak positive, and insignificant) during previous pandemics including but not limited to SARS, H5N1, H7N9, and H1N1.[7-11] For instance, during the SARS epidemic, risk perception was found to be positively associated

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with wearing masks and avoid visiting crowded places, but not with hand washing.[7] Moreover, there is limited research conducted to investigate the risk perceptions influenced by sociodemographic characteristics among Chinese population during an infectious disease epidemic or pandemic. Consequently, the role of risk perception on individual's adoption of preventive behaviors as well as factors influencing their risk perceptions need to be studied.

Risk communication guidelines from the WHO were recommended as a best practice to follow a set of guiding principles, including transparency, trust, and misinformation prevention, while communicating amidst the uncertainty, confusion, and sense of urgency[12] created by an epidemic, in order to encourage informed decision making and positive behavior change and consequently mitigate the effects of the threat.[13] The rapid development of communication technologies enables governmental risk communication messages to reach the general public through various channels; however, these channels can also be used to spread misinformation.[14,15] It was revealed that corrective messages have a moderate influence on belief in misinformation and that misinformation correction in the context of health was more achievable than in politics and marketing.[16] Respondents exposed to more accurate and credible information tend to adopt better preventive behaviors, whereas believing misinformation is associated with a decreased likelihood of adopting preventive behaviors during the outbreak of an epidemic.[17] In this epidemic, risk communication messages were translated from scientific information into messages understandable for laypeople.[18] However, previous researchers have argued that discrepancies amongst the social determinants (e.g., education, income, race/ethnicity) of the general population would cause inequities in the accessing, processing, and utilization of risk communication messages, namely communication inequity, during epidemics.[19-21] Ethnic minority population across the world often have worse social and health outcomes than non-ethnic minority populations, though the pattern is by no means consistent.[22] There are 55 different ethnic minorities (e.g., Zhuang, Man, Hui, Miao, Uyghur, Tujia, Yi, Mongo, Tibetan, Buyei etc.) in China. It was suggested that the education attainment, income, health services utilization, and health outcomes of minorities remain poorer than its Han counterparts (91.5% of the overall Chinese population, non-minority).[23-25] In addition to these inequities in social determinants of health, the shortage of masks and other personal protection materials became a major problem, especially in the early stage of the COVID-19 epidemic.[26] Few studies have investigated risk communication messages during the COVID-19 epidemic from the perspective of the general public while considering inequities with socioeconomic status, ethnicity, and mask use.

Despite the key role of risk perception and communication in the response to an epidemic, there has been limited data on how the Chinese general population perceives the risk of COVID-19 and their related preventive and behavioral responses. To fill this gap, this study aims to 1) describe the risk perception and behavioral responses among Chinese adults during the COVID-19 epidemic; and 2) assess the associations of sociodemographic factors, exposure to risk communication, and public risk perception with behavioral adherence to recommended public health measures (i.e., engagement in social distancing practices, wearing masks when in public, washing hands with soap when returning home) as well as intention to adopt a future vaccine (when available) among the Chinese population during the COVID-19 epidemic. We hypothesized that 1) sociodemographic characteristics of the respondents are associated with their risk perception, exposure to risk communication, adherence to recommended public health measures, and vaccination intention; and 2) risk perception and exposure to risk communication are associated with respondents' adherence to recommended public health measures and vaccination intention.

## Methods

### *Study design and participants*

A national cross-sectional survey was conducted between Mar 1 and Mar 16, 2020, in all 31 provinces, municipalities, and autonomous regions of China (hereafter, provinces), except for Hong Kong, Macau, and Taiwan.

The questionnaire was developed based on previous studies on risk communication,[17,27,28] and focus groups specific to understanding risk perceptions and communication related to the COVID-19 pandemic in China. Two online focus groups, each with six people in the fields of public health and medicine, were conducted to rank the most common misinformation during the epidemic. Two independent experts with backgrounds in public health and risk communication reviewed the ranking of common misinformation and further developed the questionnaire. In order to better characterize an individual's behavior in public, personal protection material supply was considered when investigating whether respondents were wearing masks when in public and washing their hands with soap upon returning home. Thirty online face-to-face interviews, covering respondents of different ages and education levels, were conducted to pretest the questionnaire. The final questionnaire included sociodemographic characteristics, COVID-19 risk communication factors, mask and soap supply, and engagement in preventive behaviors during the COVID-19 epidemic. Logic questions were set for data validity screening.

Data from this survey was coordinated and collected through province-specific investigators who were assigned to collect a convenience sample ranging from 100 to 200 families from each province, with an oversample of ethnic minority residents. Based on a prevalence estimate of 50% (most conservative), we estimated a target effective sample size of 2401, with ± 2% margin of error. Based on our prior survey experience, the sample size was upward adjusted by 20% to account for potential non-response rate. Thus, given the total number of provinces, the final sample size was 3062 in total, approximately 100 in each province. Because we were aiming to oversample ethnic minorities in our study and the proportion of ethnic minorities vary by provinces, after discussing with local partners, we set the target of sample size at 100 to 200 families in each province. The sample size was calculated using PASS software. Local partners from the provinces with most minority people lived in (i.e., Inner Mongolia, Xinjiang, Ningxia, Guangxi, Tibet, Yunnan, Guizhou, Qinghai, and Sichuan)[29] were asked to oversample at least half of the total sample size in their province with minority respondents. Residents in Wuhan (capital of Hubei Province), which was the epicenter of COVID-19 in China, were oversampled separately from Hubei Province. Online training for province-specific investigators was conducted before the launch of the survey. The investigators were responsible for fieldwork and quality control. A balance of urban and rural residents was established for sample recruiting to achieve equal representation. One family member from each contacted family was selected for the survey. The family member whose birthday was closest to the survey date of administration was selected, so as to ensure randomness in the sample. The questionnaire link was distributed to the selected respondents to fill in the web-based questionnaire. The targeted population for this study was individuals over 16 years old and who could read Mandarin. Older respondents without smartphones were encouraged to participate with assistance from their younger family members. The questionnaire instructions, along with assurances of anonymity and a statement informing respondents that participation is voluntary, were provided online before the respondents completed the questionnaire. No compensation was provided. The study was reviewed and approved by the Ethics Committee of the School of Public Health at Zhejiang University (no. ZGL202002-3).

### Variables

#### Sociodemographic characteristics

Sociodemographic characteristics included in the analysis were respondents' province of residence, age, sex, urbanicity, ethnicity, education level, and monthly household income. Provinces were categorized into three groups by the number of confirmed COVID-19 patients as of Mar 1. The first 15 provinces, with fewer confirmed patients, and the last 15 provinces, with greater numbers of confirmed patients, were grouped into low and middle groups, respectively. Hubei province, including participants from Wuhan - a statistical outlier with the highest number of confirmed patients - represented the high group.

#### COVID-19 risk communication factors

Risk communication factors including exposure to risk communication message (i.e., preventive information and misinformation correction), exposure to misinformation, and belief in the misinformation. Respondents were asked whether they had received six specific categories of preventive information regarding COVID-19 (i.e., prevention, symptoms, where to seek health care, what to do if a family member has COVID-19, updates on COVID-19 epidemic data, and overall government COVID-19 response). Items were coded as a binary (Yes/No). For this analysis, preventive information exposure was aggregated and further dichotomized into "all" (yes in all six-information exposure items) versus "not all/none." The most common four misinformation items (i.e., Shuanghuanglian oral liquid could effectively prevent COVID-19, Drink hard liquor could prevent COVID-19 and kill the coronavirus, COVID-19 is a manmade virus, Smoking could prevent COVID-19) during the epidemic were listed for respondents to specify whether they have heard of and believed in each piece of misinformation, respectively. Misinformation correction exposure was tested by asking whether respondents being exposed to information that corrects misinformation.

#### Mask and soap supply

Respondents were asked whether they have tried to purchase masks and soap for COVID-19 prevention. The answers to this question include "yes and bought successfully," "yes but cannot buy one," and "no." Individuals who tried to purchase these items but could not get one were grouped as having an "inadequate supply" of masks or soap.

#### Risk perception

Risk perception was measured by a 5-point Likert scale (very low, low, medium, high, and very high) of perception of personal risk of contracting COVID-19 during the epidemic.

#### Preventive behaviors

Preventive behaviors included practicing social distancing, wearing masks when in public, washing hands with soap when returning home, and vaccine acceptance. Respondents were asked whether they engaged in a list of 10 specific social distancing practices (three direct avoidance, three social interaction avoidance, one physical contact avoidance, and three public space avoidance). These questions were adapted from a previous study investigating responses to the Ebola outbreak.[17] The items used to test hygiene in the previous study were merged into outdoor behaviors by letting respondents rank their outdoor hygiene behavior on a four-point Likert-scale (never, occasionally, often, always), including whether they wear a mask when in public and wash hands with soap when returning home during the epidemic. The answers for two outdoor behaviors were dichotomized into "always" versus "not always." Vaccine acceptance was measured by the intention to accept the COVID-19 vaccine, when available.

**Table 1.**
Sociodemographic characteristics of the respondents ($n = 5039$).

| | $n$(%) |
|---|---|
| Province by confirmed patients | |
| Low | 2028(40.2) |
| Middle | 2413(47.9) |
| High | 598(11.9) |
| Age | |
| ≤20 | 774(15.4) |
| 21–30 | 1914(38.0) |
| 31–40 | 885(17.6) |
| 41–50 | 959(19.0) |
| ≥51 | 507(10.1) |
| Sex | |
| Male | 2090(41.5) |
| Female | 2949(58.5) |
| Urbanicity | |
| Urban | 2492(49.5) |
| Rural | 2547(50.5) |
| Ethnicity | |
| Han | 4234(84.0) |
| Ethnic minority | 805(16.0) |
| Education level | |
| Middle school and under | 668(13.3) |
| High school | 1837(36.5) |
| College and above | 2534(50.3) |
| Monthly household income | |
| <¥3000 ($435) | 846(16.8) |
| ¥ 3000–5000 ($435-$725) | 1485(29.5) |
| ¥ 5001–10,000 ($726-$1449) | 1422(28.2) |
| ¥10,000–20,000 ($1450-$2899) | 858(17.0) |
| ¥ >20,000 ($2899) | 428(8.5) |

#### Statistical analysis

Descriptive analysis, expressed as frequencies and percentages, was performed. Chi-square tests were performed to assess the differences between variables. Multivariable Logistic regressions were employed to assess the associations of exposure to risk communication, risk perception, and behavioral responses. Data were analyzed with SPSS 24.0 with statistical significance at $p < 0.05$.

## Results

Between Mar 1 and Mar 16, 2020, a total number of 5409 households were contacted, with 5124 completed and returned surveys (response rate 94.7%), among which 85 (1.7%) were excluded for inconsistency in logic questions or respondents being under 16 years old. The final analytic sample was 5039. The mean age of respondents was 33.0 years (SD 12.5). As shown in Table 1, many respondents were female (58.5%), aged 21 to 30 years old (38.0%), Han (84.0%), possessed a college or above education level (50.3%), and had a monthly income of ¥ 5001–10,000 (28.2%). This study covered people from 28 out of 55 different ethnic minorities all over China. Most of them are Tibetan (122), Yi (121), Uyghur (106), Hui (103), Miao (60), and Mongo (55).

The overwhelming majority (86.5%) of respondents had received all the preventive information items concerning COVID-19 (Table 2). Most people heard that Shuanghuanglian oral liquid (86.9%) and hard liquor (69.2%) could prevent COVID-19. Half of respondents heard that COVID-19 was a manmade virus (56%), and smoking could prevent COVID-19 (53.5%). Among them, 154 respondents (5.5%) believed the misinformation that COVID-19 was a manmade virus; 407 respondents (8.3%) believed at least one piece of misinformation to be true; 11 respondents (0.2%) believed

**Table 2.**
Risk communication response on COVID-19 epidemic.

| | $n$(%) |
|---|---|
| Total | 5039 |
| *Type of information received* | |
| Updates about COVID-19 | 4924(97.7) |
| Interventions to combat COVID-19 conducted by the community and government | 4899(97.2) |
| Symptoms of COVID-19 | 4808(95.4) |
| How to protect oneself from infected | 4965(98.5) |
| Where to seek care if suspected | 4728(93.8) |
| What to do if a family member has COVID-19 | 4639(92.1) |
| Received any of the six preventive information | 5012(95.5) |
| Received all of the six preventive information | 4357(86.5) |
| *Exposure to misinformation* | |
| Shuanghuanglian oral liquid* could effectively prevent COVID-19 | 4378(86.9) |
| Drink hard liquor (*Baijiu*) could prevent COVID-19 and kill the coronavirus | 3486(69.2) |
| COVID-19 is a manmade virus | 2820(56.0) |
| Smoking could prevent COVID-19 | 2695(53.5) |
| Exposed to any of the four statements | 4630(91.9) |
| Exposed to all four statements | 1854(36.8) |
| *Belief in misinformation* | |
| Shuanghuanglian oral liquid* could effectively prevent COVID-19 ($n = 4378$) | 216(4.9) |
| Drink hard liquor (*Baijiu*) could prevent COVID-19 and kill the coronavirus ($n = 3486$) | 90(2.6) |
| COVID-19 is a manmade virus ($n = 2820$) | 154(5.5) |
| Smoking could prevent COVID-19 ($n = 2695$) | 56(2.1) |
| Believe any of the four statements | 407(8.3) |
| Believe all four statements | 11(0.2) |
| *Risk perception (personal risk of contracting COVID-19)* | |
| Very low | 155(3.1) |
| Low | 856(17.0) |
| Medium | 1539(30.5) |
| High | 1822(36.2) |
| Very high | 667(13.2) |

* A common Chinese patent medicine containing three herbal ingredients: Radix Scutellariae, Flos Lonicerae Japonicae and Fructus Forsythiae. It is usually used to treat acute upper respiratory tract infection caused by virus or bacteria.

all pieces of misinformation were true. Half of the respondents (49.4%) reported a high or very high risk perception of themselves contracting COVID-19.

Respondents with higher education levels and higher incomes reported higher exposures to all preventive information as well as misinformation correction, and held a lower level of belief in misinformation as compared to respondents with lower education levels and lower incomes ($p < 0.05$) (Appendix A). More female respondents were exposed to all preventive information as compared to male respondents, and female respondents also believed less misinformation. A higher proportion of urban residents was exposed to misinformation but urban residents were less likely to believe in misinformation, as compared to rural residents. Minorities were more exposed to misinformation correction as compared to Han participants. Older respondents were exposed to less misinformation but held higher levels of belief in misinformation.

As shown in Table 3, an overwhelming majority of the respondents (88.3%) engaged in all social distancing practices, including direct avoidance (96.9%), social interaction avoidance (95.8%), physical contact avoidance (97.7%), and public space avoidance (93.7%). Most respondents who had gone in public during the epidemic reported always wearing a mask (93.4%) and washing hands with soap (82.3%) when returning home. A total number of 4396 respondents (87.2%) reported they would accept a COVID-19 vaccine when it became available. Three hundred and twenty-eight out of 643 respondents reported a reason for their vaccine hesitancy, 131 (39.9%) thought a vaccine was unsafe, 46 (14.9%) thought a vaccine would not work, 43 (13.1%) thought a vaccine was not needed, and 15 (4.4%) did not trust a vaccine.

The proportion of all preventive behavior engagement among respondents who were exposed to all preventive information regarding COVID-19 was significantly higher when compared to those who were not exposed to all preventive information regarding COVID-19 ($p < 0.0001$) (Table 4). Respondents who reported being exposed to misinformation correction showed a higher proportion of engaging in preventive behaviors ($p < 0.05$). The proportion of respondents who engaged in all social distancing practices and who would accept a vaccine was higher among those with higher risk perceptions than among those with lower risk perceptions ($p < 0.0001$).

Respondents of an older age were more likely to have higher risk perceptions ($p < 0.001$) (Table 5). Females had a higher level of risk perception, engagement in all social distancing practices [aOR=1.25 95%CI (1.04, 1.51)], and greater levels of always washing their hands with soap when returning home [aOR=1.47 95%CI (1.18, 1.83)] when compared to male respondents. Minorities had higher levels of risk perception [aOR=1.26 95%CI (1.06, 1.51)] and vaccine acceptance [aOR=1.44, 95%CI (1.07, 1.94)] than did Han respondents; however, they reported lower levels of engagement in all social distancing practices [aOR=0.64, 95%CI (0.50, 0.83)], wearing masks [aOR=0.48, 95%CI (0.34, 0.68)], and washing hands with soap [aOR=0.47, 95%CI (0.36, 0.63)]. Rural residents were less likely to wear masks in public [aOR=0.38, 95%CI (0.27, 0.53)] and wash their hands with soap when returning home [aOR=0.40, 95%CI (0.32, 0.51)] than were their urban counterparts.

After adjusting for sociodemographic characteristics, exposure to all preventive information items was associated with better adherence across all behaviors ($p < 0.05$). Respondents who were exposed to misinformation correction had higher levels of vaccine acceptance [aOR=1.44, 95%CI (1.12, 1.86)] and wearing masks [aOR=1.55, 95%CI (1.07, 2.25)]. Holding a belief in any misinformation item was associated with lower levels of wearing a mask [aOR=0.52, 95%CI (0.35, 0.77)]. Respondents with higher risk perceptions were more likely to engage in all social distancing practices ($p < 0.01$). COVID-19 vaccine acceptance was higher among respondents with high [aOR=2.34, 95%CI (1.49, 3.69)] and very

**Table 3.**
Adherence behavior of the respondents ($n = 5039$).

| | $n$(%) |
|---|---|
| *Direct avoidance* | |
| Avoid contact with people suspected to have COVID-19 | 4933(97.9) |
| Avoid contact with suspected COVID-19 patient | 4916(97.6) |
| Avoid contact with people suspected of recent contact with someone infected by COVID-19 | 4907(97.4) |
| Any of the three direct avoidance | 4951(98.3) |
| All of the three direct avoidance | 4882(96.9) |
| *Social interaction avoidance* | |
| Avoid visiting extended family members | 4936(98.0) |
| Avoid visiting neighbors and friends | 4911(97.5) |
| Stay at home more than usual | 4956(98.4) |
| Any of the three social interaction avoidance | 5016(99.5) |
| All of the three social avoidance | 4829(95.8) |
| *Physical contact avoidance* | |
| Reduce physical interactions with others | 4923(97.7) |
| *Public space avoidance* | |
| Avoid public spaces like markets | 4776(94.8) |
| Avoid taking public transport | 4931(97.9) |
| Avoid crowds e.g., temple fair | 4995(99.1) |
| Any of the three public space avoidance | 5011(99.4) |
| All of the three public space avoidance | 4723(93.7) |
| *Wearing a mask when going outside* ($n = 4096$) | |
| Never | 18(0.4) |
| Occasionally | 84(2.1) |
| Often | 170(4.2) |
| Always | 3824(93.4) |
| *Washing hands with soap when came back* ($n = 4096$) | |
| Never | 48(1.2) |
| Occasionally | 189(4.6) |
| Often | 490(12.0) |
| Always | 3369(82.3) |
| *Do you intend to vaccinate when COVID-19 vaccine is available?* | |
| Very unlikely | 16(0.3) |
| Unlikely | 108(2.1) |
| Uncertain | 519(10.3) |
| Likely | 1945(38.6) |
| Very likely | 2451(48.6) |

high [aOR=2.59, 95%CI (1.56, 4.34)] risk perceptions. Inadequate supply of masks was associated with lower odds of respondents engaging in wearing masks when in public [aOR=0.52, 95%CI (0.38, 0.70)], and inadequate soap supply was associated with washing hands with soap when returning home [aOR=0.32, 95%CI (0.25,0.43)].

## Discussion

The data in this study was collected during the COVID-19 epidemic across 31 provinces in China, with the aim of better characterizing the role of risk communication and individual risk perception on their preventive behaviors. First, an overwhelmingly high prevalence of Chinese people was exposed to preventive information regarding COVID-19, misinformation corrections, and an overwhelming majority of respondents reported engagement in preventive behaviors. Second, respondents exposed to all preventive information regarding COVID-19 were positively associated with engaging in preventive behaviors. Respondents exposed to misinformation correction showed higher levels of vaccine acceptance and wearing masks when in public, whereas respondents who reported believing in misinformation were less inclined to wear masks when in public. Inadequate supplies of masks and soap were negatively associated with wearing masks when in public and washing hands when returning home. Third, half of respondents reported holding a high risk perception of themselves contracting COVID-19 during the epidemic. Higher risk perception was positively associated with engagement in preventive behaviors. People who lived in Wuhan province, were of an older age, were female, were a minority, had lower education levels, or believed in misinformation reported higher levels of risk perception. Last, people who were male, in an older age group, minorities, with lower education, with lower income, and lived in rural area showed lower exposures to risk communication messages.

The overwhelmingly high proportion of Chinese respondents' exposure to COVID-19 risk communication messages, high prevalence of respondents who reported adherence to recommended behaviors, and high vaccine acceptance might be attributable to positive risk communication strategies. Though the lackluster response of Wuhan provincial government in the early stages of the pandemic was criticized by the public, the Chinese Central Government developed a series of public health emergency strategies including risk communication to release timely information and stem COVID-19 misinformation through press conferences, and enforced preventive behaviors such as mandated use of masks, and handwashing in the general population after making the decision to lock down Wuhan city.[30,31] Similar strategies including but not limited to quarantines, travel restrictions, lockdown, and contact tracing were observed in many other East Asian countries with similar disaster response cultures, including Singapore, Japan, and Korea.[32,33] Our study indicates that the risk communication practices of the Chinese government's response reached a high proportion of the general population which resulted in adherence to preventive behaviors. Further studies in other countries are needed to draw comparisons of risk communication strategies across countries and cultures.

The outbreak and response of COVID-19 has been accompanied by an overflow of information for people, in other words an 'infodemic', which set cognitive barriers for people to find reliable and trustworthy information when they needed it.[34] Our study shows that respondents with exposure to all preventive information regarding COVID-19 were more likely to engage in social distancing

**Table 4**
Sociodemographic characteristics and risk communication factors as predictors for preventive behaviors ($n = 5039$).

| | Engagement in all social distancing practices (Yes) | p | Vaccine acceptance (Yes) | p | Always wearing a mask when in public[a] ($n = 4096$) | p | Always washing hands with soap when returning home[a] ($n = 4096$) | p |
|---|---|---|---|---|---|---|---|---|
| Province by confirmed patients | | 0.140 | | 0.022 | | 0.002 | | 0.001 |
| Low | 1768(87.2) | | 1799(88.7) | | 1547(91.9) | | 1359(80.7) | |
| Middle | 2144(88.9) | | 2073(85.9) | | 1922(94.1) | | 1681(82.3) | |
| High | 535(89.5) | | 525(87.8) | | 355(95.9) | | 3369(88.9) | |
| Age | | 0.057 | | 0.567 | | <0.0001 | | <0.0001 |
| ≤20 | 671(86.7) | | 679(87.7) | | 508(89.0) | | 432(75.7) | |
| 21–30 | 1678(87.7) | | 1686(88.1) | | 1412(93.4) | | 1209(80.0) | |
| 31–40 | 794(89.7) | | 765(86.4) | | 722(96.7) | | 678(90.8) | |
| 41–50 | 841(87.7) | | 829(86.4) | | 800(94.7) | | 712(84.3) | |
| ≥51 | 463(91.3) | | 437(86.2) | | 382(90.7) | | 338(80.3) | |
| Sex | | 0.007 | | 0.138 | | 0.190 | | <0.0001 |
| Male | 1814(86.8) | | 1806(86.4) | | 1602(92.8) | | 1365(79.0) | |
| Female | 2633(89.3) | | 2590(87.8) | | 2222(93.8) | | 2004(84.6) | |
| Urbanicity | | 0.647 | | 0.001 | | <0.0001 | | <0.0001 |
| Urban | 2194(88.0) | | 2136(85.7) | | 2048(97.0) | | 1893(89.6) | |
| Rural | 2253(88.5) | | 2260(88.7) | | 1776(89.5) | | 1476(74.4) | |
| Ethnicity | | <0.0001 | | 0.002 | | <0.0001 | | <0.0001 |
| Han | 3777(89.2) | | 3667(86.6) | | 3295(94.7) | | 2935(84.3) | |
| Ethnic minority | 670(83.2) | | 729(90.6) | | 529(85.9) | | 434(70.5) | |
| Education level | | 0.136 | | 0.103 | | <0.0001 | | <0.0001 |
| Middle school and under | 582(87.1) | | 586(87.7) | | 482(88.4) | | 412(75.6) | |
| High school | 1606(87.4) | | 1624(88.4) | | 1299(91.7) | | 1103(78.0) | |
| College and above | 2257(89.1) | | 2186(86.3) | | 2044(95.7) | | 1854(86.8) | |
| Monthly household income | | 0.947 | | <0.0001 | | <0.0001 | | <0.0001 |
| <¥3000 | 751(88.8) | | 752(88.9) | | 542(86.6) | | 451(72.0) | |
| ¥3000–5000 | 1306(87.9) | | 1326(89.3) | | 1095(92.5) | | 940(79.4) | |
| ¥5001–10,000 | 1258(88.5) | | 1245(87.6) | | 1125(95.2) | | 986(83.4) | |
| ¥10,001–20,000 | 758(88.3) | | 725(84.5) | | 712(96.0) | | 664(89.5) | |
| >¥20,000 | 374(87.4) | | 348(81.3) | | 360(96.7) | | 328(90.6) | |
| Preventive information exposure | | <0.0001 | | <0.0001 | | <0.0001 | | <0.0001 |
| Not all/None | 521(76.4) | | 552(80.9) | | 476(87.5) | | 393(72.2) | |
| All | 3926(90.1) | | 3844(88.2) | | 3348(94.3) | | 2976(83.9) | |
| Exposure to misinformation correction | | 0.009 | | 0.005 | | <0.0001 | | <0.0001 |
| No | 632(85.4) | | 622(84.1) | | 504(88.1) | | 428(74.8) | |
| Yes | 3815(88.7) | | 3774(87.8) | | 3320(94.2) | | 2941(83.5) | |
| Belief in misinformation | | 0.072 | | 0.968 | | <0.0001 | | 0.625 |
| None | 3738(88.5) | | 3676(87.0) | | 3254(94.4) | | 2854(82.8) | |
| Any | 348(85.5) | | 354(87.0) | | 292(87.4) | | 273(81.7) | |
| Risk perception | | <0.0001 | | <0.0001 | | 0.765 | | 0.028 |
| Very low | 121(78.1) | | 126(81.3) | | 102(91.1) | | 85(75.9) | |
| Low | 745(87.0) | | 721(84.2) | | 620(93.7) | | 566(85.5) | |
| Medium | 1350(87.7) | | 1303(84.7) | | 1198(93.0) | | 1041(80.8) | |
| High | 1619(88.9) | | 1639(90.0) | | 1422(93.8) | | 1242(81.9) | |
| Very high | 612(91.8) | | 607(91.0) | | 482(93.1) | | 435(84.0) | |

[a] A total number of 4096 respondents reported had went outside at least one during the self-quarantine.

**Table 5**
Adjusted odds ratios for preventive behaviors.

| | Risk perception (aOR [95%CI]) ($n = 4630$) | Engagement in all social distancing practices (aOR [95%CI]) ($n = 4,630$) | Vaccine acceptance (aOR [95%CI]) ($n = 4630$) | Always wearing a mask when in public (aOR [95%CI]) ($n = 3687$) | Always washing hands with soap when returning home (aOR [95%CI]) ($n = 3101$) |
|---|---|---|---|---|---|
| Province by confirmed patients | | | | | |
| Middle | 0.86(0.75,0.99)* | 1.09(0.88,1.34) | 0.95(0.78,1.17) | 0.90(0.65,1.24) | 0.69(0.54,0.87)** |
| High | 1.37(1.12,1.68)** | 1.08(0.78,1.49) | 1.07(0.79,1.45) | 0.79(0.42,1.44) | 1.02(0.64,1.63) |
| Age | | | | | |
| 21–30 | 1.35(1.10,1.67)** | 1.04(0.76,1.41) | 1.12(0.82,1.54) | 1.45(0.93,2.29) | 1.09(0.76,1.56) |
| 31–40 | 1.89(1.47,2.42)*** | 1.11(0.75,1.63) | 0.96(0.66,1.39) | 2.81(1.48,5.31)** | 2.41(1.48,3.92)*** |
| 41–50 | 2.18(1.72,2.77)*** | 0.95(0.66,1.36) | 0.89(0.62,1.27) | 1.95(1.11,3.41)* | 1.10(0.73,1.67) |
| ≥51 | 1.98(1.51,2.61)*** | 1.51(0.97,2.35) | 0.84(0.57,1.25) | 1.04(0.59,1.82) | 1.00(0.64,1.58) |
| Sex | | | | | |
| Female | 1.29(1.14,1.45)*** | 1.25(1.04,1.51)* | 1.03(0.86,1.23) | 1.12(0.84,1.50) | 1.47(1.18,1.83)** |
| Urbanicity | | | | | |
| Rural | 1.06(0.93,1.20) | 1.11(0.91,1.35) | 1.16(0.96,1.40) | 0.38(0.27,0.53)*** | 0.40(0.32,0.51)*** |
| Ethnicity | | | | | |
| Ethnic minority | 1.26(1.06,1.51)* | 0.64(0.50,0.83)** | 1.44(1.07,1.94)* | 0.48(0.34,0.68)*** | 0.47(0.36,0.63)*** |
| Education level | | | | | |
| High school | 0.66(0.52,0.81)*** | 1.27(0.89,1.79) | 1.04(0.74,1.47) | 1.60(1.00,2.56) | 1.31(0.91,1.88) |
| College and above | 0.65(0.52,0.81)*** | 1.35(0.98,1.87) | 0.92(0.67,1.27) | 1.87(1.19,2.94)** | 1.55(1.09,2.19)* |
| Monthly household income | | | | | |
| ¥3000–5000 | 1.02(0.85,1.24) | 0.84(0.62,1.13) | 1.13(0.84,1.52) | 1.26(0.86,1.84) | 1.14(0.83,1.55) |
| ¥5001–10,000 | 0.76(0.63,0.93)** | 0.85(0.62,1.15) | 0.98(0.73,1.32) | 1.46(0.96,2.21) | 1.26(0.90,1.75) |
| ¥10,001–20,000 | 0.86(0.69,1.07) | 0.82(0.58,1.16) | 0.78(0.56,1.08) | 1.60(0.94,2.73) | 1.86(1.23,2.81)** |
| ¥>20,000 | 0.76(0.58,0.99)* | 0.71(0.47,1.07) | 0.65(0.45,0.95)* | 1.57(0.75,3.28) | 1.99(1.15,3.45)* |
| Preventive information exposure | | | | | |
| All | 1.15(0.96,1.38) | 2.70(2.17,3.37) *** | 1.79(1.42,2.25)** | 1.58(1.10,2.25)* | 1.66(1.24,2.23)** |
| Exposure to misinformation correction | | | | | |
| Yes | 0.92(0.76,1.11) | 1.19(0.92,1.55) | 1.44(1.12,1.86)** | 1.55(1.07,2.25)* | 1.34(0.99,1.82) |
| Belief in misinformation[a] | | | | | |
| Any | 1.54(1.24,1.90)*** | 0.80(0.59,1.08) | 0.95(0.70,1.30) | 0.52(0.35,0.77)** | 1.13(0.79,1.62) |
| Risk perception | | | | | |
| Low | | 1.93(1.22,3.06)** | 1.36(0.86,2.17) | 1.48(0.60,3.68) | 1.92(0.94,3.94) |
| Medium | | 2.13(1.37,3.31)** | 1.40(0.89,2.20) | 1.08(0.46,2.56) | 1.15(0.59,2.26) |
| High | | 2.37(1.53,3.69)*** | 2.34(1.49,3.69)*** | 1.35(0.57,3.20) | 1.33(0.68,2.59) |
| Very high | | 3.58(2.14,5.97)*** | 2.59(1.56,4.34)*** | 1.37(0.54,3.44) | 1.50(0.74,3.07) |
| Inadequate supply of masks[b] | | | | | |
| Yes | | | | 0.52(0.38,0.70)*** | |
| Inadequate supply of soap[c] | | | | | |
| Yes | | | | | 0.32(0.25,0.43)*** |

*$p < 0.05$, **$p < 0.01$, ***$p < 0.0001$.
[a] A total number of 4630 respondents reported exposed to at least one of the list misinformation, thus the total sample size included in the Logistic regression for risk perception, engagement in social distancing practices, and vaccine acceptance was 4630.
[b] A total number of 4921 respondents reported purchased masks, thus, there were 3687 respondents who have both exposed to at least one misinformation and purchased masks.
[c] A total number of 4156 respondents reported purchased soap thus, there were 3101 respondents who have both exposed to at least one misinformation and purchased soap.

practices, which is consistent with the findings of Vink et al.[17] Belief in misinformation was negatively associated with always wearing masks, although not with other prevention measures. A possible reason for the observed limited impact of belief in misinformation on preventive behaviors is that a relatively lower proportion of respondents believed in the misinformation since a huge effort was made by the media to distribute corrective message during the epidemic. For example, the Jinri Toutiao news app and Alipay had special platforms on their popular pages that were dedicated to misinformation correction; WeChat, which is enormously popular in China, notified users if s/he had encountered an article containing misinformation; and TV programs issued timely updates to correct misinformation in real time.[35] Even without knowing whether respondents believed in misinformation correction, our study adds to the literature by indicating that exposure to corrections of misinformation was positively associated with respondents' preventive behaviors.

People living in Hubei reported greater access to supplies of both masks and soap. After the Wuhan lockdown, a one-on-one medical resource support system was established in 16 provinces to help each city in Hubei combat the epidemic.[36] This may be a reason that fewer respondents from Hubei reported facing an inadequate supply of masks and soap. Our study found that inadequate supplies of masks and soap affected respondent's engagement in preventive behaviors. Consequently, ensuring an adequate personal protection material supply during an emerging infectious disease is crucial before recommending the general population adopt preventive behaviors.

Meta-analyses have demonstrated that risk perception was positively associated with engaging in preventive behaviors in non-emerging situations (e.g., cancer screening), and that interventions targeting risk perceptions would change an individual's behavioral intentions.[37,38] Our study showed consistent results that people with a higher risk perception were more likely to adopt a preventive behavior. [7–11] However, these findings showed inconsistencies when researchers measured associations at different time of a public health emergency.[39,40] As risk perceptions are influenced by contextual factors, a looming threat causes risk perceptions to grow higher, especially when that threat is seen as uncontrollable or dreaded.[41,42] For example, Obenauer and colleagues found a decrease in perceived likelihood of infection from the peak to the end of the Ebola epidemic.[40] Before the COVID-19 epidemic erupted in China, the whistleblower and news media described COVID-19 as a "SARS-like disease." As China was stricken by the SARS epidemic in 2003, many Chinese citizens had high levels of risk perception toward such an infectious disease.[43] When the epidemic broke out, the government instituted a lockdown of Wuhan on Jan 23. Within a week, all 31 provinces in China had declared they would engage in the highest level of public health response. Thus, our study, which was conducted in the first two weeks of early March after the peak (peak at mid to end of February 20 to 27) of the epidemic, showed that risk perceptions toward COVID-19 were still high. Consequently, time series studies to measure the change in status of risk perceptions and the impact of this change on health behaviors during the epidemic from its peak to its end are needed to better guide the risk communication strategies.

Our data showed that elderly people were more likely to have higher risk perceptions regarding contracting COVID-19, which was consistent with the literature that COVID-19′s mortality rate is higher among elderly people than among young and middle-aged people.[44] Men were found to have a higher mortality rate than women after infected with COVID-19.[45,46] Surprisingly, men demonstrated lower levels of risk perception than did women in our study. We found that women were more likely to engage in social distancing practices and hand hygiene, which was consistent with previous findings.[47] These hygiene practices might have helped women protect themselves from becoming infected.

As our study demonstrates, future communication efforts targeted at those with lower education levels, lower incomes, the young, those living in rural areas, minorities, and men, are needed to reduce communication inequalities during epidemics. Socioeconomically disadvantaged groups and some racial and ethnic minorities face a heavier burden from the COVID-19 epidemic.[48] For example, according to a retrospective cohort analysis in the United States, African Americans were reported to be 2.7 times more likely to be hospitalized than non-Hispanic White Americans.[49] However, further studies are needed to investigate the impact of risk communication disadvantages on the socioeconomically disadvantaged groups and the differences in accessing, processing, and utilizing risk communication among the COVID-19 patients.

Vaccine acceptance, when it becomes available for COVID-19, was found to be much higher among the Chinese population than was observed during the Ebola vaccine in DR Congo (87.2% vs. 63.3%).[17] Our study identified that ethnic minorities had higher levels of vaccine acceptance than did non-minorities. This result is inconsistent with the findings of Huang et al.,[50] who concluded that ethnic minority women were less likely to immunize their children after reviewing 45 papers on ethnicity and maternal and child health outcomes in western China. Possible reasons for these inconsistencies may be due to differences in clinical contexts and types of diseases targeted for prevention. Previous studies tested the vaccine uptake rate among the ethnic minority women for their children, whereas, we tested the vaccine acceptance of COVID-19 when available for individuals. Zhang and colleagues[51] found that 95% of ethnic minority caregivers believed vaccines to be effective. However, due to inadequate supply of vaccines, a lack of understanding of immunization policy, and the lower education levels of caregivers, as many as 34.6% of studied children missed the opportunity to receive a vaccination or received a delayed vaccination. Another study conducted in southwest China suggested that children in impoverished mountainous regions, which have a high population of ethnic minorities, were more likely to suffer from an inadequate supply of vaccines.[52] Thus, although the levels of vaccine acceptance among minorities are high, vaccination rates may be related to other factors, like the availability of vaccines, information on immunization policies, accessibility of the services, and a trigger to the action of getting a vaccine.[53]

There are several limitations to this study. First, we used a convenience sampling method and a snowball sampling method to conduct the survey instead of a nationally representative sampling method. A probability sampling method was deemed to not be feasible during social distancing, which prevents the use of an in-depth and systematic sampling method. We purposely oversampled ethnic minorities, and balanced urban and rural respondents for feasible comparisons. We used a random sampling method in each family to select respondents. Second, this study relied on self-reports of respondents, which might cause recall bias. However, the questions in the questionnaire focused on the experiences during the COVID-19 epidemics within the past month, which might limit the recall bias. Third, this is a one-time cross-sectional survey, thus the findings remain associational and have limited causality.

In total, our study investigated how risk communication correlated with behavioral responses among the general population in China. We found an overwhelming high proportion of Chinese people were exposed to COVID-19 related risk communication messages as well as engaged in preventive behaviors. Risk communication factors and risk perceptions were positively associated with preventive behaviors. However, people with lower education levels, lower incomes, of an older age, living in rural areas, minorities, and males showed a lower exposure to risk communication messages. Moreover, respondents who reported facing an inadequate supply of personal protection materials (i.e., masks and soap) were less likely to engage in wearing masks and washing hands. Consequently, our study contributes to the studies of risk perception on COVID-19 among the Chinese population with an eastern culture. Future investigation of risk perceptions in other cultures and contexts is needed. Future risk communication practices are recommended to use a variety of channels to disseminate official risk communication information, better monitor population risk perceptions in order to guide risk communication strategies, and pay attention to communication inequities, especially among sociodemographically disadvantaged people. Risk communication strategies should be embedded as a part of an emergency preparedness and response plan.

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## Authors' contributions

XZ and XW conceptualized the study design. XW, JX, WL, and LL design the questionnaire. XW, JX, and WL collected the data. XW, ZX, and LL contributed to the data interpretation. XW drafted the manuscript while XZ, LL, ZX, JX, and WL revising the paper critically for important intellectual content. All authors approved the final version of the paper.

## Declaration of Competing Interest

The author declares that he/she has no competing interests.

## Ethics approval and consent to participate

The study was approved by the ethics committee of the School of Public Health, Zhejiang University (no. ZGL202002–3). All participants were informed of the background, aims, anonymous nature and length of the survey. Participants were well informed that completing the questionnaire signified their informed consent.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jinf.2020.10.031.

## Appendix A. See below

Table A1 and Table A2.

**Table A1**
Sociodemographic characteristics as predictors for risk communication factors and personal protection material supply ($n = 5039$).

| | All preventive information exposure (Yes) | *p* | Exposure to misinformation correction (Yes) | *p* | Belief in any misinformation[a] ($n = 4630$) (Yes) | *p* | Inadequate supply of masks[b] (Yes) ($n = 4921$) | *p* | Inadequate supply of soap[c] (Yes) ($n = 4156$) | *p* |
|---|---|---|---|---|---|---|---|---|---|---|
| Province by confirmed patients | | 0.719 | | <0.0001 | | 0.012 | | <0.0001 | | 0.051 |
| Low | 1744(86.0) | | 1651(81.4) | | 188(10.3) | | 528(26.6) | | 205(12.2) | |
| Middle | 2093(86.7) | | 2109(87.4) | | 170(7.6) | | 473(20.1) | | 206(10.5) | |
| High | 520(87.0) | | 539(90.1) | | 49(8.6) | | 65(11.1) | | 44(8.6) | |
| Age | | 0.130 | | <0.0001 | | 0.044 | | 0.034 | | <0.0001 |
| ≤20 | 665(85.9) | | 686(88.6) | | 53(7.4) | | 167(21.6) | | 95(12.3) | |
| 21–30 | 1654(86.4) | | 1654(86.4) | | 139(7.8) | | 444(23.2) | | 203(10.6) | |
| 31–40 | 772(87.2) | | 755(85.3) | | 77(9.4) | | 162(18.3) | | 61(6.9) | |
| 41–50 | 844(88.0) | | 809(84.4) | | 91(10.4) | | 192(20.0) | | 59(6.2) | |
| ≥51 | 422(83.2) | | 395(77.9) | | 47(10.9) | | 101(19.9) | | 37(7.3) | |
| Sex | | 0.044 | | 0.062 | | <0.0001 | | 0.727 | | 0.544 |
| Male | 1783(85.3) | | 1760(84.2) | | 225(11.6) | | 435(21.4) | | 193(11.3) | |
| Female | 2574(87.3) | | 2539(86.1) | | 182(6.8) | | 631(21.8) | | 262(10.7) | |
| Urbanicity | | 0.208 | | <0.0001 | | <0.0001 | | <0.0001 | | <0.0001 |
| Urban | 2170(87.1) | | 2184(87.6) | | 172(7.3) | | 465(19.2) | | 182(8.9) | |
| Rural | 2187(85.9) | | 2115(83.0) | | 235(10.3) | | 601(24.1) | | 273(13.0) | |
| Ethnicity | | 0.732 | | <0.0001 | | 0.868 | | 0.001 | | 0.016 |
| Han | 3664(86.5) | | 3670(86.7) | | 346(8.8) | | 859(20.8) | | 365(10.4) | |
| Ethnic minority | 693(86.1) | | 629(78.1) | | 61(8.6) | | 207(26.3) | | 90(13.6) | |
| Education level | | <0.0001 | | <0.0001 | | <0.0001 | | 0.742 | | 0.001 |
| Middle school and under | 526(78.7) | | 475(71.1) | | 84(15.4) | | 140(21.4) | | 41(7.5) | |
| High school | 1581(86.1) | | 1595(86.8) | | 143(8.4) | | 381(21.2) | | 197(13.1) | |
| College and above | 2250(88.8) | | 2229(88.0) | | 180(7.5) | | 545(22.1) | | 217(10.3) | |
| Monthly household income | | 0.001 | | <0.0001 | | <0.0001 | | <0.0001 | | <0.0001 |
| <¥3000 | 697(82.4) | | 628(74.2) | | 94(13.2) | | 264(32.0) | | 113(16.6) | |
| ¥3000–5000 | 1280(86.2) | | 1220(82.2) | | 125(9.3) | | 339(23.4) | | 133(10.8) | |
| ¥5001–10,000 | 1243(87.4) | | 1261(88.7) | | 112(8.4) | | 286(20.4) | | 127(10.7) | |
| ¥10,001–20,000 | 756(88.1) | | 793(92.4) | | 53(6.4) | | 122(14.7) | | 54(7.6) | |
| >¥20,000 | 381(89.0) | | 397(92.8) | | 23(5.5) | | 55(13.3) | | 28(7.9) | |

[a] A total number of 4630 respondents reported exposed to at least one of the list misinformation.
[b] A total number of 4921respondents reported purchased masks.
[c] A total number of 4156 respondents reported purchased soap.

**Table A2**
Sociodemographic characteristics as predictors for risk perception ($n = 5039$).

| | Risk perception | | | | | |
|---|---|---|---|---|---|---|
| | Very low | Low | Medium | High | Very high | p |
| Province by confirmed patients | | | | | | <0.0001 |
| Low | 61(3.0) | 334(16.5) | 605(29.8) | 738(36.4) | 290(14.3) | |
| Middle | 83(3.4) | 434(18.0) | 779(32.3) | 836(34.6) | 281(11.6) | |
| High | 11(1.8) | 88(14.7) | 155(25.9) | 248(41.5) | 96(16.1) | |
| Age | | | | | | <0.0001 |
| ≤20 | 20(2.6) | 154(19.9) | 293(37.9) | 264(34.1) | 43(5.6) | |
| 21–30 | 85(4.4) | 296(15.5) | 679(35.5) | 639(33.4) | 215(11.2) | |
| 31–40 | 20(2.3) | 146(16.5) | 244(27.6) | 334(37.7) | 141(15.9) | |
| 41–50 | 14(1.5) | 163(17.0) | 219(22.8) | 386(40.3) | 177(18.5) | |
| ≥51 | 16(3.2) | 97(19.1) | 104(20.5) | 199(39.3) | 91(17.9) | |
| Sex | | | | | | <0.0001 |
| Male | 98(4.7) | 394(18.9) | 635(30.4) | 690(33.0) | 273(13.1) | |
| Female | 57(1.9) | 462(15.7) | 904(30.7) | 1132(38.4) | 394(13.4) | |
| Urbanicity | | | | | | 0.003 |
| Urban | 83(3.3) | 431(173) | 789(31.7) | 905(36.3) | 284(11.4) | |
| Rural | 72(2.8) | 425(16.7) | 750(29.4) | 917(36.0) | 383(15.0) | |
| Ethnicity | | | | | | 0.113 |
| Han | 126(3.0) | 724(17.1) | 1309(30.9) | 1502(35.5) | 573(13.5) | |
| Ethnic minority | 29(3.6) | 132(16.4) | 230(28.6) | 320(39.8) | 94(11.7) | |
| Education level | | | | | | <0.0001 |
| Middle school and under | 11(1.6) | 105(15.7) | 120(18.0) | 268(40.1) | 164(24.6) | |
| High school | 63(3.4) | 332(18.1) | 612(33.3) | 633(34.5) | 197(10.7) | |
| College and above | 81(3.2) | 419(16.5) | 807(31.8) | 921(3.63) | 306(12.1) | |
| Monthly household income | | | | | | <0.0001 |
| <¥3000 | 35(4.1) | 142(16.8) | 214(25.3) | 294(34.8) | 161(19.0) | |
| ¥3000–5000 | 35(2.4) | 227(15.3) | 430(29.0) | 586(39.5) | 207(13.9) | |
| ¥5001–10,000 | 43(3.0) | 247(17.4) | 479(33.7) | 481(33.8) | 172(12.1) | |
| ¥10,001–20,000 | 29(3.4) | 152(17.7) | 277(32.3) | 318(37.1) | 82(9.6) | |
| >¥20,000 | 13(3.0) | 88(20.6) | 139(32.5) | 143(33.4) | 45(10.5) | |

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