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# Knowledge, Attitude, and Behavior About COVID-19: The Roles of Health Literacy and English Proficiency Among Korean Immigrants in the United States

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Considering the fast-evolving nature of the COVID-19 pandemic and the lack of tailored public health information, health literacy and English proficiency are likely to predict knowledge, attitudes, and behavior (KAB) about COVID-19 prevention among linguistic minority populations, including immigrants. An online survey ($N$ = 104) was conducted to investigate how health literacy and English proficiency predicted KAB about COVID-19 prevention among Korean immigrants in the United States. Multiple regression analyses showed that health literacy was a significant predictor of knowledge about COVID-19. In contrast, both health literacy and English proficiency were found to be significant predictors of COVID-19 attitudes, controlling for covariates such as age, education, duration of residence in the United States, and household income. Neither health literacy nor English proficiency was a significant predictor of preventive behavior about COVID-19. These findings highlight that providing public health information tailored for lower health literacy and in multiple languages is crucial to promoting the knowledge and positive attitudes of the immigrant population toward infectious disease prevention during pandemics.

*Keywords: COVID-19 prevention, health literacy, KAB, Korean immigrants, limited English proficiency*

To adopt healthy behavior and prevent infection, the fast-evolving nature of the COVID-19 pandemic has required people to promptly find, understand, and act on health information. This ability to access, understand, evaluate, communicate, and apply health information is known as health literacy (Sørensen et al., 2012). People with lower health literacy are likely to have lower knowledge, less positive attitudes, and fewer behavioral practices about COVID-19 prevention **(**McCaffery et al., 2020; Nguyen et al., 2020**)**. For immigrants who are already faced with a lack of tailored public health information, their health literacy and English proficiency are likely to be associated with their knowledge, attitudes, and behavior about COVID-19.

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However, the impacts of these two important constructs—health literacy and English proficiency—have not been demarcated in research on immigrant populations in the context of knowledge, attitudes, and behavior (KAB) about the COVID-19 pandemic. Although existing health literacy pathway models describe the processes through which individuals develop health literacy and use it to inform health-related behaviors (e.g., Squiers, Peinado, Berkman, Boudewyns, & McCormack, 2012; Sun et al., 2013), there is less focus on how factors unique to immigrants shape these pathways. In other words, in existing health literacy pathway models, the English proficiency of immigrants has not been clearly differentiated from other demographic factors despite its potential to predict health literacy and health-related outcomes, such as knowledge, attitudes, and behaviors. Given the disparities in health outcomes witnessed during the pandemic among minority groups, including immigrants (Clark, Fredricks, Woc-Colburn, Bottazzi, & Weatherhead, 2020), more research is needed to explore how health literacy and English proficiency predict KAB about the prevention of a new infectious disease, especially for those who suffer from the lack of timely and tailored information (Blasi, Mishra, García, & Dexter, 2021; Kusters, Dean, Gutierrez, Sommer, & Klyueva, 2021).

Limited English proficiency is notably more prevalent among Koreans than among other Asian immigrant groups in the United States (U.S.; Budiman, 2021). For example, 50% of foreign-born Koreans in the U.S. have limited English proficiency, compared with 28% of foreign-born Filipinos, 23% of foreign-born Indians, 25% of foreign-born Malaysians, 35% of foreign-born Indonesians, and 33% of foreign-born Pakistanis in the U.S. (Budiman, 2021). Korean immigrants in the U.S. also report lower health literacy compared with Koreans residing in Korea, even though they are more educated than Korean citizens (Chung, Lee, Lee, & Chung, 2021).

Thus, this study aims to examine how health literacy and English proficiency predict KAB about COVID-19 prevention among Korean immigrants residing in the U.S. and whether health literacy and English proficiency hold different weights depending on the outcomes, thereby extending the theoretical frameworks for health literacy and health outcomes. Considering that more research is needed on disaggregated data on Asian immigrants in the U.S. (Nguyen, Zheng, Gugel, & Kistin, 2021), this study contributes to advancing knowledge about the health literacy and English proficiency of immigrants in relation to health outcomes and provides insights about a subgroup of Asian immigrants, namely Korean immigrants in the U.S. By doing so, this study ultimately aims to extend the existing health literacy pathway models by tailoring them to immigrant populations, especially Korean immigrants in the U.S.

## Health Literacy and Knowledge, Attitude, and Behavior (KAB)

The KAB model has been extensively used to understand behavioral changes in the public health context (Bettinghaus, 1986). The KAB model postulates that "(a) people acquire information about a behavior, which leads to (b) the development of a predisposition to respond (an attitude), which in turn leads to (c) behavior that is in agreement with the attitude" (Bettinghaus, 1986, p. 476). Understanding KAB as a continuum, the KAB model highlights information processing and its contribution to behavioral change, providing a rationale for public health education to induce health behaviors. Accordingly, KAB about COVID-19 has been studied in many different countries to provide valuable information for targeted interventions to promote health knowledge and thereby change health behaviors (Dashti, Abadibavil, & Roozbeh, 2022; Jia et al., 2021).

Several health literacy models incorporate KAB as one of the components of the pathways between health literacy and health outcomes (Baker, 2006; Paasche-Orlow & Wolf, 2007; von Wagner, Steptoe, Wolf, & Wardle, 2009). For example, Baker (2006) suggests that together with other factors, such as culture and social norms, health literacy leads to "the acquisition of new knowledge, more positive attitudes, greater self-efficacy, positive health behaviors, and better health outcomes" (p. 880). Paasche-Orlow and Wolf (2007) suggest that patient factors, such as knowledge, beliefs, motivation, and self-efficacy, contribute to the pathways between health literacy and health outcomes via patients' self-care and provider-patient interaction.

Based on these models, Sun et al. (2013) found empirical support for the pathway where prior knowledge has a direct effect on health literacy, which then predicts health behavior and ultimately health status (Figure 1). In these models, patients' demographic factors, such as education, income, and age, are often treated as predisposing factors for health literacy. For example, studies argue that health literacy serves as a mediator between socioeconomic status (SES) and health, especially among those in lower SES groups, suggesting the potential of health literacy interventions for lower SES populations (Lastrucci, Lorini, Caini, Florence Health Literacy Research Group, & Bonaccorsi, 2019). However, these models were not tailored to immigrant groups, as they did not necessarily highlight the role of English proficiency in their relationships with health outcomes, such as health-related knowledge, attitudes, and behaviors.

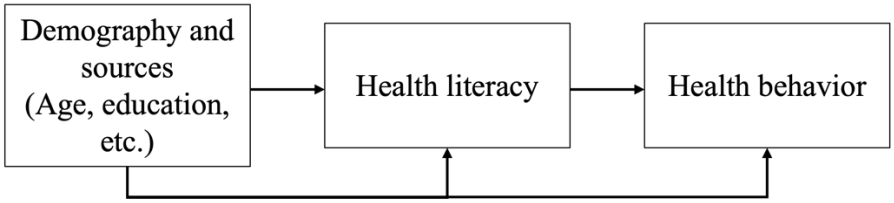


***Figure 1. Health literacy pathway model (Adapted from Sun et al., 2013).***

**Health Literacy, English Proficiency, and KAB of Immigrants**

In the context of the health literacy of immigrants, some demographic factors, such as the length of stay in the host country, acculturation, and social support, hold more importance in association with health literacy because of the challenges and needs unique to immigrants. Among these, language proficiency is a salient factor in research on the health literacy of immigrants (Lee & Choi, 2012; Lee, Choi, & Lee, 2015). Some scholars report that English proficiency mediates the relationship between demographic factors such as education and health literacy (Lee & Choi, 2012). Other studies treated language proficiency as a proxy of linguistic acculturation together with language use or length of stay (Lee, Nguyen, & Tsui, 2011) and found it to be associated with health behaviors such as smoking or alcohol consumption (Tamí-Maury et al., 2017).

Studies have found that immigrants with both lower health literacy and limited English proficiency (LEP) are at a greater disadvantage in terms of health behaviors and general health status (Harris et al., 2017; Sentell & Braun, 2012; Sentell, Braun, Davis, & Davis, 2013). Sentell and Braun (2012) argued that their findings provide "some empirical support to the notion that LEP alone carries a greater disadvantage

than low health literacy alone" (p. 93), as they found that in full samples, people with limited English proficiency only reported a higher prevalence of poor health status than did people with low health literacy only. However, this finding was not significant in the Korean sample.

Moreover, Mantwill and Schulz (2017) argued that language proficiency and health literacy may carry varying degrees of importance depending on the healthcare context. For example, with direct patient-provider interactions, language proficiency may be more important than health literacy, whereas in patients' self-management of diseases, health literacy may play a more important role (Mantwill & Schulz, 2017). In summary, although previous research implied that the importance of health literacy and English proficiency varied among immigrant populations depending on the context, literature has not provided definitive evidence as to whether English proficiency solely influences health literacy or directly affects health outcomes.

In other words, existing health literacy pathway models, such as Squiers et al. (2012) or Sun et al. (2013), neither focused on the role of English proficiency nor differentiated it from other demographic factors such as age or gender. Furthermore, in immigrant-focused literature, English proficiency was either treated as a proxy for acculturation (Lee et al., 2011) or as a predictor of health literacy without enough attention to its role in facilitating the development of knowledge, attitudes, or health behaviors (Lee & Choi, 2012). However, considering some empirical evidence about the potential role of English proficiency in predicting health status or patient-provider interactions (Mantwill & Schulz, 2017; Sentell & Braun, 2012; Sudore et al., 2009), English proficiency may also act as a direct predictor of health outcomes depending on the context. Thus, more research is warranted to examine how the roles of health literacy and English proficiency may differ in predicting knowledge, attitudes, and behaviors about health among immigrants. Accordingly, this study aims to investigate the associations of health literacy and English proficiency with the knowledge, attitude, and behavior of COVID-19 prevention among Korean immigrants in the U.S. The hypothesized model for this research is illustrated in Figure 2.

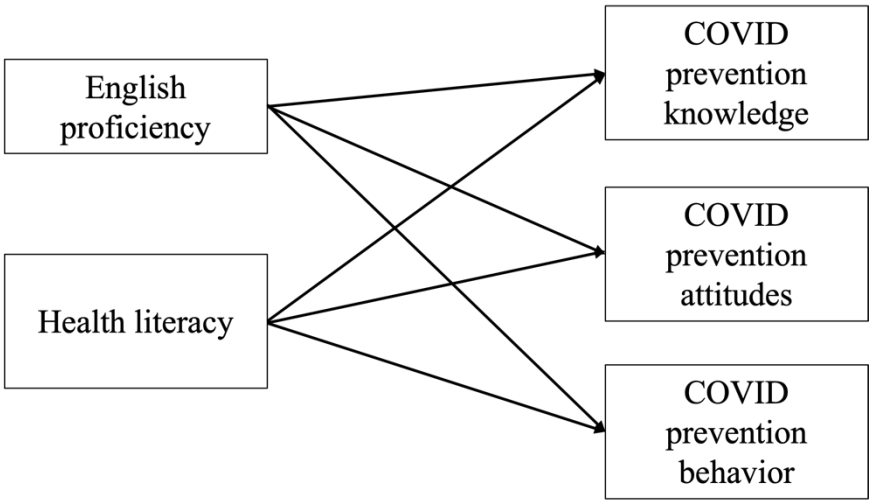


***Figure 2. Hypothesized model of health literacy and English proficiency.***

**Health Literacy and English Proficiency of Immigrants During the COVID-19 Pandemic**

Health literacy is associated with attitude and behavior about health, including COVID-19 prevention (McCaffery et al., 2020; Nguyen et al., 2020; Riiser, Helseth, Haraldstad, Torbjørnsen, & Richardsen, 2020). In other words, immigrants with low health literacy may struggle to find credible COVID-related information in English, understand the impact and response of their local community to the pandemic, and apply health information to take necessary actions, such as testing for COVID-19 or seeking healthcare services (Jacobs, Karavolos, Rathouz, Ferris, & Powell, 2005; Smith, 2009).

In noncrisis times, the impact of health literacy and English proficiency among immigrants may be alleviated through health literacy interventions (Fox, Kramer, Agrawal, & Aniyizhai, 2022; Santos, Handley, Omark, & Schillinger, 2014) as well as the use of interpreters or linguistic resources (Flores, 2005). However, during the pandemic, these resources may not be promptly available to linguistic minority groups (Nezafat Maldonado, Collins, Blundell, & Singh, 2020). With the lack of tailored assistance, the relationship between health literacy and KAB about COVID-19 prevention may be greater than usual among linguistic minority groups, exacerbating the health disparities caused by structural barriers, such as access to health care. In addition to health literacy, the KAB about COVID-19 prevention may also be associated with immigrants' language proficiency.

Research has demonstrated that public health communication during the COVID-19 pandemic lacks tailoring for low health literacy or LEP (Caballero, Leath, & Watson, 2020). COVID-19 materials disseminated by public health departments in the U.S. had room for improvement in readability and clarity (Mani, Ottosen, Fratta, & Yu, 2021). The U.S. Centers for Disease Prevention and Control (CDC) was criticized for not releasing enough multilingual information, especially at the beginning of the pandemic (Moreno & Bernal, 2020). Public health information from government agencies, such as the CDC and local health departments, indicated inequitable access to health information (Blasi et al., 2021; Kusters et al., 2021). Researchers suggested that approximately half of these people who were not proficient in English or Spanish lacked access to COVID-19 guidance in their primary language (Blasi et al., 2021). Even when multilingual information was available, its quantity, quality, readability, and ease of navigation were not consistent across languages (Blasi et al., 2021; Kusters et al., 2021).

Considering the limited availability of multilingual information, immigrants with LEP are likely to rely on information in their native language, which may not reflect the situations in their host country or align with information from their local health departments (Seale et al., 2022). Interviews with representatives from Culturally and Linguistically Diverse Communities (CALD) in Australia revealed that CALD members experience "voids or gaps" (Seale et al., 2022, p. 5) in news or government information about COVID-19 because of "delays in getting official information translated, or translated materials not being available in all languages" (Seale et al., 2022, p. 5). Participants were found to rely on transnational media, especially in their country of origin, over which concerns were raised about the information "not reflect[ing] the situation in Australia nor the rules/recommendations around COVID-19 pandemic control measures" (Seale et al., 2022, p. 6). The lack of timely and accurate information from official sources might influence Korean immigrants in their risk assessments and consequent health behaviors.

Thus, based on the literature reviewed above, the following hypotheses and research questions were proposed.

*H1: Health literacy and English proficiency predict (a) knowledge, (b) attitudes, and (c) behavior about COVID-19 prevention after controlling for demographic factors.*

*RQ1: Does health literacy or English proficiency weigh more in predicting KAB about COVID-19 prevention among Korean immigrants in the U.S.?*

## Methods

### *Study Design*

The current study was part of a larger, mixed-methods project examining health literacy and patient engagement in healthcare communication among Korean immigrants in the U.S. The current study focuses on responses to an online survey on health literacy, English proficiency, and KAB about COVID-19 prevention that was conducted in March and April 2021. This study received Institutional Review Board (IRB) approval from the relevant institution (21X032) and required informed consent from the participants.

### *Sampling and Data Collection*

Using convenience sampling, participants were recruited through ethnic media websites, online forums, and Facebook clubs for Korean immigrants in the U.S. After removing missing data for the main measures and data from U.S. native-born participants, 104 responses from first-generation Korean American immigrants, that is, Korean-born immigrants residing in the U.S., were used for analysis. Participants were eligible for the survey if they were 18 years or older and self-identified as Korean immigrants residing in the U.S. Because of the design of the larger study, eligible participants also needed to self-report that they had seen a doctor in the previous 12 months. Recruitment information was provided in both English and Korean. However, data collection was conducted in English, as the focus of this study was the health literacy of immigrants for health information provided in English in the U.S. Participants were offered a US $5 e-mail gift card as compensation for participation.

### *Measures*

*Demographic*

Participants ($N$ = 104) were asked demographic questions, including age, gender, education, income, immigration status, duration of residence in the U.S., language spoken at home, self-reported English proficiency, and types of health insurance. A summary of the demographic information on the sample is provided in Table 1.

***Table 1. Demographic Information of the Sample***

| | *N* (%) |
|---|---|
| Age | |
| 20–29 | 13 (12.7%) |
| 30–39 | 47 (46.1%) |
| 40–49 | 34 (33.4%) |
| 50–59 | 7 (6.8%) |
| 60 and older | 1 (0.8%) |
| Gender | |
| Female | 89 (85.6%) |
| Male | 15 (14.4%) |
| Education | |
| Highschool diploma or equivalent | 1 (1%) |
| Some college or Bachelor's degree | 47 (45.2%) |
| Some graduate school or more | 56 (53.8%) |
| Annual household income | |
| Less than $30,000 | 16 (15.4%) |
| $30,000–$49,999 | 12 (11.5%) |
| $50,000–$74,999 | 19 (18.3%) |
| $75,000–$99,999 | 16 (15.4%) |
| $100,000–$124,999 | 10 (9.6%) |
| $125,000–$149,999 | 11 (10.6%) |
| $150,000 or more | 20 (19.2%) |
| Residence in the US | |
| 5 years or less | 30 (28.8%) |
| 6 to 10 years | 31 (29.9%) |
| 11 to 15 years | 17 (16.3%) |
| 16 to 20 years | 18 (17.3%) |
| Over 20 years | 8 (7.7%) |
| Immigration status | |
| Temporary visa | 28 (26.9%) |
| Permanent resident | 54 (51.9%) |
| U.S. citizen | 21 (20.2%) |
| Prefer not to answer | 1 (1%) |
| Healthcare coverage | |
| Medicare, Medicaid, or Children's Health Insurance Program (CHIP) | 6 (5.8%) |
| Military plans (TRICARE, VA, CHAMP-VA) | 3 (2.9%) |
| Other state sponsored health plans | 3 (2.9%) |
| Health care coverage purchased through an employer | 81 (77.9%) |

| | |
|---|---|
| Health care coverage purchased directly from an insurer | 5 (4.8%) |
| Uninsured | 4 (3.8%) |
| Other | 2 (1.9%) |
| English proficiency | |
| Poor | 5 (4.8%) |
| Fair | 28 (26.9%) |
| Good | 30 (28.8%) |
| Very good | 23 (22.1%) |
| Excellent | 18 (17.3%) |
| Language spoken at home | |
| Korean only | 49 (47.1%) |
| Mostly Korean | 36 (34.6%) |
| English only | 3 (2.9%) |
| Mostly English | 6 (5.8%) |
| Korean and English, equally | 10 (9.6%) |

*English Proficiency*

We adapted the English proficiency item used in nationally representative surveys, such as the California Health Interview Survey or Census data. English proficiency ($M$ = 3.20, $SD$ = 1.16) was measured in a single-item measure of self-reported English proficiency, "How would you rate your English proficiency?" (on a 5-point Likert scale ranging from 1 = "Poor" to 5 = "Excellent").

*Health Literacy*

General health literacy ($M$ = 8.28, $SD$ = 1.50) was measured using the short-form version of the Health Literacy Skills Instrument (HLSI-SF) (Bann, McCormack, Berkman, & Squiers, 2012). The HLSI-SF consists of 10 items on the multiple dimensions of health literacy, such as print literacy, numeracy, oral literacy, and Internet literacy. To illustrate, participants were required to navigate an Internet page to find information, understand quantitative nutrition information, listen to an announcement in an audio clip, or read and understand a written passage or a map to answer questions. This instrument was designed for computer-based administration and was appropriate for an online survey. According to the developer of this scale, a health literacy score of 7 or higher is regarded as adequate, and 6 or lower is regarded as inadequate (RTI International, 2010).

*KAB About COVID-19*

Knowledge about COVID-19 ($M$ = 7.11, $SD$ = 0.90) was measured by eight true or false questions, which combined newly developed statements based on information from the U.S. CDC website and adapted statements from the previous literature (Bates, Moncayo, Costales, Herrera-Cespedes, & Grijalva, 2020; Gao et al., 2020). The statements were about symptoms, treatment, transmission, and community control measures for COVID-19. An example of a knowledge item is "Indoor activities generally entail a lower risk of exposure to COVID-19 than outdoor activities." Participants were asked to answer if they thought a statement was true (yes,

no, or not sure). A correct answer was scored as 1 to create a knowledge score for each participant, whereas an incorrect answer or "not sure" was given as zero. The score could range from 0 to 8, with a higher score indicating better knowledge of COVID-19.

Attitude toward COVID-19 prevention and control ($M$ = 16.86, $SD$ = 3.12) was measured by four items on a 5-point Likert scale ranging from 1 = "Strongly disagree" to 5 = "Strongly agree," adapted from the previous literature (Ferdous et al., 2020; Gao et al., 2020; Li et al., 2020). Participants were asked if they agreed with statements such as "I am willing to cooperate with the relevant authorities to take prevention and control measures for COVID-19, such as quarantining and contact tracing." Following the practice in the studies where the measure originated (Gao et al., 2020), a summative scale was created that could range from 4 to 20, with a higher score indicating a more positive attitude toward prevention and control measures.

Behavior about prevention and control measures ($M$ = 18.09, $SD$ = 1.98) was measured by four items on a 5-point Likert scale ranging from 1 = "Never" to 5 = "Always" about the frequency of their prevention behaviors, such as handwashing, mask-wearing, and quarantining, for the past 2 weeks. The items were adapted from previous research (Bates et al., 2020; Gao et al., 2020). An example of behavior items is "I tended to stay at home to prevent exposure to COVID-19." Following the practice in the studies where the measure originated (Bates et al., 2020; Gao et al., 2020), a summative scale was created for each participant, with a higher score indicating a more frequent practice of preventive behavior. The total score ranged from 4 to 20.

### *Data Analysis*

Descriptive statistics, such as means and standard deviations, were used to describe the characteristics of the sample. Multiple regression and correlational analyses were employed to test H1 and examine RQ1. All statistical data analyses were performed using SPSS version 28.

## Results

### *Descriptive Characteristics of the Sample*

The average age of the participants was 38.13 years ($SD$ = 7.63). 85.2% of the participants were women, 50.9% were permanent citizens, and 94.4% had health insurance. The participants reported that they had resided in the U.S. for 10.58 years on average ($SD$ = 7.15). 45.4% had some college education or bachelor's degree, and 53.7% had some graduate school or more education. 82.4% of the participants reported that they either spoke only Korean (46.3%) or mostly Korean (36.1%) at home. About a third of the participants rated their English proficiency as less than good (Poor 4.6%, Fair 25.9%). Only 16.7% reported that their English proficiency was excellent. On average, participants rated their English proficiency as slightly better than "Good" ($M$ = 3.20, $SD$ = 1.14). The mean score for health literacy among the participants who completed the health literacy questionnaire was 8.28 ($SD$ = 1.47).

Participants generally showed a high level of knowledge ($M$ = 7.10, $SD$ = 0.90) and positive attitudes toward prevention and control measures for COVID-19 ($M$ = 16.88, $SD$ = 3.08). The average of the prevention scores for COVID-19 ($M$ = 18.06, $SD$ = 1.98) was slightly higher than attitude.

### *Bivariate Correlations*

Before conducting multiple regression analyses, bivariate correlational analyses were conducted to examine the relationships among the variables. Table 2 shows the bivariate correlations among KAB, health literacy, English proficiency, and other sociodemographic variables. Some demographic factors such as age, education, and the duration of residence in the U.S. were found to be significantly correlated with English proficiency. For example, age was negatively correlated with English proficiency, whereas education and duration of residence were positively correlated with English proficiency. On the other hand, among the demographic factors, only education was significantly correlated with health literacy.

***Table 2. Bivariate Correlations and Partial Correlations***

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | COVID Knowledge | | | | | | | | | |
| 2. | COVID Attitudes | 0.12 | | | | | | | | |
| 3. | COVID Behavior | 0.02 | 0.12 | | | | | | | |
| 4. | Health Literacy | 0.26** | 0.38*** | 0.05 | | | | | | |
| 5. | English proficiency | 0.19* | 0.23* | 0.00 | 0.22* | | | | | |
| 6. | Age | 0.09 | 0.09 | 0.01 | −0.06 | −0.21* | | | | |
| 7. | Income | 0.13 | 0.11 | 0.07 | 0.14 | 0.00 | 0.39*** | | | |
| 8. | Education | 0.12 | 0.13 | 0.01 | 0.22* | 0.26** | 0.10 | −0.01 | | |
| 9. | Length of residence | 0.21* | 0.08 | −0.07 | 0.04 | 0.24* | 0.46*** | 0.23* | 0.02 | |

Note: * $p$ <.05, ** $p$ < .01, *** $p$ < .001

### *Health Literacy, English Proficiency, and KAB About COVID-19 Prevention*

Multiple regression models were built to examine how health literacy and English proficiency predicted KAB about COVID-19 prevention, controlling for possible demographic covariates. Potential confounders for health literacy and English proficiency based on the correlation analyses were included in the regression models, such as education, duration of residence, age, and household income.

As shown in Table 3, health literacy ($\beta$ = .21, $p$ <.05) was found to be the only significant predictor of knowledge about COVID-19 prevention, after controlling for English proficiency and other covariates. In contrast, both health literacy ($\beta$ = .35, $p$ < .001) and English proficiency ($\beta$ = .24, $p$ < .05) were found to be significant predictors of attitudes about COVID-19 prevention, controlling for covariates. Lastly, the regression model was not significant for COVID-19 behavior, where none of the variables were found to be significant predictors. Semi-partial correlations of health literacy ($sr$ = 33) and English proficiency ($sr$ = 20) demonstrated that both health literacy and English proficiency had unique contributions to attitudes about COVID-19 prevention, controlling for covariates.

***Table 3. Multiple Regression Results***

| | *B* | *SE* | *ß* | *T* | *p* | *R* | $R^2$ | *F* |
|---|---|---|---|---|---|---|---|---|
| Model 1: COVID-19 knowledge as dependent variable | | | | | | 0.35 | 0.12 | 2.20* |
| (Constant) | 5.30 | 0.84 | | 6.34 | < 0.001 | | | |
| **Health Literacy** | **0.13** | **0.06** | **0.21** | **2.07** | **< 0.05** | | | |
| English Proficiency | 0.07 | 0.09 | 0.08 | 0.74 | 0.46 | | | |
| Age | −0.002 | 0.02 | −0.01 | −0.11 | 0.92 | | | |
| Duration of residence | 0.02 | 0.02 | 0.17 | 1.45 | 0.15 | | | |
| Education | 0.08 | 0.18 | 0.05 | 0.44 | 0.66 | | | |
| Household income | 0.03 | 0.05 | 0.07 | 0.65 | 0.52 | | | |
| Model 2: COVID-19 attitude as dependent variable | | | | | | 0.45 | 0.21 | 4.23** |
| (Constant) | 6.29 | 2.73 | | 2.31 | < 0.05 | | | |
| **Health Literacy** | **0.73** | **0.20** | **0.35** | **3.67** | **< 0.001** | | | |
| **English Proficiency** | **0.66** | **0.29** | **0.24** | **2.26** | **< 0.05** | | | |
| Age | 0.09 | 0.05 | 0.22 | 1.80 | 0.08 | | | |
| Duration of residence | −0.04 | 0.05 | −0.09 | −0.80 | 0.42 | | | |
| Education | −0.19 | 0.58 | −0.03 | −0.32 | 0.75 | | | |
| Household income | 0.01 | 0.15 | 0.01 | 0.05 | 0.96 | | | |
| Model 3: COVID-19 behavior as dependent variable | | | | | | 0.11 | 0.01 | 0.21 |
| Constant | 17.35 | 1.93 | | 9.00 | < 0.001 | | | |
| Health Literacy | 0.071 | 0.14 | 0.05 | 0.51 | 0.61 | | | |
| English Proficiency | 0.02 | 0.21 | 0.01 | 0.07 | 0.94 | | | |
| Age | 0.01 | 0.04 | 0.03 | 0.20 | 0.85 | | | |
| Duration of residence | −0.03 | 0.03 | −0.10 | −0.78 | 0.44 | | | |
| Education | −0.02 | 0.41 | −0.01 | −0.06 | 0.95 | | | |
| Household income | 0.05 | 0.11 | 0.06 | 0.49 | 0.62 | | | |

## Discussion

This study examined how health literacy and English proficiency related to KAB about COVID-19 prevention among Korean immigrants in the U.S. during the pandemic. Our findings about health literacy are generally consistent with previous literature in that health literacy predicts knowledge and attitudes about COVID-19 (McCaffery et al., 2020; Nguyen et al., 2020; Riiser et al., 2020). This finding reaffirmed the importance of health literacy for immigrant populations in accessing and understanding fast-changing health information and developing a socially responsible attitude toward the pandemic (McCaffery et al., 2020). Controlling for demographic factors, health literacy was the only predictor of COVID-19 knowledge, indicating that immigrants with higher health literacy were able to access, understand, and acquire information about COVID-19 distributed from English sources. Health literacy also predicts attitudes about COVID-19 prevention, indicating that those with more acquired knowledge about a novel disease have positive attitudes toward a health behavior, as suggested by the KAB model (Bettinghaus, 1986). Our

findings support the idea that improving health literacy among immigrants can enhance their knowledge and attitudes toward health promotion, thereby contributing to better public health for this group.

In addition to health literacy, English proficiency was also a significant predictor of attitudes toward COVID-19. This finding was also consistent with the existing literature that showed a link between English proficiency and health-related attitudes (Morey, Valencia, & Lee, 2022; Nguyen, Schiaffino, & Lipton, 2021). Even after controlling for health literacy and demographic covariates, English proficiency seemed to still predict the attitudes of immigrants about COVID-19 prevention (*sr* = 20), although health literacy (*sr* = 33) was more associated with the outcome. According to the health literacy pathway model by Sun et al. (2013), demographic factors such as age, gender, and education directly predict health behavior and ultimately health status. Building upon the existing pathways for health literacy and health behaviors (Squiers et al., 2012; Sun et al., 2013), this study teased out the English proficiency of immigrants from other demographic factors and health literacy and provided some support for the argument that English proficiency has a direct relationship with health-related attitudes for this population group, reflecting the uniqueness of this group. This finding provides a rationale for adapting or tailoring existing health literacy pathway models to immigrants to accurately reflect the relevant contextual factors for health outcomes when designing interventions and programs.

Furthermore, although some previous studies treated English proficiency only as a predictor of health literacy (Lee & Choi, 2012; Lee et al., 2015), the findings of this study indicate that English proficiency may have a unique and direct contribution to health-related attitudes, even when controlling for health literacy or the duration of residence. This finding can be interpreted further in line with the linguistic acculturation of the participants, as English proficiency and duration of residence are the two commonly used proxies for the acculturation of immigrants (Lee et al., 2011; Tamí-Maury et al., 2017). Therefore, future research should explicate how linguistic acculturation affects health literacy development and health-related attitudes by focusing on the multiple dimensions of acculturation (Berry, 2003).

This finding can be alarming, as we saw during the early days of the COVID-19 pandemic that public health authorities were slow in releasing health guidelines in languages other than English (Blasi et al., 2021; Kusters et al., 2021). Unless multilingual information is available with the same consistency and readability as English, immigrants with limited English proficiency are likely to miss out on the latest prevention and control measures in their host country, which may hinder their cooperative attitudes toward prevention efforts.

One may argue that since the COVID-19 pandemic is a global public health crisis, Korean immigrants are likely to receive information about this novel virus not only in English but also in their native language from their friends, family, or the media of their country of origin. Although this may be true, it does not change the fact that immigrants with limited English proficiency have inequitable access to public health information disseminated by government agencies and hence experience constraints in their choice of information sources (Blasi et al., 2021; Kusters et al., 2021). This argument only reveals that immigrants' access to accurate and most up-to-date health information can depend on their language proficiency and that their risk assessment and consequent knowledge and attitudes toward a health condition may be limited by inequitable health information. When Korean immigrants with limited English proficiency in the U.S. are

reliant on health information in the Korean language through transnational media and interpersonal channels (Islam et al., 2016), they might suffer from a lack of timely information or even fall prey to misinformation (Seale et al., 2022), which can lead to discrepancies in their attitudes related to COVID-19 prevention.

Of note is that neither health literacy nor English proficiency was associated with preventive behaviors related to COVID-19. This finding is inconsistent with the literature on nonimmigrant populations that found associations between health literacy and COVID-19 behaviors (An et al., 2021). A possible explanation is that Korean immigrants had other stronger predictors of preventive behaviors despite differing levels of health literacy or English proficiency. For example, Korean immigrants may share social norms to comply with society's regulations. As immigrants, they may also feel stronger motivations toward adopting preventive behaviors because of higher anxiety about infection and its consequences. More research is needed to explore these possibilities.

Our findings suggest that health literacy ($sr$ = 33) is more strongly associated with attitudes about COVID-19 prevention than English proficiency ($sr$ = 20). This finding is inconsistent with Sentell and Braun's (2012) argument that "LEP alone carries a greater disadvantage than low health literacy alone" (p. 93). Instead, our findings indicate that health literacy correlates more strongly with the knowledge and attitudes of Korean immigrants about COVID-19, while English proficiency is only weakly associated with attitudes and health literacy. Although the language proficiency and health literacy of immigrants are intertwined, this finding suggests that their importance may vary depending on the contexts and outcomes being measured (Mantwill & Schulz, 2017). As suggested by Mantwill and Schulz (2017), this may indicate that English proficiency plays a less significant role in the context of COVID-19, as self-management is more relevant for COVID-19 prevention than interactions with healthcare providers.

This study underscores the need to make health information available in languages other than English and to tailor health literacy to target populations, especially during a rapidly evolving public health crisis such as the COVID-19 pandemic. Health communication practitioners should recognize the critical impact of making health information equitable for immigrant populations when they are already faced with disproportionate effects from the pandemic.

Considering that health literacy is associated more strongly with outcome variables than English proficiency, health literacy interventions for Korean immigrants can effectively enhance their knowledge about health issues and promote positive attitudes toward public health goals. Given that limited health literacy often co-exists with limited English proficiency among immigrant populations (Hoffman-Goetz, Donelle, & Ahmed, 2014), practitioners need to incorporate both health literacy and English language education in future interventions while recognizing that health literacy may play a more crucial role than English proficiency alone in public health interventions.

As with any research, this study has some limitations. First, as the data were collected in English, it may not have captured the lowest English proficiency group well. However, considering that this study focused on the health literacy of immigrants in their host country, using a Korean health literacy measure would have caused an inaccurate representation of the sample. Previous research indicated that participants with limited English proficiency achieved higher health literacy scores when they encountered health information scenarios in their first language than in English (Chen, Goodson, Acosta, Barry, & McKyer,

2018). A follow-up study that measures health literacy in Korean may be helpful in further examining how relationships might change depending on the language used for surveys. Second, this study employed an instrument for general health literacy instead of COVID-19-specific health literacy, as there was no validated scale about COVID-19 health literacy at the time of data collection in March 2021, to the best of the authors' knowledge. Furthermore, this study used a single-item measure of self-reported English proficiency, which may have reduced the validity of the construct. Although the use of this measure makes this study comparable to census data or other nationally representative surveys, such as the California Health Interview Survey, future research may benefit from using disaggregated data on English proficiency. Additionally, this study employed convenience sampling through ethnic online communities and ethnic media webpages. There was an overrepresentation of female participants and participants with higher levels of education. The use of a convenience sample may have reduced the inference validity of this study. Hence, future research should attempt to extend the scope of research by recruiting a larger and more diverse sample, which may be more representative of the Korean immigrant population in the U.S. Lastly, this study employed an online survey that may have required some digital literacy skills for the participants to complete the survey, and thus future research should use more varied, complementary methods of data collection. However, despite these limitations, it is important to note that by studying hard-to-reach populations, such as Korean immigrants, this study provides valuable insights into the health literacy of this underrepresented group and contributes to informing targeted interventions and future research.

## Conclusions

This study investigated the role of health literacy and English proficiency on KAB about COVID-19 prevention among Korean immigrants in the U.S. with the goal of extending the existing health literacy pathway models. We found that health literacy predicts COVID-19 knowledge when English proficiency and other demographic factors are controlled for. On the other hand, both health literacy and English proficiency were significant predictors of COVID-19 attitudes when other demographic factors were controlled for. Our findings indicate that there are unique contributions from health literacy to knowledge and attitudes about COVID-19 prevention. In addition, English proficiency seems to have a direct relationship with COVID-19 attitudes, which is not fully explained by health literacy or other demographic factors. These findings underscore the need to tailor public health information to the health literacy levels and language needs of immigrant populations to promote health information as well as positive attitudes toward infectious disease prevention during the pandemic.

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