RMJ

Original Article

Effects of a Health Literacy Enhancement Programs for COVID-19 Prevention on Health Literacy and COVID-19 Preventive Behaviors Among Caregivers of Dependent Older People

Phisit Yuyong[1], Supichaya Wangpitipanit[2*], Phachongchit Kraithaworn[2]

[1] Community Nurse Practitioner Program, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

[2] Community Health Nursing, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Abstract

Background: Older people with dependent conditions are highly vulnerable to COVID-19 due to exposure to respiratory droplets from talking, coughing, sneezing, or close contact with caregivers.

Objectives: To evaluate the effectiveness of a health literacy enhancement program on caregivers' health literacy and preventive behaviors.

Methods: This quasi-experimental study was conducted in Phak Hai district, Phra Nakhon Si Ayutthaya province, from September 2023 to January 2024. The study included 50 caregivers selected through simple random sampling and divided into the experimental group (n = 25) and control groups (n = 25). The experimental group participated in an 8-week COVID-19 prevention program based on Nutbeam's health literacy framework, while the control group received standard care. The instruments used for data collection included 3 components: a personal information questionnaire; the COVID-19 Health Literacy Questionnaire (content validity index [CVI] = 0.88, Cronbach α = 0.84); and the COVID-19 Preventive Behavior Questionnaire (CVI = 0.88, Cronbach α = 0.76). Statistical tests included *t* tests, the Wilcoxon signed rank test, the Mann-Whitney *U* test, and analyses of covariance (ANCOVA).

Results: The experimental group achieved significantly higher postintervention health literacy scores compared to their preintervention scores and the control group ($P < .05$). Improvements were observed in accessing information, decision-making, and health behavior changes ($P < .05$). Also, postintervention preventive behavior scores of the experimental group were significantly higher in the control group, even after adjusting for baseline differences ($P < .05$).

Conclusions: This study has reinforced the importance of health literacy programs in effectively empowering caregivers to prevent COVID-19. Primary healthcare units should implement this program to better protect dependent older people from COVID-19.

Keywords: Caregivers, COVID-19 prevention, Dependent older people, Health literacy enhancement program

Citation: Yuyong P, Wangpitipanit S, Kraithaworn P. Effects of a health literacy enhancement programs for COVID-19 prevention on health literacy and COVID-19 preventive behaviors among caregivers of dependent older people. *Res Med J*. 20XX;XX(X):e274008. doi:10.33165/rmj.2026.e274008

*** Corresponding Author:** supichaya.wan@mahidol.ac.th

Received: 3 March 2025
Revised: 9 June 2025
Accepted: 9 June 2025
Published: 26 January 2026

Introduction

COVID-19, caused by the SARS-CoV-2 virus, is primarily transmitted through respiratory droplets produced during speaking, coughing, sneezing, or close contact, particularly in

crowded settings. The disease manifests with a wide range of symptoms, from mild to severe, including life-threatening pneumonia. The COVID-19 pandemic has had a profound global impact and has disrupted health systems, mental well-being, societal structures, and economies[1] while incurring significant healthcare expenses and widespread business losses. Between January 2020 and May 2024, approximately 775.48 million cases and over 7.04 million deaths were reported globally.[1] In Thailand, the pandemic resulted in 4.7 million confirmed cases and 34 553 deaths, with widespread community transmission posing substantial challenges to public health management. In 2021, there were 182 950 confirmed cases of COVID-19 among older adults in Thailand, comprising approximately 11% of the total infections reported nationwide that year. Concurrently, 14 597 older adults died due to COVID-19, representing about 70% of all COVID-19-related fatalities during the same period.[2] On 29 February 2020, COVID-19 was officially designated as a dangerous infectious disease under the Communicable Diseases Act, B.E. 2558.[2] Certain regions, such as Phra Nakhon Si Ayutthaya in the fourth health administrative area, experienced continuous increases in cases, particularly among high-risk populations. In this province, significant outbreaks were reported, with 70 866 confirmed cases and 588 deaths recorded between 1 April 2021 and 27 May 2024.[2]

The pandemic disproportionately affected vulnerable groups, including low-income populations, children, individuals with disabilities, and older adults with chronic illnesses. Economic disruptions, such as job losses and reduced work opportunities, exacerbated social vulnerabilities and restricted access to education and healthcare services. Older people faced challenges in self-care, daily activities, and medical access due to these compounded vulnerabilities. Family caregivers encountered heightened burdens, including financial strain, limited personal time, and emotional stress, especially when providing continuous care for older people with disabilities.

Health literacy is critical in enabling caregivers to prevent COVID-19 infections among dependent older people. Caregivers with higher levels of health literacy are better equipped to understand and implement preventive measures, such as frequent handwashing, proper mask usage, and physical distancing.[3, 4] Moreover, health literacy empowers caregivers to assess and validate health information critically, reducing the spread of misinformation and supporting informed decision-making. This knowledge is essential for protecting older people, who are at increased risk of severe COVID-19 complications. Extensive research has highlighted a significant correlation between health literacy and adherence to COVID-19 preventive behaviors. Programs utilizing group-based interventions, individual counseling, and multimedia tools have been effective in enhancing preventive practices.[5-7] However, much of the existing research had focused on community health volunteers, with limited attention to caregivers of dependent older people.

Caregivers were pivotal in safeguarding the health of dependent older people during the pandemic. Improved health literacy enabled caregivers to understand better and implement critical preventive measures, reducing infection risks and alleviating the healthcare burden associated with severe COVID-19 outcomes. Despite its importance, caregiver-specific health literacy research remained underexplored, as most interventions have targeted broader community initiatives rather than addressing the unique challenges faced by caregivers of older adults with dependency.

Promoting health literacy among caregivers has become essential for mitigating COVID-19 infection risks and enhancing the quality of life for dependent older people. By equipping caregivers with accurate information and practical skills, they can adopt

effective preventive behaviors, combat misinformation, and make informed decisions. Enhanced health literacy not only benefits dependent older people but also alleviates caregiver stress and improves mental well-being. This study aimed to evaluate the impact of a health literacy promotion enhancement program on caregivers' COVID-19 preventive behaviors, guided by Nutbeam's health literacy framework.[8, 9] Moreover, it aimed to compare the mean scores of COVID-19 health literacy and preventive behaviors within the experimental group (pre- and post-intervention) and between the experimental and control groups postintervention among caregivers of dependent older people. The program emphasized education and skill-building to enhance caregivers' understanding and application of preventive measures. By targeting caregiver health literacy, this study sought to improve health outcomes for dependent older people, reduce hospitalization rates, and alleviate the economic and emotional strain on families.

Methods

Data Collection

This study employed a quasi-experimental, 2-group pretest-posttest control group design to assess the effectiveness of a health literacy promotion enhancement program on COVID-19 prevention among caregivers of older people with dependency in Phak Hai district, Phra Nakhon Si Ayutthaya province. This study used Nutbeam's health literacy framework in a quasi-experimental pretest-posttest design with 44 participants. An effect size of 0.83 indicated a large effect, which required 20 participants per group at 80% power and 0.05 significance. To account for attrition, the sample was increased to 25 per group (total 50). Participants were randomly assigned by subdistrict to experimental and control groups. The sample consisted of 50 caregivers aged 18-59 years who were literate in Thai, without mental health problems, and who had served as primary family caregivers for at least one year. All participants had a close relationship or kinship with the dependent older people. Participants were recruited through community networks and randomly assigned using simple random sampling into the experimental or control group, with 25 participants each. Data collection was conducted in 2 subdistricts: Lat Chit for the experimental group, and Na Khok for the control group.

The 8-week intervention for the experimental group was designed based on Nutbeam's health literacy framework, addressing functional, communicative, and critical health literacy.[8, 9] Weekly activities focused on enhancing caregivers' skills in information comprehension, access, self-management, communication, media literacy, and critical decision-making. The intervention employed a blended approach, including interactive group sessions, practical exercises, and online discussions facilitated via the LINE application. In addition to these activities, validated questionnaires were provided to track participants' progress. The control group also received a handbook containing COVID-19 prevention guidelines and continued with routine caregiving practices.

Ethics approval for this study was obtained from the Faculty of Medicine Ramathibodi Hospital, Mahidol University (MURA2023/265). Permissions were also secured from provincial, district, and local health offices. Stakeholders were briefed on the study objectives to ensure alignment and support. Trained research assistants with experience in community health promotion conducted recruitment and data collection to maintain procedural consistency and data quality. Baseline data were collected before the intervention, including the Barthel Index,[10] COVID-19 Health Literacy Questionnaire, and COVID-19 Preventive Behavior Questionnaire, which ask close-ended questionnaires. The responses were rated on a Likert scale. Experts evaluated content validity, language clarity, alignment with research

variables, and comprehensiveness of content. Based on the expert feedback, the researcher revised the COVID-19 Preventive Behavior Questionnaire, which demonstrated good content validity (content validity index [CVI] = 0.88) and acceptable internal consistency reliability (Cronbach α = 0.76). Similarly, the COVID-19 Health Literacy Questionnaire demonstrated strong content validity (CVI = 0.88) and high reliability (Cronbach α = 0.84).

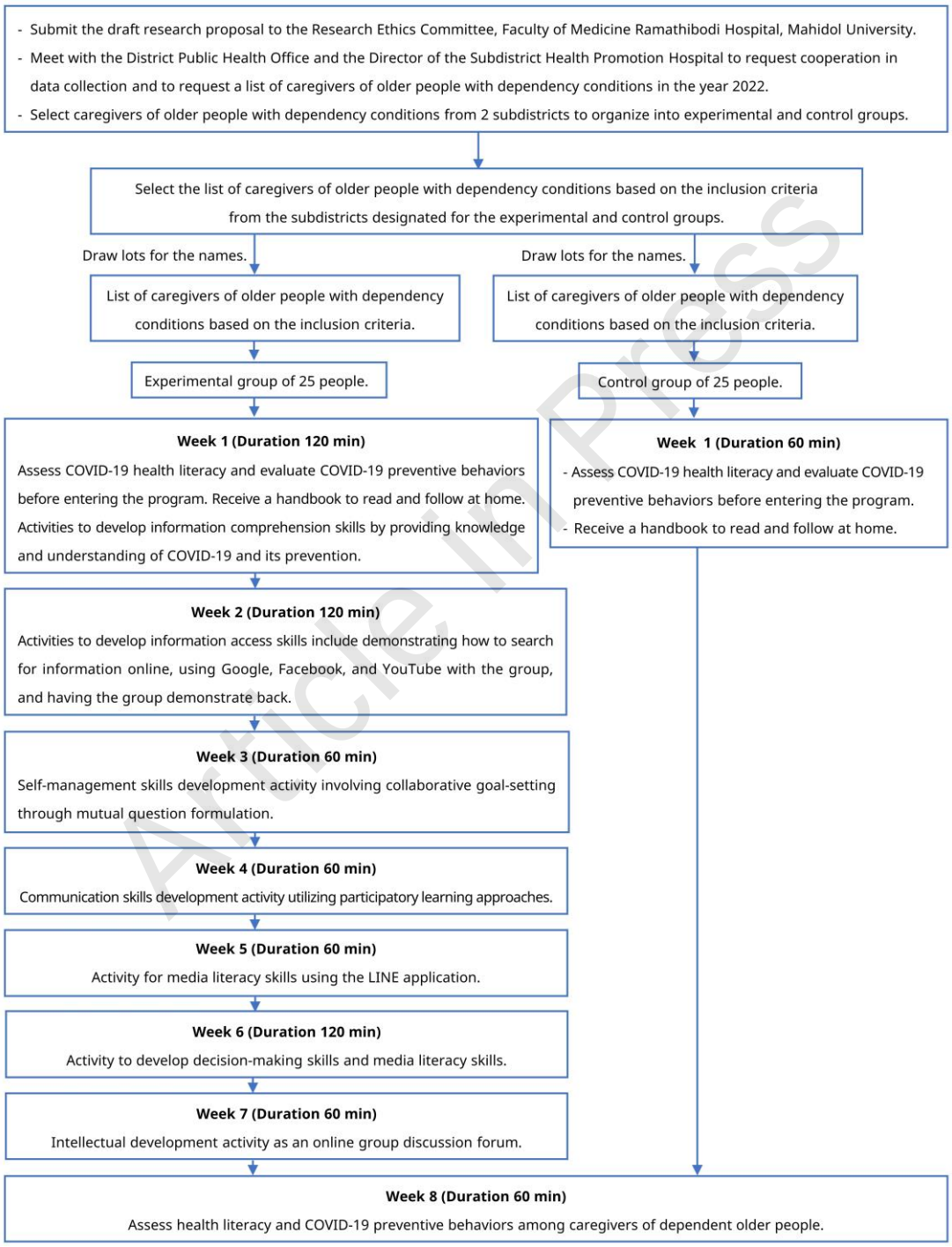
A pilot test with 15 family caregivers yielded a reliability coefficient of 0.84. The main study (n = 50) assessed internal consistency using Cronbach α. The COVID-19 Health Literacy Questionnaire showed a reliability coefficient of 0.88, and the COVID-19 Preventive Behavior Questionnaire yielded 0.93, indicating high reliability. The selection of the subdistricts for the experimental and control groups was done using simple random sampling through a lottery draw of subdistricts in Phak Hai district out of a total of 16 subdistricts. The first subdistrict drawn was assigned to the experimental group (Lat Chit subdistrict), and the second subdistrict drawn was assigned to the control group (Na Khok subdistrict). Both subdistricts are in rural communities and are approximately 10 kilometers apart. Lat Chit subdistrict comprises 10 villages, while Na Khok subdistrict comprises 7 villages. The intervention lasted 8 weeks, during which the experimental group participated in weekly health literacy activities targeting COVID-19 prevention. The data collection spanned 8 weeks and involved both experimental and control groups. The experimental group participated in a structured health literacy intervention comprising sessions of varying durations — 120 minutes during Weeks 1, 2, and 6, and 60 minutes in Weeks 3, 4, 5, 7, and 8 — while the control group received standard health information sessions of 60 minutes in Weeks 1 and 8. In Week 1, baseline assessments were conducted, and participants received a self-study handbook along with foundational learning activities to enhance their understanding of COVID-19 related information. Week 2 focused on developing information access skills through training in digital searches using platforms such as Google, Facebook, and YouTube, supplemented by group demonstrations. Week 3 emphasized self-management by facilitating personalized goal setting and the formulation of individual health questions. Week 4 focused on developing communication skills through participatory learning methods, while Week 5 introduced media literacy through practical exercises using the LINE application. In Week 6, decision-making and critical evaluation skills were reinforced through a guided assessment of health information credibility and applicability. Week 7 engaged participants in intellectual development through online discussion forums, and Week 8 concluded with postintervention assessments to evaluate changes in health literacy and COVID-19 preventive behaviors (Figure 1). Postintervention evaluations were conducted to assess changes in health literacy and preventive behaviors. Participants were fully informed about the study objectives, procedures, and their rights, including the option to withdraw at any point without repercussions. Data confidentiality was maintained, and findings were reported transparently to uphold scientific integrity.

Statistical Analysis

Data analysis was performed using SPSS software version 26.0 (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp; 2019). Descriptive statistics were calculated to summarize demographic and caregiving-related characteristics, including frequency, percentage, mean (SD), and median. Inferential statistics were used to evaluate the intervention's impact. The Shapiro-Wilk test assessed the normality of the data. The Wilcoxon signed rank test was used for within-group comparisons of nonnormally distributed variables, while the Mann-Whitney *U* test compared differences between groups.

Additionally, analysis of covariance (ANCOVA) was applied to adjust for baseline differences and compare postintervention COVID-19 preventive behavior scores between groups. This rigorous analytical approach ensured the reliability and validity of the study's findings, offering robust insights into the effectiveness of the health literacy promotion program.

Figure 1. Flow Diagram of Intervention Between Experimental and Control Group



Results

The study involved 50 older people with dependency and their 50 primary caregivers, equally divided into experimental and control groups (n = 25 each) from 2 subdistricts in Phak Hai district, Phra Nakhon Si Ayutthaya province. Among the older participants, most were female, aged between 73 and 78 years, and moderately dependent for daily activities. The majority were single, widowed, divorced, or separated, and they had at least a primary education, identified as Buddhist, and lived with family members. Hypertension was the most common chronic illness. Most were related to their caregivers. In terms of income, a greater proportion of the experimental group reported adequate income without savings or debt, whereas the control group showed more variability. Access to communication technology was generally limited, particularly in the experimental group. Nearly all participants were covered under Thailand's universal health coverage scheme. Statistical analysis revealed no significant differences between the groups in baseline characteristics ($P > .05$) (Table 1).

The results showed that almost all primary caregivers were children or grandchildren, predominantly female and married, with both groups mainly identifying as Buddhist. Educational attainment differed, with the experimental group having more caregivers with at least a high school education, while the control group had more with elementary education or below. Common chronic conditions include hypertension and diabetes. Family roles varied, with the experimental group evenly split between heads of families and members, while most in the control group were family members. Universal health coverage was the main welfare benefit, which was more common in the control group. Caregivers had varied proficiency in using phones and digital applications, with differences analyzed using chi-square tests (Table 2).

Table 1. Characteristics of Older People With Dependency

Personal Information	No. (%)		Statistics	*P* Value
	Experimental Group	Control Group		
Barthel ADL Index				
Severe and complete dependence (0-8)	9 (36)	12 (48)	0.74[b]	.390
Moderate dependence (9-11)	16 (64)	13 (52)		
Gender				
Male	12 (48)	8 (32)	1.33[b]	.248
Female	13 (52)	17 (68)		
Education level				
No formal education	4 (16)	4 (16)	NA	1.00[a]
Primary education and above	21 (84)	21 (84)		
Marital status				
Marital status/partner/single/widowed	5 (20)	6 (24)	0.12[b]	.733
Divorced/separated	20 (80)	19 (76)		

Table 1. Characteristics of Older People With Dependency (Continued)

Personal Information	No. (%)		Statistics	*P* Value
	Experimental Group	Control Group		
Living arrangements				
Living independently with spouse/family including children/grandchildren	24 (96)	2 (8)	NA	1.00[a]
Living with family, including children/grandchildren occasionally	1 (4)	23 (92)		
Family membership				
Householder	2 (8)	2 (8)	NA	1.00[a]
Family member	23 (92)	23 (92)		
Ability to use the telephone to communicate				
Yes	3 (12)	10 (40)	5.10[b]	.024
No	22 (88)	15 (60)		

Abbreviation: ADL, activities of daily living; NA, not applicable.

[a] Fisher exact test.

[b] Chi-square test.

Table 2. Characteristics of Primary Caregivers

Personal Information	No. (%)		Statistics	*P* Value
	Experimental Group	Control Group		
Relationship				
Child/grandchild	16 (64)	18 (72)	0.37[b]	.544
Spouse/sibling	9 (36)	7 (28)		
Gender				
Male	4 (16)	2 (8)	NA	.667[a]
Female	21 (84)	23 (92)		
Education level				
Primary education or below	7 (28)	13 (52)	NA	NA
Secondary education or higher	18 (72)	12 (48)		
Marital status				
Single/widowed	6 (24)	7 (28)	0.10[b]	.747
Divorced/separated/married	19 (76)	18 (72)		
Family membership				
Head of the family	13 (52)	3 (12)	9.20[b]	.002
Family member	12 (48)	22 (88)		

Abbreviation: NA, not applicable.

[a] Fisher exact test.

[b] Chi-square test.

Participants in the control group had a higher average monthly income (mean [SD], ฿4124 [฿3455.22]) compared to the experimental group (mean [SD], ฿5720 [฿2614.38]), though income variability was greater in the control group. Older people in the control group were also older on average (mean [SD], 77.96 [10.31] years) compared to the experimental group (mean [SD], 72.88 [7.89] years). Despite these differences, statistical analysis indicated no significant differences in income or age between groups ($P > .05$). Analysis using the Mann-Whitney *U* test revealed no significant differences in age (Z = -0.058, $P = .954$). Chi-square tests indicated no significant differences in caregiver characteristics, except for education and welfare benefit use.

The analysis comparing the mean rank scores for health literacy on COVID-19 among caregivers of older people with dependency in the experimental and control groups before the intervention revealed no statistically significant difference (Z = -1.084, $P = .278$). In contrast, comparing the mean scores of COVID-19 prevention behaviors between the experimental and control groups before the intervention showed a statistically significant difference ($t = -5.643$, $P < .001$), from which the mean preventive behavior in the experimental group was higher than the control group, which showed notable variations (Table 3).

The hypothesis was that the health literacy and COVID-19 prevention behavior scores would improve post-program and be higher in the experimental group. The Shapiro-Wilk test assessed normalities. Most variables were normally distributed, except for specific pre- and post-program health literacy scores. The Wilcoxon signed-rank test showed significant improvements in health literacy scores for the experimental group postintervention (Z = -2.40, $P = .016$). No significant differences were observed in the control group (Z = -0.701, $P = .483$). COVID-19 prevention behavior scores using paired *t* tests revealed no significant changes in either group (experimental: $t = -0.712$, $P = .483$; control: $t = -0.097$, $P = .923$) (Table 4).

Comparative analysis of preintervention health literacy scores between groups showed no significant differences (Z = -1.084, $P = .278$). However, postintervention scores were significantly higher in the experimental group (Z = -2.09, $P < .05$). ANCOVA confirmed that postprogram COVID-19 prevention behavior scores were significantly higher in the experimental group than in the control group ($P < .05$) (Table 5).

Table 3. Comparison of Scores for Health Literacy on COVID-19 and COVID-19 Preventive Behaviors Between Control and Experimental Groups Before and After the Program

Study Variable	Possible Scores	Control Group (n = 25)		Experimental Group (n = 25)		Z	*t*	*P* Value
		Min-Max	Mean (SD)	Min-Max	Mean (SD)			
Before received the program								
Scores of COVID-19 health literacy	0-40	27-38	33.04 (3.28)	23-38	33.56 (4.25)	-1.084	NA	.278
Scores of COVID-19 preventive behaviors	0-80	46-72	58.16 (7.67)	51-80	70.44 (7.71)	NA	-5.643	< .001
After received the program								
Scores of COVID-19 health literacy	0-40	17-40	31.08 (7.18)	31-40	35.52 (2.63)	-2.09	NA	< .05

Abbreviation: NA, not applicable.

Table 4. Comparison of Average Scores of COVID-19 Preventive Behaviors Among Caregivers of Older People With Dependency Before and After the Intervention in Each Group With Paired *t* Test

Study Variable	Status	No.	Min-Max	Mean (SD)	*t*	*df*	*P* Value
Experimental group							
COVID-19 preventive behaviors	Before the experiment	25	51-80	70.44 (7.71)	-0.712	24	.483
	After the experiment	25	61-80	71.48 (5.92)			
Control group							
COVID-19 preventive behaviors	Before the experiment	25	27-38	58.16 (7.67)	-0.097	24	.923
	After the experiment	25	17-40	58.40 (11.57)			

Abbreviation: *df*, degree of freedom; NA, not applicable.

Table 5. Comparison of Mean Scores of COVID-19 Prevention Behaviors Between Control and Experimental Groups at Pretest (Week 1) and Posttest (Week 8) Using Parametric ANCOVA

Source of Variance	SS	*df*	MS	*F*	*P* Value
Prevention Behaviors Pretest	349.097	1	349.900	4.418	.041
Group	578.097	1	578.097	7.299	.010
Error	3722.340	47	79.199	NA	NA

Abbreviation: *df*, degree of freedom; MS, mean square; NA, not applicable; SS, sum of squares.

Discussion

Data collection was conducted on the same day in both settings to control for potential variation from participant interaction across study sites. The personal information of dependent older people included factors such as their ability to perform daily living activities (Barthel ADL Index),[10] gender, age, education, marital status, chronic diseases, family membership, income, and use of communication technologies. Most dependent

older people were female, with the average age in the experimental and control groups being 72.88 and 77.96 years, respectively. This aligned with global trends, as older females generally live longer than males.[11] Both groups exhibited moderate dependency on the Barthel ADL Index, consistent with previous research.[12, 13] Many participants were widowed, divorced, or separated, supporting findings from other studies.[13, 14] Most participants had primary education or higher, and most were Buddhists. The study revealed that most lived with family members, and many had multiple chronic conditions, particularly hypertension, in line with earlier studies.[13, 14] Regarding income, most participants reported sufficient income but no savings or debt, consistent with economic challenges faced by older Thai people.[15]

Caregivers of dependent older people were predominantly female and in late adulthood, typically children or grandchildren, reflecting traditional caregiving roles in Thai culture[16, 17] Most caregivers were married, with spousal support critical in caregiving effectiveness.[16, 18] Caregivers with higher education levels demonstrated better caregiving outcomes, which aligned with previous research.[19] The health status of caregivers varied, with some reporting chronic conditions, particularly hypertension, which could impact

caregiving capacity. The role of family members, particularly heads of the family, differed between the experimental and control groups, with the former demonstrating better caregiving awareness, which may enhance care quality.[19] Both groups were covered under universal health coverage and were proficient in using mobile phones and communication applications, which was crucial for staying connected and accessing information. These findings highlight the importance of educational and health interventions for caregivers, particularly those with lower education or chronic health issues. Further research should examine the long-term impact of caregiving on physical and mental health and the role of spousal support.

The findings of this study supported the hypothesis, which posited that primary caregivers of older people with dependency in the experimental group would demonstrate enhanced health literacy and improved COVID-19 preventive behaviors postintervention. The results revealed a significant increase in the mean health literacy score related to COVID-19 among participants in the experimental group following the program. In addition, the caregivers exhibited a marked improvement in their COVID-19 preventive behaviors. This improvement can be attributed to the structured health literacy promotion activities incorporated in the program, which focused on 6 key skills: information access, comprehension, communication, self-management, decision-making, and media literacy. These activities facilitated caregivers' acquisition of knowledge about COVID-19 and engaged them in online platforms that supported knowledge sharing and self-monitoring, which were essential for mitigating risk behaviors. The program's emphasis on communication, media literacy, decision-making, and cognitive skills empowered caregivers to understand and apply COVID-19-related information, promoting safer practices in their caregiving.

The program's success aligned with Nutbeam's framework for health literacy, which emphasizes developing social and analytical skills to motivate and enable individuals to access, understand, and apply health information. In this context, caregivers gained functional health literacy by learning about COVID-19 prevention practices, and their ability to communicate effectively was enhanced through group discussions and online exchanges. Communicative health literacy was also advanced by engaging caregivers in online discussions and sharing knowledge within a LINE application group, which fostered social skills necessary for effective participation in health-related activities. Moreover, critical health literacy was promoted through activities that required caregivers to analyze and solve problems related to COVID-19 risks. This process contributed to their ability to make informed decisions and effectively manage health behaviors. The expectation that the experimental group's caregivers would exhibit more significant health literacy and COVID-19 preventive behaviors than the control group, was also supported. After completing the program, the experimental group showed significantly higher mean health literacy scores than the control group. This improvement was primarily due to the program's focus on enhancing 6 essential health literacy components: access skills, cognitive skills, communication skills, self-management, decision-making skills, and media literacy. These components were reinforced through various activities, including demonstrations of reliable information sources, video presentations, group discussions, and simulated caregiving scenarios that allowed caregivers to practice decision-making and problem-solving. Integrating the LINE application to track and monitor COVID-19 preventive behaviors was crucial in ensuring continuous learning and caregiver engagement with the program.[20, 21] The findings of this study were consistent with those of Choojai et al,[22] who demonstrated that a structured health literacy promotion program significantly improved COVID-19-related health literacy among village health volunteers. Similarly, following a comparable intervention, Srithongpim[23] reported enhanced health literacy and preventive

behaviors among individuals with chronic diseases. These studies have supported the efficacy of skill-based health literacy programs in promoting preventive behaviors. Education level was also a significant factor in determining the program's success. The experimental group mainly consisted of participants with higher education levels than the control group, who had only completed primary education. Higher education levels are known to correlate with better health literacy, as shown by studies which have found that individuals with higher education levels exhibited better health literacy and more effective health behaviors.[24-28] Although the control group received general COVID-19 prevention information from public health officials and media, their lack of participation in the health literacy enhancement program resulted in lower health literacy and preventive behaviors than the experimental group.[29] This was consistent with Bloom's Taxonomy[30] learning theory, which highlights the cognitive domains involved in learning and applying information, suggesting that the experimental group benefited from structured learning and ongoing support through the LINE application, which facilitated self-assessment and sustained behavior change.

Conclusions

Based on the results, a health literacy enhancement program significantly improved caregivers' health literacy and COVID-19 prevention behaviors. Adapting the program to fit caregivers' schedules and incorporating follow-up measures, such as information exchange via the LINE application, will enhance adherence, build confidence, and ensure consistent application of preventive practices. These improvements will better safeguard older adults with dependencies, promoting their health and well-being.

Additional Information

Acknowledgments: The authors sincerely thank all family caregivers in Lat Chit and Na Khok subdistricts, Phak Hai district, Phra Nakhon Si Ayutthaya Province, Thailand, for their invaluable cooperation in this study. This research is part of a master's thesis in the Community Nurse Practitioner Program at the Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand.

Ethics Approval: This study was approved by the Human Research Ethics Committee, Faculty of Medicine Ramathibodi Hospital, Mahidol University (MURA2023/265 on 1 April 2023). The researchers initially gave the participants a full explanation of the research and its aims and obtained verbal informed consent from the participants. All data remained confidential, and the data were kept as encrypted files in computers which were only available to the study researchers. Study researchers asked for permission to use the secondary data before conducting the research. Additionally, the study was conducted in accordance with the Declaration of Helsinki.

Financial Support: No financial support was provided for this study.

Conflict of Interest: The authors declare no known financial interests or personal relationships that could have influenced the work reported in this paper.

Author Contributions:
Conceptualization: Phisit Yuyong, Supichaya Wangpitipanit
Formal Analysis: All authors
Funding Acquisition: Phisit Yuyong
Methodology: All authors
Visualization: All authors
Writing – Original Draft: Phisit Yuyong, Supichaya Wangpitipanit
Writing – Review & Editing: All authors

References

1. World Health Organization. COVID-19 Cases, World: Number of COVID-19 cases reported to WHO. Updated 25 May 2025. Accessed 7 June 2025. https://data.who.int/dashboards/covid19/cases?n=o
2. Department of Disease Control, Ministry of Public Health. Weekly COVID-19 Situation Report. Updated 23 December 2024. Accessed 7 June 2025. https://ddc.moph.go.th/covid19-dashboard
3. Manzari ZS, Rafiei H, Ghaderi MS, Abedi F, Mafi MH. Relationship between resilience and caregiver burden among home caregivers of COVID-19 patients. *Home Healthc Now*. 2023;41(1):42-48. doi:10.1097/NHH.0000000000001133
4. Mirzaei A, Raesi R, Saghari S, Raei M. Evaluation of family caregiver burden among COVID-19 patients. *Open Public Health J.* 2020;13. doi:10.2174/1874944502013010808
5. Damsangsawat N, Hunnirun P. Development of a health literacy model for COVID-19 prevention among restaurant workers in Regional Health Area 12. *The Southern College Network Journal of Nursing and Public Health*. 2022;9(3):141-156.
6. Kristjansdottir OB, Vågan A, Svavarsdóttir MH, et al. Training interventions for healthcare providers offering group-based patient education. a scoping review. *Patient Educ Couns.* 2021;104(5):1030-1048. doi:10.1016/j.pec.2020.12.006

7. Greer V, Canham SL, Hong A, Agutter J, Garcia Zambrana I, Van Natter JM. Aging in place through the COVID-19 pandemic: perspectives from aging service providers. *J Appl Gerontol.* 2023;42(7):1530-1540. doi:10.1177/07334648231159375
8. Nutbeam D. The evolving concept of health literacy. *Soc Sci Med.* 2008;67(12):2072-2078. doi:10.1016/j.socscimed.2008.09.050
9. Nutbeam D, McGill B, Premkumar P. Improving health literacy in community populations: a review of progress. *Health Promot Int.* 2018;33(5):901-911. doi:10.1093/heapro/dax015
10. National Health Security Office, Ministry of Public Health. *Manual to support the management of the system of long-term care in public health for dependent elderly in the system of the Universal Health Coverage scheme.* NHSO; 2016. 7 February 2021. Accessed 7 June 2025. https://eh.anamai.moph.go.th/th/elderly-manual/201572
11. Population Division, Department of Economic and Social Affairs, United Nations. *World Population Prospects 2022: Summary of Results.* United Nations; 2022. Accessed 7 June 2025. https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf
12. Vilasri S, Amnatsatsue K, Kerdmongkol P, Boonyamalik P. Predictive factors for the quality of life of dependent older adults under the long term care system in Bangkok. *Nursing Journal of The Ministry of Public Health.* 2020;30(2):164-176
13. Wicha S, Saovapha B, Sripattarangkul S, Manop N, Muankonkaew T, Srirungrueang, S. Health status of dependent older people and pattern of care among caregivers: a case study of Hong Ha Health Promoting Hospital, Lampang, Thailand. *Asian Journal for Public Opinion Research.* 2018;5(3):228-249. doi:10.15206/ajpor.2018.5.3.228
14. Piriyajaratchai N. *Factors Predicting Caregiver'S Readiness for Dependent Older Persons in Transition Period on Hospital to Home.* Master's thesis. Chulalongkorn University Theses and Dissertations (Chula ETD); 2017. Accessed 7 June 2025. https://digital.car.chula.ac.th/chulaetd/1569
15. Department of Older Persons. *Situation of The Thai Older Persons 2022*. Amarin Corporations Public Company Limited; 2023. Accessed 7 June 2025. https://library.anamai.moph.go.th/mmi/Main/cvr/000/004/690/8/240531-135343-27123_2565_eng.pdf
16. Sutthilak C, Wirojratana V, Puwarawuttipanit W, Cheewakriengkrai L. Factors predicting health status on caregivers of elderly people with dementia. *Journal of The Royal Thai Army Nurses.* 2018;19(1):191-200.
17. Phoomphit C, Panuthai S, Thamdee D. (2021). Care ability, positive aspects of caregiving and quality of care for dependent older persons. *Nursing Journal CMU.* 2021;48(3):226-236.
18. Wongti S. *Factors Affecting Preventive Behavior for Coronavirus Disease 2019 Among Village Health Volunteers, Sukhothai Province.* Master's thesis. Naresuan University; 2021. Accessed 7 June 2025. https://nuir.lib.nu.ac.th/dspace/bitstream/123456789/3227/3/62060668.pdf
19. Choomyen S. *Factors Influencing Role Performance Among the Caregivers for Caring of the Dependent Elderly People in Uttaradit Province.* Master's thesis. Accessed 7 June 2025. https://nuir.lib.nu.ac.th/dspace/bitstream/123456789/5160/3/61062311.pdf
20. Santiparp P. Factors influencing preventive COVID-19 practices of people in Suayai-Uthit community, Chatuchak District, Bangkok. *Journal of MCU Buddhapanya Review.* 2022;7(3):72-84.
21. Suwannarong K, Bumrerraj S. Health literacy and eHealth literacy in the prevention and control of COVID-19 among village health volunteers in area health region number 7 of Thailand. *Journal of Health Research*. 2024;38(3):251-261. doi:10.56808/2586-940X.1080
22. Chujai R, Boonsiri C, Paetchip K. Effects of a health literacy promotion program for COVID-19 prevention on health literacy and COVID-19 prevention behaviors of village health volunteers in Don Tako sub-district, Mueang district, Ratchaburi province. *The Southern College Network Journal of Nursing and Public Health*. 2021;8(1):250-262.

23. Sritongpim J. *Effects of the Health Literacy Promotion Program on Health Literacy and Practices in Prevention of Coronavirus Disease 2019 Among Persons with Chronic Disease in Community*. Master's thesis. Chiang Mai University; 2022. Accessed 7 June 2025. https://cmudc.library.cmu.ac.th/frontend/Info/item/dc:163654
24. Wittenberg E, Goldsmith J, Parnell TA. Development of a communication and health literacy curriculum: optimizing the informal cancer caregiver role. *Psychooncology.* 2020;29(4):766-774. doi:10.1002/pon.5341
25. Cianfrocca C, Caponnetto V, Donati D, Lancia L, Tartaglini D, Di Stasio E. The effects of a multidisciplinary education course on the burden, health literacy and needs of family caregivers. *Appl Nurs Res*. 2018;44:100-106. doi:10.1016/j.apnr.2018.10.004
26. Estrela M, Semedo G, Roque F, Ferreira PL, Herdeiro MT. Sociodemographic determinants of digital health literacy: a systematic review and meta-analysis. *Int J Med Inform.* 2023;177:105124. doi:10.1016/j.ijmedinf.2023.105124
27. Yang P, Ou Y, Yang H, et al. Research on influencing factors and dimensions of health literacy in different age groups: before and after the COVID-19 Era in Chongqing, China. *Front Public Health*. 2021;9:690525. doi:10.3389/fpubh.2021.690525
28. Li Z, Tian Y, Gong Z, Qian L. Health literacy and regional heterogeneities in China: a population-based study. *Front Public Health*. 2021;9:603325. doi:10.3389/fpubh.2021.603325
29. Zhao Y, Xu Y, Yao D, et al. Changes in infectious disease-specific health literacy in the post-COVID-19 pandemic period: two-round cross-sectional survey study. *JMIR Public Health Surveill.* 2024;10:e52666. doi:10.2196/52666
30. Armstrong, P. *Bloom's Taxonomy.* Vanderbilt University Center for Teaching; 2010.