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Effect of a community-based participatory health literacy program on health behaviors and health empowerment among community-dwelling older adults: A quasi-experimental study

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ABSTRACT

This study evaluated the effect of a community-based participatory health literacy program aimed at improving the health behaviors and health empowerment for older adults. A two-group pretest and posttest quasi-experimental design with surveys conducted at baseline (T_1), immediately after the intervention (T_2), and 6 months after the intervention (T_3). The intervention group ($n = 94$) attended a 12-week health literacy program; while the comparison group ($n = 78$) did not. The results demonstrated that intervention group had significantly better health behavior practices for weight control (OR = 3.71, 95% CI = 1.59–8.64), regular exercise (OR = 15.26, 95% CI = 1.92–121.13), and health information navigation (OR = 2.61, 95% CI = 1.16–5.84). Health empowerment was significantly higher in the intervention group than the comparison group ($p < 0.01$). This study suggests that integrating community-based participatory design is effective in improving some health behaviors and health empowerment in older adults over a short period.

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Introduction

In many countries, older adults are the fastest growing population; this may lead to substantial burdens of chronic diseases on society. The prevention and management of chronic diseases depend not only on the availability of health care resources but also the self-care behaviors of individuals.^{1,2} More now than ever before, older adults are increasingly expected to play a more proactive role in promoting health and managing diseases.

Health literacy has been recognized as a key factor influencing chronic disease prevention and management because of its relevance to self-care activities, health information navigation, communication of health problems, self-efficacy, and health-related decision-making.^{3–7} Accordingly, various health literacy interventions have been implemented; some programs have prioritized the communication of information designed for people with low health literacy, whereas others have placed emphasis on health literacy skill training to improve knowledge, behavior, or health outcomes. Most health

literacy interventions thus far are health communication initiatives focused on providing easier-to-use health information and improving patient–provider communication. These techniques include predominant use of verbal education with simplified explanations and teach-back techniques to assess patient comprehension, literacy-appropriate health education materials, videos, and multimedia aids.^{8–12} Compared with traditional health education approaches, using communication strategies specific to health literacy is more effective for improving some health-related outcomes, particularly knowledge.^{7,13–15} Although knowledge gained from easy-to-read material or multimedia aids increases for individuals with limited health literacy, no studies have demonstrated that simpler written materials improve long-term desired behaviors and health outcomes.^{8,11} A growing number of interventions aimed at improving the comprehensive health literacy of individuals in terms of ability to navigate, understand, communicate, evaluate, and apply health information, and subsequently, increase their engagement in health concerns.^{16–18} Evidence reveals promising results of comprehensive programs for improving health literacy in terms of knowledge, health behavior, and in some cases, enhances health outcomes.^{9,19,20} However, much of the relevant literature focuses on disease-specific populations.^{16,21,22} Relatively little is known regarding the benefits of comprehensive health literacy interventions on the prevention and

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management of chronic disease among older adults in general, with or without chronic disease.^{18,23}

Older adults are at a risk of low health literacy and a rapid decline in health literacy skills has been observed in those aged older than 55 years.^{24,25} In response to the burden of low health literacy and the demand of self-care management skills for older adults, increasing attention has been paid to designing health literacy strategies for older adults, such as live interactive presentations, easy-to-use brochures, and online resources.^{5,10,12,26} The findings of a review indicate that providing training workshops for older adults to improve their knowledge and skills regarding searching for relevant and useful health information on the Internet and thereby acquire more disease knowledge, skills for navigating information, and willingness to use the Internet as a health information resource.⁵ However, no data have supported the robust effect of these outcomes on higher-order thinking, such as making health decisions. Some studies using health literacy-directed intervention approaches suggested that combining motivational interview techniques or live presentations was a more effective teaching approach in older adults.^{10,26} Although evidence has been provided in support of the efficacy of these intervention strategies for either health literacy-informed or -directed interventions, the underlying problem is the lack of proactive participation.^{9,23} Emerging evidence has demonstrated that participatory designs can substantially benefit from incorporating health literacy principles into their efforts because they both focus on empowering individuals by acquiring health knowledge and implementing actions for health.^{23,27,28} An increasing number of health literacy researchers are adopting participatory strategies and strengthening interventions, as demonstrated by the success of collaboratively designed health literacy initiatives for improving patient engagement and chronic disease management.²⁸ Although the evidence of the effects of these initiatives is promising, it remains limited to Western culture, with the exception of one study that was conducted in Japan.^{9,18,23}

Health empowerment and health literacy represent two independent but equally crucial determinants of health-related behaviors and outcomes.²⁹ Health empowerment can build confidence and enable individuals to engage in self-management, solve health-related problems, and make informed decisions, thus promoting effective management of health conditions and achievement of satisfactory health outcomes,^{3,30,31} particularly in populations with low health literacy.³² Some researchers have asserted that health literacy is an antecedent of health empowerment^{33–36}; others have argued that health empowerment may mediate the link between health literacy and outcomes.^{29,37} Although many debates have consistently attempted to elucidate the relationship between health literacy and health empowerment, increasing evidence suggests that health literacy and empowerment can reinforce each other to achieve synergistic effects on health outcomes.^{38,39} As noted by Schulz and Nakamoto,³⁸ being highly empowered and simultaneously possessing a high level of health literacy is the best-case scenario for effective self-management. Given the scope of current research evidence, health literacy interventions may have synergistic effects when community-based participatory design, health literacy, and health empowerment are integrated to promote the health of older adults. However, evidence from older adults is limited.

This paper evaluates the effects of a community-based participatory initiative health literacy program on health behaviors and health empowerment for older adults aged 50 years or older. We hypothesized that (1) that healthy behaviors would be significantly better in elderly who received the participatory initiative health literacy program compared to elderly who did not receive the intervention program. We similarly hypothesized (2) that a sense of health empowerment would be significantly higher among older adults who received the participatory initiative health literacy

program than among older adults who did not receive the intervention program.

Methods

Study design

This was a two-group pretest and posttest quasi-experimental study conducted between November 2015 and August 2017. The participants in the intervention group attended a 12-week health literacy program, whereas those in the comparison group did not receive the intervention. Face-to-face interviews were conducted for the pretest survey (T₁). The posttest survey was administered over the telephone directly after completion (T₂) and at 6 months after completion of the health literacy program (T₃).

Participants

Community-dwelling adults aged ≥ 50 years who were able to perform basic daily activities and lived in northern Taiwan were eligible for participation in this study. The sample size was determined based on a calculation of power and estimated attrition rate. With a significance level of $\alpha = 0.05$, power of 0.8, and effect size of 0.25, power calculation software (G*Power version 3.1) indicated a minimal sample requirement of 80 for both the intervention and comparison groups. We collaborated with community stakeholders, public health centers, and regional hospitals to recruit participants. A total of 256 eligible adults were approached, and 254 agreed to participate. Selection for the intervention and comparison groups was determined primarily based on willingness to participate in the health literacy program. A total of 172 participants completed the second posttest (T₃) survey at 6 months after program completion (Fig. 1).

This study was initiated after a detailed explanation of the procedures had been provided to the participants, and was approved by the Institutional Review Board of National Yang-Ming University (No. YM103096E).

Community-based participatory health literacy health literacy program

We used the five components of the fidelity guideline recommended by the Behavior Change Consortium (BCC) of the National Institute of Health (NIH) to describe the considerations of intervention fidelity and the methodological strategies applied in the current study^{40,41}; details are as follows.

Study framework

This study framework was guided by community-based participatory design strategies and a health literacy framework.

Community-based participatory approaches are often labelled as participatory action research (PAR) initiatives.⁴² PAR is a reflective process that increases the awareness of its participants and enacts a plan for action to gain control over their lives.⁴³ In PAR, the researchers are more able to access the knowledge of participants, which then combines with the researchers' own knowledge to facilitate the development of the change process.⁴⁴ A community-based participatory approach is viewed as a form of health empowerment that may promote the engagement of older adults in the community in health care and through co-learning opportunities to achieve health empowerment and behaviors.⁴⁵ Accordingly, the use of participatory approaches with diverse groups in the community has been well documented in health research.^{42,46} In this study, a community-based participatory approach was integrated to design learning activities and interventions for promoting participants' health literacy competence with respect to health information access, comprehension, and usage. The participants were encouraged to collaboratively identify

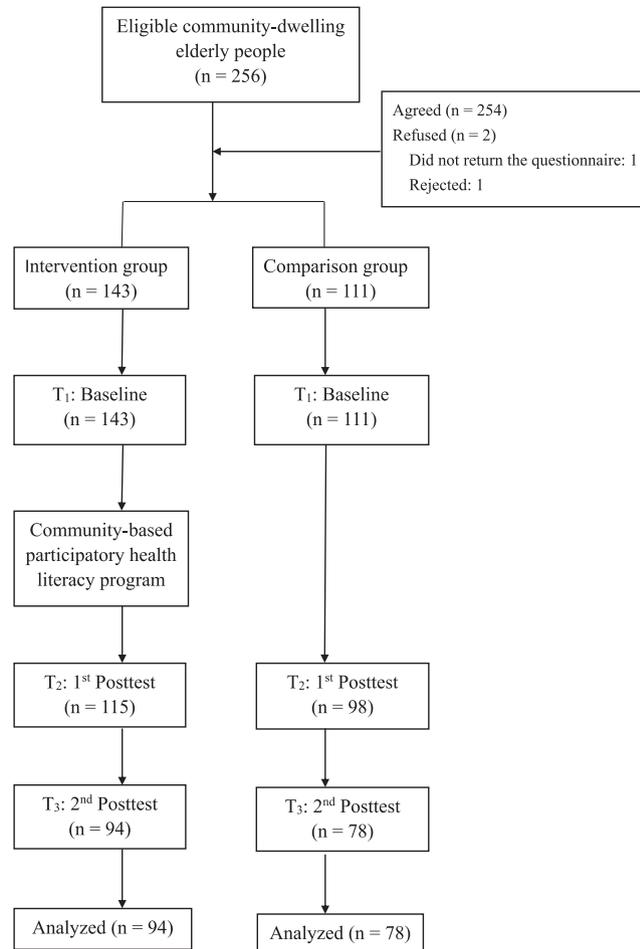


Fig. 1. Flowchart of participants at each stage of this study.

problems, priorities, existing resources, and need and desire for health action in every stage of all learning activities. Through these participations, we expected that participants would have increased empowerment in terms of awareness, sense of control, and ability to take action, manage their health, and improve their healthy behaviors.

The health literacy framework of this program adapted Nutbeam's health literacy concepts across three levels of a health promotion and disease prevention model.^{34,47,48} The program included 12 topics that covered various cognitive and social skills necessary for older adults to achieve simple understanding and competence with respect to navigating, understanding, communicating, appraising, and applying health information in tasks concerning decision making in healthcare, disease prevention, and health promotion. A curriculum matrix matching the health literacy framework and learning objectives of each topic was developed as a guide for lesson plans and activities (Supplement 1). Core and supplemental versions of the learning material and activities were thus developed to meet the learning objectives of each topic, including didactic lectures, group discussions, role-play, hands-on practice, games, and field tours. For each topic, the core set included the minimal information required for the concept and was tailored to those with low health literacy; the supplemental set included an elaboration of the concepts presented and additional learning resources. Scenarios were developed based on daily life to improve the acquisition of new knowledge related to health literacy and self-care management that would be meaningful for older adults. Learning activities and materials for each topic were

designed by a group of experts with backgrounds in medicine, nursing, or public health.

Facilitator training

The intervention was delivered by a primary intervention provider and several facilitators. All intervention providers and facilitators had a background in nursing. Before beginning the program, the PI and intervention teams had several meetings at which the study protocol, learning objectives, activity goals, how the activities would be performed, and how test participants could be assisted were all explained. The PI and intervention providers also visited the community in advance to collaborate with the community stakeholders and identify the community's unique characteristics, needs, and resources. A pilot program was conducted in a suburban community to test its feasibility and justified the program according to participant feedback. To maintain the consistency of the interventions, the same group of intervention teams implemented the programs. The PI onsite observed the intervention delivery and discussed the problem of delivering the content of each session. During this process, the facilitators must be able to lead participants in a discussion and reflection of each topic, and a primary intervention provider was required to observe each participant's response and adjust the session progress in different groups.

Intervention delivery

The community-based participatory health literacy program comprised 12 topic discussions that were held weekly for 2 h and

conducted in groups. Group dynamics were designed to promote mutual knowledge as well as support and exchange of personal experiences among peers. In total, four intervention groups were formed, two of which were urban communities and the remaining were suburban communities in Northern Taiwan. Each intervention group, comprising 25–30 participants, collaborated with one intervention provider and four group facilitators.

To ensure the fidelity of intervention delivery, the same combination of intervention provider and facilitators implemented the program for each of the four groups. In addition, we used an intervention manual and regularly met with the PI to review all aspects of the intervention. The intervention manual included all core and supplemental learning materials and toolkits covering a range of information that enabled instructional flexibility but entailed standardization of the content delivery. Despite each learning group potentially selecting the specific resources and tools they preferred, all participants were guided by the intervention manual and expected to achieve the same learning objective. Depending on the purpose of each session, the content was delivered using various methods, such as a standard PowerPoint presentation with notes for the intervention provider, planned drama, reflective discussion, or interactive games.

With the permission of the participants, we videotaped each session of the intervention. The intervention provider and facilitators recorded the attendance and responded to questions at the end of each session. After each session, a regular team meeting was held to discuss topics related to delivery of the intervention.

Intervention receipt

Each week of the 12-week program, the participants were asked to evaluate their own learning outcomes at the end of the session. Participants were encouraged to participate in various activities, practices, and demonstrations while group facilitators consistently observed and recorded participants' active engagement with, interaction with, and use of materials during the program. Group facilitators applied a teach-back technique to assess participants' understanding of learning materials and ability to use the skills relevant to the specific topic.

Intervention enactment

We evaluated the participants' enactments during and at the end of the study. During the study, we assessed the enactment of specific intervention skills throughout the role-play and hands-on practices. For instance, in the "My health and chronic disease" session, participants were taught how to measure blood pressure. The group facilitators then asked participants to demonstrate how to measure blood pressure and interpret the results correctly. In the "What did my doctor say?" session, role-play enabled participants to practice their communication skills at a medical encounter and receive feedback from peers and group facilitators. In the "Health information navigation" session, we provided some health-related news in print, media, and digital resources, and group facilitators led participants to discuss and evaluate the reliability as well as apply news resources. The final test of the fidelity of the intervention included two follow-up surveys conducted by telephone interview. We assessed the participants' health behaviors and health empowerment immediately and 6 months after completing the intervention.

Measurement

Health Literacy was assessed using the short-form Mandarin Health Literacy Scale (**s-MHLS**).⁴⁹ This scale, which consists of 11 items to measure comprehension of health-related text and numeracy skills, demonstrated high internal reliability (Cronbach's $\alpha = 0.94$)

and split-half reliability (Spearman-Brown correction = 0.94). A correct answer to each item was awarded one point. Higher scores indicated higher levels of health literacy.

The Health Empowerment Questionnaire (HEQ) is a 22-item scale designed to assess an individual's level of health empowerment. The HEQ was developed based on a multifaceted view of the psychological empowerment process,^{31,50,51} which consists of four dimensions, namely awareness, perceived competence, perceived control, and motivation to act. The validity and reliability of the HEQ was assessed using 200 convenient samples. The CVI of the HEQ, as assessed by three experts, was 0.81. The construct validity was examined using the Psychological Health Empowerment Scale developed by Menon (2002)⁵² and the Empowerment Scale developed by Song (2006),⁵³ both of which had a high Pearson's coefficient ($p < 0.01$). In the sample, Cronbach's α was 0.95, indicating satisfactory internal reliability. The participants responded using a 4-point Likert scale ranging from strongly disagree (1) to strongly agree (4). Higher scores indicated higher levels of health empowerment.

Health Behaviors were assessed eight health behaviors in the past 3 months, including controlling body weight, doing regular exercise, eating healthy, taking medications safely, navigating health information, adhering to health providers' instructions, performing health-screening, and keeping a good mood. Each variable was coded "1" if the respondent answered "yes" and "0" if the answer was "no."

The final section of the questionnaire contained the demographic information and medical history of the participants, including age, educational background, gender, and type of chronic disease presented.

Statistical analysis

Pearson's chi-squared test and a *t*-test were performed to compare the sociodemographic characteristics and health literacy of the intervention and comparison groups at baseline. For testing hypothesis (1), we used binomial logistic regression analysis to examine the effects of a community-based participatory health literacy program on healthy behaviors and the likelihood of the participants exhibiting each behavior in the intervention and comparison groups at T₂ and T₃. For testing hypothesis (2), we used an independent *t*-test and analysis of variance (ANOVA) to examine whether the community-based participatory health literacy program promoted health empowerment and to compare the mean changes in the intervention and comparison groups at the three time points. The level of significance was set at $p < 0.05$. Statistical analyses were performed using SPSS version 20.

Results

Participant characteristics

The participants' sociodemographic data are listed in [Table 1](#). The vast majority of the participants were women (71.6%), and more than 60% of the participants had no education beyond junior high school. More than 40% of the participants reported having hypertension, 16.1% reported having heart disease, and 15.7% reported having diabetes. The mean age of the participants was 68.06 years (standard deviation [SD] = 8.44). The mean score of the participants on the s-MHLS was 6.49 (SD = 4.5).

A comparison of the sociodemographic characteristics of the intervention group and comparison group revealed that the educational level of the participants in the intervention was significantly lower than that of those in the comparison group ($p = 0.04$). No significant differences between the intervention and

Table 1
Sociodemographic characteristics of participants at baseline.

	ALL (n = 172) n (%)	Intervention group (n = 94) n (%)	Comparison group (n = 78) n (%)	p Value ^a
Gender				0.11
Men	49 (28.4)	22 (23.4)	27 (34.6)	
Women	123 (71.6)	72 (76.6)	51 (65.4)	
Educational level				0.04
Illiterate	17 (10)	13 (13.8)	4 (5.1)	
Primary school	61 (35.4)	37 (39.3)	24 (30.8)	
Junior high school	27 (15.7)	15 (15.9)	12 (15.3)	
High school	31 (18)	12 (12.7)	19 (24.4)	
College or university	35 (20.3)	16 (17.0)	19 (24.4)	
Graduate school	1 (0.6)	1 (1.3)	0 (0)	
Chronic disease				0.65
Having a chronic disease	98 (56.9%)	52 (55.3%)	46 (58.9%)	
Cancer	15 (7.9)	11 (9.9)	4 (5.1)	0.24
Diabetics	27 (14.2)	13 (11.7)	14 (17.7)	0.76
Renal disease	13 (6.8)	9 (8.1)	4 (5.1)	0.12
Heart disease	28 (14.7)	17 (15.3)	11 (13.9)	0.46
Hypertension	70 (36.9)	37 (33.3)	33 (41.8)	0.53
Cerebrovascular disease	7 (3.7)	5 (4.5)	2 (2.5)	0.36
Liver disease	12 (6.3)	6 (5.4)	6 (7.6)	0.76
Lung disease	18 (9.5)	13 (11.7)	5 (6.3)	0.26
	Mean ± SD	Mean ± SD	Mean ± SD	p Value ^b
Age	68.06 ± 8.44	69.11 ± 8.10	66.79 ± 8.72	0.08
s-MHLS (0–11)	6.49 ± 4.50	6.22 ± 4.54	6.82 ± 4.46	0.38
Community A	9.68 ± 2.26	9.85 ± 1.60	9.47 ± 2.89	0.63
Community B	4.00 ± 4.61	2.38 ± 3.67	5.24 ± 4.91	0.01
Community C	7.67 ± 3.71	8.28 ± 2.82	7.14 ± 4.34	0.33
Community D	6.11 ± 4.45	5.90 ± 4.80	7.17 ± 1.83	0.29

^a Chi-squared test.

^b Independent *t*-test.

comparison groups were observed for gender, age, chronic disease type, or health literacy.

Effect of the community-based participatory health literacy program on health behaviors

Our hypothesis that the intervention group would adopt more healthy behaviors than the comparison group was supported. A community-based participatory health literacy program encouraged healthy behaviors. The results of the binomial logistic regression analysis revealed that compared with the comparison group, the intervention group exhibited significantly different results regarding

controlling body weight, doing regular exercise, and navigating health information (Table 2).

After completion of the intervention (T₂), the odds ratio of controlling body weight was 3.71 (95% confidence interval [CI] = 1.59–8.64), that of doing regular exercise was 15.26 (95% CI = 1.92–121.13), and that of navigating health information was 2.61 (95% CI = 1.16–5.84) for the intervention group; these values were significantly higher than the corresponding values in the comparison group (*p* < 0.01). At 6 months after completion of the intervention (T₃), the odds ratios of the intervention group and comparison group did not differ significantly, indicating this program did not exert a significant effect on health behaviors (*p* > 0.05), with the exception of regular exercise (odds ratio = 6.75, 95% CI = 2.17–20.92).

Effect of the community-based participatory health literacy program on health empowerment

Our hypothesis that the intervention group would have higher scores than the comparison group on health empowerment scale was supported. A community-based participatory health literacy program encouraged health empowerment. The results for the effect of the health literacy program on health empowerment are listed in Table 3. Based on the repeated measures ANOVA results, health empowerment did not differ significantly between the two groups (*p* = 0.09). The baseline (T₁) mean score for the intervention group was 69.69 (SD = 7.38) and increased after completion of the intervention (T₂) to 69.90 (SD = 5.15) but subsequently decreased 6 months after completion of the intervention (T₃) to 68.34 (SD = 4.98). The mean scores of the intervention group exhibited an increasing trend, whereas those of the comparison group exhibited a decreasing trend.

The scores after completion of the intervention (T₂) were significantly different within the same period for the two groups (mean difference = 3.23, *p* < 0.01), indicating that the community-based participatory health literacy program had a significant effect after completion of the intervention (T₂). Both groups demonstrated decline 6 months after completion of the intervention (T₃) relative to baseline (T₁).

Discussion

This study showed that a community-based participatory health literacy program was effective in improving health behavior and health empowerment in older adults, although the effects declined 6 months after the completion of the intervention.

Based on the causal pathways linking health literacy to self-care,⁵⁴ the present study selected health behaviors as outcome indicators to

Table 2
Effects of the community-based participatory health literacy program on health behaviors.

Item	T ₂				Odds ratio (95% CI)	T ₃				Odds ratio (95% CI)
	Intervention group (n = 94)		Comparison group (n = 78)			Intervention group (n = 94)		Comparison group (n = 78)		
	No n (%)	Yes n (%)	No n (%)	Yes n (%)		No n (%)	Yes n (%)	No n (%)	Yes n (%)	
Controlling body weight	9 (9.6)	85 (90.4)	22 (28.2)	56 (71.8)	3.71 (1.59–8.64)	24 (25.5)	70 (74.5)	20 (25.6)	58 (74.4)	1.01 (0.50–2.00)
Doing regular exercise	1 (1.1)	93 (98.9)	11 (14.1)	67 (85.9)	15.26 (1.92–121.13)	4 (4.3)	90 (95.7)	18 (23.1)	60 (76.9)	6.75 (2.17–20.92)
Eating healthy	0 (0)	94 (100)	8 (10.3)	70 (89.7)	–	9 (9.6)	85 (90.4)	9 (11.5)	69 (88.5)	1.23 (0.46–3.27)
Taking medications safely	31 (33)	63 (67)	22 (28.2)	56 (71.8)	0.80 (0.41–1.53)	24 (25.5)	70 (74.5)	24 (30.8)	54 (69.2)	1.30 (0.66–2.52)
Navigating health information	11 (11.7)	83 (88.3)	20 (25.6)	58 (74.4)	2.61 (1.16–5.84)	33 (35.1)	61 (64.9)	31 (39.7)	47 (60.3)	1.22 (0.65–2.26)
Adhering to health providers' instructions	6 (6.4)	88 (93.6)	9 (11.5)	69 (88.5)	1.91 (0.64–5.63)	11 (11.7)	83 (88.3)	13 (16.7)	65 (83.3)	1.51 (0.63–3.58)
Performing health screening	33 (34)	62 (66)	33 (42.3)	45 (57.7)	1.37 (0.74–2.55)	39 (41.5)	55 (58.5)	33 (42.3)	45 (57.7)	1.03 (0.56–1.90)
Keeping a good mood	0 (0)	94 (100)	2 (2.6)	78 (97.4)	–	2 (2.1)	92 (97.9)	5 (6.4)	73 (93.6)	3.15 (0.59–16.71)

Table 3
Effects of the community-based participatory health literacy program on health empowerment.

Item	Intervention group (n = 94)	Comparison group (n = 78)	Mean difference	p Value
	Mean ± SD	Mean ± SD		
Health empowerment				0.09 ^a
T ₁	69.69 ± 7.38	68.63 ± 7.96	1.06	0.36 ^b
T ₂	69.90 ± 5.15	66.68 ± 4.41	3.23	<0.01 ^b
T ₃	68.34 ± 4.98	67.35 ± 6.13	0.99	0.24 ^b

T₁ = baseline, T₂ = immediately after the intervention (12 weeks), and T₃ = 6 months after the intervention.

^a Repeated measures ANOVA.

^b Independent *t*-test.

evaluate the effects of this comprehensive health literacy intervention. Our findings provide evidence of significant improvement in weight control, physical activities, and health information navigation among older adults after the intervention. A large number of existing health literacy intervention studies used disease-specific knowledge or skills as short-term outcome indicators because they can be directly tied to the intervention.^{55–59} In the present study, because it was a comprehensive health literacy program tailored to community-dwelling older adults, with or without chronic disease, we expected health-related behavior change than disease-specific indicators. In addition, the present study targeted relatively healthy older adults in the community. It is possible that the effects of intervention may not be as significant as on patients. Furthermore, evidence from systematic reviews suggests that the effects of health literacy interventions on health behaviors are limited or mixed.⁵⁵ Although improvements in health literacy can enhance people's self-care abilities and improve their health behaviors, improving health literacy is a lengthy process that does not yield immediate results.⁵⁹ Besides, participatory design is often a long-term process. It does not always align well with time constraints of health literacy efforts.²⁸ In future studies, evaluation of health literacy as an intermediate outcome may lead to greater understanding of the link between improved health literacy and changes in health behaviors.⁶⁰

In this health literacy intervention, no significant long-term effects on health behaviors were observed. Extant evidence indicates that most such interventions have short-term effects on behavioral change, while sustained change is the most significant challenge to overcome.⁶¹ The absence of long-term effects could be attributed to changes in health behavior often resulting from complex factors that intersect at the individual, interpersonal, community, and societal levels. Improvements in health literacy and health empowerment alone may not be sufficient to change health behaviors. Different health behaviors are embedded in different causal processes and mechanisms that may require specific techniques for health behavioral changes.^{62,63} Thus, to achieve more efficient and sustainable effects, future studies could integrate theoretical mechanisms of behavioral change into a coherent framework for health literacy programs. Additionally, behavioral changes require continual encouragement and reminders from one's support network. Thus, future studies could invite participants' family members or primary caregivers to be involved in intervention programs.

The present study provided empirical evidence supporting significant improvements in health empowerment following the intervention, but no significant sustained effects observed at 6 months after completion of the intervention. In this program, participants were able to form collaborative relationships with researchers and other members of their communities, and to communicate with people from a similar culture and background and with similar everyday health concerns. These features of community-based participatory initiatives made the participants more likely to increase their health awareness and motivation to practice self-care.^{64,65} In addition, it is

possible that the participants were empowered by acquiring factual and procedural knowledge and reflecting on the process of the health literacy program. However, the absence of long-term effects on health empowerment could be explained according to two aspects. First, as Palumbo³⁰ indicated, improving health empowerment should extend beyond individual factors and pay equal attention to acknowledging social barriers such as limited individual control, an unbalanced patient-provider power dynamic, and lack of support from health care providers. The present study emphasized empowerment at the individual level, and thus the effects gradually diminished at times when individuals were exposed to social interaction in everyday contexts. Second, although this study targeted individuals aged 50 years and older, the mean age of the intervention group was 69 years. Aging causes a decline in physical function and cognitive abilities, thereby affecting individual levels of participation in activities and the abilities to process and comprehend health information and new topics, problem solve, and develop social skills.^{66,67} Furthermore, we analyzed the association between levels of health literacy and health empowerment at baseline, and improvement in health empowerment following the intervention, and had two notable findings. First, similar to evidence from other studies,^{29,38} our findings revealed no significant associations between health literacy and health empowerment at baseline, thereby indicating their independence. Second, our findings provided empirical evidence for a significant positive correlation between health literacy and increased health empowerment following intervention. In other words, participants who possessed a higher level of health literacy were more likely to demonstrate improved health empowerment immediately after the intervention program. Cron Dahl and Eklund Karlsson³⁹ reported that health literacy may be considered a tool for empowerment but may not automatically lead to empowerment. Accordingly, when designing a health literacy intervention program, we should not presuppose that an increase in health literacy implies a simultaneous increase in health empowerment across different levels of health literacy groups. Future studies are warranted to outline health literacy intervention models that may strengthen synergistic and long-term effects for optimal practice and benefits.

The findings of this study should be interpreted in the context of the study's limitations. First, the quasi-experimental design could have resulted in selection bias. Non-randomization was the main limitation of this study. Second, the loss of participants in longitudinal studies as a result of loss of contact, refusal, or death might lead to bias in the results. Third, we conducted face-to-face interviews to collect baseline data and telephone interviews to collect feedback from two post intervention surveys. Fourth, the PAR program is a long-term process; therefore, a longer observation period will yield better health literacy outcomes.²⁸ Different modes of administration might have caused administrative biases.⁶⁸ Finally, we were unable to not exclude the possibility that measurement errors occurred as a result of respondents being repeatedly exposed to the same survey questions.

Conclusion

This study provided promising evidence that the community-based participatory health literacy program improved some health behaviors and health empowerment among older adults over a short period. Although no long-term effects were observed, our findings provided some preliminary considerations regarding intervention strategies specifically designed for older adults. More research on this topic is required to develop health literacy intervention programs with sustained effects, in order to respond to the health demands of an aging society.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.gerinurse.2019.03.013.

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