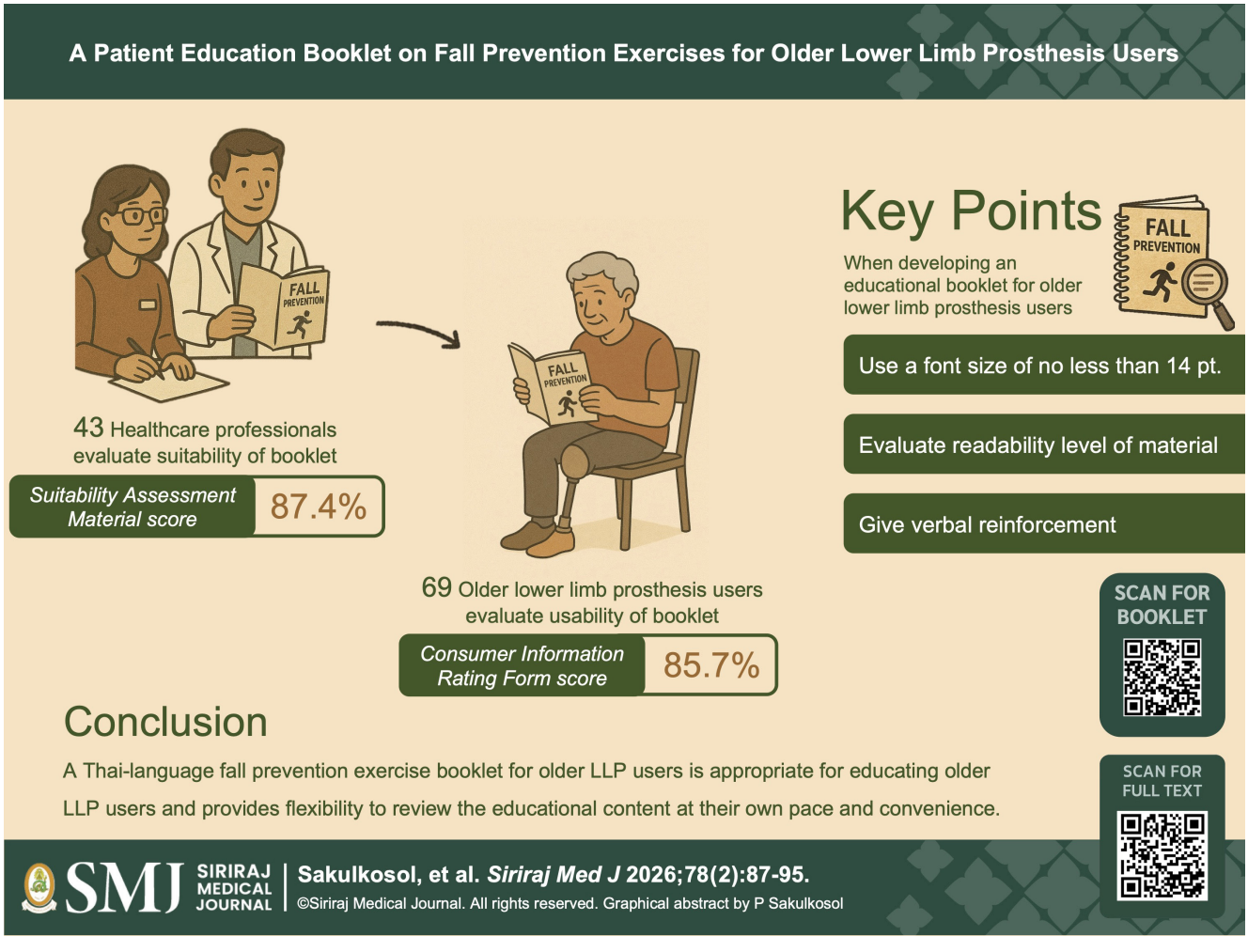
Development and Evaluation of a Patient Education Booklet on Fall Prevention Exercises for Older Lower Limb Prosthesis Users

Prawina Sakulkosol, M.Sc.[1], Pieter U Dijkstra, Ph.D.[1], Kazuhiko Sasaki, Ph.D.[1], Gary Guerra, Ph.D.[2], Jutamanee Poonsiri, Ph.D.[1,*]

[1]Sirindhorn School of Prosthetics and Orthotics, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand, [2]Department of Exercise and Sport Science, St. Mary's University, San Antonio, Texas, USA.



*Corresponding author: Jutamanee Poonsiri
E-mail: jutamanee.poo@mahidol.ac.th
Received 14 October 2025 Revised 17 November 2025 Accepted 18 November 2025
ORCID ID:http://orcid.org/0000-0002-4957-0990
https://doi.org/10.33192/smj.v78i2.277785

ABSTRACT

Objective: To assess the suitability and usability of a patient education booklet on fall prevention exercises for older lower limb prosthesis (LLP) users.

Materials and Methods: A descriptive study was conducted from February 2024 to March 2025. A fall prevention exercise booklet was developed based on literature and clinical guidelines. The booklet covered the following domains: falls and fall prevention in older adults, benefits of exercises, exercise principles and precautions, and exercise descriptions. Healthcare professionals who care for LLP users assessed the educational booklet's suitability using the Suitability Assessment of Material (SAM) tool. Based on their feedback, the font size was increased from 12 to 14 points. Thereafter, older LLP users (over 60) assessed the educational booklet's usability using the Consumer Information Rating Form (CIRF).

Results: Suitability was assessed by 43 evaluators (30 prosthetists, six physical therapists, four nurses and three rehabilitation physicians). The median (IQR) SAM score was 88.1 (81.0; 95.2). Usability was assessed by 69 participants. The median (IQR) CIRF score was 86.9 (80.8; 90.9).

Conclusion: The results of the suitability and usability assessments indicate that the developed fall prevention exercise booklet is appropriate for educating older LLP users. The booklet provides a practical tool that enables LLP users to perform exercises safely at home and review educational content at their own pace.

Keywords: Fall prevention education; fall prevention exercise; older adult; amputee; prosthesis (Siriraj Med J 2026;78(2):87-95)

INTRODUCTION

The majority of falls among older adults result from a combination of age-related and disease-related factors, along with their interaction with the social and physical environment.[1] In 2003, about 20% of older adults living in urban areas of Thailand experienced a fall.[2] Falls are the most common cause of injury[3] among older adults and the sixth leading cause of death in this population.[4] Falls are also common among adults with lower limb amputation (LLA).[5] More than half of community-dwelling adults with an LLA experience at least one fall a year, and about one-third have multiple falls after completing rehabilitation.[6] Of these falls, 40-60% result in injuries such as fractures,[7] brain injury,[8] or stump injury,[9] often requiring a hospital stay. Approximately 13% of individuals with transfemoral amputation have fallen while wearing a prosthesis and required hospitalization.[10] The average six-month direct medical cost of fall-related hospitalization in individuals with transfemoral amputation is estimated at US$25,652, while emergency department visits cost about US$18,091.[10]

Fall prevention training has been shown to reduce falls and improve balance confidence in adults with an LLA.[11] Most previous studies on fall prevention education for people with LLA have adopted programs designed for older adults.[12] However, no studies to date have confirmed the effectiveness of these programs in reducing fall risk among older lower limb prosthesis (LLP) users.

In general, written materials are preferred when developing health educational material[13], as they can be reread when needed, which is especially useful for older adults who may experience cognitive difficulties. Older adults favor written materials that begin with a concise summary of relevant risk information, which helps capture attention and allows them to focus on information that is of priority.[14] Furthermore, older adults prefer materials specifically tailored to their needs.[14]

The personalized OTAGO exercise program has been shown to decrease fall rates from 80% to 27% among older patients at a Geriatric Rehabilitation Clinic.[15] The OTAGO exercise booklet tailored for older LLP users, a population at heightened risk of falls, may improve engagement, safety, and overall program effectiveness. Before using the booklet in patient education, it is important to validate the written content to ensure alignment with the intended educational objectives[16] and to confirm that the booklet is understandable to most individuals. Therefore, the objective of this study was to assess the suitability and usability of a patient education booklet on fall prevention exercises specifically developed for older LLP users.

MATERIALS AND METHODS

This descriptive study was approved by the Institutional Review Board of the Faculty of Medicine Siriraj Hospital, Mahidol University (COA no. Si 076/2024).

Booklet development

Based on the WHO Falls Prevention Model for Active Ageing, fall prevention material was developed for LLP users.[17] The model consists of three steps: increasing awareness through education, building capability through assessment, and providing training.[17] In this study, we focused on two components: increasing awareness and training.

Information on the importance of fall prevention was taken from posters developed by the Department of Disease Control, Ministry of Public Health, Thailand.[18] The exercise component was based on the OTAGO exercise program, which has been shown to have a positive effect on reducing fall rates among older adults over a period of one year (incidence rate ratio = 0.68, 95% CI: 0.56; 0.79).[19] The developed booklet includes 16 exercises — five strength and 11 balance exercises. The exercises were translated by researchers from English to Thai. An English linguist verified the accuracy of the translation, while a Thai linguist evaluated readability and comprehension. Based on their feedback, the Thai text was refined for clarity and accessibility. Illustrations were adapted to depict an older LLP user as the model. The final booklet was printed in color, using a standard A5 format (14.8 x 21.0 cm). (See additional material).

Suitability assessment

Participants

Healthcare professionals assessed the suitability of the booklet. They were included if they were a prosthetist, physical therapist, rehabilitation nurse, rehabilitation physician or geriatric medicine physician and had published work related to LLP care, elderly care, falls, or fall prevention.

Data were collected from February to July 2024. Healthcare professionals were recruited using the snowball sampling technique, starting with a small number of initial contacts who met the inclusion criteria.[20] The researcher first contacted the head officers of each involved profession at the Faculty of Medicine Siriraj Hospital to suggest professionals who met inclusion criteria. These professionals subsequently referred additional potential participants.[20] The researchers mailed hard copies of participant information sheet, consent form, booklet, Suitability Assessment of Materials (SAM), and forms to suggest other potential participants to the professionals. The booklet was provided to participants in hard copy so the participants could examine the book's size, color, and quality. Healthcare professionals who agreed to participate in the study provided written informed consent, evaluated the booklet, and sent it back to the researcher. Based on a previous study, it was estimated that a sample of 45 professionals would be adequate for assessing suitability.[21]

Measures

The fall prevention exercise booklet was assessed using the SAM tool. SAM consists of 22 items categorized into six domains: content, literacy demand, graphics, layout and typography, learning stimulation and motivation, and cultural appropriateness.[22] The item related to interaction was excluded as it was not applicable to exercise materials for older LLP users. Each item was rated, 0 indicating unsuitable, 1 indicating adequate, and 2 indicating superior suitability.[22] The overall suitability score was calculated as a percentage of the maximum score; (Sum of the item ratings/ 21*2) * 100. For cases with missing data, the formula was (Sum of the valid item ratings/ $n_{\text{valid answers}}$*2) * 100. Scores of 70–100% indicated superior materials, 40–69% adequate material, and 0–39% unsuitable material.[22]

Before conducting the usability assessment among older LLP users, minor revisions were made based on the professionals' feedback, including increasing the font size from 12 to 14.

Usability assessment

Participants

Older LLP users evaluated the usability of the booklet. Inclusion criteria were: age of at least 60 years, use of a prosthesis for more than one year, ability to walk every day with a prosthesis either with or without a gait aid for at least eight hours a day[23] without pain, and ability to speak and read Thai. Exclusion criteria included: cognitive impairment or a history of severe depression or other mental disorders. Cognitive impairment was screened using the Montreal Cognitive Assessment (MoCA); participants scoring below 26 were excluded.[24]

Data were collected from November 2024 to March 2025. Potential participants contacted the researcher after viewing invitation posters at the Sirindhorn School of Prosthetics and Orthotics. The researcher provided an information sheet and explained the study's purpose and procedures to the participants. Participants who agreed to participate in the study provided written informed consent. Convenience sampling was applied. The sample size was calculated with nQuery Advisor software using the formula for confidence intervals for proportions with normal approximation, assuming an expected proportion of 80% and standard error of 8%. With power set at 80% and the significance level at 0.05, the required sample size was 62 participants. Allowing for a 10% dropout rate, the target sample size was 69 LLP users.

Measures

Participant characteristics were recorded, including age, gender, underlying diseases, medication use, cause and level of amputation, and level of education. After that, participants read the fall prevention exercise booklet and assessed its usability using the Consumer Information Rating Form (CIRF). The CIRF was developed and validated to assess written medication information (WMI).[25] The Thai version of the CIRF used in this study demonstrated acceptable construct validity through principal component analysis, known-group validity, and internal consistency (Cronbach's alpha = 0.904).[26] The Thai CIRF includes four domains: comprehensibility, future use, utility, and design quality. The five comprehensibility items, rated on a 5-point Likert scale (1: very hard, to 5: very easy), assess how easy it is to read, understand, seek information, remember, and retain for future reference. The three future use items, also rated on a 5-point Likert scale (1: very unlikely to 5: very likely), assess future use of the information received. To assess the perceived usefulness and quantity of the WMI, six utility items, rated on a 3-point Likert scale (1: = not so useful to 3: very useful) and one additional question assessing the adequacy of the information quantity (0: too little or too much information, 1: right amount of information), were used. The seven design quality items, rated on a 5-point Likert scale (1: low quality, 5: high quality), assess opinions regarding the information's design, layout, and tone. The overall score was calculated as a percentage of the maximum score. A score of 80% or more indicated acceptable usability for patients.[27]

Data analysis

Descriptive statistics were used to summarize participant characteristics and the suitability and usability scores of the developed booklet. As the SAM and CIRF results were not normally distributed, the median and interquartile range (IQR) were reported. For comparison with studies reporting mean values, mean scores were also presented in the discussion section.

RESULTS

Suitability assessment of materials

A total of 43 healthcares participated in the study, including 30 prosthetists, six physical therapists, four nurses and three rehabilitation physicians. The median (IQR) SAM score was 88.1 (81.0; 95.2). Overall, 93% of professionals (40 of 43) gave an overall suitability score of 70% or higher.

Frequencies of item scores for each SAM domain are presented in Fig 1. More than half of the healthcare professionals rated most items as "superior", with the exception of the Reading level item (superior; 40%, adequate; 37%, unsuitable; 16%, missing; 7%). Nine percent of evaluators did not rate the Typography item (superior; 84%, adequate; 7%, missing; 9%).

Usability assessment of material

In total, 69 older LLP users (median (IQR) 65 (62; 70) years, 63 males) participated (Fig 2 and Table 1).

The median (IQR) CIRF score was 86.9 (80.8; 90.9). In total, 77% of older LLP users (53 of 69) gave an overall usability score of 80% or higher. Frequencies of item scores for each domain are presented in Fig 3.

Within the Comprehensibility domain, more than half of the participants rated three of the five items as "very easy" (Read, Understand and Keep for future use). However, the Remember and Locate information items received lower ratings: 46% of participants rated the Remember item as "very hard and pretty hard" and 41% rated the Locate information item as "very hard and pretty hard."

Within the Future use, the Data quantity and the Design quality domain, more than half of the participants rated all items as "very likely", "right amount", and "very high", respectively.

In the Data utility domain, over half of the participants rated four of the six items (Storage, Precautions, Directions, and Benefits) as "very useful". Adverse effects and the Contraindications items were rated "not so useful." by 14% and 12% of participants, respectively.

DISCUSSION

This study evaluated the suitability and usability of a fall prevention exercise booklet for older LLP users. The findings support its use in clinical settings, with over 90% of healthcare professionals rating the booklet's suitability at 70% or higher. The mean SAM scores across the six domains was 87.4%, which is comparable to the 86.8% SAM score reported in a Spanish study evaluating an educational booklet promoting healthy lifestyles in sedentary adults with cardiometabolic risk factors. [28]

More than half of the healthcare professionals rated most SAM items as "superior", except for the Reading level item. A possible explanation is the lack of standardized tools to assess reading grade levels in Thai. While such tools are well-established for English, they may not be directly applicable to Thai, a syllabic-alphabetic language.[29] Unlike English, Thai lacks word segmentation, capital letters, sentence endings or explicit word boundary delimiters.[30] The meaning of a Thai word can vary depending on the context, functioning as a full sentence

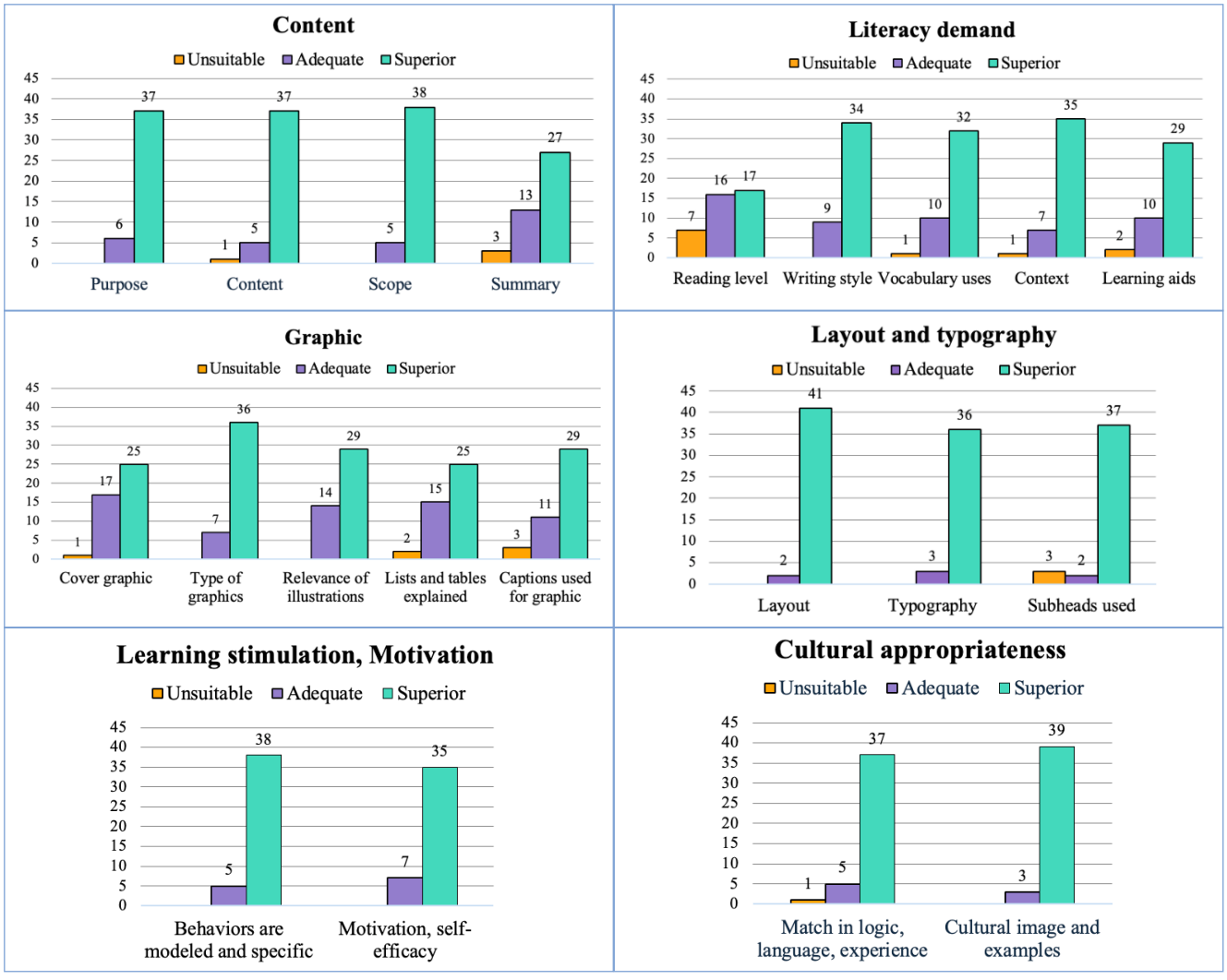


Fig 1. Frequencies of item scores across each domain of the Suitability Assessment of Materials tool (n=43).

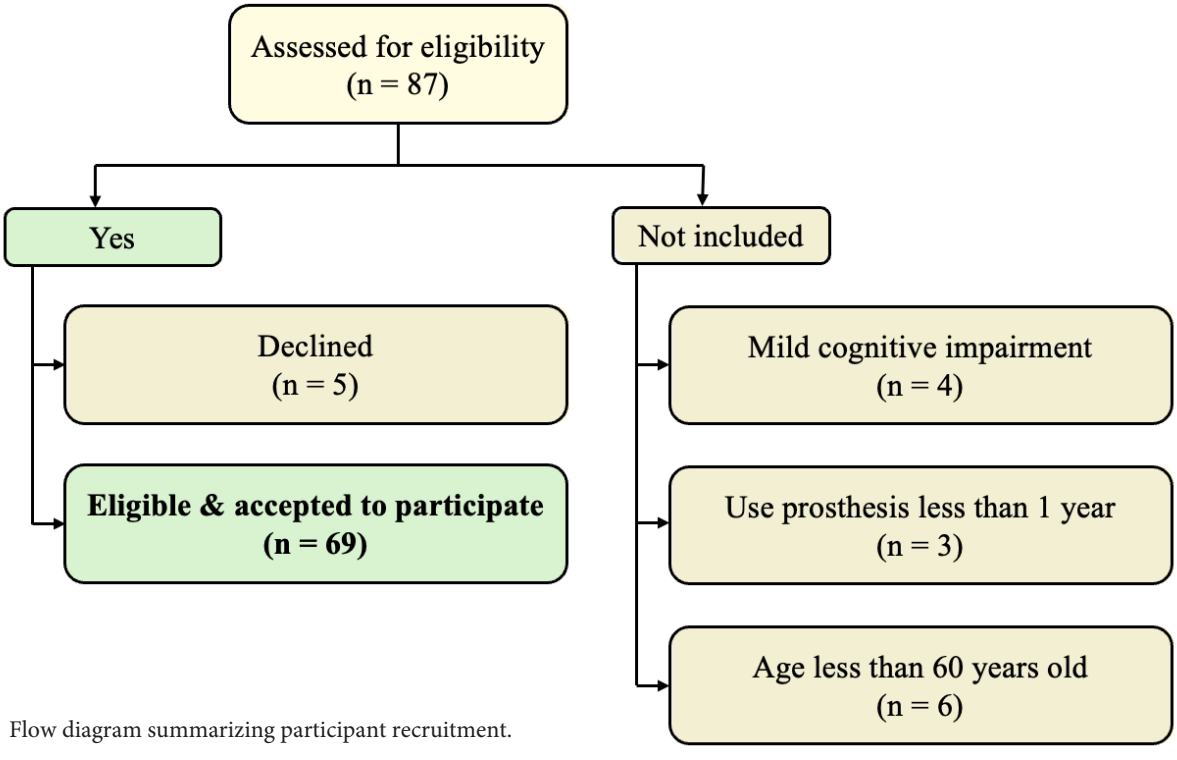


Fig 2. Flow diagram summarizing participant recruitment.

TABLE 1. Participant characteristics in the usability assessment (n=69).

Characteristic	Median	IQR
Age (years)	65	62; 70
n	%	
Gender		
Male	63	91%
Level of amputation		
TF	16	23%
KD	3	4%
TT	48	70%
AD	2	3%
Cause of amputation*		
Accident	62	90%
Diabetes	3	4%
Tumor	2	3%
Congenital	1	1%
Snake bite	1	1%
Education		
Primary	36	52%
Secondary	18	26%
College	4	6%
Bachelor	9	13%
Master	2	3%

* The sum of percentages isn't equal to 100 because of rounding.

Abbreviations: IQR = interquartile range, TF = transfemoral, KD = knee disarticulation, TT = transtibial, AD = ankle disarticulation

or compound noun.[30] Developing suitable educational material for individuals with lower limb amputation is particularly challenging since 44% reportedly did not complete high school.[31] In our study 52% of participants had completed only primary education. Healthcare professionals must therefore recognize the importance of tailoring education material to the reading ability of users with low health literacy to enhance comprehension and health outcomes.[32] Another possible explanation for the lower scores on the Reading level item is that many healthcare professionals who treat LLP users may not have specific training in educational material design or in assessing the readability of texts. Moreover, the SAM criteria may not align well with the structure of the Thai education system, which consists of pre-primary (ages 3-5), primary (6 years), lower secondary (3 years), and upper secondary (3 years) levels.

Similarly, 9% of evaluators did not rate the Typography item (superior; 84%, adequate; 7%, missing; 9%). The SAM criteria for typography, such as "no all caps for long headers or running text" and "uppercase and lowercase serif or sans serif" do not apply directly to Thai script. A study from Saudi Arabia evaluating health education brochures reported similar issues when using the SAM.[33]

Initially, we printed the developed booklet using a 12-point font size, following design guidelines for written patient education materials.[34] However, one-third of the suitability evaluators provided open-ended feedback, suggesting that font size was too small. In response, we increased the font size to 14 points, consistent with recommendations from a recent scoping review advising that patient education materials use a minimum font size of 14 points.[14]

In this study, the target population of older LLP

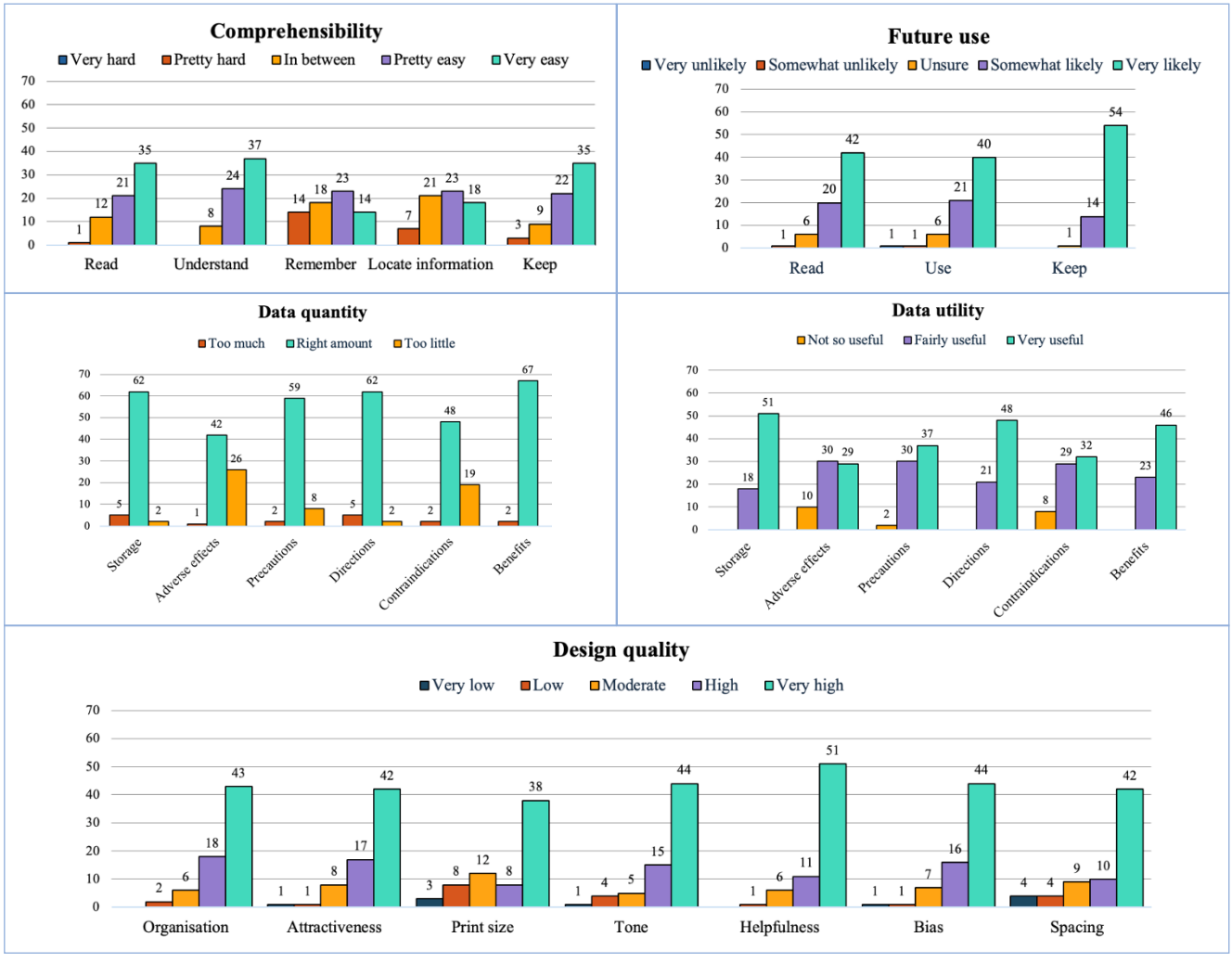


Fig 3. Frequencies of item scores across each domain of the Consumer Information Rating Form.

users evaluated the usability of the developed booklet, allowing for authentic feedback from actual end users regarding its clarity and usefulness. Overall, 77% of older LLP users rated the booklet with a usability score of 80% or higher, indicating that it is suitable for use among older LLP users. The mean CIRF scores across the four domains was 85.7%, which closely aligns with findings from a previous study assessing a pictographic action plan for individuals with low literacy and adrenal insufficiency (85.2%).[35]

In the Comprehensibility domain, more than half of the participants rated the booklet as "very easy" to read and understand, and they would keep it for future use. But about 65% reported difficulty locating specific information and 74% reported difficulty remembering information. These difficulties likely reflect characteristics of the study sample. More than half of the participants had only primary-level education, which may affect their ability to navigate written materials and retain new information. Additionally, many participants were not accustomed to receiving written instructions for home exercises, which could contribute to challenges in retrieving information. Cognitive decline and lower education levels have been associated with reduced recall[36,37] and information-seeking ability among older adults.[38] Therefore, a prior study recommended that healthcare professionals should review the booklet together with patients and provide verbal reinforcement when introducing the exercise.[21] Structured follow-up sessions may further support older LLP users who experience difficulty remembering instructions over time.

In the data quantity domain, older LLP users rated the adverse effects and contraindications items as providing "too little" information. These ratings may affect the overall rating of the utility domain. When older LLP users experience that little information was available, they may rate these items as "not so useful".

The findings underscore the importance of tailored educational materials for older LLP users, a population at particularly high risk for falls. The developed

booklet demonstrates promise as a practical tool for promoting fall prevention when used alongside clinical guidance. Additionally, the strong alignment between professional and older LLP users' usability evaluations supports its broader implementation in rehabilitation care settings.

Some limitations of this study must be noted. Although the study aimed to include five different categories of healthcare professionals, only four were ultimately represented. The absence of a geriatric physician is unlikely to have substantially influenced the suitability assessments much because the included rehabilitation physicians had extensive experience in caring for older LLP users. The booklet was designed specifically for older LLP users, with an age cut-off of 60 years, consistent with the definition of older adults by the Thai Ministry of Social Development and Human Security.[39] However, definitions of elderly individuals vary across contexts and may reflect chronological age, or declines in social roles, and or decline in functional capacities.[40] Given the heterogeneous nature of aging, where the degree and onset of age-related decline varies among individuals, our chosen age threshold may limit the generalizability of findings to the broader population of older LLP users. Furthermore, most participants were male with a transtibial amputation with a traumatic cause, which is consistent with findings from previous studies conducted in Thailand.[41] Therefore, while the sample may not be representative for the global population of LLP users it is representative for lower limb amputees in Thailand.[42]

Future research should assess the memory retention and comprehension of the educational content after they have read the fall prevention educational booklet to make sure the content is understandable and memorable. In addition, future research should evaluate the effectiveness of the fall prevention educational booklet in reducing fall incidence among older LLP users in real-world settings.

CONCLUSION

This study developed and evaluated the suitability and usability of a Thai-language fall prevention exercise booklet for older LLP users. The booklet is appropriate for educating older LLP users and provides flexibility to review the educational content at their own pace and convenience.

Data availability statement

Data supporting the findings of this study are available in the supplementary material. Additional details can be obtained from the first author upon request.

ACKNOWLEDGEMENTS

The authors would like to thank the evaluators and participants for their valuable contributions to this study. Additionally, the authors express their gratitude to undergraduate students Ekarin Fuengniem, Jutharat Khamjeak, and Thitphichaphon Wanthanaphithak for their assistance in collecting pilot data for the suitability assessment.

DECLARATIONS

Grants and Funding Information

This research was supported by the Faculty of Medicine Siriraj Hospital, Mahidol University, Grant number (IO) R016731031.

Conflict of Interest

The authors declare no conflicts of interest.

Author Contributions

Conceptualization and methodology, P.S., P.U.D., K.S., G.G., and J.P. ; Investigation, P.S. and J.P. ; Formal analysis, P.S. and J.P. ; Visualization, P.S. ; Writing – original draft, P.S., P.U.D., and J.P. ; Writing – review and editing, P.S., P.U.D., K.S., G.G., and J.P. ; Funding acquisition, P.S. and J.P. ; Supervision, P.U.D., K.S., G.G., and J.P. All authors have read and agreed to the final version of the manuscript.

Use of Artificial Intelligence

The authors declare no use of artificial intelligence.

REFERENCES

1. Rubenstein LZ. Falls in older people: epidemiology, risk factors and strategies for prevention. Age Ageing. 2006;35(Suppl_2):ii37–ii41.
2. Assantachai P, Praditsuwan R, Chatthanawaree W, Pisalsarakij D, Thamlikitkul V. Risk factors for falls in the Thai elderly in an urban community. J Med Assoc Thai. 2003;86(2):124–30.
3. World Health Organization. Ageing And Life Course Unit, Université De Genève. Centre Interfacultaire De Gérontologie. A global response to elder abuse and neglect: building primary health care capacity to deal with the problem worldwide. Geneva: World Health Organization; 2008.
4. Zalewski CK. Aging of the human vestibular system. Semin Hear 2015;36(3):175–96.
5. Hunter SW, Batchelor F, Hill KD, Hill A-M, Mackintosh S, Payne M. Risk factors for falls in people with a lower limb amputation: a systematic review. PM R. 2017;9(2):170–80. e1.
6. Miller WC, Speechley M, Deathe B. The prevalence and risk factors of falling and fear of falling among lower extremity amputees. Arch Phys Med Rehabil. 2001;82(8):1031–7.
7. Lewallen R, Johnson Jr E. Fractures in amputation stumps: review of treatment of 16 fractures. Mayo Clin Proc. 1981;56(1):22-6.

8. Kulkarni J, Wright S, Toole C, Morris J, Hirons R. Falls in patients with lower limb amputations: prevalence and contributing factors. Physiotherapy. 1996;82(2):130–6.
9. Behar T, Burnham S, Johnson Jr G. Major stump trauma following below-knee amputation. Outcome and recommendations for therapy. J Cardiovasc Surg (Torino). 1991;32(6):753–6.
10. Mundell B, Maradit Kremers H, Visscher S, Hoppe K, Kaufman K. Direct medical costs of accidental falls for adults with transfemoral amputations. Prosthet Orthot Int. 2017;41(6):564–70.
11. Kaufman KR, Miller EJ, Deml CM, Sheehan RC, Grabiner MD, Wyatt M, et al. Fall prevention training for service members with an amputation or limb salvage following lower extremity trauma. Mil Med. 2024;189(5-6):980–7.
12. Clemens S, Doerger C, Lee S-P. Current and emerging trends in the management of fall risk in people with lower limb amputation. Curr Geriatr Rep. 2020;9(3):134–41.
13. Smith JA, Kindo CC, Kurian S, Whitaker LM, Burke C, Wachel B, et al. Evaluation of patient chemotherapy education in a gynecology oncology center. Support Care Cancer. 2004;12(8): 577–83.
14. Goodman C, Lambert K. Scoping review of the preferences of older adults for patient education materials. Patient Educ Couns. 2023;108:107591.
15. Dajpratham P, Thitisakulchai P, Pongratanakul R, Prapavanond R, Haridravedh S, Muangpaisan W. Effectiveness of personalized multifactorial fall risk assessment and intervention in reducing fall rates among older adults: a retrospective study. Siriraj Med J. 2025;77(1):64–72.
16. Pantera E, Pourtier-Piotte C, Bensoussan L, Coudeyre E. Patient education after amputation: systematic review and experts' opinions. Ann Phys Rehabil Med. 2014;57(3):143–58.
17. World Health Organization. WHO global report on falls prevention in older age. Geneva: World Health Organization; 2007.
18. Division of noncommunicable diseases [Internet]. Nonthaburi: The division; 2021. Fall prevention for the elderly; [cited 2025 July 1]; [about 2 screens]. Available from: http://ftp.thaincd.com/2016/media.php?gid=1-015-009
19. Thomas S, Mackintosh S, Halbert J. Does the 'Otago exercise programme'reduce mortality and falls in older adults? a systematic review and meta-analysis. Age Ageing. 2010;39(6):681–7.
20. Parker C, Scott S, Geddes A. Snowball sampling. SAGE research methods foundations. 2019.
21. Ximenes MAM, Fontenele NÂO, Bastos IB, Macêdo TS, Galindo NM, Caetano JÁ, et al. Construction and validation of educational booklet content for fall prevention in hospitals. Acta Paul Enferm. 2019;32:433–41.
22. Doak C, Doak L, Root J, editors. Assessing suitability of materials. Teaching patients with low literacy skills. Philadelphia: Lippincott; 1996:41–60. Available form: https://catalog.nlm.nih.gov/discovery/fulldisplay/alma995897153406676/01NLM_INST:01NLM_INST
23. Klute GK, Berge JS, Orendurff MS, Williams RM, Czerniecki JM. Prosthetic intervention effects on activity of lower-extremity amputees. Arch Phys Med Rehabil. 2006;87(5):717–22.
24. Nasreddine ZS, Phillips NA, Bédirian V, Charbonneau S, Whitehead V, Collin I, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc. 2005;53(4):695–9.
25. Krass I, Svarstad BL, Bultman D. Using alternative methodologies for evaluating patient medication leaflets. Patient Educ Couns. 2002;47(1):29–35.
26. Wongtaweepkij K, Krska J, Pongwecharak J, Pongpunna S, Jarernsiripornkul N. Development and psychometric validation for evaluating written medicine information in Thailand: the consumer information rating form. BMJ Open. 2021;11(10):e053740.
27. Reeves PT, Kenny TM, Mulreany LT, McCown MY, Jacknewitz-Woolard JE, Rogers PL, et al. Development and assessment of a low literacy, pictographic asthma action plan with clinical automation to enhance guideline-concordant care for children with asthma. J Asthma. 2023;60(4):655–72.
28. Espigares-Tribo G, Ensenyat A. Assessing an educational booklet for promotion of healthy lifestyles in sedentary adults with cardiometabolic risk factors. Patient Educ Couns. 2021;104(1):201–6.
29. Tongtep N, Coenen F, Theeramunkong T. Content-based readability assessment: a study using a syllabic alphabetic language (Thai). In: Pham DN, Park SB, editors. Artificial Intelligence. PRICAI 2014: Proceeding of the 13th Pacific Rim International Conference on Artificial Intelligence; 2014 Dec 1-5; Gold Coast, Australia. Switzerland: Springer; 2014. p. 863–70.
30. Chen Y-H, Daowadung P. Assessing readability of Thai text using support vector machines. Maejo Int J Sci Technol. 2015;9(3):355–69.
31. Corey MR, Julien JS, Miller C, Fisher B, Cederstrand SL, Nylander WA, et al. Patient education level affects functionality and long term mortality after major lower extremity amputation. Am J Surg. 2012;204(5):626–30.
32. Sudore RL, Schillinger D. Interventions to improve care for patients with limited health literacy. J Clin Outcomes Manag. 2009;16(1):20–9.
33. Jahan S, Al-Saigul AM, Alharbi AM, Abdelgadir MH. Suitability assessment of health education brochures in Qassim province, Kingdom of Saudi Arabia. J Family Community Med. 2014;21(3): 186–92.
34. Dreeben-Irimia O. Patient education in rehabilitation: Jones & Bartlett Learning; 2010.
35. Reeves PT, Packett AC, Burklow CS, Echelmeyer S, Larson NS. Development and assessment of a low-health-literacy, pictographic adrenal insufficiency action plan. J Pediatr Endocrinol Metab. 2022;35(2):205–15.
36. Vinkers DJ, Gussekloo J, Stek ML, Westendorp RG, Van Der Mast RC. Temporal relation between depression and cognitive impairment in old age: prospective population based study. BMJ. 2004;329(7471):881.
37. Rastall M, Brooks B, Klarneta M, Moylan N, McCloud W, Tracey S. An investigation into younger and older adults'memory for physiotherapy exercises. Physiotherapy. 1999;85(3):122–8.
38. Peterson DJ, Gargya S, Kopeikin KS, Naveh-Benjamin M. The impact of level of education on age-related deficits in associative memory: Behavioral and neuropsychological perspectives. Cortex. 2017;91:9–24.
39. Nanasilp P. Gerontological nursing's core knowledge: Who are the older persons, determinant by age or other factors. J Nurs. 2015;42:156–62.
40. Sabharwal S, Wilson H, Reilly P, Gupte CM. Heterogeneity of the definition of elderly age in current orthopaedic research. Springerplus. 2015;4:1–7.
41. Thirapatarapong W, Dajpratham P. Prosthetic usage among the Thai lower limb amputees. Siriraj Med J. 2017;61(4):185–8.
42. Godlwana L, Nadasan T, Puckree T. Global trends in incidence of lower limb amputation: a review of the literature. S Afr J Physiother. 2008;64(1):8–12.