COVID-19: access to information, health service, daily life facility and risk perception of foreigners during the coronavirus pandemic in South Korea

Md Nazirul Islam Sarker[1], Lamiur Raihan[2], Yang Peng[3], Tahmina Chumky[2], MM Kamruzzaman[4], Roger C. Shouse[5], Huh Chang Deog[6]

[1]School of Social Sciences, Universiti Sains Malaysia, USM, Penang 11800, Malaysia
[2]Laboratory of Sustainable Rural Development, Graduate School of Global Environmental Studies, Kyoto University, Kyoto, Japan
[3]Office of the President, West China Hospital, Sichuan University, Chengdu, China
[4]Department of Computer and Information Science, Jouf University, Sakaka, Al-Jouf, KSA, Saudi Arabia
[5]Department of Education Policy Studies, Pennsylvania State University, University Park, United States
[6]Department of Sociology, Yeungnam University, Gyeongsan, South Korea
*Md Nazirul Islam Sarker, and Yang Peng are co-first authors

Corresponding author:
Md Nazirul Islam Sarker PhD
School of Social Sciences,
Universiti Sains Malaysia,
USM, Penang 11800,
Malaysia
Phone: +88 01816739039
E-mail:
sarker.usm@yahoo.com

Abstract

Introduction: The coronavirus disease outbreak has become a top global challenge. Critical issues have emerged regarding access to information, health services, and daily necessities. Effective access to such components is expected to promote public safety and survival as well as to help combat social fear and risk perception. This study aims to fill this gap by exploring public perceptions of access, risk, and government response during the COVID-19 outbreak.

Material and methods: A quantitative field survey using a structured mailed questionnaire was conducted to collect primary data from 100 foreigners living in various cities in South Korea. Access to information, health and daily necessities, and overall risk perception were examined based on individual reports regarding sources, availability, credibility, and overall satisfaction.

Results: Our findings suggest that foreigners are receiving reliable information from public and private sources. Although access to health services, daily necessities, and protection measures were perceived as limited due to government protection measures, survey respondents tended to perceive an overall satisfactory government response in terms of providing resources and reducing risks related to COVID-19.

Conclusions: Model analysis indicates that gender, home location, and duration of stay are significantly related to lower levels of risk perception. This study provides a new lens for policymakers, administrators, and academicians by which they can ensure smooth public access to information, health, and daily necessities regarding the protection and containment of coronavirus.

Key words: public health, disease transmission, information access, social networking, social media, risk management.

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Introduction

The COVID-19 outbreak is now a global challenge due to its rapid spreading nature, frequently changing genetic characteristics, and an absence of effective vaccines and or medications. Traced to Wuhan, China in the winter of 2019–2020, the emergent coronavirus SARS-CoV-2 was officially identified as the cause of the COVID-19 outbreak [1]. COVID-19 is considered the most dangerous infectious virus due to its comparative ease of human transmission. Humanity is thus an active vector of this virus [2], the long-term consequences of which are as yet not fully known. Based on early experience and data, COVID-19 appears to be the most destructive virus for the last 100 years and developed countries such as the United States, China, Italy, Spain, and Germany have struggled to control its transmission. As of July 26, 2021, the total number of confirmed cases is 195,546,714 and of deaths is 4,187,072 [3] (Figure 1). Experts have urged people to maintain critical health practices of daily life and social distancing as a basic means of individual and social protection. Some scientists go further, suggesting that people stay home during this pandemic situation [4, 5]. In addition to such effective information, a great deal of false information and rumors have been spread over the internet, especially through social networking sites that encourage many to adopt ineffective or harmful preventative practices [6, 7]. The availability of credible information sources thus serves as a critical resource for preventing and preparing for this potentially deadly virus infection [8, 9] (Figure 1).

The increasing demand for coronavirus information has tended to produce an increase in sources and variation of information flowing from internet websites and social media [10, 11]. This in turn places greater importance on the cognitive capacity of individuals to distinguish the validity and reliability of the information they receive. This capacity appears to vary by age, gender, health-related literacy, and internet usage frequency [12]. The cognitive demands placed on information seekers is made even more daunting by a broad sense of uncertainty or disagreement among experts as to how to best contain, cure, and prevent it [13]. Yet more confusion may emerge as experts' conclusions become interpreted and articulated by political leaders, policy makers, and other non-technical spokespersons around the globe [14]. Considering the global importance of the fight against COVID-19, members of the public agencies are rightly concerned and justified in seeking and expecting reliable information that is needed to prepare and protect themselves from the pandemic's impact [15].

Public uncertainty and need for information thus appear shaped within a vector field of uncertainly and fear. At the early stages of the pandemic, many disease experts voiced beliefs that the coronavirus was preventable and curable [13] or had low transmission among humans. Though such early assumptions were later proven incorrect [14], they likely promoted general public certainty and calm and reduced the necessity for political or policy amplification. The gradually increasing spread of infection and reports of deaths did not immediately lead to a scientific consensus or public certainty [16], but differing views were expressed among scientists and policy makers as to how to best respond to the problem [17]. Yet as the infection began to spread rapidly and death rates grew, expert and policy consensus emerged supporting the use of quarantine and widespread use of facial masks [18]. As this stage emerged, public fear and demand for trustworthy information likely increased [19].

Although several recent studies have addressed the biological and epidemiologic characteristics, incubation, diagnosis, treatment, and containment measures of COVID-19 [7, 20–29], fewer studies exist on public perceptions of information
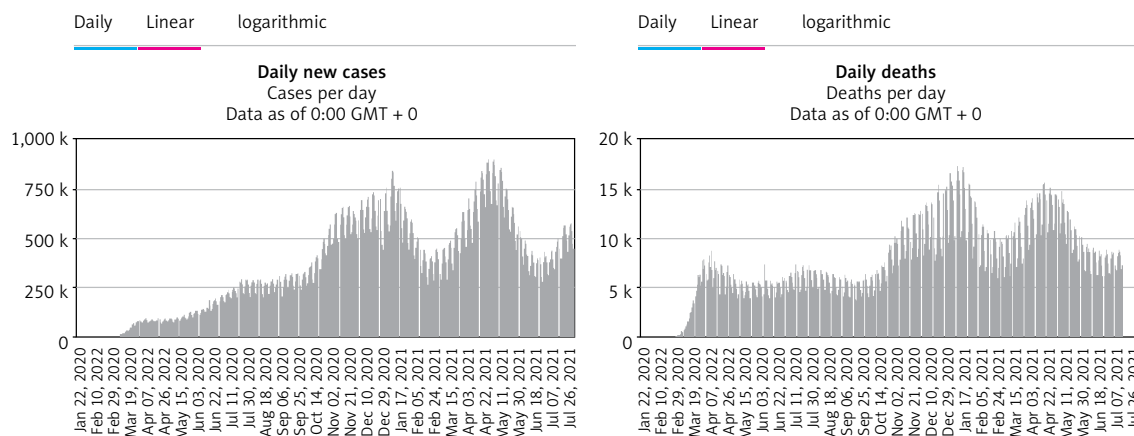

Figure 1. Infection and death cases caused by COVID-19 as of July 26, 2021 [3]

access [30] and reliability regarding the availability of health services [31], daily life necessities, the overall risk posed by COVID-19, and an effective government response [32]. As over 200 countries and regions have faced and had to deal with COVID-19, it is high time to assess people's access to information, their daily responses, and the ability of their governments to effectively provide information and other resources (masks, sanitizer, etc.) as needed [33].

Awareness of and access to needed information and resources is crucial for any population impacted by COVID-19. It may be even more critical, however, for persons living in foreign countries, a group that is more vulnerable due to language, cultural, or bureaucratic barriers, as well as to a general unfamiliarity with the salient infrastructures under which they live. Managing a crisis like COVID-19 becomes much more difficult if a foreigner community misperceives the overall pandemic situation, government strategies, or opportunities to acquire resources. It may increase overall community risk as well as confusion and mental stress among a potentially marginalized foreigner community.

This study therefore focuses on the foreign community's perception regarding their prime information sources, health services, and level of satisfaction regarding government risk management strategies, all of which compose key elements for individuals, families, and communities to overcome the challenges of the COVID-19 pandemic. Based on data from a well-documented success story – South Korea – the study is expected to highlight important strategies and indicators of effective pandemic management.

Review of the related literature

Information greatly influences people's capacity to make proper decisions and take proper action during public emergencies such as a pandemic – decisions related to basic daily needs, education, health, possible risks and explicit dangers, and attendance to basic daily needs [12]. Jacobs *et al.*' [34] study on health-related information seeking behavior reports on the availability of such information through various internet websites, cautioning, however, that availability of information does not necessarily lead to proper decisions or actions. Focusing on adolescents, Esmaeilzadeh *et al.* [35] reported that most adolescents tended to first gather information from the internet, and then from social media. Information, however, may not lead to proper decision making, as Khaleel [8] cautions that information overload can occur, creating uncertainty or confusion among consumers. Building public capacity to recognize and act upon authentic health and resource information

building on health-related literacy is expected to serve as an effective approach to helping people to save themselves in the pandemic condition of COVID-19 [13].

Shim and Jo [36] researched the benefits of internet websites for health-related information, reporting a growing public tendency to rely upon online websites. Examining key variables such as user satisfaction, repetitive visits, and perceived advantages, the researchers found significant relationships with service quality [27]. Similarly, Wenjing *et al.* [37] assessed information needs of consumers and argued that they acted as a motivator for the information seeker. They also mentioned that several factors are necessary for measuring information needs such as importance level, frequency, amount, timing, and fulfillment of needs.

Petersen *et al.* [38] explored potential COVID-19 exit strategies and suggested three major points: (1) raising awareness about the rapidity of community transmission; (2) the importance of mass testing; and (3) maintaining a sufficient supply of protective equipment for health workers. Access to protective equipment is also important for general people who are living in the mass infected areas. One health approach is also important to protect environmental, animal and human health through communicating, collaborating and coordinating among different stakeholders. All these issues are dependent on smooth information flow and people's access to information and health related resources. Alexander *et al.* [23] also argued that health related information technology can be a long-term solution for ending the COVID-19 outbreak.

Lack of information can mislead people about risk perception, health maintenance, and appropriate daily activity. Wenjiang *et al.* [37] argued that many studies have already been done on consumer health information needs (CHIN) but research on the social aspects of health related information is still lacking. Within the context of COVID-19, there are numerous ongoing debates on the need for social distancing, mask wearing, and lockdown policies. Many people question or dismiss the importance of these practices as control and protective measures [5], while others insist on their effectiveness against community transmission. Without proper information, community opinion leaders may encourage counterproductive public action during the COVID-19 crisis. Pointing out South Korea's successful action to control the outbreak of COVID-19 without a hard lockdown, Moon [6] highlights critical factors such as transparency and public participation.

Participation related to effective access to information, health, daily affairs and strategies to avoid risks. Gu and Li [22] emphasized the importance of easily accessed early warning systems

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about a disease outbreak. All the available variables and indicators of information availability, reliability, and satisfaction have been considered in this study to present a realistic picture of people's access to information, health services, and daily life facility during the COVID-19 pandemic.

Material and methods

A quantitative dominant qualitative mixed method was used for this study. This approach utilized a structured questionnaire survey. The study was based on a cross-sectional survey of foreigner respondents living in various cities in South Korea during the COVID-19 outbreak.

Locale of the study

This study intentionally selected South Korea as a case for study because of its development, modern facilities, and high level of public services. South Korea has taken special care of its citizens, particularly for foreigners working and studying there. Moreover, the World Health Organization (WHO) and other related organizations have already recognized the nation for its effective handling of the pandemic. Figure 2 provides relevant statistics in support of this recognition.

The study was conducted in nine big cities in South Korea (Figure 3), all of which have many foreigners working or studying there. The city of

Daegu was early on discovered to be the epicenter of COVID-19 infection, with one particular patient found to be a superspreader. The total number of confirmed cases is 10,765 with 247 deaths and, most importantly, 9,059 patient recoveries as of April 30, 2020 [3].

Population and sampling procedure

This study considers foreigners living in major South Korean COVID-19 epicenter cities such as Daegu, Seoul, Gyeongsan, Gwangju, Daejeon, Busan, Jeju, Sejeong, and Suwon. The sample consists of foreigners of various professions such as university teachers, researchers, undergraduate and graduate students, workers, and general expatriates. The sample size was determined by the following formula developed by Guilford and Fruchter [39], which has been used by other researchers (see, Jacobs *et al.* [40]; Esmaeilzadeh *et al.* [35]; Shim and Jo [36]) for calculating the sample size for livelihood research. The sample size was determined by using the standard formula as stated below: $n = (z^2pq/d^2)$, $n = ((1.96)^2 \times 0.5 \times 0.5)/(0.01)^2$, $n = 96$, where: n = the desired sample size, z = the standard normal deviate set at 1.96, p = estimated to be at 50% level, $q = 1 - p$, d = degree of accuracy set at 10%. The estimated sample size was 96. Finally, 100 respondents were included in this study.

Nation-wide
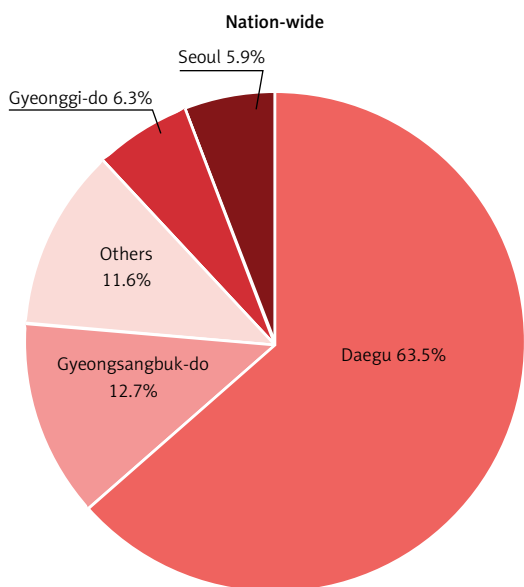
Confirmed cases	10,793
Daily change	**(+13)**
Quarantined	1,360
Recovered (released from quarantine)	9183
Deceased	250
Number of confirmed cases for every 100,000 people	20.82

Figure 2. COVID-19 infected cases based on province of South Korea as of April 19, 2020 (Source: Korea Centers for Disease Control and Prevention)

Figure 3. Study areas in South Korea (Source: https://www.vectorstock.com/royalty-free-vector/map-of-south-korea-vector-15992071)

Data collection

Data were collected from foreigners primarily through the use of interviews with sampled individuals from February to March 2020. A structured interview schedule was designed and pretested using Survey Monkey software and sent to a random sample of respondents through various social network sites.

Approach for measuring access to information, health and daily life necessities

Information access was explored by measuring key indicators such as information sources, availability, credibility, and user satisfaction. In relation to their relationship with information access, access to markets, medical products, daily necessities, and protection measures were also examined. A four-point rating Likert scale was incorporated to obtain data regarding respondents' preference of information and satisfaction. Tendencies across demographic categories were also explored (i.e., age, gender, education, family size, area and length of residency, and nationality).

Based on relevant variables, information access was measured using a Computed Preference Information Source Score (CPISS), a widely used method for determining people's preference for information sources [37, 38]. The CPISS method was applied to determine the major source of information regarding COVID-19 infection (Equation 1): $CPISS = Rhp \times 3 + Rmp \times 2 + Rlp \times 1 + Rnp \times 0$ (1), where: Rhp = high preference of the respondents; Rmp = moderate preference of the respondents; Rlp = low preference of the respondents; Rnp = no preference of the respondents.

Similarly, people's access to markets, daily necessities, and medical products was measured using a binary scale. SPSS (25.0 version) was used to analyze the data. Descriptive statistics were gathered for all variables with values expressed as percentage, mean, and standard deviation.

Binary logistic regression model analysis

For the association analyses, gender status was dichotomized as 'male' and 'female' with respective scores of '1' and '0'. Place of living in South Korea was dichotomized as 'epicenter' and 'non-epicenter' of COVID-19 in South Korea. Daegu and the adjacent Gyeongsan (under Gyeongsan south province) were considered as epicenters [20] and seven other cities were considered as non-epicenters and assigned respective scores of '1'. Educational qualification was also dichotomized and similarly scored based on the completion of bachelor or 'undergraduate' and 'higher study holder' (Master's and Ph.D.). Family size and duration of stay in South Korea were taken as continuous variables. The Shapiro-Wilk test was employed to determine the normality of data distribution [41]. Categorical variables (gender, place of living and educational qualification) were analyzed using Pearson's χ^2 test for proportions and Fisher's exact test for 2 × 2 contingency tables [42]. Continuous variables were analyzed using the nonparametric Mann-Whitney test [37]. Binary logistic regression analysis was used to determine associations between the dependent and independent variables. The categorical dependent variable was the risk perception of the COVID-19 pandemic situation. In total, 67 respondents perceived risk feelings due to the COVID-19 pandemic and 33 respondents did not perceive any risk.

Table I. Demographic characteristics of foreigners in South Korea

Demographic characteristics	Categories (years)	No.	Percent	Mean	Standard deviation
Age	Very young (18–20)	2	2	28.39	4.92
	Young (21–30)	58	58		
	Middle age (above 30)	40	40		
Education	Bachelor (> 12 years of schooling)	13	13	16.25	1.05
	Master (15 to 16 years of schooling)	53	53		
	Doctorate (> 16 years of schooling)	34	34		
Duration of stay	Short duration (0–2)	40	40	2.31	1.13
	Medium duration (3–5)	58	58		
	Long duration (above 5)	2	2		
Family size	Single (1)	75	75	1.43	0.86
	Couple (2)	12	12		
	Medium family (3-4)	12	12		
	Big family (above 4)	1	1		

Source: Field survey, 2020.

Thus, the score was given '1' for risk feelings and '0' for no risk feelings. The variables with a p-value < 0.05 remained in the final model. Odds ratios (OR) and 95% confidence intervals (CI) were calculated.

Results

Demographic characteristics of foreigners in South Korea

Sample demographic characteristics are represented by age, gender, education level, family size, years of residence, residential area, and nationality (Table I). The analysis shows that most of the respondents are male (73%). Respondents tend to be young (58%), just two percent are very young, and the remainder (40%) are middle aged. Most respondents held a Master's or higher-level degree. Fifty-eight percent of respondents have resided in Korea for three to 5 years and 42% for 2 years or less. Sixty-four percent of respondents are single. Most of the respondents (75%) have one or fewer children and 12% have 2 to 4 family members.

As Figure 4 shows, most of the respondents (46%) are residing in Daegu, 28% in Gyeongsan, with the remainder living in Seoul, Gwangju, Daejeon, Busan, Jeju, Sejeong, and Suwan.
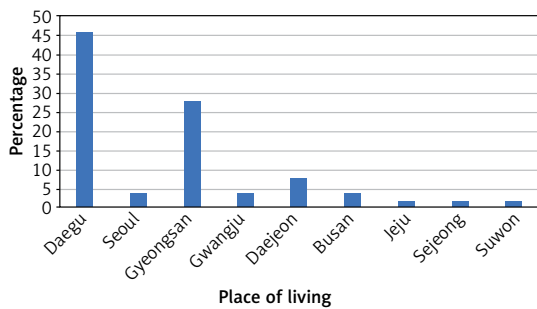

Figure 4. Distribution of respondents based on the place of living in Korea

As Figure 5 shows, most respondents (37%) are Bangladeshi. Eight percent are from Pakistan and Sri Lanka while the rest are from Afghanistan, Uzbekistan, Nepal, South Africa, East Timor, Senegal, Somalia, Ethiopia, Malaysia, Indonesia, Uganda, Mexico, India, Papua New Guinea, Kenya, Cambodia, Vietnam, Laos, Ruanda, Philippines, and Myanmar.

Health status

Health insurance is considered as one of the most effective protective measures to help people avoid financial loss during and after infection [43]. Owing to South Korean government policy, all respondents have health insurance. Most respondents (83%) have private insurance while only 17% have national insurance. Despite its reduced coverage for serious illness, single people living in South Korea prefer private insurance because of its lower cost. National health insurance, however, provides more comprehensive coverage and is more likely to be used by persons with families or expecting children. Medical service, including COVID-19 testing or other services, is provided at no cost. This may help explain why South Korea tested significantly more persons per capita than most other nations. In terms of COVID-19 infection and recovery, just two percent of respondents reported being infected, all of whom reported recovery due to treatment and care provided by the South Korean government (Figure 6). For purposes of confidentiality, the nationalities of the infected patients are not disclosed here.

Access to information

Information sources

The sources of COVID-19 related information have been categorized into 5 categories: government agency [44], private agency [24], personal
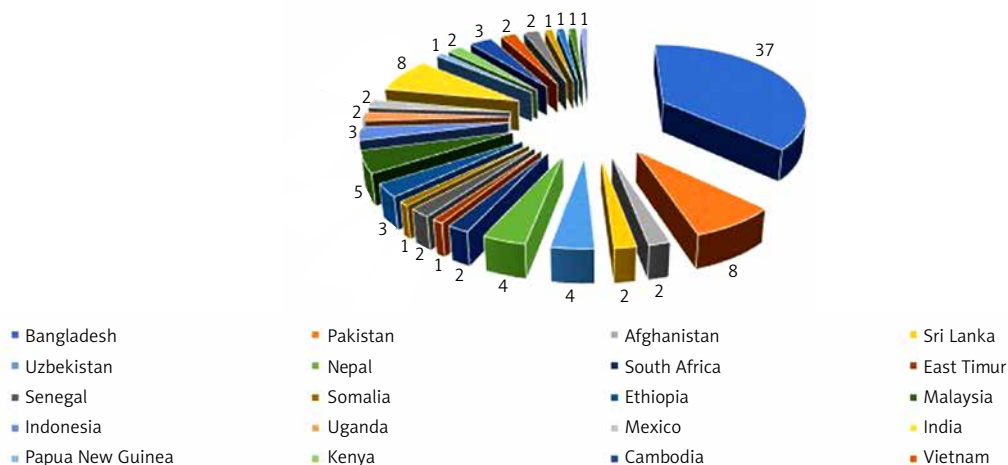

Figure 5. Pie distribution of respondents based on nationality

contact [45], social media [25], and mass media [8]. All the major categories have some sub-categories for meaning presentation. A Computed Preference Information Source Score (CPISS) has been calculated in this study to present the information sources by ranking order (Table II). The analysis reveals that most of the respondents collected information from the university website or email, most likely due to their profession and connection to the university. Facebook is ranked second in the information source ranking due to its popularity and easy connectivity in the foreigner community [36]. Ranking third, many respondents collect information from friends living in South Korea. Following this, sources such as international media, friends or relatives in other countries, government or city office, Korean TV, Twitter, Newspaper, company or landlord are respectively ranked fourth to tenth. The analysis indicates the authenticity of all possible sources utilized.

Information preferences, availability and credibility

Respondent preferences of information source indicate satisfaction and trust [11]. Preferences have been categorized into low, moderate, and high sub-categories based on their obtained score. The results reveal that most respondents (95%) have moderate preferences of information sources while only 4% and 1% have low and high preferences respectively. Information availability means the extent of the available information regarding COVID-19 infection, how to protect, manage, and recover from it. The analysis shows that the majority (97%) of the respondents easily obtained information while 3% mentioned that information is controlled by various agencies. The respondents were asked their opinion on the credibility of COVID-19 related information. Most (94%) reported that information is credible while
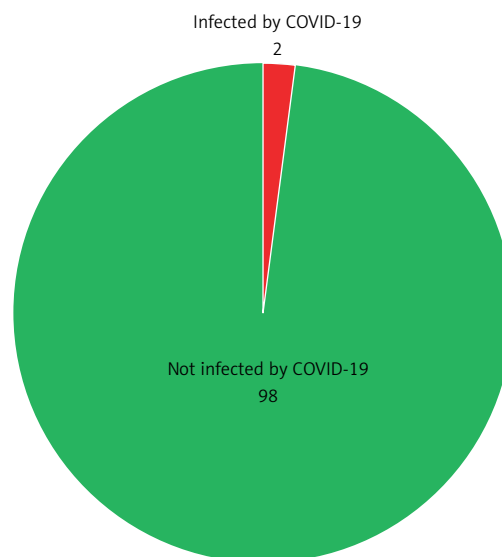

Figure 6. COVID-19 infection and recovery rate

only 6% opined that information is manipulated by various agencies (Table III).

Access to hygiene, medical products and services, and health facilities

Hygiene is an important defense against COVID-19 infection [38]. The analysis shows that foreigners in South Korea can maintain 100% hygiene at the individual level while only 59% can maintain hygiene at the family level. The values indicate that 78% of respondents could maintain hygiene in public places while 7% did not see any hygiene maintenance measures in public places (Table IV). About 41% of people opined that they are not sure about hygiene at a family level probably because of single living. 100% of respondents adopted and were satisfied with their own personal hygiene practices.

Most of the foreigners (53%) reported that masks were moderately available, 40% report-

Table II. Rank order of information sources based on CPISS (Computed Preference Information Source Score)

Information sources		Extent of preference				CPISS	Rank order
		High	Medium	Low	No		
Government agency	Government or city office	3	16	24	57	65	6
	University website or email	89	9	2	0	287	1
Private agency	Company or landlord	0	0	5	95	5	10
Personal contact	Friends living in Korea	77	14	6	3	265	3
	Friends or relatives in other countries	12	37	18	33	128	5
Social media	Facebook	86	14	0	0	286	2
	Twitter	7	3	19	71	46	8
Mass media	Newspaper	0	0	9	91	9	9
	Korean TV	12	4	5	79	49	7
	International media	76	6	11	7	251	4

Source: Field survey, 2020.

Table III. Distribution of respondents according to their overall preference of information sources

Major dimensions	Category	Number	Percent
Preference of information sources (scores)	Low (up to 10)	4	4
	Moderate (11–20)	95	95
	High (above 20)	1	1
Information availability	Easily obtained	97	97
	Agency controlled	3	3
	Depends on friends/relatives	0	0
	Not available	0	0
Information credibility	True	94	94
	False	0	0
	Manipulated	6	6

Source: Field survey, 2020.

ed sufficient availability, and 7% reported them as not available. Hand sanitizer was moderately available (62%) in South Korea. General medicines are very important to tackle emergencies and treat routine acute and chronic symptoms caused by COVID-19 or seasonal colds and flues. Most respondents (54%) found emergency medicine to be sufficiently available, 19% moderately available, and 27% not available. Similarly, personal protective equipment (PPE) is also an important element to deal with the COVID-19 situation. The analysis revealed that 56% of respondents had no PPE while 14%, 23%, and 7% respectively reported sufficient, moderate, or non-availability. This study also found that 98% of respondents wear a mask while only 2% of respondents did not (Table V).

Risk feelings and mental stress

Pandemics like COVID-19 are likely to affect people's psychological attitudes or stress levels [46]. Respondents were thus asked to report on their feelings of risk and mental stress due to the COVID-19 pandemic. Most felt high risk (37%), 30% of respondents felt moderate risk, and 33% felt little or no risk. So, overall 67% of respondents still felt risks of COVID-19. It may have been due to a number of factors, mental condition, socio-economic status, demographic characteristics, the possibility of pandemic recurrence in South Korea, and the existing conditions at home and in other countries globally. About 59% of respondents felt moderate mental stress due to COVID-19, 27% felt high stress, and 14% felt low mental stress. As a context, foreigners (87%) reported they had high access to availability of daily necessities. All foreigners had full access to markets (Table VI).

Risk perception of respondents towards COVID-19

Binary logistic regression was performed to assess the impact of several factors, i.e., independent variables representing respondent perception of risk due to the COVID-19 pandemic [47]. The model contained five independent variables (gender, duration of stay in South Korea, place of residence in Korea, family size, and educational qualification). The full model containing all pre-

Table IV. Access to hygiene

Characteristics	Available (%)	Not available (%)	Not sure (%)
Individual hygiene	100	0	0
Family hygiene	59	0	41
Hygiene in a public place	78	7	15

Source: Field survey, 2020.

Table V. Medical product availability and service

Characteristics	Sufficiently available (%)	Moderately available (%)	Not available (%)	Don't know (%)
Mask	40	53	7	0
Hand sanitizer	21	62	17	0
Emergency medicine	54	19	0	27
Personal protection equipment (PPE)	14	23	7	56

Source: Field survey, 2020.

dictors was statistically significant, χ^2 (5, N = 100) = 69.18, p < 0.001, indicating that the model was able to distinguish between respondents who reported and did not report risk feelings. The model as a whole explained between 27.5% (Cox and Snell R square) and 34.3% (Nagelkerke R squared) of the variance in risk perception, and correctly classified 73% of cases. As shown in Table VII, only three of the independent variables made a unique statistically significant contribution to the model (gender, duration of staying in South Korea and place of living in South Korea).

The strongest predictor of reporting an extreme feeling of risk was gender, recording an odds ratio of 6.26. This indicated that female respondents who had an extreme feeling of risk caused by COVID-19 were over 7 times more likely to report a risk feeling than the male respondents, controlling for all other factors in the model. The reason for this excessive risk feeling for female respondents might be due to the emotion, soft mind and vulnerability when living abroad with or without the family. Fischer *et al.* [48] reported that naturally women tend to harbor more sensitive feelings than men. The odds ratio of 0.21 for living place or city in South Korea was less than 1, indicating that for moving from an epicenter to a non-epicenter of coronavirus, respondents were 0.21 times as likely to report having a risk feeling, controlling for other factors in the model. Duration of stay in South Korea significantly contributes to the model (significant at 0.01 level). The

model fitted 67% based on the Hosmer and Lemeshow test [49].

Satisfaction with COVID-19 management

The satisfaction of foreigners was measured by two dimensions, satisfaction with health services and satisfaction with overall risk management. In this study, satisfaction with health services comprises sufficient testing, ensuring isolation and quarantine, and availability of health facilities for general diseases [50]. This study indicates that foreigners are either highly (33%) or moderately (30%) satisfied with testing, perceiving that it would be immediately available if needed, though 37% reported dissatisfaction. Satisfaction regarding isolation and quarantine (91%) and health access for other diseases (66%) was relatively high. Similarly, overall risk management comprises environment control, attitude in handling risk, panic control, security control, market control, gaining people's confidence, and inter-country diplomatic relation management [51]. The analysis indicates that 59% of foreigners were moderately satisfied in terms of environmental control while 27% had high and 14% low satisfaction. The value also shows that respondents were highly satisfied with the attitude of service providers in handling risk (81%), panic control (49%), security control (97%), market control (77%), enhancing people's confidence (86%), gaining people's confidence with concerned agencies, mostly governmental, and

Table VI. Risk feelings, mental stress, movement and access to daily necessities with respect to COVID-19

Major indicators	Sub-indicators	High	Moderate	Low	Not at all
Risk feelings and mental stress	Risk feelings	37	30	0	33
	Mental stress	27	59	14	0
Free movement in public places	Intercity movement restriction	0	34	0	66
	Intracity movement restriction	0	0	0	100
Access to daily necessities	Availability of daily products	87	13	0	0
	Access to market	100	0	0	0

Source: Field survey, 2020.

Table VII. Logistic regression model for risk perception towards COVID-19

Items	B	S.E.	Wald	df	*P*-value	OR	95% CI for *OR*	
							Lower	Upper
Gender	1.84	0.75	6.01	1	0.00	6.26	1.45	27.11
Duration of stay	−0.50	0.23	4.93	1	0.01	0.61	0.39	0.95
Place of living	−1.64	0.58	8.06	1	0.00	0.20	0.06	0.61
Family size	0.05	0.30	0.02	1	0.88	1.05	0.59	1.87
Educational qualification	−0.06	0.78	0.01	1	0.94	0.95	0.21	4.37
Constant	1.95	0.73	7.22	1	0.01	7.03		
Goodness of fit*	0.67							

*S.E. – standard error, OR – odds ratio, *Determined using Hosmer and Lemeshow test. Source: Field survey, 2020.*

inter-country diplomatic management. This study indicates that overall management was very well planned, optimistic, and satisfactory (Table VIII).

Problem confrontation during the pandemic

This study asked respondents about the problems faced during the COVID-19 pandemic days. Problem confrontation during the pandemic days is important for psychological health [52]. This study reveals that 43% of respondents faced a high degree of problems during studying and research while 19% faced moderate problems, 6% faced a low degree of problems and 22% did not face any problems at all (Table IX). This study also found that 87% of respondents did not face a problem with a scholarship/fellowship, particularly those who were studying in various universities. This suggests economic stability and sensibility among the scholarship providers in both government and non-government contexts. 13% of respondents faced problems in part-time jobs due to consequences of the COVID-19 pandemic.

Discussion

This study explored access of foreigners to information, health services, daily life facilities, and perception of government risk management approaches during the COVID-19 crisis. Information access was measured by assessing perception of information sources, availability, and credibility, and user satisfaction. Computed Preference Information Source Score (CPISS) was used to assess people's preference for obtaining information. Most of the respondents were male (73%) and young (58%t) and have a master's degree (53%) and single family (75%). The respondents are living in major cities like Daegu and Gyeongsan while others are living in Seoul, Gwangju, Daejeon, Busan, Jeju, Sejeong, and Suwan. They also cover a number of nationalities: Bangladesh, Pakistan, Sri Lanka, Afghanistan, Uzbekistan, Nepal, South Africa, East Timor, Senegal, Somalia, Ethiopia, Malaysia, Indonesia, Uganda, Mexico, India, Papua New Guinea, Kenya, Cambodia, Vietnam, Laos, Ruanda, Philippines, and Myanmar. Most of the respondents (83%) have private insurance while only 17% have government insurance.

Table VIII. Satisfaction of respondents with management

Major indicators	Sub-indicators	Highly satisfied	Moderately satisfied	Lower satisfaction	Not satisfied at all
Satisfaction with health services	Sufficient test and if the individual feels suspicion then the possibility of being tested	33	30	0	37
	Ensuring isolation and quarantine	91	9	0	0
	Health facility in hospital for general diseases	66	27	7	0
Satisfaction with overall risk management	Environment control	27	59	14	0
	Attitude in handling risk	81	16		
	Panic control	49	37	14	0
	Security control	97	3	0	0
	Market control	77	23	0	0
	Gaining people's confidence	86	13	1	0
	Inter-country diplomatic relation management	72	21	2	5

Source: Field survey, 2020.

Table IX. Problem confrontation related to study due to COVID-19

Characteristics	High problem	Moderate problem	Low problem	No problem at all	Not sure
Study and research environment (laboratory work pressure)	43	19	6	22	10
Scholarship/fellowship	0	0	0	87	13
Part time job	7	6	0	0	86

Source: Field survey, 2020.

A majority of respondents obtain information from a university website or email. It may be due to their profession and connection to the university. Information availability refers to the platforming and distribution of available information regarding COVID-19 infection. Most respondents report having easy access to information. Maintaining hygiene in public places is difficult, though about 78% of respondents report little or no difficulty maintaining hygiene. This level is encouraging and ideal for attaining in other countries. It is therefore said that the overall hygiene maintenance by the government in public places such as buses, subways, trains, elevators and escalators, markets, common lavatories and/or restrooms is very positively perceived and praiseworthy [53].

Medical products and services are considered as the main weapon to save people from COVID-19 infection [38]. More than 53% of people easily obtained masks during the COVID-19 crisis. Masks were distributed by the local post offices and drug stores at a specific time, checking the individual identity cards to manage the distribution perfectly [5].

For protecting against rapid transmission, many countries imposed lockdown and restriction on people's movement, but South Korea was an exception. So, foreigners were asked to mention their movement ability and restriction during pandemic days. About 66% of foreigners mentioned low restriction for intercity movement while 34% mentioned moderate restriction. For intercity movement, there was no restriction for movement from one place to another. Model analysis indicates that the longer the length of residency in South Korea, the lower the risk perception and vice versa. It is may be due to the experience in terms of living status, management of health facilities, and government risk management efforts [54]. Most of the respondents are satisfied with information provided by various government agencies and facilities. The practices and guidance of the South Korean authorities will be helpful for other nations to control the outbreak of the COVID-19 pandemic.

Information flows more freely and effectively in the digital era, and people can gather diverse information from diverse sources [55]. Generally, people value ready access to information about their daily life affairs. During the outbreak of the coronavirus across the world, numerous countries have been officially or unofficially locked down because of the rapid transmission nature of COVID-19, which is primarily a function of person-to-person contact. Since people under lockdown conditions highly depend on social media for information, they are likely to receive some incorrect or misleading information [56]. From the newspaper, we learned that about 300 people died from drinking poisonous alcohol in Iran based on false social media information about curing pneumonia caused by COVID-19. Similar cases were reported in India, where people drank antiseptic chemicals or animal waste as a protection measure against coronavirus infection. So, authentic information, proper timing, and information access are necessary for taking preparation to protect communities from the attack of COVID-19. The findings of this study will be helpful for policymakers, political leaders, researchers, and practitioners to take proper steps by following the effective strategy of South Korea.

In conclusion, in light of South Korea's reported success in controlling COVID-19 transmission, we selected key cities to assess national strategies regarding access to information, health services, and daily life facilities. Access to information was measured by assessing information sources, preferences, availability, and credibility. In addition, the Computed Preference Information Source Score method was applied to measure the preferences of information sources. Simultaneously, the demographic characteristics of the respondents, health status, access to hygiene and medical products, and psychological stress were measured. In this study most of the respondents were male (73%), young (58%) and have a master's degree (53%) with private health insurance (83%). The analysis reveals that most of the respondents collected information from the university website or email. Facebook is ranked second in the information source ranking due to its popularity and easy connectivity in the foreigner community. The majority (97%) of the respondents easily obtained information and argue that information (94%) is credible. Model analysis indicates that gender, duration and place of living have a significant positive relationship with risk perception. The analysis shows that foreigners in South Korea believe they can maintain 100% hygiene using masks (98%) and hand sanitizer (62%). About 59% of respondents felt moderate mental stress due to the COVID-19 pandemic while 27% felt high and 14% low mental stress. The results also show that respondents were highly satisfied with service providers in handling risk (81%), panic control (49%), security control (97%), market control (77%), enhancing people's confidence (86%), and inter-country diplomatic management. This study recommends following the strategy for ensuring access to information, health services, and daily necessities, and for maintaining general protection from COVID-19. Specifically, one of the strategies implemented by South Korea in controlling the pandemic was to follow WHO guidelines for widespread testing. Such strategies should be fol-

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lowed by other countries. Finally, the South Korean experience indicates that promoting a general sense of confidence among the population will likely increase public adherence to guidelines and precautionary measures.

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Conflict of interest

The authors declare no conflict of interest.

References

1. Wu JT, Leung K, Bushman M, et al. Estimating clinical severity of COVID-19 from the transmission dynamics in Wuhan, China. Nat Med 2020; 26: 506-10.
2. Shaw R, Kim Y, Hua J. Governance, technology and citizen behavior in pandemic: lessons from COVID-19 in East Asia. Prog Disaster Sci 2020; 6: 100090.
3. Worldometers.info. Coronavirus Update: Deceember 13, 2020. Retrived from: https://www.worldometers.info/coronavirus/ on July 26, 2021.
4. Lillie PJ, Samson A, Li A, et al. Novel coronavirus disease (Covid-19): the first two patients in the UK with person to person transmission. J Infect 2020; 80: 578-606.
5. Grint K. Leadership, management and command in the time of the Coronavirus. Leadership 2020; 16: 314-9.
6. Moon MJ. Fighting COVID-19 with agility, transparency, and participation: wicked policy problems and new governance challenges. Public Adm Rev 2020; 80: 651-6.
7. Sun K, Chen J, Viboud C. Early epidemiological analysis of the coronavirus disease 2019 outbreak based on crowdsourced data: a population-level observational study. Lancet Digit Heal 2020; 2: e201-8.
8. Khaleel I, Wimmer BC, Peterson GM, et al. Health information overload among health consumers: a scoping review. Patient Educ Couns 2020; 103: 15-32.
9. Abeler J, Bäcker M, Buermeyer U, Zillessen H. COVID-19 contact tracing and data protection can go together. JMIR mHealth uHealth 2020; 8: e19359.
10. Howlader AI, Islam MA. Information-seeking behaviour of undergraduate students: a developing country perspective. IFLA J 2019; 45: 140-56.
11. Magsamen-Conrad K, Dillon JM, Billotte Verhoff C, Faulkner SL. Online health-information seeking among older populations: family influences and the role of the medical professional. Health Commun 2019; 34: 859-71.
12. Bansal A, Koepl LM, Fedorenko CR, et al. Information seeking and satisfaction with information sources among spouses of men with newly diagnosed local-stage prostate cancer. J Cancer Educ 2018; 33: 325-31.
13. Diviani N, Zanini C, Jaks R, et al. Information seeking behavior and perceived health literacy of family caregivers of persons living with a chronic condition. The case of spinal cord injury in Switzerland. Patient Educ Couns 2020; 103: 1531-7.
14. Qi Y, Du CD, Liu T, et al. Experts' conservative judgment and containment of COVID-19 in early outbreak. J Chinese Gov 2020; 5: 140-59.
15. Alshammari N, Sarker MNI, Kamruzzaman MM, et al. Technology-driven 5G enabled e-healthcare system during COVID-19 pandemic. IET 2022; 16: 449-63.

16. Bhagavathula AS, Aldhaleei WA, Rahmani J, et al. Knowledge and perceptions of COVID-19 among health care workers: cross-sectional study. JMIR Public Heal Surveill 2020; 6: e19160.
17. Zhao Y, Cheng S, Yu X, Xu H. Chinese public's attention to the COVID-19 epidemic on social media: observational descriptive study. J Med Internet Res 2020; 22: e18825.
18. Geldsetzer P. Use of rapid online surveys to assess people's perceptions during infectious disease outbreaks: a cross-sectional survey on COVID-19. J Med Internet Res 2020; 22: e18790.
19. Iorfa SK, Ottu IFA, Oguntayo R, et al. COVID-19 knowledge, risk perception, and precautionary behavior among Nigerians: a moderated mediation approach. Front Psychol 2020; 11: 566773.
20. Ahmad T, Hui J. One health approach and coronavirus disease 2019. Hum Vaccin Immunother 2020; 16: 931-2.
21. Chetwynd AJ, Wheeler KE, Lynch I. Best practice in reporting corona studies: minimum information about Nanomaterial Biocorona Experiments (MINBE). Nano Today 2019; 28: 100758.
22. Gu E, Li L. Crippled community governance and suppressed scientific/professional communities: a critical assessment of failed early warning for the COVID-19 outbreak in China. J Chinese Gov 2020; 5: 160-77.
23. Alexander GL, Georgiou A, Doughty K, et al. Advancing health information technology roadmaps in long term care. Int J Med Inform 2020; 136: 104088.
24. Linn AJ, van Weert JCM, Gebeyehu BG, et al. Patients' online information-seeking behavior throughout treatment: the impact on medication beliefs and medication adherence. Health Commun 2019; 34: 1461-8.
25. Sherman LD, Patterson MS, Tomar A, Wigfall LT. Use of digital health information for health information seeking among men living with chronic disease: data from the health information national trends survey. Am J Mens Health 2020; 14: https://doi.org/10.1177/1557988320901377.
26. Wong SP, Jacobson HN, Massengill J, et al. Safe interorganizational health information exchange during the COVID-19 pandemic. J Am Med Dir Assoc 2020; 21: 1808-10.
27. Lv Y, Ma C, Li X, Wu M. Big data driven COVID-19 pandemic crisis management: potential approach for global health. Arch Med Sci 2021; 17: 829-37.
28. Fedorowski J. Could amantadine possibly interfere with COVID-19 vaccines based on LNP-mRNA platform? Arch Med Sci 2021; 17: 827-8.
29. Rajwa P, Przydacz M, Krajewski W, et al. Changing patterns of urologic emergency visits and admissions during the COVID-19 pandemic: a retrospective, multicenter, nationwide study. Arch Med Sci 2020; 26: 67-75.
30. Sittig DF, Singh H. COVID-19 and the need for a national health information technology infrastructure. JAMA 2020; 323: 2373.
31. Muñoz Fernández L, Díaz García E, Gallego Riestra S. The responsibilities arising from the use of information and communication technologies in health professional practice. An Pediatr 2020; 92: 307.e1-6.
32. Wang CJ, Ng CY, Brook RH. Response to COVID-19 in Taiwan: big data analytics, new technology, and proactive testing. J Am Med Assoc 2020; 323: 1341-2.
33. Zhong Y, Liu W, Lee TY, et al. Risk perception, knowledge, information sources and emotional states among COVID-19 patients in Wuhan, China. Nurs Outlook 2021; 69: 13-21.

34. Jacobs W, Amuta AO, Jeon KC. Health information seeking in the digital age: an analysis of health information seeking behavior among US adults. Cogent Soc Sci 2017; 3: 1302785.

35. Esmaeilzadeh S, Ashrafi-Rizi H, Shahrzadi L, Mostafavi F. A survey on adolescent health information seeking behavior related to high-risk behaviors in a selected educational district in Isfahan. PLoS One 2018; 13: e0206647.

36. Shim M, Jo HS. What quality factors matter in enhancing the perceived benefits of online health information sites? Application of the updated DeLone and McLean Information Systems Success Model. Int J Med Inform 2020; 137: 104093.

37. Wenjing P, Song S, Zhang Y. Consumer health information needs: a systematic review of measures. Inf Process Manag 2020; 57: 102077.

38. Petersen E, Wasserman S, Lee SS, et al. COVID-19 – We urgently need to start developing an exit strategy. Int J Infect Dis 2020; 96: 233-9.

39. Guilford JP, Fruchter B. Fundamental Statistics in Psychology and Education. 6th ed. McGraw-Hill Book Co., New York 1977.

40. Jacobs RJ, Caballero J, Parmar J, Kane MN. The role of self-efficacy, flexibility, and gender in pharmacy students' health information technology readiness. Curr Pharm Teach Learn 2019; 11: 1103-10.

41. Khan MU, Shah S, Ahmad A, Fatokun O. Knowledge and attitude of healthcare workers about middle east respiratory syndrome in multispecialty hospitals of Qassim, Saudi Arabia. BMC Public Health 2014; 14: 1281.

42. Magalhães BG, de-Sousa ST, de Mello VVC, et al. Risk factors for temporomandibular disorder: binary logistic regression analysis. Med Oral Patol Oral Cir Bucal 2014; 19: 232-6.

43. Xie X, Zang Z, Ponzoa JM. The information impact of network media, the psychological reaction to the COVID-19 pandemic, and online knowledge acquisition: evidence from Chinese college students. J Innov Knowl 2020; 5: 297-305.

44. Brown L, Jones G, Bond M. E-health: psychosocial challenges for South Australian rural mental health consumers. Rural Remote Health 2019; 19: 5103.

45. Shieh C, Mays R, McDaniel A, Yu J. Health literacy and its association with the use of information sources and with barriers to information seeking in clinic-based pregnant women. Health Care Women Int 2009; 30: 971-88.

46. Jerant A, Lichte M, Kravitz RL, et al. Physician training in self-efficacy enhancing interviewing techniques (SEE IT): effects on patient psychological health behavior change mediators. Patient Educ Couns 2016; 99: 1865-72.

47. Gong K, Xu Z, Cai Z, et al. Internet hospitals help prevent and control the epidemic of COVID-19 in China: multicenter user profiling study. J Med Internet Res 2020; 22: e18908.

48. Fischer AH, Kret ME, Broekens J. Gender differences in emotion perception and self-reported emotional intelligence: a test of the emotion sensitivity hypothesis. PLoS One 2018; 13: e0190712.

49. Hosmer DW, Lemeshow S. Applied Logistic Regression. Wiley Ser. Probab. Sattistics 2000.

50. Chundakkadan R, Ravindran R. Information flow and COVID-19 recovery. World Dev 2020; 136: 105112.

51. Fahey RA, Hino A. COVID-19, digital privacy, and the social limits on data-focused public health responses. Int J Inf Manage 2020; 55: 102181.

52. Hau YS, Chang MC. Healthcare information technology convergence to effectively cope with the COVID-19 crisis. Heal Policy Technol 2021; 10: 27-8.

53. Musche V, Bäuerle A, Steinbach J, et al. COVID-19-related fear and health-related safety behavior in oncological patients. Front Psychol 2020; 11: 1984.

54. Escolà-Gascón Á, Marín FX, Rusiñol J, Gallifa J. Measuring psychosocial reactions to COVID-19: the COVID Reaction Scales (COVID-RS) as a new assessment tool. Front Psychol 2020; 11: 607064.

55. Faasse K, Newby J. Public perceptions of COVID-19 in Australia: perceived risk, knowledge, health-protective behaviors, and vaccine intentions. Front Psychol 2020; 11: 551004.

56. Tang C, Wu X, Chen X, et al. Examining income-related inequality in health literacy and health-information seeking among urban population in China. BMC Public Health 2019; 19: 221.