Public Perceptions, Individual Characteristics, and Preventive Behaviors for COVID-19 in Six Countries: A Cross-Sectional Study

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Abstract

Background: Public perceptions and personal characteristics are heterogeneous between countries and subgroups, which may have different impacts on health-protective behaviors during the coronavirus disease 2019 (COVID-19) pandemic. To assess whether self-reported perceptions of COVID-19 and personal characteristics are associated with protective behaviors among general adults and to compare patterns in six different countries.

Methods: We conducted this study based on a cross-sectional online survey between 15 and 23 April 2020 across six countries (China, Italy, Japan, Korea, UK, and US). A total of 5,945 adults aged 18 years or older was eligible for our analysis. Logistic regression model was used to examine the associations between personal characteristics, public perception for COVID-19, and three recommended behaviors (wearing a mask, handwashing, and avoiding social gatherings).

Results: In most countries, the participants who perceived the preventive behaviors as being extremely effective to curtail the pandemic were more likely to take each preventive behavior. The associations between personal characteristics, living environment, psychological status, and preventive behaviors varied across different countries. Individuals who changed their behavior because of recommendations from doctors/public health officials were more likely to take preventive behaviors in many countries.

Conclusions: These findings suggest that higher perceived effectiveness may be a common factor to encourage preventive behaviors in response to the COVID-19 pandemic. These results may provide a better understanding of the homogeneity and heterogeneity of factors related to preventive behaviors and improve public health policies in various countries and groups.

Background

In December 2019, an outbreak of coronavirus disease 2019 (COVID-19) was identified in Wuhan, China. From mid-January to February 2020, the virus spread to Asian countries, and over the next few months, around the world.[1] As of 14 August, 2020, a total of 21,321,811 cases and 762,184 deaths due to the COVID-19 had been reported around the world.[2] The spread of the pandemic over time has varied substantially across not only countries, but also regions within countries. Many plausible reasons underlie this geographic variation, such as the prevalence of preexisting conditions,[3,4] administrative orders, and recommendations for slowing the spread.[5,6]

Given the lack of effective pharmaceutical interventions against COVID-19, preventive measures at the individual level have been crucial to reduce the risk of infection. In fact, some recent papers have suggested that wearing a mask and handwashing are effective to prevent the spread of severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2).[7–9] Many previous interdisciplinary studies have attempted to comprehend the determinants of individual preventive behaviors using established conceptual frameworks, e.g. Health Belief Model (HBM). According to these studies, engaging in

preventive behaviors may be triggered by a complex combination of constructs, such as barriers, optimistic biases, social contexts, science communication, and personal perceptions/beliefs.[10–14] In addition, diverse factors underlying individual perceptions, such as demographic, psychological, and socioeconomic characteristics, need to be considered.[15]

Since the outbreak of COVID-19, a growing number of studies have attempted to predict the spread of the disease using mathematical modeling.[16–18] In those studies, researchers set parameters that govern individual behavior and the transmission of the disease among populations and impact the simulation results substantially. Therefore, understanding the interactions between individual demographic and socioeconomic characteristics, cultural and social contexts, perceptions about the disease, and health preventive behaviors is a fundamental step to develop advanced modeling and provide critical insights into how public health experts should best respond to the pandemic.

Given that factors related to preventive behaviors are country-dependent, in this cross-sectional study, we aimed to describe international differences in personal characteristics, cultural backgrounds, and perceptions about the pandemic, and to examine the associations between these factors and health preventive behaviors in six countries.

Methods

Cross-sectional Online Survey

In order to analyze the relationship between public perceptions, individual characteristics, and preventive behaviors for COVID-19 in six countries, this cross-sectional study was based on information obtained through an online survey conducted across six different countries (China, Italy, Japan, Korea, the UK, and the US) from 15 to 23 April 2020[19]. The online survey was performed with the support of two market research companies (Lucid Holdings, LLC, New Orleans, LA and dataSpring, Inc., Tokyo, Japan; the data are publicly available at https://osf.io/aubkc/). The interview form was developed for this study and is available as Additional file 1 in English version. Before participating in the online survey, informed consent was obtained from all participants after specifying that anonymized individual-level data would be made public. Participation was remunerated according to general compensation schemes defined by each company. The median response time to complete the questionnaire was about 14 minutes. To ensure the reliability of the survey, those who responded at less than 50% of the median response time were excluded beforehand. The original study protocol was approved by the ethics board at the University of Exeter (eUEBS003014 v2.0), covering surveys in all countries in the midst of a time-sensitive crisis. In addition, the protocol was officially reviewed by the ethics review board of Fujita Health University (HM20-182).

Study Population

A total of 6,089 adults aged 18 years or older were eligible for this survey. The participants are nationally representative in terms of age structure, sex, and household income. We excluded 144 individuals from

the analysis because of missing values on the questionnaire, resulting in a data set consisting of 5,945 individuals (2,900 men and 3,045 women).

Public Perceptions

Perceived susceptibility was assessed according to whether participants believed that they are or had been infected with SARS-CoV-2. Perceived severity was assessed according to whether participants believed that they would develop a serious illness requiring hospitalization because of the virus. These question items were answered in terms of percentage points (0–100%). The perceived effectiveness of each preventive behavior was assessed according to whether participants believed that a specific action would help slow the spread of COVID-19 based on the following five options: 1) not effective at all, 2) slightly effective, 3) moderately effective, 4) very effective, or 5) extremely effective.

Health Behaviors

Participants were asked questions regarding the frequency of various daily behaviors. The questions about each behavior were prefaced by the statement, "Please tell us how often you have engaged in each of the following behaviors". The participants responded to the question items about these behaviors on a five-point scale (never, rarely, sometimes, very often, or always). We selected two behaviors that had been recommended by government offices and national official institutes: wearing a mask and either handwashing with water and soap or using hand sanitizer. The participants who answered "never" or "rarely" were defined as those who were *not* taking preventive behaviors, whereas those who answered "sometimes", "very often", or "always" were defined as those who *were* taking preventive behaviors. By contrast, we selected one unfavorable behavior—participation in a social gathering with more than 20 people—for which the participants who answered "never" or "rarely" were defined as those who *were* taking preventive behaviors, whereas those who answered "sometimes", "very often", or "always" were defined as those who were *not* taking preventive behaviors. Participants were also asked questions regarding the different reasons why they changed their daily behaviors. In this study, we selected the variables of recommendations from family/friends, doctors/public health officials, or politicians, and conformity. Since the questionnaire did not specify the changed behavior, the responses to those questions should be interpreted as representing how likely an individual's behavior was affected by conformity or recommendations from others during the pandemic.

Statistical Analysis

We calculated means and standard deviations for continuous variables and numbers and percentages for categorical variables. We performed country-stratified logistic regression analyses to estimate the multivariable association between public perceptions, personal characteristics, and the three preventive behaviors. We included the following variables in our analyses: sex, age (65 years or older), residential area, living arrangements, income level (five groups), perceived probability, perceived severity, perceived effectiveness, feeling anxiety, and preventive behaviors before the pandemic, and the variable of region as a covariate. All statistical analyses were performed using R version 4.0.0 (R Foundation for Statistical

Computing, Vienna, Austria). The codes used for the statistical analysis are uploaded to GitHub (https://github.com/fujichaaan/covid19_opendata).

Results

Table 1 shows the respondents' characteristics by country. The proportions of respondents who answered that he/she wore a mask (at the time of survey) were above 85% in three Asian countries and Italy, compared with 73.3% and 27.6% in the UK and US, respectively. Over 90% of respondents washed their hands/used hand sanitizer in all countries except for Japan. Finally, the proportions of respondents who avoided social gatherings ranged from 81.5% in the US to 92.6% in Japan.

Table 2 shows the associations between public perceptions, personal characteristics, and wearing a mask by country. Lower odds ratios (ORs) were observed with a 1% increment of perceived susceptibility in China (OR, 0.97; 95% confidence interval [CI], 0.96−0.99) and Korea (OR, 0.97; 95% CI, 0.96−0.99). In the US, high perceived severity was associated with wearing a mask (OR, 1.01; 95% CI, 1.00−1.01). Except for China, those who perceived that wearing a mask was extremely effective had higher ORs in Italy (OR, 4.78; 95% CI, 2.36−9.44), Japan (OR, 4.69; 95% CI, 1.95−11.58), Korea (OR, 8.03; 95% CI, 1.49−46.43), the UK (OR, 18.71; 95% CI, 8.54−45.83), and the US (OR, 5.87; 95% CI, 3.04−11.51). Older people were more likely to wear a mask in Japan (OR, 2.01; 95% CI, 1.12−3.73) and the US (OR, 1.50; 95% CI, 1.03−2.22), whereas the inverse association was observed in the UK (OR, 0.43; 95% CI, 0.22−0.81). Male participants were less likely to wear a mask only in Japan (OR, 0.30; 95% CI, 0.18−0.49). Those who lived in urban areas had high ORs in the UK (OR, 1.67; 95% CI, 1.12−2.48) and the US (OR, 1.46; 95% CI, 1.04−2.07). The participants in the fifth income quintile were more likely to wear a mask in China (OR, 3.82; 95% CI, 1.47−10.71), Korea (OR, 13.1; 95% CI, 3.41−87.04), and the US (OR, 3.49; 95% CI, 2.01−6.15). Feeling anxiety was positively associated with wearing a mask in Japan (OR, 2.12; 95% CI, 1.30−3.51), the UK (OR, 1.48; 95% CI, 1.01−2.18), and the US (OR, 1.64; 95% CI, 1.18−2.28).

Table 3 shows the associations between public perceptions, personal characteristics, and handwashing/using hand sanitizers by country. Inverse associations were observed between hand sanitizing and perceived susceptibility in China (OR, 0.98; 95% CI, 0.96−0.99) and Korea (OR, 0.97; 95% CI, 0.95−0.99). Those who had higher perceived effectiveness were more likely to wash their hands in Italy (OR, 9.84; 95% CI, 1.59−57.19), Japan (OR, 5.09; 95% CI, 1.10−26.53), Korea (OR, 13.22; 95% CI, 1.32−139.34), and the US (OR, 7.80; 95% CI, 1.31−42.74). In line with wearing a mask, older people were more likely to wash their hands in Japan (OR, 1.93; 95% CI, 1.64−10.11) and the US (OR, 5.86; 95% CI, 1.38−35.72). In Japan only, male respondents were less likely to wash their hands (OR, 0.45; 95% CI, 0.23−0.86). Those who lived in urban areas had lower ORs for hand sanitizing in Korea (OR, 0.39; 95% CI, 0.17−0.84), and those who lived alone were less likely to wash their hands in Japan (OR, 0.43; 95% CI, 0.22−0.84). Feeling anxiety was positively associated with washing hands in China only (OR, 2.41; 95% CI, 1.28−4.70).

Table 4 shows the associations between public perceptions, personal characteristics, and avoiding social gatherings in the six different countries. Perceived susceptibility was inversely associated with avoiding social gatherings in China (OR, 0.97; 95% CI, 0.96−0.98), Japan (OR, 0.97; 95% CI, 0.96−0.99), Korea (OR, 0.97; 95% CI, 0.96−0.99), and the US (OR, 0.98; 95% CI, 0.97−0.99). Participants with high perceived severity in China were more likely to avoid social gatherings (OR, 1.03, 95% CI, 1.02−1.04), whereas an inverse association was observed in the UK (OR, 0.99; 95% CI, 0.98−1.00). Those who had higher perceived effectiveness were more likely to avoid social gatherings in China (OR, 3.52; 95% CI, 1.12−10.07), Italy (OR, 4.37; 95% CI, 1.31−13.25), Korea (OR, 7.97; 95% CI, 1.68−35.51), the UK (OR, 7.07; 95% CI, 1.85−25.60), and the US (OR, 7.89; 95% CI, 2.82−22.30), but not in Japan. Older people tended to avoid social gatherings in China (OR, 3.14; 95% CI, 1.31−8.25). Male participants were less likely to avoid social gatherings in Japan (OR, 0.26; 95% CI, 0.12−0.53) and the US (OR, 0.51; 95% CI, 0.32−0.81). Although those who lived in urban areas were more likely to avoid social gatherings in Korea (OR, 1.93; 95% CI, 1.19−3.14), an inverse association was found in the UK (OR, 0.49; 95% CI, 0.29−0.83). Participants with higher incomes were more likely to avoid social gatherings in Japan (OR, 4.46; 95% CI, 1.29−15.99). Feeling anxiety was associated with avoiding social gatherings in the UK (OR, 1.74; 95% CI, 1.02−3.00).

Table 5 shows the associations between behavioral changes and the three preventive measures. Those who changed their behaviors because of recommendations from doctors were more likely to wear a mask in China (OR: 2.54, 95% CI: 1.34−4.93), Italy (OR: 2.22, 95% CI: 1.46−3.39), Japan (OR: 4.10, 95% CI: 1.80−10.78), and the US (OR: 2.05, 95% CI: 1.47−2.85). The same positive association was observed with handwashing/using hand sanitizers in China (OR: 2.49, 95% CI: 1.28−4.94) and Korea (OR: 4.14, 95% CI: 1.17−20.99), and with avoiding social gatherings in Italy (OR: 1.78, 95% CI: 1.01−3.15), Korea (OR: 2.33, 95% CI: 1.21−4.69) and the US (OR: 2.49, 95% CI: 1.59−3.94). Statistically significant associations were observed only between behavioral changes triggered by politicians and wearing masks in the US (OR: 1.78, 95% CI: 1.24−2.58) and avoiding social gatherings in the UK (OR: 2.34, 95% CI: 1.35−4.11). Japan was the only country in which a statistically significant positive association was observed between behavioral changes triggered by conformity (OR: 8.55, 95% CI: 2.21−58.2) and recommendations by family members to wear a mask (OR: 4.50, 95% CI: 1.39−20.94).

Discussion

In this study, we examined the association between perceptions, personal characteristics, recommendations from others, and three preventive behaviors in six countries during the COVID-19 pandemic. According to the HBM, a canonical model of behavioral medicine, the three individual perceptions examined here affect the preventive measures to be taken.[19] Among these three perceptions, we found that perceived effectiveness was a common driving factor for engaging in preventive behaviors in all six countries. Regarding the other two perceptions, we found that the effects varied across countries. Associations between other individual demographic and socioeconomic traits and preventive behaviors were also heterogeneous across countries.

In behavioral medicine, it is widely accepted that perceived susceptibility (likelihood of contracting a disease or developing a condition), perceived severity (seriousness of an illness), and perceived effectiveness (effectiveness of a suggested preventive measure) are key components in taking preventive measures and thereby controlling infectious disease outbreaks. During the influenza A virus subtype H1N1 pandemic of 2009, both perceived susceptibility and severity were found to be significant factors in persuading the public to change their preventive behavior.[10–12] Contrary to our theoretical expectations, however, our results showed inverse associations between perceived susceptibility and severity and preventive behaviors in some countries. This could potentially be attributed to reverse causality, i.e., we hypothesized that because of the cross-sectional design, the respondents who took preventive behaviors were more likely to perceive a low likelihood of having been infected. In addition, the design of the questionnaire might have failed to gauge empirically the concept of perceived susceptibility. Therefore, the association observed in this study between preventive behaviors and perceived susceptibility requires careful interpretation. Through the lens of the HBM, perceived effectiveness is a concept similar to the construct of "perceived benefit". Previous studies have reported positive associations between an individual's perceived effectiveness and preventive behaviors, e.g., during the SARS epidemic of 2003, people who perceived the effectiveness of preventive measures in Hong Kong were more likely to wear a mask (OR: 7.15, 95% CI: 4.25–12.05), wash their hands (OR: 32.00, 95% CI: 13.88–73.78), and avoid crowded places (OR: 31.56, 95% CI: 15.61–63.82).[14] Considering the observed homogeneous effects of perceived effectiveness across preventive behaviors and countries, government recommendations and social communications should enhance their effectiveness to promote better compliance.

Although the results of this study were not uniform across all countries, personal characteristics, including sex, age, and income groups, were associated with all three preventive behaviors. Similar to the previously reported effect of sex on health behaviors, female participants tended to engage in more preventive behaviors than did males. Consistent with previous studies on SARS,[10,11,14,21] we also found that older adults were more likely to take preventive measures. High-income groups were associated with an increased probability of taking preventive behaviors, but educational experience and ethnicity may have been potential confounders underlying this association.[22–24] A study on sociodemographic factors in response to SARS in New York suggested that high-income groups were more likely to access accurate information.[25] Therefore, high-income individuals may take more appropriate actions when faced with emerging diseases. We also assessed the effect of living environment on taking preventive behaviors. Given the high passenger density and difficulty of social distancing in public transportation, we would expect that those who use public transportation are more likely to take preventive measures. However, our results showed that the use of public transportation (as of the survey date) was negatively associated with the probability to wear a mask. This unexpected result may be explained by the downward bias of the coefficient estimate driven by the potential negative correlation between the covariate and unobserved variables. For instance, an individual who is more seriously concerned about a disease and thus more inclined to wear a mask may be more likely to avoid using public transportation. To verify this potential endogeneity problem, we also ran a regression involving the use of public transportation before the pandemic, which may be correlated with the use of transportation after the pandemic will be independent

of the unobserved variables. The results yielded theoretically consistent estimates, i.e., the use of public transportation was associated with a higher probability of wearing a mask. In addition, feeling anxiety may have been associated with preventive behaviors in some countries, which was consistent with the results observed in previous studies.[21, 25]

Behavioral changes triggered by conformity and recommendations from others showed different impacts on preventive behaviors across countries, and the impacts also varied across all three preventive behaviors within each country. However, the bottom line is that individuals who changed their behavior because of recommendations from doctors/public health officials were more likely to take preventive behaviors in many countries, e.g., wearing a mask in China, Italy, Japan, and the US, handwashing in China and Korea, and avoiding social gatherings in Italy and Korea. On the other hand, recommendations by politicians did not significantly affect preventive behaviors, except for wearing a mask in the US. In many countries during the pandemic, local governments have been holding regular press conferences to provide daily updates on the pandemic and call for preventive measures. Our results suggest that the engagement of medical professionals in addressing the significance of preventive measures is more effective. Another interesting finding was that individuals in Japan who changed their behavior after taking conformity into account were more likely to wear a mask. This may reflect cultural norms in Japan, in which individual behavior is affected greatly by the behaviors of others around him/her.[26,27]

Several methodological issues need to be mentioned as limitations. First, this study was conducted in a limited sample population, which may affect the external and internal validity. Ideally, an epidemiological study should be conducted on randomly selected participants from the general population. This online survey was designed to retain national representation regarding basic demographic variables, even though we could not acquire the response rate and sampling method. The sampling method was not perfect, but appeared to minimize the possibility of a response bias as an emergency survey. Second, important covariates such as ethnicity, educational experience, and preexisting comorbidities were not available in this study. Previous studies have reported that ethnicity is a major factor in preventive behaviors.[23] Third, the design of questionnaire used in this study may be crucial for interpreting the results. In particular, the question item on perceived susceptibility to COVID-19 was likely critically problematic. In this survey, participants were asked "What do you think is the probability that you are or have been infected with COVID-19?", i.e., the current susceptibility for COVID-19. However, in general, a question on perceived susceptibility should ask about the possibility of being infected in the future. In addition, the questionnaire had only one question regarding personal perceptions, whereas conventional methods usually employ multiple questions to assess individual perceptions more precisely. Due to the poorly defined questionnaire and the cross-sectional design of this study, some caution is needed in interpreting the results, as described above. Further cross-country studies using a longitudinal design and well-structured questionnaires could be expected to overcome these limitations and provide a more accurate assessment of the structural relationships between different factors and preventive behaviors.

Conclusions

In conclusion, first, our results suggest that, when encouraging the general public to engage in preventive measures during a pandemic, it would be effective to publicize the effectiveness of such measures. Second, associations between individual characteristics (both demographic and socioeconomic) and preventive behaviors vary across countries and preventive measures, which highlights the importance of targeting subgroups of people when preventive measures are implemented by a health administration. Third, our results suggest that incorporating different associations between individual characteristics and preventive behaviors across countries may provide more precise simulation results in mathematical modeling.

Abbreviations

CI: confidence interval

COVID-19: coronavirus disease 2019

HBM: Health Believe Model

OR: odds ratio

SARS: severe acute respiratory syndrome

SARS-CoV-2: severe acute respiratory syndrome-coronavirus-2

Declarations

Ethics approval and consent to participate

The original study protocol was approved by the ethics board at the University of Exeter (eUEBS003014 v2.0). In addition, the protocol was officially reviewed by the ethics review board of Fujita Health University (HM20-182). Written informed consent was obtained from all participants through online form.

Consent for publication

This study used the publicly available data. Before participating in the online survey, informed consent was obtained from all participants after specifying that anonymized individual-level data would be made public.

Availability of data and materials

The data are publicly available at https://osf.io/aubkc/. The codes used for the statistical analysis are uploaded to GitHub (https://github.com/fujichaaan/covid19_opendata).

Competing interests

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Tables

Due to technical limitations, table 1 to 5 is only available as a download in the Supplemental Files section.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Questionnaire.pdf
- supplement2.xlsx