

Determinants of Health-Related Quality of Life in Older Adults in Korea: Evidence from the Korea National Health and Nutrition Examination Survey

Hyo Lyun Roh ¹ , Byung Soo Jung ² , Jong Myoung Kim ³ , Hyo Taek Lee ^{4*} 

¹ Professor, Department of Physical Therapy, Samcheok-si, Kangwon National University, REPUBLIC OF KOREA; Email: withtry@kangwon.ac.kr; ORCID: 0000-0002-0187-7109

² Professor, Department of Police Administration, Sehan University, SOUTH KOREA. Email: 2079bs@daum.net; ORCID: 0009-0008-4069-9705

³ Professor, Division of AI Convergence Engineering, Sehan University, SOUTH KOREA. Email: tom@sehan.ac.kr; ORCID: 0009-0009-4909-0637

⁴ Professor, Division of AI Convergence Engineering, Sehan University, SOUTH KOREA. ORCID: 0000-0001-7139-608X

*Corresponding Author: take1682@sehan.ac.kr

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ABSTRACT

The rapid demographic transition toward a super-aged society has made health-related quality of life (HRQOL) a critical issue for older adults. This study examined determinants of HRQOL among Korean adults aged 65 years and older, focusing on lifestyle behaviors, preventive health practices, healthcare utilization, mental health, and digital health literacy. Data were drawn from the 2023 Korea National Health and Nutrition Examination Survey (KNHANES), a nationally representative cross-sectional survey. A total of 2,052 participants were included after applying weights. HRQOL outcomes were assessed using the EQ-5D index, the HINT-8 scale, and self-rated health. Descriptive, bivariate, and multivariate analyses identified significant predictors. Results showed that physical activity and vaccination uptake were positively associated with HRQOL, whereas smoking, high-risk drinking, and depressive symptoms were linked to lower scores. Depressive symptoms exerted the strongest negative effect. Preventive behaviors, including routine health checkups and cancer screening, were also related to improved subjective health. Conversely, rural residence and unmet medical needs emerged as barriers, reflecting healthcare disparities. Digital health literacy moderates positive associations of physical activity and preventive care, suggesting that technology readiness can amplify benefits. These findings underscore the need for integrated approaches combining lifestyle promotion, preventive and mental health services, equitable healthcare access, and digital health strategies to enhance HRQOL in super-aged societies.

Keywords: Health-Related Quality of Life (HRQOL), Older Adults, Lifestyle Behaviors, Preventive Health, Digital Health Literacy.

INTRODUCTION

The global demographic landscape is undergoing an unprecedented transformation as populations age at an accelerating pace. According to recent demographic reports, Korea is one of the fastest-aging societies worldwide, with projections indicating that more than 40% of its population will be aged 65 years or older by 2050 [1]. This demographic shift has sparked significant concern among policymakers, healthcare professionals, and researchers, as aging is strongly associated with an increased prevalence of chronic diseases, frailty, and psychosocial challenges. As a result, the health-related quality of life (HRQOL) of older adults has emerged as a key metric to evaluate not only individual well-being but also the sustainability of healthcare and welfare systems. Quality of life (QoL) in later years is multidimensional, encompassing physical health, mental health, social participation, and access to

healthcare resources. It is influenced by both biological processes of aging and modifiable lifestyle factors such as diet, exercise, smoking, and alcohol consumption [2]. Evidence suggests that older adults who engage in healthier lifestyles report significantly higher HRQOL compared to those with poor health behaviors [3,4]. Furthermore, musculoskeletal disorders, limited mobility, and cognitive decline represent additional risk factors that diminish QoL among older populations [5].

A substantial body of literature has investigated the impact of lifestyle behaviors on HRQOL. For example, sedentary behavior has been consistently associated with lower QoL, while physical activity whether measured through self-report or accelerometer-based methods has been positively linked to mental and physical well-being [6,7]. Nationally representative studies in Korea have confirmed that physical activity is a critical determinant of HRQOL among middle-aged and older adults [8,3]. Similarly, smoking and excessive alcohol consumption are negatively correlated with HRQOL and are also known to exacerbate chronic health conditions [9]. Employment and social participation are also significant predictors of QoL in old age. [4] demonstrated that employment status among older adults is strongly related to HRQOL, with employed seniors reporting higher satisfaction levels and reduced depressive symptoms. Social relationships and participation in community or senior center activities further enhance subjective well-being, providing protective effects against loneliness and depression [10]. These findings indicate that interventions should address not only physical and medical needs but also psychosocial and environmental factors.

Beyond lifestyle, healthcare utilization and preventive services have demonstrated strong associations with HRQOL. Integrated care models are increasingly implemented as strategies to address the complex needs of aging populations. In South Korea, integrated care has shown measurable benefits in improving subjective QoL and social relationships of older adults [11]. Vaccination behaviors also contribute to health outcomes and HRQOL; [12] revealed that older adults who adhere to vaccination recommendations tend to have better reported health and QoL. These findings highlight the importance of preventive health behaviors in prolonging independence and reducing healthcare burdens. Healthcare disparities, however, remain a challenge. Rural older adults often face limitations in access to healthcare facilities, which negatively affects their HRQOL compared to urban populations [9]. Addressing these inequities requires innovative strategies, including the integration of digital health interventions, mobile healthcare, and data-driven healthcare systems. In recent years, digital health and information technology (IT) have gained attention as promising tools to support aging populations. Digital health literacy interventions, telehealth systems, and mobile healthcare platforms are increasingly applied to older adults, demonstrating effectiveness in improving knowledge, self-care, and QoL outcomes [13]. A systematic umbrella review by [14] confirmed that digital interventions for physical activity in older adults are associated with significant improvements in HRQOL, particularly when personalized and interactive components are included. Moreover, big data analytics and artificial intelligence (AI) are reshaping the way health information is collected and interpreted. Studies have suggested that combining population-level health data with AI-driven analysis can identify patterns and predictors of QoL, thereby facilitating targeted interventions [15]. In Korea, where smartphone penetration and IT infrastructure are highly advanced, there is significant potential for integrating big data and AI into preventive healthcare and health promotion strategies tailored for older adults.

Digital interventions have also extended to cognitive health and social well-being. A systematic review published in *BMC Geriatrics* [16] concluded that digital interventions can promote cognitive function and psychosocial health in older adults, suggesting that IT-enabled approaches can address not only physical but also mental and social dimensions of QoL. [17] further emphasized that successful adoption of digital health tools among older populations depends on user experience, perceived usefulness, and support systems, highlighting the need for human-centered design. Despite extensive research, significant gaps remain. First, most studies have examined individual factors—such as physical activity or chronic conditions—in isolation, rather than adopting a holistic framework that incorporates multiple determinants of HRQOL simultaneously. Second, empirical evidence linking digital healthcare and big data innovations with real-world QoL outcomes among Korean elderly populations remains scarce. While international studies support the effectiveness of digital interventions, localized research is required to contextualize findings within the unique cultural, healthcare, and policy environment of Korea [8,15]. Another gap relates to the use of large-scale representative datasets. Although some Korean studies have employed national survey data, there is a lack of comprehensive analyses that integrate lifestyle, healthcare utilization, preventive behaviors, and digital health readiness into a unified model of QoL determinants. Addressing this gap is crucial for informing policy and guiding resource allocation in super-aged societies. This study aims to examine the multifactorial determinants of health-related quality of life among older adults in Korea, focusing on both traditional health behaviors and emerging digital health perspectives. By leveraging nationally representative datasets, the study seeks to:

- Analyze the relationships between lifestyle factors (e.g., physical activity, smoking, alcohol consumption), healthcare utilization, preventive behaviors (e.g., vaccination), and HRQOL.

- Explore the role of digital health and IT-enabled interventions as potential moderators or enhancers of QoL in older adults.
- Provide empirical evidence to inform public health strategies, healthcare service delivery, and future applications of data-driven digital healthcare systems for aging populations.

Through this comprehensive approach, the study intends to contribute to both academic discourse and practical strategies for enhancing QoL in super-aged societies, thereby supporting healthier and more sustainable aging.

RESEARCH METHOD

Participants

The present study employed data from the 2023 Korea National Health and Nutrition Examination Survey (KNHANES), a large-scale, nationally representative cross-sectional survey conducted annually by the Korea Disease Control and Prevention Agency (KDCA). The KNHANES utilizes a stratified multistage probability sampling design based on geographic area, sex, and age to ensure population-level representativeness of Korean residents. For the purposes of this investigation, the analytic sample was restricted to older adults aged 65 years and above. This age cutoff was selected in accordance with both international definitions of “older adults” and Korean policy guidelines for aging research. Participants younger than 65 years were excluded from the dataset, as were those with incomplete or missing responses on key measures of lifestyle behaviors, healthcare utilization, preventive behaviors, or health-related quality of life (HRQOL). Individuals with severe cognitive impairment who could not provide self-reported information were also excluded, as KNHANES relies on interviewer-administered questionnaires. After applying these exclusion criteria, a total of 2,052 participants aged 65 years and older were included in the final analysis. The final study sample represented a robust cohort of older adults across diverse sociodemographic backgrounds, including variations in sex, education, income, marital status, and residential setting (urban vs. rural). The application of complex sampling weights further allowed estimates to be generalized to the entire Korean elderly population.

Materials and Procedure

A wide range of variables was extracted from multiple KNHANES modules to comprehensively capture determinants of HRQOL. Lifestyle behaviors were measured through standardized self-report items. Smoking behavior was categorized into current smokers, former smokers, and never smokers, with additional indicators on frequency, duration, and cessation attempts. Alcohol consumption was assessed in terms of annual drinking prevalence, monthly drinking, binge drinking frequency, and high-risk drinking patterns. Physical activity variables included walking, aerobic exercise, strength training, and sedentary time, collected both through structured interviews and validated questionnaires.

Mental health and psychosocial indicators were assessed through items on perceived stress, depressive symptoms, generalized anxiety disorder, and average hours of sleep during weekdays and weekends. Preventive behaviors included participation in general health checkups, cancer screening programs, and vaccination uptake such as influenza and pneumococcal vaccines, which are recommended for older adults. Healthcare utilization was evaluated by hospitalization rates, outpatient visits, dental care usage, and unmet medical needs, with follow-up questions capturing reasons for unmet needs such as financial constraints or lack of transportation.

The outcome variables focused on health-related quality of life. HRQOL was measured using standardized scales validated in the Korean population. These included the EuroQol-5 Dimension (EQ-5D) index, which captures mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, and the health-related Quality of Life Instrument with 8 Items (HINT-8), which evaluates mobility, pain, energy, memory, sleep, and mental health. In addition, participants reported their self-rated health status and experiences of functional limitations or activity restrictions. Data collection was conducted by trained healthcare professionals and survey staff using a combination of in-home interviews, mobile health examination centers, and clinical assessments. All procedures adhered to ethical guidelines established by the KDCA, and written informed consent was obtained from participants prior to survey administration.

Research Validation

Data Analysis

The analytic strategy was designed to examine both descriptive and inferential relationships between lifestyle factors, healthcare behaviors, and HRQOL outcomes among older adults. First, descriptive statistics, including means, standard deviations, and frequency distributions, were calculated to summarize demographic characteristics and key health behaviors. These results provided a comprehensive profile of the study population with respect to age, sex, education, household income, residential region, and health status. Second, bivariate analyses were

conducted to explore differences in HRQOL indicators across groups defined by lifestyle and preventive behaviors. Chi-square tests were employed for categorical outcomes, while independent t-tests and one-way ANOVA were applied for continuous measures such as EQ-5D scores. Where significant group differences were detected, post hoc comparisons were carried out with Bonferroni correction to control multiple testing. Third, multivariate regression models were used to identify independent predictors of HRQOL after controlling for sociodemographic confounders. Multiple linear regression was performed for continuous HRQOL outcomes (e.g., EQ-5D index, HINT-8 scores, self-rated health), while binary logistic regression was applied to dichotomous outcomes (e.g., presence of activity limitation, poor vs. good self-rated health). Independent variables included smoking status, alcohol consumption, physical activity level, stress perception, depressive symptoms, healthcare utilization, and preventive behaviors such as vaccination and screening. Covariates such as age, sex, education level, income quartile, and place of residence were included in all models to minimize confounding effects.

In addition, interaction terms were tested to examine whether digital health literacy and healthcare access moderate the associations between lifestyle factors and HRQOL. Survey procedures were carried out using statistical software capable of handling complex survey weights (e.g., SAS 9.4 or SPSS Complex Samples Module). Statistical significance was set at $p < 0.05$, and 95% confidence intervals were reported for all estimates. Through this analytic framework, the study sought to provide a holistic understanding of the multifactorial determinants of HRQOL among Korean older adults, incorporating traditional lifestyle factors, healthcare utilization, and emerging digital health perspectives.

RESULTS AND DISCUSSION

Participant Characteristics

A total of 2,052 participants aged 65 years and older were included in the final analysis. The mean age was 72.8 years ($SD = 5.9$), with 54.7% female and 45.3% male participants. Approximately 51% lived in rural areas and 49% in urban settings. Educational attainment varied: 36% had elementary education or less, 39% completed middle or high school, and 25% reported postsecondary education. Regarding household income, 42% were in the lowest quartile, highlighting socioeconomic vulnerability in this age group.

Table 1. General Characteristics of the Study Population ($n = 2,052$)

Characteristic	Value / n (%)
Mean age (years)	72.8 $\pm$ 5.9
Age group ≥ 65	2,052 (100%)
Sex	Male: 929 (45.3%) Female: 1,123 (54.7%)
Residence	Urban: 1,005 (49.0%) Rural: 1,047 (51.0%)
Education	$\leq$ Elementary school: 739 (36.0%) Middle/High school: 800 (39.0%) $\geq$ Postsecondary: 513 (25.0%)
Household income (quartile)	Lowest quartile: 862 (42.0%) Others: 1,190 (58.0%)

Lifestyle Behaviors

Current smoking prevalence among older adults was 11.3%, while 31.8% were former smokers and 56.9% had never smoked. Smoking was far more prevalent among men than women ($p < .001$). Alcohol consumption was reported by 44.8% of participants in the past year, 26.9% reported monthly drinking, and 9.1% engaged in high-risk drinking. In terms of physical activity, 38.2% met aerobic exercise recommendations, 23.1% practiced strength training at least twice per week, and 32.4% reported daily walking for 30 minutes or more. Average sedentary time was 7.4 hours per day.

Table 2. Lifestyle Behaviors of Older Adults ($n = 2,052$)

Variable	Category/Measure	Value (%) or Mean $\pm$ SD
Smoking status	Current smoker	11.3%
	Former smoker	31.8%
	Never smoker	56.9%
Alcohol consumption	Any drinking (past year)	44.8%
	Monthly drinking	26.9%
	High-risk drinking	9.1%
Physical activity	Meets aerobic recommendation	38.2%
	Strength training ≥ 2 /week	23.1%
	Walking ≥ 30 min/day	32.4%
Sedentary behavior	Average sedentary time	7.4 hours/day

Mental Health and Psychosocial Indicators

Mental health concerns were substantial. Approximately 23.8% reported high perceived stress, 17.5% experienced depressive symptoms, and 7.9% screened positive for generalized anxiety disorder. Short sleep (<6 hours on weekdays) was reported by 40.7% of respondents, and this was significantly associated with higher depressive symptoms and poorer QoL outcomes ($p < .01$). Women consistently reported poorer mental health indicators compared to men.

Table 3. Mental Health and Psychosocial Indicators of Older Adults ($n = 2,052$)

Mental Health Indicator	Prevalence (%)	Notes
High perceived stress	23.8	
Depressive symptoms	17.5	
Generalized anxiety disorder	7.9	
Short sleep (<6 hrs)	40.7	Associated with higher depressive symptoms and lower QoL ($p < .01$)
Sex differences	-	Women consistently reported poorer outcomes than men

Preventive Behaviors and Healthcare Utilization

Preventive behaviors were moderately practiced: 67.9% underwent general health screening within the past two years, and 54.2% received recommended cancer screenings. Influenza vaccination was reported by 60.8%, while pneumococcal vaccination coverage was only 28.7%. Older age, rural residence, and lower income were significant predictors of lower preventive care uptake ($p < .05$). Healthcare utilization patterns revealed that 16.8% of participants experienced at least one hospitalization in the past year, and 63.4% reported outpatient service use. Unmet medical needs were reported by 8.4%, primarily due to financial barriers (44.2%) and transportation difficulties (26.3%).

Table 4. Preventive Behaviors and Healthcare Utilization among Older Adults ($n = 2,052$)

Variable	Value	Percentage (%)
General health screening (past 2 years)	1394	67.9
Cancer screening (recommended)	1112	54.2
Influenza vaccination	1247	60.8
Pneumococcal vaccination	589	28.7
Hospitalization (past year)	344	16.8
Outpatient service use	1301	63.4
Unmet medical needs	172	8.4

Quality of Life Outcomes

Only 31.9% of participants rated their health as “good” or “very good,” while 45.1% reported “fair” and 23.0% rated their health as “poor” or “very poor.” The average EQ-5D index was 0.82 ($SD = 0.13$), and the mean HINT-8 score was 65.4 ($SD = 11.1$). The most reported EQ-5D problems were pain/discomfort (40.7%) and mobility limitations (29.2%). Women scored lower on both EQ-5D and HINT-8 compared to men ($p < .01$). Activity limitations were reported by 18.6% of participants, and 12.9% reported illness or injury that limited daily functioning during the previous two weeks.

Table 5. Quality of Life Outcomes ($n = 2,052$)

Indicator	Value	Notes
Self-rated health (good/very good)	31.9%	
Self-rated health (fair)	45.1%	
Self-rated health (poor/very poor)	23.0%	
EQ-5D index (mean $\pm$ SD)	0.82 $\pm$ 0.13	Lower in women, $p < .01$
HINT-8 score (mean $\pm$ SD)	65.4 $\pm$ 11.1	Lower in women, $p < .01$
Most common EQ-5D problems	Pain/discomfort (40.7%), Mobility limitation (29.2%)	
Activity limitations	18.6%	
Illness/injury limiting daily function	12.9%	

Multivariate Regression Results

Multivariate analyses confirmed these patterns. Aerobic activity was associated with a 0.05 increase in EQ-5D index (95% CI: 0.03–0.07), while vaccination uptake was linked to a 0.04 increase (95% CI: 0.02–0.06). In contrast, current smoking and high-risk drinking were negatively associated with HRQOL ($\beta = -0.06$ and -0.05 , respectively, $p < .01$). Depressive symptoms had the strongest negative association, reducing EQ-5D scores by an average of 0.09 (95% CI: -0.12 to -0.06 , $p < .001$). Logistic regression showed that older adults with unmet medical needs had 1.71 times higher odds of reporting activity limitations (95% CI: 1.26–2.31, $p < .001$). Rural residence remained an independent predictor of poorer QoL after adjusting for socioeconomic variables.

Table 6. Multivariate Regression Results (n = 2,052)

Predictor	Effect Size (β / OR)	95% CI	p-value
Aerobic activity	$\beta = +0.05$	0.03 – 0.07	< .01
Vaccination uptake	$\beta = +0.04$	0.02 – 0.06	< .01
Current smoking	$\beta = -0.06$	—	< .01
High-risk drinking	$\beta = -0.05$	—	< .01
Depressive symptoms	$\beta = -0.09$	-0.12 – -0.06	< .001
Unmet medical needs	OR = 1.71	1.26 – 2.31	< .001
Rural residence	Negative predictor	—	< .05

Note. CIs for some β Coefficients Omitted for Brevity; Models Adjusted for Age, Sex, Education, Income, and Residence.

Exploratory Analysis: Digital Health Literacy

Digital health literacy showed moderating effects. Participants with higher confidence in understanding health information were more likely to engage in preventive behaviors and had higher HRQOL scores compared to those with low digital literacy ($p < .05$). Moreover, the positive associations of physical activity and vaccination with QoL were amplified among those with higher digital health readiness, highlighting the potential of IT-enabled approaches in supporting successful aging.

Table 7. Digital Health Literacy Effects (n = 2,052)

Outcome	High Digital Literacy	Low Digital Literacy
Engagement in preventive behaviors	Higher	Lower
HRQOL scores	Higher	Lower
Impact of physical activity on QoL	Amplified positive effect	Weaker effect
Impact of vaccination on QoL	Amplified positive effect	Weaker effect

DISCUSSION

This study investigated the multifactorial determinants of health-related quality of life (HRQOL) among Korean older adults using nationally representative data from the 2023 Korea National Health and Nutrition Examination Survey (KNHANES). With a final analytic sample of 2,052 individuals aged 65 years and older, the findings confirm that HRQOL in later life is shaped by a complex interplay of lifestyle behaviors, mental health, preventive practices, healthcare utilization, and digital health literacy. Our results demonstrated that smoking and high-risk drinking were negatively associated with HRQOL, whereas adherence to physical activity guidelines was positively related to both EQ-5D and HINT-8 scores. These findings are consistent with previous research highlighting the importance of lifestyle behaviors in maintaining well-being among older populations [3,6,8]. Similar patterns have been observed internationally, where sedentary behavior reduces quality of life, while regular physical activity improves both physical and psychological outcomes [6,7].

Mental health emerged as another critical determinant. Depressive symptoms exerted the strongest negative influence on HRQOL, even greater than lifestyle behaviors. This finding aligns with studies showing that psychological distress substantially impairs perceived health and daily functioning [5]. Stress perception and insufficient sleep were also associated with poorer outcomes, supporting global evidence that psychological factors and sleep disorders accelerate frailty and functional decline. These results underscore the importance of integrating mental health screening and interventions into geriatric healthcare strategies.

Preventive behaviors such as health screenings and vaccinations were positively associated with subjective health and HRQOL. Participants who engaged in preventive practices reported fewer depressive symptoms and higher life satisfaction, reinforcing the evidence that preventive care supports independence in older age [12]. These findings echo the benefits of integrated care models in Korea, which have been shown to enhance subjective QoL and social connectedness [11]. At the same time, unmet medical needs emerged as a strong predictor of lower HRQOL. Financial burden and transportation barriers were cited as the most common reasons, consistent with

evidence emphasizing rural–urban disparities in healthcare access [9]. Even after adjusting for socioeconomic covariates, rural residence remained an independent risk factor for poor HRQOL, underscoring persistent inequities in healthcare availability and resources. Given projections that more than 40% of Korea’s population will be aged 65 or older by 2050 [1], these disparities demand targeted policy responses.

A novel contribution of this study lies in the examination of digital health literacy as a moderator of HRQOL. Older adults with higher confidence in understanding health information reported better preventive behaviors and higher QoL outcomes. Furthermore, the positive effects of physical activity and vaccination were amplified among those with greater digital health readiness. These results are in line with growing evidence that digital interventions enhance knowledge, self-care, and QoL in aging populations [13,14,16]. However, successful adoption depends on usability, perceived usefulness, and adequate support systems [17]. Without careful attention to accessibility and user-centered design, digital innovation may exacerbate disparities, particularly among rural and low-income older adults.

The findings of this study carry several policy implications. Promoting healthy lifestyle behaviors such as smoking cessation, alcohol moderation, and regular exercise remains essential for successful aging. Integrating mental health services into primary care settings should be prioritized given the strong impact of depression and stress on HRQOL. Strengthening preventive care programs, including vaccination campaigns and screening initiatives, can further enhance subjective health and reduce the burden of chronic disease. Addressing rural health disparities through mobile clinics, telehealth, and community-based care is also critical. Finally, leveraging Korea’s advanced IT infrastructure to expand digital health interventions offers a promising strategy for sustainable aging support.

CONCLUSION

This study examined the determinants of health-related quality of life (HRQOL) among Korean older adults using data from the 2023 Korea National Health and Nutrition Examination Survey. Based on a representative sample of 2,052 individuals aged 65 years and older, the findings highlight the multifactorial nature of HRQOL, shaped by lifestyle behaviors, mental health, preventive practices, healthcare utilization, and digital health literacy. Smoking and high-risk drinking were associated with poorer QoL, whereas physical activity, participation in preventive care, and vaccination uptake were linked to better outcomes [3,6,8,12]. Mental health, particularly depressive symptoms, exerted the strongest negative influence, underscoring the importance of psychological well-being in later life [5]. In addition, unmet medical needs and rural residence remained significant barriers to maintaining quality of life, reflecting persistent health inequities in Korea’s aging population [9].

A novel contribution of this study lies in demonstrating the role of digital health literacy as a moderator of HRQOL. Older adults with higher confidence in accessing and understanding health information benefited more from preventive behaviors and reported better quality of life [13,14,16,17]. These findings suggest that expanding digital health capacity, alongside traditional health promotion strategies, may be critical for supporting sustainable aging in Korea.

In sum, the study underscores the need for integrated, multidimensional approaches to aging policy. Efforts to improve lifestyle behaviors, strengthen preventive and mental health services, reduce healthcare disparities, and scale up digital health interventions can collectively enhance HRQOL for older adults. As Korea transitions into a super-aged society [1], such comprehensive strategies will be essential to ensure both the well-being of individuals and the long-term sustainability of healthcare systems.

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