

Digital literacy among Korean older adults: A scoping review of quantitative studies

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Abstract

Background: While digital literacy has become an essential competency for individuals across generations and sectors of society, supporting digital literacy in older adults is particularly challenging. South Korea is among the many countries undergoing rapid digitalization and population aging. Therefore, it is timely to identify the current understanding of digital literacy among older adults in South Korea.

Aim: To identify prior studies that quantitatively measure digital literacy among older adults in South Korea and to identify and evaluate how digital literacy was measured in the reviewed studies.

Methods: The study followed Arksey and O’Malley’s scoping review framework, searching through four international (PubMed, CINAHL, Embase, and Cochrane Library) and four Korean (RISS, KISS, KCI, and KMBase) databases.

Results: Among 42 studies included in the final analysis, 38 were cross-sectional studies, and 21 employed primary data. Digital literacy was assessed in various scopes, including digital literacy, e-health literacy, Internet use, and smartphone use. Of the 25 identified measures, three were validated; the rest varied greatly, from using a few items from large surveys to employing investigator-developed measures. Based on the European Commission’s Digital Competence Framework, the most commonly addressed components were “information and data literacy” and “communication and collaboration.”

Conclusions: In recent years, attention toward digital literacy among South Korean older adults has grown rapidly. However, the level of digital literacy among older adults in South Korea remains inconclusive given measurement heterogeneity. Developing and validating more robust measures are warranted to evaluate digital literacy among older adults with diverse functions and circumstances.

Keywords

Digital health, digital literacy, e-health, measurement, older adults, scoping review

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Introduction

Since the concept of “digital literacy” was first introduced in the late 1990s,¹ it has become an indispensable competence in the rapidly digitalizing world. As technology continues to expand and introduce new skills and competencies into our daily lives,² the definition of digital literacy has evolved from the emphasis on the mastery of digital tools,¹ to a focus on domain-specific literacy, such as e-health literacy.³ According to the European Commission’s Digital Competence (DigComp) Framework⁴ (one of the most widely recognized digital literacy frameworks), digital

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literacy comprises five dimensions: (1) information and data literacy, (2) communication and collaboration, (3) digital content creation, (4) safety, and (5) problem solving.

Although cultivating digital literacy is an ongoing demand for every generation and sector in society, supporting digital literacy in older adults is particularly challenging.^{5–7} For older adults, barriers to adopting new technology are multifaceted, including declines in physical function, emotional resistance, or cognitive decline.⁸ Studies consistently report that old age is associated with low technology usage,^{9,10} and older adults are less likely to search the Internet for health information.¹¹ Considering that population aging is a global trend,¹² understanding and supporting digital literacy for older adults in a constantly evolving digital realm is crucial to building an inclusive and sustainable digital environment.

To date, few reviews have examined digital literacy among older adults.^{5,13,14} Chesser et al.⁵ examined the e-health literacy gap among underserved populations in the United States, ranging from immigration and employment statuses to ethnicity and age. However, considering that the experiences of underserved populations are heterogeneous by their characteristics, the experience of each identity deserves more attention. Another review by Shi et al.¹⁴ targeted Chinese older adults and assessed studies that measured e-health literacy using the eHealth Literacy Scale (eHEALS). However, as the concept of digital literacy is multidimensional and most validated scales do not necessarily cover all domains of digital literacy,^{4,13} conducting a review of digital literacy that covers studies based on diverse measures is necessary for a comprehensive understanding of the current status of older adults' digital literacy.

Regarding digital literacy in older adults, South Korea deserves attention because the country is currently undergoing rapid digitalization and population aging, phenomena that are highly prominent among many industrialized countries. South Korea witnessed the beginning of the digital society with approximately half of the population using the Internet and mobile services circa 2000.¹⁵ Two decades after, in 2022, South Korea has achieved widespread technology use, as exemplified by the high rate of smartphone penetration (97.1%), even among individuals 60 years old and above (90%).¹⁶ According to the Organization for Economic Cooperation and Development (OECD), out of 38 OECD member countries, South Korea has the fastest aging rate and is on track to reach the highest old-age-to-working-age ratio by 2070.¹⁷ Thus, understanding digital literacy among older adults in South Korea can provide valuable insights into the challenges and opportunities that may apply to other countries undergoing similar trends in their population and technologies.

Therefore, we conducted a scoping review¹⁸ aimed to (1) identify and critically appraise studies that quantitatively measured digital literacy among older adults living in

South Korea, (2) identify measures used to evaluate digital literacy in the selected studies, and (3) evaluate digital literacy measures used in the selected studies by addressing the elements of digital literacy via the DigComp Framework.⁴

Materials and methods

Search strategy and data sources

This scoping review was planned and developed following the updated version of Arksey and O'Malley's¹⁹ methodological framework of scoping studies.²⁰ Based on the Population, Concept, and Context model for scoping reviews,^{21,22} we focused on older adults' (Population) digital literacy (Concept) in South Korea (Context). While older adults are generally defined as individuals aged 65 and older,²³ we found that many studies used age criteria younger than 65 years (e.g., 60 or 55 years and older) to define older adults.^{6,24–42} Therefore, we applied broader age criteria for older adults—which includes those aged younger than 65 if researchers of the original studies defined them as older adults—to align with such studies. Moreover, this study defined digital literacy as literacy in or utilization of any type of digital device. We employed a broad definition to gain a comprehensive understanding of current research on older adults' use and literacy of digital devices in varying domains, including digital health literacy, e-health literacy, m-health literacy, and general or specific technology use (e.g. Internet use and smartphone use). To identify relevant peer-reviewed journal articles, we searched through four international electronic databases (PubMed, CINAHL, Embase, and Cochrane Library) and four Korean databases (RISS, KISS, KCI, and KMBase). Primary search terms included "digital literacy," "older adults," and "Korean," with a combination of alternative keywords in the Boolean search. Supplemental Table S1 presents a full list of database-specific search terms. Covidence (Veritas Health Innovation Ltd) was used for data management and extraction.

Eligibility criteria

Studies were eligible for the review if they (1) quantitatively measured individual-level digital literacy, (2) targeted Korean older adults aged 60 years or older living in South Korea, (3) were published in Korean or English language between January 2000 and June 2022, and (4) were published in peer-reviewed journals. Studies that did not directly target older adults were excluded. However, studies in which the younger population was included as a distinct age category to compare against older adults were included for analysis. As this study aimed to identify quantitative studies on Korean older adults' digital literacy in peer-reviewed journal articles, the following types of studies were excluded: reviews, case reports, commentaries,

letters to editors, studies of qualitative design, unpublished master's theses or doctoral dissertations, conference abstracts, and book chapters. Despite the concept of digital literacy first introduced in the 1990s, we set the search period from January 2000 because the wide use of digital technologies and devices began around the 2000s in South Korea.¹⁵

Study selection

Upon completion of the literature search, all references from the databases were transferred to the reference management system (Covidence, Veritas Health Innovation Ltd), and duplicates were removed. Based on the eligibility criteria, two reviewers (HK, JC) conducted title and abstract screening. They (HK, JC) then independently conducted full-text reviews. For each step, reviewers discussed to resolve any disagreement and reached a consensus regarding the eligibility of each study.

Figure 1 summarizes an overview of the study screening and selection process in the PRISMA flow diagram. A total of 450 articles were identified from the initial search: 263 articles from the international databases (PubMed: 94; CINAHL: 61; Embase: 41; Cochrane Library: 12; and additional PubMed search: 55) and 187 articles from the Korean databases (RISS: 26; KCI: 65; KMBase: 26; and KISS: 70). After removing 160 duplicates, the titles and abstracts of 290 articles were screened. Finally, a full-text screening was conducted with the remaining 63 articles, resulting in 42 articles as the final sample.

Data extraction and synthesis

Once the final study sample was determined, one reviewer (HK) extracted the following data from the sample studies: general information, study methods, participant characteristics, information on digital literacy, mode of data collection (online, offline, or mixed), study aims, and main findings. Two reviewers (JB, JC) reviewed and verified the extracted data. As this study aims to examine the level of digital literacy in prior studies, details about digital literacy were collected, including the scope of digital literacy (e.g. e-health literacy, Internet use, and smartphone use) and measures of digital literacy. Means and standard deviations of measures were extracted when available. When the numeric score of measures was not reported, relevant descriptive statistics were collected. For example, if a study gauged smartphone use via a yes–no binary questionnaire, the proportion of older adults using smartphones was collected. Furthermore, given the heterogeneity among measures of digital literacy, measures used in the sample studies were assessed based on the DigComp Framework.⁴ For the studies that used measures with a complete list of items available, two reviewers (HK, JB) independently evaluated the measures and cross-checked the findings. Any

disagreements were resolved through discussion. The final evaluation was reviewed by all reviewers (HK, JB, and JC).

Quality assessment

One reviewer (HK) independently rated each study based on the Mixed-Methods Appraisal Tool (MMAT),⁴³ and two independent reviewers (JB, JC) reviewed and validated the quality assessment ratings to assess the quality of the articles. Any disagreements were resolved through discussion. The MMAT was developed to evaluate the quality of a wide range of studies, from mixed-methods studies and randomized controlled trials to quantitative and qualitative studies.⁴³ We reported overall quality scores using asterisks: 0 (None, indicating none of the quality criteria were met) to 100% (*****, indicating all five criteria were met).⁴³ This system has been used for quality assessment in descriptive quantitative reviews that examined older adults as the main target population.^{14,44}

Results

Study characteristics

Of the 42 sample studies, the year of publication ranged from 2014 to 2022, with a particularly large volume of studies since 2020 (see Figure 2). Among them, 31 (73.8%) studies were published in Korean, while 11 (26.2%) studies were published in English. Most of the studies employed a cross-sectional design (38/42), while few employed longitudinal (2/42), non-randomized experimental (1/42), and single-group pre-posttest (1/42) designs. Half of the studies used primary data (21/42), and the other half used secondary data (21/42). Most of the secondary data include the National Survey of Older Koreans (8/21), the Digital Divide Survey (4/21), and the Korea Media Panel Survey (4/21), primarily targeting older adults. However, when the data targeted the general population (e.g. the Korea Media Panel Survey), data from older participants were extracted and analyzed in each study. Studies examined digital literacy in varying scopes, such as digital literacy (18/42), e-health literacy (9/42), Internet use (4/42), smartphone use (2/42), specific technology use/utilization (6/42), and others (3/42). Table 1 summarizes the study characteristics.

Table 2 shows the author, year of publication, sample size, study design, scope of digital literacy, mode of data collection, study aims and findings, and MMAT scores of the sample studies. The sample is restricted to the older population aged 60 years or above, excluding the comparative younger population sample, if any. All but three studies used offline data collection (39/42): one study used an online method, another used a mixed method (offline and online), and another did not report any. The aims of the

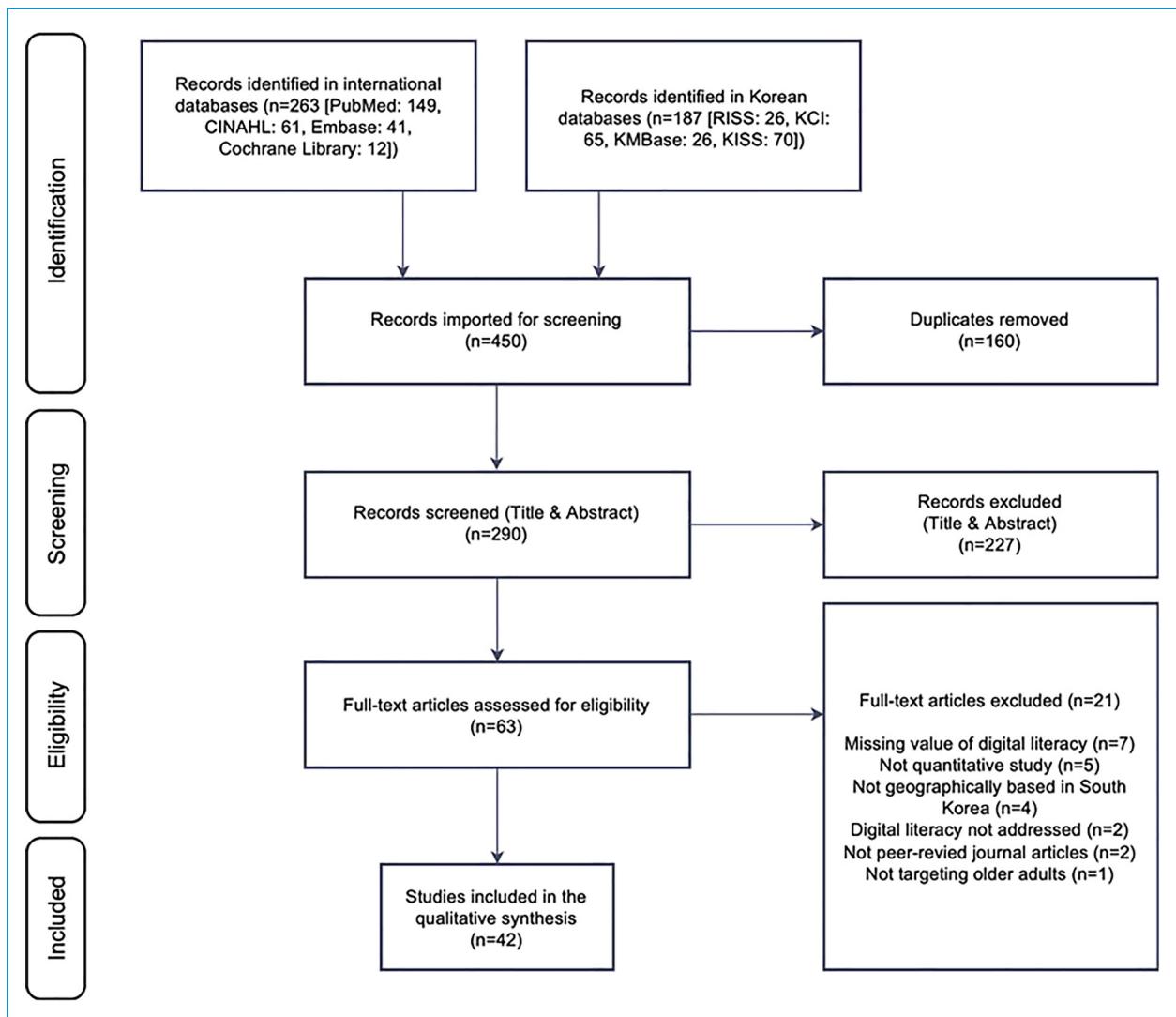


Figure 1. PRISMA flowchart of literature search and selection process.

studies ranged from validating measures of digital literacy^{46,57} to examining the associations between digital literacy and relevant factors.

Associated factors of digital literacy

Figure 3 summarizes the associated factors of digital literacy identified in the sample studies. Individual factors included those associated with health, attitudes, perceptions, and behaviors of individuals. Social and environmental factors encompassed factors associated with social interactions and accessibility to devices and learning to use them.

Measurement of digital literacy

The measurement of digital literacy was heterogeneous across studies. Each measure in the sample studies was

assessed based on the DigComp Framework.⁴ As the fair evaluation of the scales requires all items, only the measures with a full list of items presented were assessed based on the DigComp Framework. However, if the studies used secondary datasets with items available online, the items were retrieved from the online codebook, and those studies were included in the DigComp evaluation (see Table 3).

In total, 25 measures were identified, among which only three were validated: eHEALS,³ the Korean version of the Digital Health Literacy Instrument (K-DHLI),^{57,67} and the Functional Assessment of Currently Employed Technology Scale (FACETS)⁶⁸ (3/25). The eHEALS was used in nine studies to measure digital literacy, while the K-DHLI and the FACETS were used in one and two studies, respectively. Seven studies employed investigator-developed measures (7/25). Among secondary studies that used national survey data,

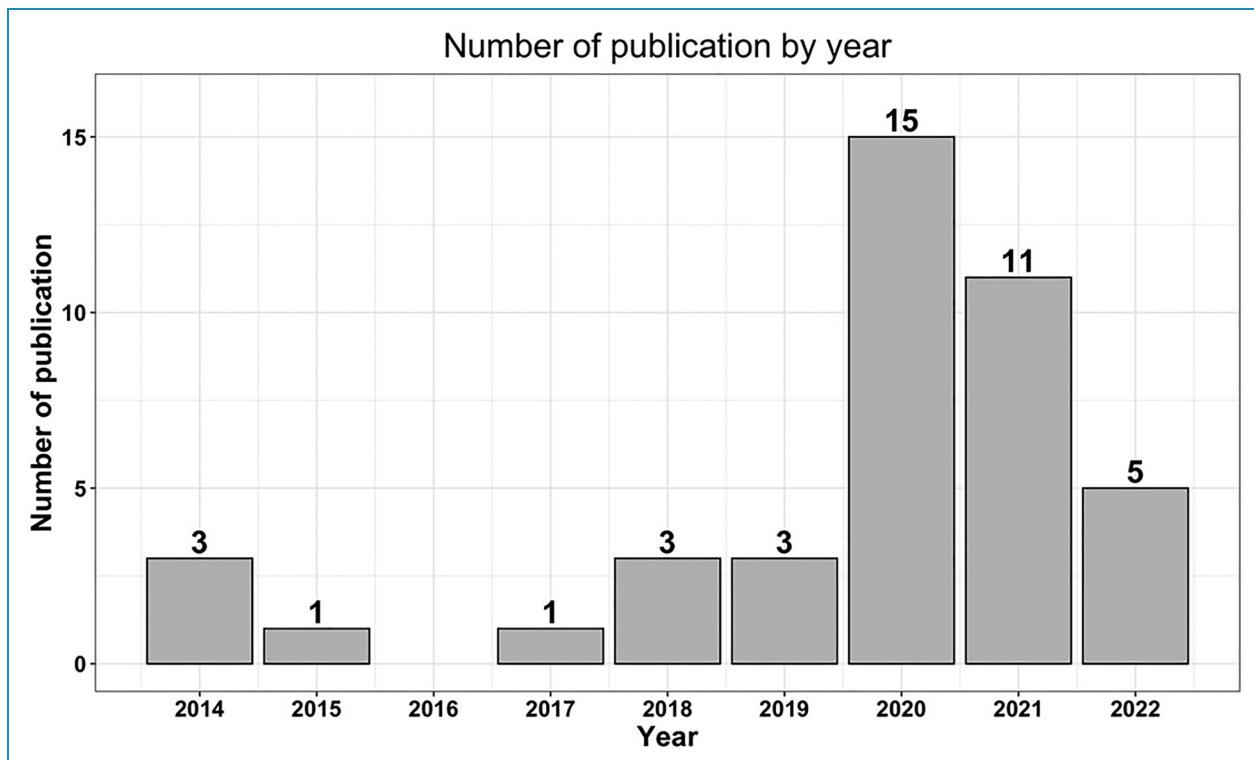


Figure 2. Number of publications by the year of publication ($N=42$).

a large variability in digital literacy measures was observed even when the same dataset from the same year was used (15/25). The number of items varied from 1 to 47 items.

Most of the measures included the information and data literacy (24/25) and communication and collaboration (21/25) components of the DigComp Framework. The digital content creation component was assessed in more than one-third of the measures (10/25), while the safety (8/25) and problem-solving (9/25) components were assessed at a slightly lesser frequency. Interestingly, using the same dataset did not yield the same result from the DigComp evaluation, as each study operationalized digital literacy using different sets of survey questions. For example, the evaluation based on the Digital Divide Survey ranged from three to five components, assessed as the number of items ranging from a minimum of 7 to a maximum of 38.

Comparison of studies using the eHEALS

Among 19 measures that contained full items, the eHEALS, originally developed by Norman and Skinner,³ was the only validated scale that was used in nine studies. Table 4 summarizes nine studies that used the eHEALS.

Seven studies had sample sizes of more than 100 participants, while two did not. Further, seven studies provided the mean age of participants, all of whom were over 70 years old. Information on the place of residence was

limited and somewhat varied but was focused mostly on urban areas. Regarding other notable participant characteristics, one study recruited participants receiving treatment for hypertension,²⁵ while two studies had more than 70% of participants with diseases^{45,49} and three other studies had more than 50% of participants with diseases.^{46,53,57}

Among these nine studies, five used the translated version by Chang et al.,⁵⁷ and one used the translated version by Lee et al.⁶⁹ Three studies did not provide details on the version of the scale used. The eHEALS scores ranged from 17.07 on a 40-point scale among older adults in their 70s³⁵ to 30.91 on a 40-point scale.⁵⁷ Notably, two studies reported low levels of digital literacy, one of which targeted participants receiving treatment for hypertension, with mean scores of 2.42 to 2.92 on a five-point scale based on age groups.²⁵ The other study targeted community-dwelling female older adults with a total score of 17.07 on a 40-point scale among those in their 70s.³⁵

Discussion

In this review, we identified 42 quantitative studies that examined Korean older adults' digital literacy and provided an overview of the studies. We also evaluated the measures of digital literacy used in each study based on the DigComp Framework. Further, we compared the level of digital literacy among the studies that employed the eHEALS,³ the

Table 1. Summary of included studies ($n=42$).

| Category | <i>n</i> (%) | Studies |
|--|-----------------------|--|
| Language | | |
| English | 11 (26.2) | 31,41,45–53 |
| Korean | 31 (73.8) | 6,24–30,32–40,42,54–66 |
| Study design | | |
| Cross-sectional | 38 (90.5) | 6,24–33,35–38,40–42,46–48,50–66 |
| Longitudinal | 2 (4.8) | 34,39 |
| Non-randomized experimental | 1 (2.4) | 49 |
| Single-group pre-posttest | 1 (2.4) | 45 |
| Data collection | | |
| Primary data | 21 (50.0) | 24–28,33–35,38,42,45,47,49,50,54–57,59,63,65 |
| Secondary data | 21 (50.0) | |
| <i>Digital Divide Survey (2016, 2017, 2017, 2020)</i> | 4 (9.5) | 6,30,37,41 |
| <i>Korea Media Panel Survey (2010–2018, 2019, 2019, 2020)</i> | 4 (9.5) | 29,36,39,64 |
| <i>Korean Middle and Elderly Technology Acceptance Survey (2019, 2019)</i> | 2 (4.8) | 32,40 |
| <i>National Survey of Older Koreans (7 from 2017, 2020)</i> | 8 (19.0) | 48,51,52,58,60–62,66 |
| <i>SK Telecom Survey on the Daily Life of Older Adults</i> | 1 (2.4) | 31 |
| <i>Data collected by Chang et al.⁵⁷</i> | 2 (4.8) | 46,53 |
| Scope of digital literacy | | |
| Digital literacy | 18 (42.9) | 6,24,26,27,34,37–39,42,47,54–56,60–64 |
| E-health literacy | 9 (21.4) | 25,35,45,46,49,50,53,57,65 |
| Internet use | 4 (9.5) | 41,51,52,59 |
| Smartphone use | 2 (4.8) | 29,36 |
| Specific technology use/utilization | 6 ^a (14.3) | 28,30,32,40,48,58 |
| Others | 3 ^b (7.1) | 31,33,66 |
| Total | 42 (100.0) | |

^aIncludes text message or social networking service (SNS), desktop/laptop, digital information, and digital technology.

^bIncludes digital self-efficacy, information technology literacy, and information application level.

most frequently used scale among the sample studies. This review is timely, as South Korea is experiencing the fastest rate of aging among OECD countries,¹⁷ along with the high levels of digitalization in society.¹⁶ The topic is also

relevant to emerging older adults who are likely to be better prepared for the current digital use, as technological advances will introduce new challenges regardless of current digital competency. To our best knowledge, this

Table 2. Characteristics of the included studies ($n=42$).

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|---------------------------|------|----------------|-----------------|------------------------|-------------------------|--|---|------|
| Ahn and Seo ²⁴ | 2014 | 85 | Cross-sectional | Digital media literacy | Online | To investigate how generational and economic status affect digital media literacy. | Digital media literacy differed by generation and economic status. Older adults showed high levels of literacy in their understanding of media, evaluation of media information, and media use ethics (comparable to adolescents) while showing the lowest levels in communication and expression among age groups. | *** |
| An et al. ⁵⁴ | 2020 | 500 | Cross-sectional | Digital literacy | Offline | To explore psychological and mental health promotion based on age through the relationship with communication behavior variables. | Health information behavior mediated the relationship between age and psychological well-being. Digital literacy moderated the relationship between age and health information behavior, whereby older adults with high digital literacy showed greater health information behavior than the younger population with high digital literacy. | *** |
| An et al. ⁵⁶ | 2021 | 500 | Cross-sectional | Digital literacy | Offline | To examine how elderly and non-elderly verify health information differently based on digital literacy and health empowerment. | Health empowerment affected health information verification behavior only in the younger population. However, digital literacy moderated the relationship between health empowerment and health information verification behavior among older adults. | *** |
| An et al. ⁵⁵ | 2022 | 500 | Cross-sectional | Digital literacy | Offline | To examine health beliefs of chronic diseases as the moderator on the effects of older adults' health empowerment and digital literacy on communication with clinicians. | Older adults who had greater health empowerment with low levels of either susceptibility or perceived barriers had better communication with clinicians. | *** |

(continued)

Table 2. Continued.

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|-----------------------------|------|----------------|-----------------|------------------------------|-------------------------|---|---|------|
| Chang et al. ⁵⁷ | 2018 | 187 | Cross-sectional | E-health literacy | Offline | To translate the eHealth Literacy Scale (eHEALS) into Korean and assess its psychometric properties. | K-eHEALS was evidenced with adequate psychometric properties to evaluate e-health literacy among Koreans. | *** |
| Cho and Ha ²⁵ | 2019 | 110 | Cross-sectional | E-health literacy | Offline | To examine the mediating effects of health beliefs on the relationships between disease-related knowledge and self-care and between e-health literacy and self-care among outpatient hypertensive patients. | Positive associations were observed among e-health literacy, health belief, self-care, and disease-related knowledge (except for the association between e-health literacy and self-care). Disease-related knowledge and self-care were mediated by health beliefs. | *** |
| Choi and Song ²⁶ | 2020 | 396 | Cross-sectional | Digital information literacy | Offline | To examine self-efficacy as a mediator between digital information literacy and life satisfaction among older adults. | Digital information literacy was positively associated with life satisfaction and self-efficacy. Self-efficacy mediated the relationship between digital information literacy and life satisfaction. | *** |
| Hu ²⁷ | 2020 | 173 | Cross-sectional | Digital literacy | Not stated | To examine the effects of digital literacy and accessibility on digital communication, confidence, self-control, and life satisfaction among older adults. | Digital literacy positively predicted digital self-control. Digital accessibility predicted positive overall digital life, mediated by digital confidence and self-control. | ** |
| Kim et al. ⁴² | 2017 | 158 | Cross-sectional | Digital literacy | Offline | To examine the effect of information technology (IT) education on digital literacy and quality of life among middle-aged and older adults. | IT education generally had a positive effect on middle-aged and older adults' digital literacy and quality of life. | *** |
| Kim et al. ²⁸ | 2014 | 119 | Cross-sectional | Desktop/laptop use | Offline | To understand the types of Internet use and identify barriers of use among older adults in Korea. | Entertainment (music/movie) and knowledge (information search) were the main uses of the Internet for older adults; sex and age differences existed. Complexity in computer and | *** |

(continued)

Table 2. Continued.

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|--|------|----------------|-----------------|-------------------------------|-------------------------|--|--|------|
| Internet use was identified as a barrier to Internet access. | | | | | | | | |
| Kim et al. ³³ | 2014 | 374 | Cross-sectional | Information application level | Offline | To understand the present status of older adults' information use level and examine its effect on quality of life. | Older adults' information use level was positively associated with information searches and quality of life. | *** |
| Kim et al. ⁵⁹ | 2021 | 289 | Cross-sectional | Internet literacy | Offline | To examine older adults' intention to participate in exercise based on Internet literacy and extended technology acceptance model. | Internet literacy of older adults who participate in exercise positively affected the usefulness and ease of the Internet-based reservation system. | *** |
| Lee et al. ³⁵ | 2019 | 203 | Cross-sectional | E-health literacy | Offline | To examine influencing factors of older women's health behaviors. | A difference in e-health literacy between women in their 60s and 70s was observed, though not in health concern, information orientation, or behavior. Health information orientation and living with a spouse affected the health behavior of women in their 60s and 70s, respectively. | *** |
| Lee et al. ⁵⁰ | 2020 | 104 | Cross-sectional | E-health literacy | Offline | To compare the role and influencing factors of information and communication technology (ICT) use among older adults from South Korea and the USA. | Koreans reported higher levels of e-health literacy than Americans. In both groups, education levels and confidence in ICT use positively predicted e-health literacy. | *** |
| Lee et al. ⁴⁷ | 2020 | 200 | Cross-sectional | Digital literacy | Offline | To assess the differences in the need for Internet of Things (IoT) among people with disabilities, older adults (collectively, vulnerable groups), their caregivers, and their healthcare providers. | People with disabilities, older adults, and their caregivers rated emergency and security as the most needed IoT service features, while healthcare providers rated safety as the most needed feature for vulnerable groups. | *** |
| Lim et al. ⁶³ | 2020 | 239 | Cross-sectional | Digital literacy | Offline | To examine the effect of the level of older | Motivation and capacity to use digital devices positively predicted older | *** |

(continued)

Table 2. Continued.

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|-----------------------------|------|----------------|-----------------|---|-------------------------|---|---|------|
| Park and Kim ³⁸ | 2021 | 203 | Cross-sectional | Digital literacy | Mixed | To determine the role of cognitive flexibility in the association between older adults' digital literacy and successful aging. | adults' digital literacy on their quality of life. adults' social relationships and sense of personal growth. | *** |
| Song and Shin ⁶⁵ | 2020 | 102 | Cross-sectional | E-health literacy | Offline | To examine associations between e-health literacy, perceived health status, and health-seeking behaviors. | Health-seeking behaviors were positively associated with e-health literacy and subject health. | **** |
| Jung and Choi ⁵⁸ | 2022 | 6264 | Cross-sectional | Text message or social networking service (SNS) | Offline | To examine the contact frequency with others as the mediator between the use of text messages or SNS and psychological well-being among Korean older adults; to investigate the moderating role of household composition on the mediating effect of frequency of contact. | Older adults with a higher ability to text or use SNS reported higher contact frequency, life satisfaction, and lower depressive symptoms, with no difference based on household composition. Contact frequency was a mediator between the ability to text or use SNS and psychological well-being only among those living with a spouse. | **** |
| Kim ²⁹ | 2020 | 1364 | Cross-sectional | Smartphone use | Offline | To systematically examine the factors that influence smartphone use among Korean older adults. | Smartphone use experience differed by sex, age, education, income, residential area, employment, marital status, and household composition. The purpose of use also differed by sociodemographic factors except for marital status. | **** |
| Kim and Lee ⁶ | 2018 | 1463 | Cross-sectional | Digital literacy | Offline | To examine the determining factors of digital information use among senior mobile consumers. | Income, motivation to use or attitude toward the use of digital devices, digital literacy, and family support positively predicted digital information use in quality and quantity, while | *** |

(continued)

Table 2. Continued.

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|---|------|----------------|-----------------|---------------------------------|-------------------------|--|--|-------------|
| negative attitude was a negative predictor. | | | | | | | | |
| Kim and Shim ⁶⁰ | 2020 | 9248 | Cross-sectional | Digital literacy | Offline | To identify the association between perceived age and digital literacy among older adults and examine the effect of these variables on the social activity participation of older adults. | Older adults' digital literacy was low; however, it was positively associated with social activity participation and satisfaction. | **** |
| Kim et al. ³⁰ | 2020 | 1494 | Cross-sectional | Digital information utilization | Offline | To identify the types of digital information use among middle-aged/older adults and examine the effect of each type on life satisfaction. | Middle-aged/older adults were classified as active, medium, and suboptimal levels of digital information use. Active use had a positive effect on life satisfaction. | ***** |
| Kim et al. ³¹ | 2021 | 623 | Cross-sectional | Digital self-efficacy | Offline | To investigate enjoyment and anxiety as mediators in the association between digital music service use and self-efficacy. | Enjoyment and anxiety significantly mediated the relationship between digital music experience and self-efficacy. | *** |
| Kim et al. ³² | 2021 | 500 | Cross-sectional | Digital technology utilization | Offline | To understand the effect of digital device accessibility on the attitude toward aging among middle-aged and older adults; to examine multimediation of digital technology utilization and online health information-seeking behaviors. | Middle-aged/older adults' digital device accessibility had a positive effect on digital technology utilization. Digital technology utilization and online health information-seeking behaviors mediated the relationship between digital device accessibility and attitude toward aging. | ***** |
| Kim et al. ⁴⁶ | 2021 | 180 | Cross-sectional | E-health literacy | Offline | To examine and compare K-DHLL and K-eHEALS in assessing e-health literacy among Korean older adults. | Both measurements were evidenced with adequate psychometric properties to assess older adults' e-health resource use. | **** |
| Lee ⁵² | 2021 | 9920 | Cross-sectional | Digital literacy | Offline | To examine social networks as mediators in the relationship between digital use. | Digital literacy and quality of life were **** | (continued) |

Table 2. Continued.

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|------------------------------|------|----------------|-----------------|------------------------|-------------------------|---|--|-------|
| Lee and Tak ⁶¹ | 2020 | 8942 | Cross-sectional | Digital literacy | Offline | To investigate the effect of digital literacy and contact with children and grandchildren using ICT on older adults' cognitive function. | Digital literacy was the greatest influencing factor for older adults' cognitive function. Contact with grandchildren using ICT had a positive association with digital literacy and cognitive function. | ***** |
| Lee et al. ⁴⁸ | 2021 | 10,055 | Cross-sectional | Digital technology use | Offline | To investigate the moderating effect of social interaction in the association between digital technology use and depressive symptoms among Korean older adults. | Digital technology use and social connections were negatively associated with depressive symptoms. Older adults with infrequent (vs frequent) contact benefited more from digital technology use. | ***** |
| Oh ³⁶ | 2021 | 2780 | Cross-sectional | Smartphone use | Offline | To assess the effects of smartphone skills and the innovativeness of online shopping among older adults. | Online shopping users (vs non-users) reported higher innovativeness and smartphone skills, both of which positively predicted online shopping. | ***** |
| Oh and Yoo ³⁷ | 2018 | 329 | Cross-sectional | Digital literacy | Offline | To understand the effect of digital literacy on older adults' psychological well-being and quality of life. | Older adults' digital literacy improved their depression, loneliness, anxiety, self-esteem, and life satisfaction. | **** |
| Park and Jeong ⁶⁴ | 2022 | 2281 | Cross-sectional | Digital literacy | Offline | To compare the status of digital literacy and levels of online community and social participation of older adults in single-person households to the MZ generation in single-person households and multiperson households and highlight the causal mechanism between digital literacy and social participation. | Older adults in single-person (vs multiperson) households showed lower levels of digital literacy and online or social community participation. Online community participation mediated the association of digital literacy and social community participation among older adults in single-person households. | ***** |

(continued)

Table 2. Continued.

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|----------------------------|------|----------------|-----------------|------------------------|-------------------------|--|---|------|
| Park and Kim ⁵² | 2020 | 1919 | Cross-sectional | Internet use | Offline | To examine associated factors of Internet use, such as opportunity, motivation, and other health variables, among Korean older adults with diabetes. | Internet use was positively associated with education, economic status, motivation to learn, ICT training, physical and cognitive health, and community service and negatively associated with age. ICT training and better health were key predictors. | **** |
| Park and Kim ⁵¹ | 2020 | 1919 | Cross-sectional | Internet use | Offline | To categorize older adults with diabetes into different groups depending on their Internet use. | Older adults with diabetes were classified into non-users, communicating users, and smart users. Smart users (relative to other classes) were positively associated with education, income, and physical, cognitive, and psychosocial health. Communicating users reported a lower incidence of depression. | **** |
| Um et al. ⁶⁶ | 2021 | 10,058 | Cross-sectional | IT literacy | Offline | To examine the relationship between Korean older adults' IT literacy and healthy aging based on age groups. | IT literacy was positively associated with subjective well-being, cognitive function, and social participation and negatively associated with chronic disease and depression. It predicted only cognitive, social, and psychological health among the oldest-old group while predicting wider aspects of health among the younger- and middle-old groups. | **** |
| Um et al. ⁴⁰ | 2021 | 500 | Cross-sectional | Digital technology use | Offline | To investigate the relationship between health literacy and the digital divide among middle-aged and older adults and examine sex-based differences. | Middle-aged/older adults' health information literacy was positively associated with technology literacy among men but not women. | **** |
| Yang and Lee ⁴¹ | 2022 | 3629 | Cross-sectional | Internet use | Offline | To investigate the associated factors behind mobile use and the mobile use | Older adults with disabilities (relative to those without) reported lower use of | **** |

(continued)

Table 2. Continued.

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|----------------------------|------|----------------|-----------------------------|-------------------|-------------------------|---|--|-------|
| | | | | | | | mobile Internet while reporting stronger associations between mobile Internet use and (1) Internet use skills, (2) motivation and attitude toward technology use, and (3) operational skills for mobile devices. | ***** |
| Yang et al. ⁵³ | 2020 | 187 | Cross-sectional | E-health literacy | Offline | To examine associated factors of older adults' e-health literacy. | Positive attitudes toward Internet health information predicted e-health literacy in older and young adults. | ***** |
| Lee ³⁴ | 2015 | 122 | Longitudinal | Digital literacy | Offline | To understand how cognitive-pragmatic language in normal aging changes over time and examine the influencing factors using a longitudinal design. | Those who maintained cognitive-pragmatic language ability (vs those who declined) showed higher levels in all but one domain of cognitive-pragmatic language abilities. The two groups differed in age, education, language experience, digital literacy, and social participation. | ***** |
| Park and Kim ³⁹ | 2019 | 4065 | Longitudinal | Digital literacy | Offline | To investigate the longitudinal trend of the digital divide across different generations of older adults. | Digital access improved in all generations despite the digital divide observed, with income and education levels predicting smartphone access. A disparity in digital literacy and use was observed between the ages of 55–74 and over 75. Smartphone ownership and digital literacy had a positive effect on older adults' digital use. | ***** |
| Lee et al. ⁴⁹ | 2022 | 52 | Non-randomized experimental | E-health literacy | Offline | To assess the results of a 12-week program based on mutual aid and | Older adults who participated in the program reported decreased anxiety | ***** |

(continued)

Table 2. Continued.

| Ref. | Year | Sample size, N | Design | Scope | Mode of data collection | Study aim | Main findings | MMAT |
|----------------------------|------|----------------|---------------------------|-------------------|-------------------------|---|---|-------|
| | | | | | | intergenerational exchange between older adults and young adults. | and increased (1) ICT skills, (2) confidence in using computers, and (3) overall e-health literacy. | ***** |
| Chang et al. ⁴⁵ | 2021 | 11 | Single-group pre-posttest | E-health literacy | Offline | To examine the feasibility and preliminary results of the newly developed education program focused on Internet health information. | The intervention resulted in improved knowledge of, attitude toward, and understanding of Internet-based health information, e-health literacy, and search performance. | |

N: sample size; MMAT: Mixed-Methods Appraisal Tool.

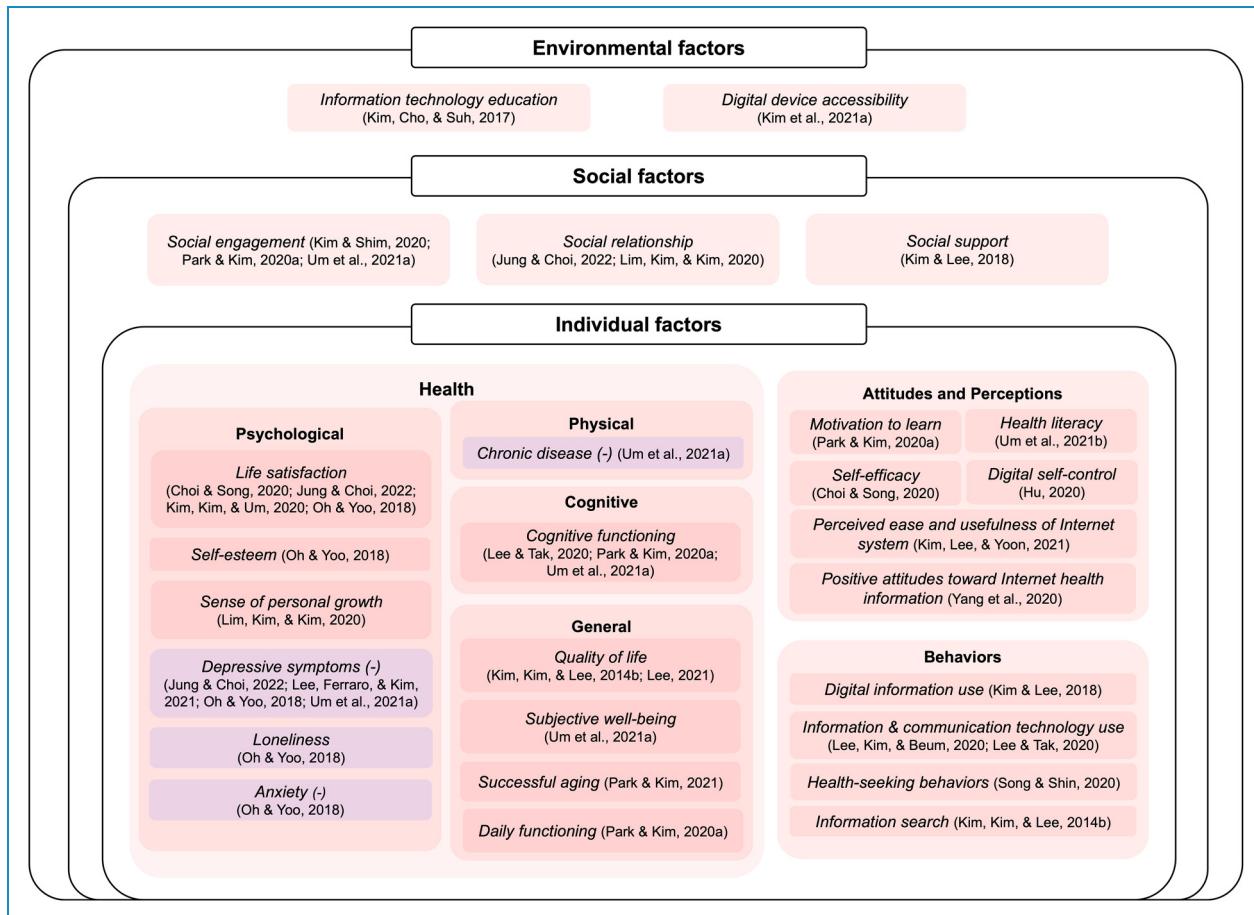


Figure 3. Summary of associated factors of digital literacy in the included studies.

Note. Associations are positive, except for the factors that are noted with (-) which indicates negative associations.

scoping review is among the first to evaluate the current understanding of digital literacy among Korean older adults and identify limitations in previous quantitative studies. This review revealed that most studies on this topic were published in 2020 and onward, perhaps indicating that older adults in South Korea are in the process of entering the digital realm. We found that 38 of 42 studies used cross-sectional data, 18 of which conducted research using open government data.^{6,29,30,32,36,37,39-41,48,51,52,58,60-62,64,66} We also observed that factors promoting digital literacy varied across studies, including self-efficacy, health empowerment, positive attitudes toward technology, technology education, health-seeking behavior, family support, and cognitive flexibility.^{6,26,38,42,53,65} Studies also examined associations between digital literacy and physical and mental health.^{26,30,33,37,38,48,52,58,61,63,66}

Interestingly, studies are limited in identifying regional variations in digital literacy among older adults. Previous studies highlight the digital divide between rural and urban areas in Korea⁷⁰ and globally.^{71,72} Future research on regional variations in digital literacy may help furnish

insights into region-specific differences and avenues for future interventions. For example, older adults in rural areas may show lower levels of digital literacy relative to those in urban areas, but they may also report lower levels of perceived need for digital literacy given the slow rate of digitalization in rural areas.⁷³ A region-specific nuance should be understood to better design an intervention program to improve digital literacy and advocate for equity in digital access across regions.

Regarding the measures, despite the increase in the volume of research on older adults' digital literacy, the operationalization and assessment were heterogeneous and mostly insufficient to fulfill all five components of the DigComp Framework. Among 25 identified assessments, the most frequently used measure was the eHEALS. Even so, it was limited in covering all components of the DigComp Framework¹³ and was focused primarily on skills to use the Internet for health-related purposes.^{3,74} The concept of digital literacy will continue to evolve and diversify as the digital environment keeps expanding with the emergence of new digital devices and

Table 3. Digital literacy measurement based on the DigComp Framework.

| Source | Studies | Number of items, scoring | DigComp components ^a | | | | |
|---|----------------------------|--|---------------------------------|---|----------------|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| eHEALS ^b | 25,35,45,46,49,50,53,57,65 | 8-item, 5-point | 0 ^c | 0 | X ^d | 0 | 0 |
| K-DHLI ^e | 46 | 21-item, 4-point | 0 | 0 | 0 | 0 | X |
| FACETS ^f | 32,40 | 10-item, 6-point | 0 | 0 | 0 | X | 0 |
| Digital Divide Index ^g | 26 | 5-item, 5-point | 0 | 0 | X | X | X |
| Internet literacy ^g | 59 | 5-item, 5-point | 0 | X | X | X | X |
| Digital literacy ^g | 63 | 25-item, 5-point | 0 | 0 | 0 | 0 | 0 |
| Daily usage and amount of desktop and laptop use; type of Internet use ^g | 28 | 2-item, reported hour of usage; 2-item, 4-point; 7-item, binary ^h | 0 | 0 | X | X | X |
| Information and communication technology (ICT) device use, online activity, and information search ^g | 33 | 9-item, 5-point | 0 | 0 | X | X | X |
| Perception of the Internet, smartphone, and Internet of Things ^g | 47 | 7-item, binary | 0 | X | X | X | X |
| Frequency of Internet and email usage ^g | 34 | Single-item, 4-point | 0 | 0 | X | X | X |
| Digital Divide Survey | | | | | | | |
| 2016 version | 37 | 11-item, scale point unknown | 0 | 0 | 0 | 0 | X |
| 2017 version | 6 | 38-item, 4-point | 0 | 0 | 0 | 0 | 0 |
| 2017 version | 30 | 7-item, 4-point | 0 | 0 | 0 | X | X |
| 2020 version | 41 | 1-item, binary; 25-item, 4-point | 0 | 0 | 0 | X | X |
| Korea Media Panel Survey | | | | | | | |
| 2010–2018 versions | 39 | 18/20-item, binary | 0 | 0 | 0 | 0 | 0 |
| 2019 version | 29 | 14-item, binary | 0 | 0 | X | X | 0 |
| 2019 version | 36 | 20-item, binary | 0 | 0 | 0 | 0 | 0 |
| 2020 version | 64 | 47-item, 5-point | 0 | 0 | 0 | 0 | 0 |
| National Survey of Older Koreans | | | | | | | |
| 2017 version | 60,61,66 | 10-item, binary | 0 | 0 | X | X | X |
| 2017 version | 58 | 3-item, 4-point | X | 0 | X | X | X |
| 2017 version | 48 | 9-item, binary | 0 | 0 | X | X | X |

(continued)

Table 3. Continued.

| Source | Studies | Number of items, scoring | DigComp components ^a | | | | |
|---|---------------|--------------------------|---------------------------------|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2017 version | ⁵² | Single-item, binary | 0 | X | X | X | X |
| 2017 version | ⁵¹ | 10-item, binary | 0 | 0 | X | X | X |
| 2020 version | ⁶² | 11-item, binary | 0 | 0 | X | X | X |
| SK Telecom Survey on the Daily Life of Older Adults | ³¹ | 10-item, 5-point | 0 | X | X | X | 0 |

^aDigital Competence (DigComp) components are as follows: (1) information and data literacy, (2) communication and collaboration, (3) digital content creation, (4) safety, and (5) problem solving. For more information, see Ferrari et al.⁴

^beHEALS: eHealth Literacy Scale.

^cO: included in the questionnaire.

^dX: not included in the questionnaire.

^eK-DHLI: Korean version of the Digital Health Literacy Instrument.

^fFACETS: Functional Assessment of Currently Employed Technology Scale.

^gInvestigator-developed measurement.

^hBinary: yes/no binary choice.

software,⁷⁵ which warrants measures that can capture one's competency across the digital realm. However, given the constantly evolving nature of digital technology, measurement inconsistencies may be inevitable. Furthermore, it is important to note that discrepancies in findings based on measurement methods (i.e., offline vs. online) are unavoidable because older adults who participate in online assessments are more likely to have higher levels of digital literacy and accessibility compared to those who do not participate in online. Considering this fundamental difference that can potentially introduce bias into the findings, studies focusing on older adults' digital literacy and engagement should be cautious when reporting results. It is crucial for these studies to consider how their chosen measurement method could unintentionally skew the outcomes and their subsequent interpretation.

Notably, four studies based on national surveys addressed all five components of the DigComp evaluation,^{6,36,39,64} though they may pose potential limitations. First, researchers used different sets of survey items—even when using the same national survey dataset—in operationalizing digital literacy. Inconsistencies in the choice of items may make comparisons among studies challenging. Second, national surveys employ lengthy questionnaires, which may unintentionally burden older adults and ultimately affect the quality of survey data. For example, the Digital Divide Survey comprised 18 pages,⁷⁶ and the Korea Media Panel Survey had 23 pages, including a three-day media use tracking.⁷⁷ As older adults experience reduced attention,^{78,79} a lengthy questionnaire may not be appropriate and could compromise the data quality.⁸⁰ Third, national surveys may pose selection bias risks

because older adults participating in the survey may overrepresent cognitively well-functioning older adults. This systematically differential representation may compromise the generalizability of the data. Therefore, there is a need for more robust and succinct digital literacy measures targeted at general older adults.

While acknowledging the limitations in the digital literacy assessment, most measures included components of information search or use and communication or collaboration based on the DigComp Framework.⁴ Alternatively, three other components (content creation, safety, and problem solving) were not addressed in more than half of the measurements. This trend accords with the previous systematic review that examined the validated measures of digital literacy for older adults.¹³ It may also evidence the broad spectrum of digital literacy introduced in response to the constant development of digital technology^{81,82} (e.g., computer literacy, media literacy, and e-health literacy) and how each type of digital literacy measures targets different types of digital use. Alternatively, information search and communication through digital devices may be more easily expected for older adults than digital content creation or problem solving. Hence, researchers may have focused on assessing those two domains that seem more appropriate for older adults' competency. Evidently, this area deserves further investigation.

We additionally examined the level of older adults' digital literacy based on the eHEALS. The eHEALS scores were comparable to the US sample of 866 older adults recruited online,⁸³ but the online sample in the US study may have higher familiarity with digital utilization and, hence, report higher levels of digital literacy.

Table 4. Studies that used the eHEALS ($n = 9$).

| Study | N | Mean age (SD ^a) or proportion | Residence | Other sample characteristics | Scale adaptation | Total/mean score ^a (SD) |
|-----------------------------|-----|---|--------------------------------------|---|---|--|
| Chang et al. ⁵⁷ | 187 | 73.18 (4.76) | Seoul | 57.2% currently having a disease | Adapted from Norman and Skinner ³ in Korean | 30.91 (4.17) |
| Cho and Ha ²⁵ | 110 | 60s: 31.4% 70s: 30.8% 80+: 8.3% (excluding those aged ~60) | Busan | Patients receiving treatment for hypertension | Adapted version in Chang et al. ⁵⁷ | 60s: 2.92 (0.93) 70s: 2.75 (0.86) 80+: 2.42 (0.88) |
| Lee et al. ³⁵ | 203 | 60s: 66.5% 70s: 33.5% | N/A | Community-dwelling female older adults | Adapted version in Lee et al. ⁶⁹ | 60s: 24.31 (7.99) 70s: 17.07 (9.51) |
| Lee et al. ⁵⁰ | 104 | 71.34 (6.69) | Urban areas | From low-income urban areas | Adaptation not stated | 3.56 (0.6) |
| Song and Shin ⁶⁵ | 102 | 70.01 (4.84) 60s: 54.4% 70-74: 29.1% 75+: 15.5% | Seoul, Gyeonggi, Northern Gyeongsang | N/A | Adapted version in Chang et al. ⁵⁷ | 28.35 (5.01) |
| Kim et al. ⁴⁶ | 180 | 73.07 (4.76) | Seoul | 57.8% currently having a disease | Adapted version in Chang et al. ⁵⁷ (same data) | 3.88 (0.52) |
| Yang et al. ⁵³ | 187 | 73.2 (4.78) | N/A | 57.8% having a disease | Adaptation not stated | 30.95 (4.17) |
| Lee et al. ⁴⁹ | 52 | 72.9 (N/A) | Seoul | 82% having an average of 1.27 chronic illnesses | Adaptation not stated | 3.45 (0.60) |
| Chang et al. ⁴⁵ | 11 | 74.64 (N/A) | N/A | 72.7% currently having a disease | Adapted version in Chang et al. ⁵⁷ | 28.31 (1.08) |

^aTotal score indicates the sum of eight items of the eHealth Literacy Scale (eHEALS) with scores ranging from 8 to 40. Mean score indicates the total score divided by the number of items, thereby ranging from 1 to 5.
N: sample size; SD: standard deviation; N/A: not applicable.

Alternatively, much lower eHEALS scores were reported in the systematic review of Chinese older adults' digital literacy.¹⁴ However, the sample studies varied in regions and health conditions, making a fair comparison challenging. Regardless, given the simple digital competencies described in the eHEALS items, Korean older adults' digital literacy remains low and requires further improvement.

This review has several limitations. First, the systematic literature search may have missed some articles. We restricted the search to peer-reviewed journal articles published in English or Korean. Even though the topic of digital literacy in South Korea is highly likely to be published in either of these languages, there remains a possibility of failing to identify relevant articles in other languages and databases. Second, this review was limited to quantitative studies. While qualitative studies are beyond the scope of this review, they would have provided a broader picture of digital literacy among older adults in South Korea. Third, the older population is a heterogeneous group in their digital experiences and their device accessibility and need to use digital devices.⁸⁴ However, such experiences were beyond the study scope. Hence, more attention should be paid to different groups of older adults with diverse digital identities and experiences to develop a tailored intervention approach to support them.

Future research can develop a novel measure for older adults' digital literacy for a comprehensive evaluation of diverse aspects of the construct. As technology evolves, digital space will expand, and the concept of digital literacy will change and become diversified.^{85,86} Using the DigComp Framework to capture the diverse aspects of digital literacy revealed that few measures fulfilled all five components in the sample studies. Thus, future research should develop an optimal measure that can capture the varying aspects of digital literacy while considering the cognitive capacity of older adults to keep up with the expanding digital realm. Further, the proposed potential sociodemographic factors are worth exploring to appreciate the digital literacy and usage level. Hence, future empirical research should focus on how individual and environmental factors promote or hinder digital literacy in older adults to help policymakers develop supportive programs and policies to promote aging in place in the digitalized society. Lastly, when measuring older adults' digital literacy and engagement, future research should make sure to disclose measurement methods because of the increased likelihood of higher digital literacy and accessibility among those who participate in online assessments. Therefore, clear reporting and transparent disclosure of measurement methods are essential for research targeting older adults and their digital experience.

Conclusion

Scholarly interest in digital literacy among older adults has rapidly risen in South Korea over the past few years. While

the level of digital literacy among older adults in South Korea remains inconclusive given measurement heterogeneity, demographic characteristics may facilitate the digital experiences of older adults in varying circumstances. Inconsistencies observed in digital literacy measures give scope for future research to develop a more streamlined measure that can promote consistent measures to systematically comprehend individual levels of digital literacy.

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Guarantor: JC

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