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Research Article

Health Literacy of Japanese Elderly who Participated in A Long-term Care Prevention Exercise Program by Household Composition

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ABSTRACT

Objectives: With the development of services to improve the daily lives of older adults and the use of Internet of Things technology in healthcare in Japan, there is a growing need to address health literacy, especially among older adults living alone. The current study aims to fill this research gap by assessing the current state of health literacy in this population, and potentially providing guidance for future support strategies.

Methods: In this study, 22 older female participants in long-term care preventive services were assessed for health literacy, cognitive function, and activities of daily living using the Household Composition and Basic Demographic Information, the Health Literacy Scale, the Japanese version of the Montreal Cognitive Assessment, and the Occupational Self-Assessment-Short Form.

Results: The household composition was 13 older adults living alone and nine living with others. Older adults living alone had significantly lower functional health literacy than those living with others, which affected their ability to understand and apply health information. Difficulties reading health materials were also prevalent in this group, suggesting that visual impairment or a lack of assistive devices may affect their understanding of health information. Considering these specific needs through tailored strategies is essential for helping older adults to adapt to an increasingly digital society.

Conclusions: Understanding the current state of functional health literacy among older adults living alone in the community is essential for developing strategies to improve their well-being, prevent isolation, and enable them to make informed decisions about their health.

INTRODUCTION

The Japanese Ministry of Health, Labour and Welfare has identified making daily life easier for older adults as a key initiative within Japan's comprehensive community-based care system [1]. In parallel, the Ministry of Internal Affairs and Communications has promoted the use of health information by seniors themselves, emphasizing a self-directed strategy based on the understanding that declining self-perceived health among older adults often leads to less activity in daily life, triggering a harmful cycle of further health deterioration [2].

According to the Ministry of Internal Affairs and Communications [3], the previous version, referred to as Society 4.0, faced several challenges, such as insufficient knowledge and information sharing, and the burden of finding and analyzing necessary information amidst an overabundance of data. Society 5.0 aims to address these issues by sharing diverse knowledge and information through the Internet of Things (IoT), fostering unprecedented value creation. In-

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ternet-based health literacy, referred to as e-health literacy [4], is the promotion of proactive health behaviors through information seeking from information media. In the elderly, Internet use and e-health literacy promote self-directed health management using health information [5]. However, it is unclear what factors prevent Internet access and how the elderly who do not use the Internet obtain medical and health information.

The long-term care insurance system for older adults in Japan is undergoing significant changes in these changing times. The Japan Business Federation has put forward a proposal that aims to enable individuals to proactively manage their health throughout their lives in the 100th era [6]. This proposal includes the establishment of artificial intelligence-assisted medical and wellness support services, the expansion of remote health care, and a system that allows individuals to use and manage their life history data in relation to health care for older adults. As a result, it is expected that the use of IoT-based healthcare will gradually become commonplace among older adults. Meanwhile, the Cabinet Office has reported that 23.7% of people aged 65 and older use the Internet to gather information, highlighting the important role of digital devices in information gathering. In the elderly, it is important to be both vulnerable to disease and appropriately distant from society. In particular, the digital divide is believed to reduce social connectedness, which can lead to health problems [7]. Morimoto noted that there have been remarkable advances in technologies such as VR in the healthcare field [8]. On the other hand, he states that if a higher level of literacy is required of users, the benefits will be limited to a few [8]. Therefore, he states that it is desirable to make progress in a direction that corrects the literacy gap. Izumi [9] states the need to build a life infrastructure using technology-based platforms in the healthcare field as well. Thus, as technology advances, it is important to correct the literacy gap among the elderly as well.

The term health literacy was coined in the 1970s [10], and refers to the ability to acquire, understand, and apply accurate information related to health and medical care. In the context of health care, health literacy embodies the ability to access, understand, interpret, and evaluate medical information, as well as the ability to follow medical advice [11]. Numerous studies have shed light on health literacy. For example, in the early 2000s, a study led by Michael et al. [12] found that individuals with lower health literacy tended to have poorer physical functioning and mental health, and that low health literacy acted as a predictor of poor physical health. Kim et al. [13] reported that individuals with lower health literacy had significantly higher rates of arthritis and hypertension, establishing a link between health literacy and disease prevalence. In the early 2010s, Bostock et al. [14] reported that one-third of older adults aged 65 and over in the United Kingdom had difficulty understanding basic written health information. Furthermore, this lack of understanding was associated with an increased risk of death over a 5-year period, highlighting the strong association between health literacy and disease. Recently, Nakayama et al. identified the benefits of improved health literacy, including utilization of preventive services, effective disease management, and improved communication of personal concerns to healthcare professionals [15]. Consequently, among older adults, an increase in health literacy facilitated by the IoT is expected to not only foster a greater sense of connectedness with the outside world, but also to empower seniors to make informed decisions for their own health promotion. Health literacy among the elderly is associated with physical activity engagement [16]. It has also been reported that improved physical activity promotes a reduction in sedentary activity time [17]. In other words, improving health literacy among older adults may indirectly reduce sedentary activity time and promote health behaviors.

In recent years, there have been significant changes in the living arrangements and lifestyles of older adults, including changes in household composition. The Ministry of Health, Labour and Welfare [18] reported that the percentage of "older one-person households" in Japan increased from 14.9% in 1990 to 28.8% in 2019. Conversely, the proportion of previously dominant "three-generation households" experienced a significant decline from 39.5% to only 9.4%. As a result, more older people are choosing to live alone than in the past. As a result, support for these lone-living older people often includes the distribution of monitoring tools, information, and other programs to counteract potential isolation. Therefore, improving health literacy, as discussed earlier, will play a critical role in preventing isolation among older adults living alone in the community.

In Japan, many previous studies have been conducted to support lonely older adults. Among them, Shirasuna et al. [19] emphasized the importance of promoting social health as a form of support for lonely older adults. The researchers emphasized that promoting positive and constructive relationships with others and society is essential for maintaining good health [19]. However, little research has been conducted specifically on the health literacy of older adults living alone in the community, indicating a gap in current knowledge that needs to be addressed in future research.

Therefore, the primary objective of the current study is to determine the current state of health literacy among older adults living alone in the community. The current findings may provide a basis for future consideration of how to improve health literacy as a form of support for lonely older adults.

METHODS

Participants and Ethical Approval

This study involved older adults living in the community who were not eligible for long-term care insurance and who participated in long-term care preventive services run by Namegata City in Ibaraki Prefecture, Japan in 2021. Participants were recruited by the local comprehensive support center of the city of Miyakata, which published an invitation

to the event in a public relations magazine. Elderly people who expressed their willingness to participate in the class after reading the magazine informed the community support center of their wish to participate in the class. Then, the staff of the City of Missing Persons gave informed consent for participation in the health class to those who wished to attend. The principal investigator then explained the purpose of the study to the individual participants and obtained their consent. A total of 22 community-dwelling older adults responded to our request for participation in the study (Figure 1). Preventive long-term care services programs are mainly provided by specialists. In the exercise program, participants underwent exercise and stretching sessions with the following regimen: i) a 10-minute warm-up session with stretching, ii) 40–50 minutes of strength-building exercise, iii) 40–50 minutes of strength training, followed by brain activation exercises, and iv) cool down for 5–10 minutes. This program lasted for approximately 120 minutes once a week and was held 10 times in total.

The study was conducted with the informed consent of the participants and was approved by the Ethics Committee of AHRU Medical Care and Welfare Professional Training College (approval number: cc-0018) and adhered to the ethical guidelines of the 1975 Declaration of Helsinki.

Content of the Survey

Basic Information

Age and name information was obtained from the subjects. A pen and paper survey method was conducted by the staff in a face-to-face manner.

Household Composition

A survey was conducted on the household composition of the subjects. The survey was conducted face-to-face by the staff. Subjects were asked to report whether they had family members living with them.

Health Literacy Scale ver.14

Health literacy was assessed using the Health Literacy Scale 14 developed by Suka et al. [20]. The 14-item scale is modified for the Japanese population and includes functional health literacy (five items), communicative health literacy (five items), and critical health literacy (four items). Functional health literacy items were scored on a scale from "1: strongly agree" to "5: strongly disagree," and both communication and critical health literacy were scored on a scale from "1: strongly disagree" to "5: strongly agree." The total possible score for all 14 items was 70, with higher scores representing better health literacy.

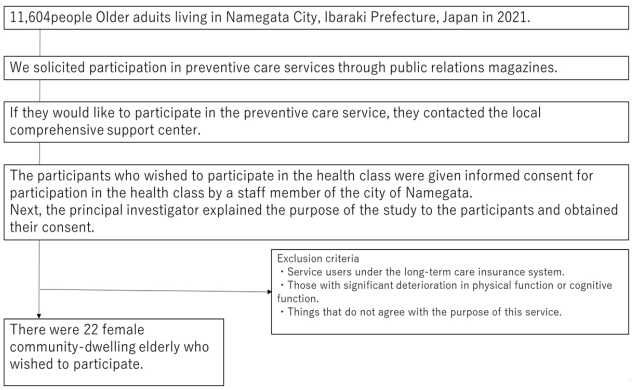

Figure 1. **Flow chart describing participant recruitment.**

Cognitive Function Assessment

The Japanese version of the Montreal Cognitive Assessment (MOCA-J) was used to assess cognitive function [21]. This tool assesses several cognitive domains (such as attention, executive function, and orientation) in approximately 10 minutes. The total possible score is 30, and scores of 26 or above are considered to be within the normal range.

Activities of Daily Living Assessment

The Occupational Self-Assessment-Short Form (OSA-SF) [22] was used to assess activities of daily living. This assessment tool is based on the model of human occupation and consists of 12 items related to the performance of activities of daily living. Each item was scored on a scale from "0: This does not apply to me" to "4: I do this very well," with a maximum total score of 48. Higher scores indicate greater frequency and skill in performing activities of daily living.

Statistical Analysis

Statistical analysis initially involved calculating the mean ±standard deviation for each measure. Participants were then categorized according to whether they lived with family members, and the mean ± standard deviation of each measure was calculated for each group. The Shapiro–Wilk test was used to examine the normality of each measure. In the absence of a normal distribution, the Mann–Whitney U test was used to compare survey items between groups. In addition, response patterns for each health literacy scale item were compared between groups using Fisher's exact probability test and residual analysis. A Ridit analysis [23] was also performed, in which responses to each health literacy scale item were converted to Ridit scores, and these scores were compared between groups using the Mann–Whitney U test. IBM SPSS Statistics, version 24.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. The significance level was set at 5% for all tests. Cohen's d was used to compare all measures by household and Ridit scores of the health literacy scale were used to calculate effect size. Cramer's V was used to compare response patterns on the Health Literacy Scale.

RESULTS

The mean age of the 22 participants was 82.0 ± 4.9 years, and all participants were female. The household composition

Table 1. Comparison of each assessment item 354 on the basis of household composition, with living alone/together households

Assessment items	Total	Household composition		*p-value*	Effect size
		LA	LT		
N	22	13	9		
Age (years)	82.0±4.9	82.1±1.4	81.9±5.0	.933	0.11
Functional health literacy (points)	17.7±4.1	16.0±4.3	20.1±2.2	.010	1.14
Communicative health literacy (points)	12.8±4.4	13.5±4.9	11.7±3.4	.338	0.41
Critical health literacy (points)	11.4±2.8	11.6±3.1	11.0±2.2	.555	0.22
Total health literacy (points)	41.9±7.1	41.2±8.2	42.9±5.6	.578	0.23
Moca-j (points)	25.3±5.2	25.1±4.6	25.5±6.0	.892	0.08
OSA-SF (points)	35.1±4.5	35.7±5.0	34.3±3.9	.518	0.30

Mann-Whitney U-test
Effect size: Cohen's d
Values are mean ± standard deviation.
Abbreviations: LA, living alone; LT, living together; MOCA-J, Japanese version of the Montreal Cognitive Assessment; OSA-SF, Occupational Self-Assessment- Short Form.

included 13 older adults living alone and nine living with others (specifically their children). Table 1 shows the comparison of each assessment item on the basis of household composition, with living alone/together households.

The mean age was 82.1 ± 1.4 years for those living alone and 81.9 ± 5.0 years for those living together. In terms of health literacy, mean functional health literacy scores were 16.0 ± 4.3 points for those living alone and 20.1 ± 2.2 points for those living together. Mean communicative health literacy scores were 13.5 ± 4.9 points for those living alone and 11.7 ± 3.4 points for those living together. Critical health literacy scores were 11.6 ± 3.1 points for those living alone and 11.0 ± 2.2 points for those living together (Figure 2). Overall health literacy scores were 41.2 ± 8.2 points for those living alone and 42.9 ± 5.6 points for those living together. Mean MOCA-J scores were 25.1 ± 4.6 points for those living alone and 25.5 ± 6.0 points for those living together. Mean OSA-SF scores were 35.7 ± 5.0 points for those living alone and 34.3 ± 3.9 points for those living together. According to the results of the Shapiro–Wilk test, these scores did not follow a normal distribution, thus, the Mann–Whitney U test was used to compare the results based on household composition. A significant decrease in functional health literacy was observed in living alone households compared with living together households. A large effect size was observed for functional health literacy, whereas small effect sizes were observed for communicative health literacy, critical health literacy, and overall health literacy, although these were not significant according to the U test. The estimated effect size for OSA-SF was also small.

Fisher's exact probability tests and residual analyses were then used to compare response patterns for each health literacy item between living alone and together households (Table 2). Significant differences were found for the item "Q4. It takes a long time to read them." Residual analysis confirmed the significance of this finding. However, none of the respondents from living alone households answered in this way, and the residual analysis indicated that this difference was significant. For the item "Q6: I collect information from various sources," Fisher's exact probability test showed no significant difference. However, residual analysis indicated that a significant number of respondents in living alone households "strongly disagreed," whereas a higher percentage of those living together "agreed." Both of these effects were significant.

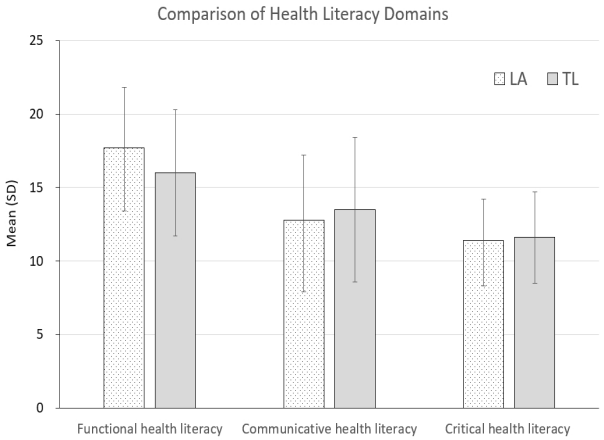

Figure 2. Comparison of each health literacy by household composition
Abbreviations: LA, living alone; LT, living together

A Ridit analysis was conducted to compare health literacy by household composition, with living alone/together households (Table 3). Mean Ridit scores were calculated for each group for each question in each health literacy domain. Mean Ridit scores above 0.50 indicate higher health literacy for each item, while Ridit scores below 0.50 indicate lower health literacy. When comparing mean Ridit scores by household composition using the Mann-Whitney U test, health literacy for item "Q4: It takes a long time to read them" was found to be significantly lower in the group living alone. In addition, the effect size was larger. The Mann-Whitney U test also showed a larger effect size for the item "Q3: The content is too difficult for me" although the difference was not statistically significant.

DISCUSSION

The call for participants was issued by the local Community

Table 2. Response patterns for each health literacy item between household composition, with living alone/together households

Survey items	HC	SD	D	NS	A	SA	*p-value*	Effect size
Functional health literacy		5 points	4 points	3 points	2 points	1 points		
Q1: I find characters that I cannot read	LA	2	5	3	2	1	.882	0.23
	LT	1	5	2	1	0		
Q2: The print is too small for me	LA	2	6	1	3	1	.450	0.40
	LT	3	5	1	0	0		
Q3: The content is too difficult for me	LA	0	5	3	4	1	.211	0.45
	LT	0	6	3	0	0		
Q4: It takes a long time to read them	LA	0*	3	4	3	3	.042	0.65
	LT	3*	4	2	0	0		
Q5: I need someone to help me read them	LA	6	3	0	3	1	.341	0.45
	LT	5	3	1	0	0		
Communicative health literacy		1 points	2 points	3 points	4 points	5 points		
Q6: I collect information from various sources	LA	1	6*	1	2	3	.086	0.60
	LT	1	0	2	5*	1		
Q7: I extract the information I want	LA	0	4	2	4	3	.725	0.24
	LT	0	1	2	4	2		
Q8: I understand the obtained information	LA	1	3	1	5	3	.312	0.46
	LT	0	0	1	7	1		
Q9: I tell my opinion about my illness to my doctor, family, or friends	LA	1	3	1	6	2	.924	0.20
	LT	0	2	1	4	2		
Q10: I apply the obtained information to my daily life	LA	1	5	1	3	3	.396	0.43
	LT	1	1	3	3	1		
Critical health literacy		1 points	2 points	3 points	4 points	5 points		
Q11: I consider whether the information is applicable to me	LA	0	3	1	6	3	.852	0.18
	LT	0	2	0	5	2		
Q12: I consider whether the information is credible	LA	0	4	4	4	1	.739	0.23
	LT	0	4	1	3	1		
Q13: I check whether the information is valid and reliable	LA	0	7	2	3	1	.282	0.47
	LT	1	2	1	5	0		
Q14: I collect information to make my healthcare decisions	LA	1	6	3	3	0	.709	0.31
	LT	0	4	2	2	1		

The table shows the number of people in each category.
Fisher's exact test was used for the test
Effect size: Cramer's V
As a result of the residual analysis, * was marked as significant at the 5% level.
Survey item values in each category represent the number of people. * is significant at the 5% level following a residual analysis.
Abbreviations: A, agree; D, disagree; LA, living alone; LT, living together; NS, not sure; SA, strongly agree; SD, strongly disagree.

Comprehensive Support Center in Namegata City, and we recruited individuals who expressed interest in participating in the study. Thus, it can be concluded that our study participants were a group with a high level of health promotion awareness because they were willing to participate in long-term care preventive services.

A comparison of each measure, categorizing households as either living together or living alone, revealed that functional health literacy scores were significantly lower for the latter group. Functional health literacy reflects the ability to understand and apply accurate, useful information in everyday life, and is the foundation of overall health literacy [20]. It has been reported that levels of functional health literacy can have a direct impact on overall health literacy [20]. Furthermore, functional health literacy has been reported to affect the range of living of community-dwelling older people. According to Matsuda et al., higher functional health literacy indicates a wider range of living [24]. Low functional health literacy is also reported to be a factor that leads to depression [25]. One implication of measuring functional health literacy is that health communication and materials should be adapted to those with inadequate health literacy [26]. This suggests that individuals in living alone households, who may have significantly poorer interpersonal and social interactions (including communication) compared with those in shared households, require strategies to increase opportunities for information gathering and interaction. Furthermore, it has been reported that the narrowing of living space increases mortality and hospitalization rates [27, 28]. The decline in functional health literacy of older people living alone, which was revealed in this study, is likely to increase mortality and hospitalization rates because of the narrowing of living space, in addition to the isolation of older people because of the inability to obtain appropriate information. Furthermore, this pattern may increase the risk of becoming withdrawn

Table 3. Comparison of health literacy by household composition, with living alone/together households using Ridits analysis

Survey items	Household composition		*p-value*	Effect size
	LA	LT		
N	13	9		
Functional health literacy				
Q1: I find characters that I cannot read	0.48±0.30	0.54±0.25	.63	0.21
Q2: The print is too small for me	0.42±0.29	0.61±0.23	0.115	0.71
Q3: The content is too difficult for me	0.42±0.29	0.62±0.19	0.082	0.80
Q4: It takes a long time to read them	0.35±0.24	0.71±0.20	<.001	1.61
Q5: I need someone to help me read them	0.46±0.30	0.56±0.23	.399	0.37
Communicative health literacy				
Q6: I collect information from various sources	0.55±0.31	0.43±0.24	.365	0.40
Q7: I extract the information I want	0.53±0.31	0.46±0.26	.568	0.25
Q8: I understand the obtained information	0.54±0.32	0.45±0.17	.430	0.31
Q9: I tell my opinion about my illness to my doctor, family, or friends	0.52±0.29	0.46±0.28	.632	0.21
Q10: I apply the obtained information to my daily life	0.51±0.31	0.49±0.26	.895	0.06
Critical health literacy				
Q11: I consider whether the information is applicable to me	0.51±0.28	0.49±0.27	.862	0.08
Q12: I consider whether the information is credible	0.49±0.27	0.51±0.32	.893	0.06
Q13: I check whether the information is valid and reliable	0.53±0.27	0.45±0.30	.536	0.27
Q14: I collect information to make my healthcare decisions	0.54±0.28	0.45±0.29	.469	0.32

Mann-Whitney U-test
Effect size: Cohen's d
Values are mean ± standard deviation.
Abbreviations: LA, living alone; LT, living together

and exhibiting a depressive state. Thus, investigating the functional health literacy of older people living alone is important because it can lead to preventive care.

We further examined each health literacy question. The item "Q4: It takes time to read them," which is part of functional health literacy, showed significant differences by household composition. Residual analysis showed that individuals living together characteristically responded "not at all" to this question. Conversely, no participant who lived alone selected "I don't agree at all." Therefore, it can be assumed that older people living alone have varying degrees of difficulty reading information. In addition, the results of the Ridit analysis showed that older people living alone scored significantly lower than those living with others on this item, with a larger effect size underscoring the significance of this difference. The mean Ridit score for "The content is difficult to understand" was also lower for living alone households, suggesting that the difference was substantial, although this effect was not statistically significant because of the small sample size.

However, no significant differences were found in the results of the MOCA-J assessment of cognitive function. Although we were not able to identify the factors that led to these results in the current study, age-related vision loss is a possible reason for the reported difficulty in reading brochures and other materials. Because poor vision is a limiting factor in reading and walking among older people [29], older households without family lack adequate support to cope with poor visual function. Because there was no significant age difference between the two groups in this study, we suggest that the use or lack of assistive devices such as magnifiers and reading glasses may be a contributing factor. Because the cohabiting households included younger members, these family members may provide appropriate assistive devices or help create an environment that is conducive to their use.

The OSA-SF, a measure of activities of daily living, showed a small effect size that did not reach statistical significance. Although the difference was small, older people living alone showed a trend toward higher work performance. The slightly larger standard deviation among older people living alone may have been caused by individual differences among the study participants or by their high level of motivation. These issues warrant further investigation in future studies with larger samples. Although there was no difference in daily life by household composition, there was a significant difference in functional health literacy, as described above. From the perspective of care prevention, it may be possible to assess whether a person is likely to fall into a state of need for care in the future by evaluating functional health literacy, rather than checking the state of daily life. Yamada et al. reported that the higher the comprehensive health literacy, the lower the risk of frailty 2 years later [30]. On the basis of this previous finding, we speculate that the functional health literacy of older people living alone could be a useful indicator for evaluating the risk of needing long-term care. Therefore, the current findings demonstrated that the characteristics and determinants of health literacy differ among older adults living alone, a population that is expected to increase in size in the future. The digital divide is an important challenge for older people in an information society. Local governments are addressing this issue through

services such as lending information and communication devices and the establishment of counseling centers [31]. However, we speculate that older people could better adapt to the information society if strategies were also developed to address the specific needs of individuals with different household compositions.

Several limitations of the current study should be acknowledged. The purpose of this study was to assess the current state of health literacy in various household configurations. Our objective was to explore strategies to support elderly people living alone, which is expected to increase in the future, and to prevent social isolation. The target population for this study was elderly people living in the community who were not covered by long-term care insurance and who participated in the long-term care prevention service operated by the city of Namegata in Ibaraki Prefecture. Therefore, the following two limitations of the study can be mentioned. First, the sample size of this study was small and limited to a single region. Therefore, an increase in sample size and comparisons with multiple regions are needed to provide a broader perspective. Second, because the study participants were participants who had received health education, their health awareness and ability to acquire information may have been relatively high. In future studies, it is important to make comparisons with the general elderly population who have never participated in long-term care prevention services. In addition, it is necessary to examine the level of awareness of health promotion and health literacy among the elderly.

CONCLUSIONS

Improving the health literacy of older adults living alone in the community is essential to improve their well-being and support, in line with Japan's comprehensive community-based care system and the vision of Society 5.0, which emphasizes knowledge and information sharing through IoT technology. Understanding the current state of health literacy, particularly functional health literacy, among older adults living alone in the community is essential for developing strategies to improve their well-being, prevent isolation, and enable them to make informed decisions about their health. Improved functional health literacy enables older adults to make informed decisions about their health and promotes stronger connections to the outside world. Furthermore, functional health literacy may serve as an index for care prevention.

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Conflicts of Interest

The authors declare no conflict of interest.

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