Original Article

Appropriate Characters on Drug Labels for Elderly Thai Patients

Nattanich Sukanonsawat MD[1], Narucha Komolsuradej MD[1], Chanon Kongkamol MD[1], Patama Bhurayanontachai MD[2], Siwaluk Srikrajang PT, MSc[3]

[1] Department of Family Medicine and Preventive Medicine, Faculty of Medicine, Prince of Songkla University, Songkhla, Thailand

[2] Department of Ophthalmology, Faculty of Medicine, Prince of Songkla University, Songkhla, Thailand

[3] Department of Physical Therapy, Faculty of Medicine, Prince of Songkla University, Songkhla, Thailand

Background: Medication errors are a major health concern among the elderly causing a wide range of adverse events. Drug label misreading is one such problem that contributes to these errors. Therefore, evidence suggesting appropriate characters on drug labels is required as a useful instruction for improving understanding.

Objective: To investigate the appropriate characters on drug labels for the elderly, both in reading accuracy and satisfaction dimensions.

Materials and Methods: A quasi-experimental study was conducted on 56 elderly Thai patients with a mean age of 65.9±5.2 and including 26 males and 30 females. Six drug labels were provided for all participants to read, with three different fonts, which were Angsana New, Microsoft San Serif, and TH Far Kwang, and two character-sizes at 0.22 and 0.26 cm in height. Their reading voices were recorded to examine reading accuracy, with words corrected per minute (WCM). The satisfaction scores were obtained by an opinion assessment in three components, which were ease of reading, aesthetically pleasing, and overall satisfaction.

Results: The results showed that Angsana New, with a size of 0.26 cm, presented the highest score in WCM (mean±SD: 148±28.3 words per minute), and was shown to have the most satisfaction score. A generalized linear mixed model revealed that a larger character size and Angsana New, with a size of 0.26 cm, were significantly associated with higher WCM (p=0.003 and 0.005, respectively), whereas increasing age was significantly associated with lower WCM (p=0.035).

Conclusion: The size of 0.26 cm of Angsana New and Microsoft San Serif were appropriate for use in drug labeling for elderly Thai patients.

Keywords: Drug label; Elderly; Character size; Fonts

Received 30 March 2022 | Revised 9 September 2022 | Accepted 27 September 2022

J Med Assoc Thai 2022;105(11):1089-94

Website: http://www.jmatonline.com

At present, Thailand, as with other countries worldwide, is edging into an aging society. According to the Department of Elderly Affairs, the overall elderly population in Thailand in 2019 accounted for approximately 17.5% of the total Thai population and was expected to continue to grow in the coming years[1].

There are degenerative changes among the elderly such as physical, mental, intellectual, and social declines that lead to multiple chronic conditions[2]. As a result, older adults are often prescribed complex medications[3], with the previous studies reporting that approximately 30.0% of patients aged 65 or over in the developed countries were prescribed five or more medications[4,5]. However, various age-related impairments of the elderly have an impact on drug self-management, which may contribute to harm[6], such as vision problems[7,8], memory problem[9,10], and dependency status, all of which may increase the risk of adverse drug reactions. These can affect the elderly in several dimensions including cognitive impairment, functional decline[11], increased risk of hospitalization, and mortality[12]. Among these various problems affecting the elderly, age-related visual impairment is advocated as one of the major concerns. A previous study reported that age is the best predictor of visual impairment, especially over the age of 60 years[7].

Correspondence to:

Komolsuradej N.

Department of Family and Preventive Medicine, Faculty of Medicine, Prince of Songkla University, Songkhla 90110, Thailand.

Phone: +66-74-451331

Email: narucha.ko@psu.ac.th

How to cite this article:

Sukanonsawat N, Komolsuradej N, Kongkamol C, Bhurayanontachai P, Srikrajang S. Appropriate Characters on Drug Labels for Elderly Thai Patients. J Med Assoc Thai 2022;105:1089-94.

DOI: 10.35755/jmedassocthai.2022.11.13697

Misinterpretation of drug label instructions is a medication safety and health literacy concern[13], and it can lead to adverse drug events, as found in 11.0% to 46.0% of the elderly[12,14-18]. The elderly misread drug labels 1.2 times more frequently than their younger counterparts[19]. Previous studies suggested that less complex and more explicit instructions for drug labels might improve patient understanding[20]. However, there is little evidence supporting best practices for writing drug prescriptions[19], regardless of the appropriate characters for drug labeling for elderly patients. Therefore, the evidence of appropriate characters on drug labels has been considered a persistent need for the elderly.

The present study aimed to investigate the appropriate drug label font and character size by comparing words corrected per minute (WCM) and the satisfaction scores between three different fonts and two character-sizes of drug labels in Thai elderly patients. The results of the present study could provide evidence for drug labeling that is appropriate both in terms of reading accuracy and satisfaction issues.

Materials and Methods

Study design and populations

The present study was a quasi-experimental study with purposive sampling. The study was registered in the Thai Clinical Trial Registry (TCTR 20200913002) and was approved by the Human Research Ethics Committee, Faculty of Medicine, Prince of Songkhla University (REC 63-011-9-4). Participant recruitment was conducted between February and May 2020. Data collection was conducted at the Department of Ophthalmology, Faculty of Medicine, Prince of Songkla University. All participants provided informed consent prior to participating in the present study. The present study enrolled 56 participants, including 30 women and 26 men, with an age of at least 60 years that visited the primary care clinic of Songklanagarind Hospital and were able to communicate in Thai. Participants were excluded, if they had a best corrected visual acuity score (VA) of less than 20/200[21], had Thai mental state examination (TMSE) scores of less than a 23 score[9], had Thai geriatric depression scale (TGDS-15) scores over a 5 score[22], had generalized anxiety disorder 7-items (GAD-7) scores over a 10 score[23], or had identified eye diseases by an ophthalmologist such as cataracts, glaucoma, pterygium, macular aged degeneration, and diabetic retinopathy[8]. The sample size was calculated by using the repeated measures ANOVA with the G*Power version 3 program (Cohen effect size 0.25, Type 1 error of 0.05, Type 2 error of 0.20). The calculated sample size permitted a 5% drop out. The total sample size of the study was 56 participants.

Procedure

The present study was conducted in a laboratory room, with a brightness of at least 400 lux[24]. A reading desk, which adjusted the vision angle to 60° was provided in the room, and the distance between the participants' eyes and drug labels was approximately 20 inches[25].

Six drug labels in the Thai language were provided with three different fonts and two different character-sizes. The labels were as follow, label 1 with Angsana New, 0.22 cm, label 2 with Angsana New, 0.26 cm, label 3 with Microsoft San Serif, 0.22 cm, label 4 with Microsoft San Serif, 0.26 cm, label 5 with TH Far Kwang, 0.22 cm, and label 6 with TH Far Kwang, 0.26 cm. The fonts were compared between Microsoft San Serif, which is recommended for use in drug labeling guidelines in different countries[19,26], TH Far Kwang, which has been suggested as an appropriate font for reading on tablet screens by the Thai elderly[27], and Angsana New, which is commonly used in the Thai education system. The character sizes were compared between 12 point, with a height of 0.22 cm, which is the one used according to the guidelines of labeling for human prescription drugs of the United States[26] and 14 point, with a height of 0.26 cm, which was considered the closest size in Thai font.

The participants had to read all six drug labels aloud one time, with their reading voices recorded with a voice recorder. The recorded voices were used for calculating the WCM by two researchers, which were a family physician and an ergonomist. They had good intrarater and interrater reliability for scoring the WCM prior to the study. After that, participants obtained the opinion assessment form, to evaluate the ease of reading, aesthetically pleasing, and overall satisfaction with the drug label. The flow of the present study participants is presented in Figure 1.

Outcome measures

The primary outcome of the present study was reading accuracy, as evaluated by the WCM. Each drug label had a total of 10 scores, with each score representing correctly reading the following issue[28]: name and surname, date of drug receipt, drug name, dosage (mg), type of drug used such as topical or taking, times of drug use per day, the medication

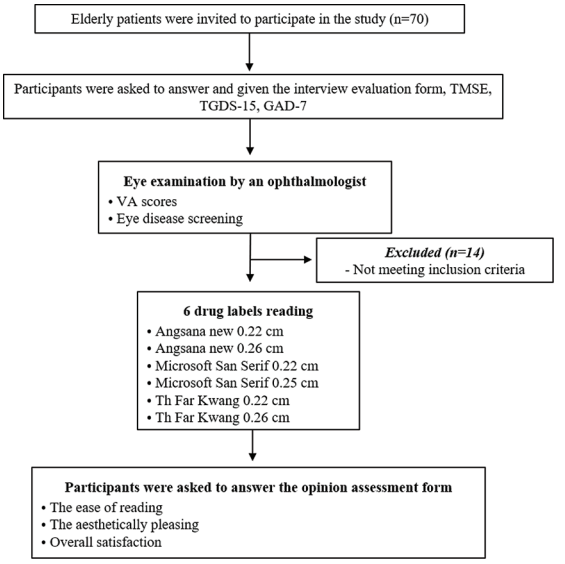

Figure 1. Summary of research procedures.

method such as before meals or after meals, the time required for medication such as morning, lunch, or evening, the drug categories such as antibiotic, and the drug warning.

The total score of reading error including omissions, substitutions, and insertions, was counted. Self-correction by a participant would not be included. Then, the error score was subtracted from the total score of correctly read words. The total time it took the participants to read the label was converted into seconds, and the WCM was calculated by dividing the score of words read correctly by the time in seconds to obtain the WCM.

The secondary outcome was satisfaction measurement. The scores were categorized into five rating scales. The opinion assessment form was divided into three parts with ease of reading, aesthetically pleasing, and overall satisfaction.

Statistical analysis

The statistical analyses were performed with the R Program version 3.6.1 (R Core Team, Austria). A descriptive analysis of the participants' general characteristics was conducted. The data for categorical variables were shown as a percentage. According to distribution analysis by the Shapiro-Wilk test, the normal distribution of data in all variables was shown. Therefore, the results were presented as the mean and standard deviation (SD). Inferential statistics were analyzed by using the generalized linear mixed model (GLMM) to investigate the predictive factors, with the level of statistical significance set at 0.05.

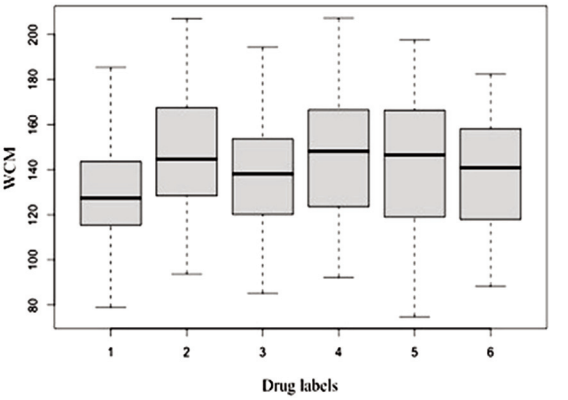

Figure 2. Box plot diagram of WCM value.

Table 1. Demographic characteristics of participants (n=56)

Demographic characteristics	n (%)
Age (years); mean±SD	65.9±5.2
Sex	
Female	30 (53.6)
Male	26 (46.4)
Occupations	
Office workers (i.e., officers, teachers, policemen)	28 (50.0)
Non-office workers (i.e., housekeepers, agriculture, commerce)	28 (50.0)
Underlying diseases	40 (71.4)
Reading with eyeglasses	43 (76.8)
Visual acuity decimal	
0.32	1 (1.8)
0.40	4 (7.1)
0.50	6 (10.7)
0.63	10 (17.9)
0.80	25 (44.6)
1.00	10 (17.9)

SD=standard deviation

Results

Fifty-six participants were included in the present study. The demographic characteristics are presented in Table 1. The WCM for each drug label was presented in Figure 2. Drug label 2, which was Angsana New, 0.26 cm, had the most WCM. In detail, mean±SD values of WCM in drug label 1 to drug label 6 were 130±25.5, 148±28.3, 138±27.2, 145±29.4, 144±29, and 138±27, respectively. The GLMM analysis was adjusted for the fonts, character size, age, occupation, and interaction between fonts and sizes (R^2GLMM (C)=0.78). The adjusted analysis used a Microsoft San Serif, with a size of 0.22 cm as a reference[28].The results showed that the WCM between character size of 0.22 and 0.26 cm was statistically significant different. The WCM between

Table 2. Generalized linear mixed model

	Estimate WCM	Lower	Upper	Df	t value	p-value
(Intercept)	217.4	137.147	299.525	56.18	5.354	<0.001
Character size: 0.26 cm	7.078	1.883	11.7	280	2.810	0.005
Font type: Angsana New	–7.901	–13.376	–2.697	280	–3.137	0.002
Font type: TH Far Kwang	5.208	1.027	10.574	280	2.068	0.040
Age	–1.312	–2.521	–0.132	56	–2.164	0.035
Occupation	14.924	2.932	27.547	56	2.481	0.016
0.26 cm* Angsana New	10.798	4.321	17.596	280	3.032	0.003
0.26 cm* TH Far Kwang	–12.18	–18.674	–4.712	280	–3.420	0.001

WCM=words corrected per minute

Model: lmer (formula = WCM ~ size + font + (1 | id) + age + occ2 + size:font, data=DTlab, REML=F)

Table 3. Means of the ease of reading, aesthetically pleasing and overall satisfaction scores (n=56)

Label	Ease of reading; mean±SD	Aesthetically pleasing; mean±SD	Overall satisfaction; mean±SD
Angsana New, 0.22 cm	3.20 (0.73)	3.23 (0.71)	3.15 (0.71)
Angsana New, 0.26 cm	4.13 (0.56)	3.77 (0.65)	3.93 (0.56)
Microsoft San Serif, 0.22 cm	3.32 (0.57)	2.90 (0.52)	3.00 (0.59)
Microsoft San Serif, 0.26 cm	3.90 (0.69)	3.68 (0.58)	3.88 (0.68)
TH Far Kwang, 0.22 cm	3.80 (0.73)	3.52 (0.57)	3.58 (0.68)
TH Far Kwang, 0.26 cm	3.73 (0.71)	3.63 (0.75)	3.71 (0.67)

SD=standard deviation

Angsana New and TH Far Kwang was significantly different from Microsoft San Serif. Moreover, age was also significantly associated with WCM. Participants who worked as office workers were reading 14.924 words per minute, significantly higher than the non-office worker group (Table 2). The satisfaction score of Angsana New with 0.26 cm was presented as the most satisfied font on the drug label (Table 3).

Discussion

The present study is the first study aimed at investigating an appropriate font and character size in drug labeling for Thai elderly patients. The present study found a larger font at 0.26 cm of Angsana New presented the highest score of WCM and satisfaction. The present study revealed that the font and character size affected reading accuracy on drug labels in the elderly[29].

In the current study, three fonts in the Thai language were compared. After multiple comparison analyses, Angsana New was not presented as statistically different from Microsoft San Serif. Therefore, the results implied that either Angsana New or Microsoft San Serif could be used on drug labels, because both of them have bolder characters than TH Far Kwang, which had a thin and square-edged style. These findings correspond with the previous studies, which found boldface characters could provide more readable conditions on drug label[29,30] and better visual-word recognition that influenced the speed of words accessed[31]. In addition, the letter spacing may be a factor affecting reading accuracy because the present study found Angsana New and Microsoft San Serif have more space than TH Far Kwang. Concurrently, Smither et al and Russell-Minda et al also described adequate letter-spacing had a better result in reading than non-proportional spacing. Moreover, it could reduce letter confusion in older adults[29,30]. Furthermore, the present study was conducted on two different character-sizes and revealed that a larger character size could produce more WCM. In accordance with the previous studies, the readability of the elderly with visual impairments would be improved by reading a character size of more than 12 point or 0.22 cm[24] or at the largest size available to decrease eye fixation time while reading[30].

The GLMM analysis revealed that age was significantly associated with WCM. Being one year older would have significantly changed the mean of WCM –1.3 words, which may have occurred from increased eye fixation duration and ineffective eye movement in elderly people[32,33]. Additionally, an enlarged crowding zone and a lessening of the

visual span were also found in the elderly[34]. For the assessment of participants' satisfaction, Angsana New at 0.26 cm has the highest score. Notably, participants tended to choose a larger character size and wider character and letter spacing. Moreover, the assessment of the ease of reading seemed to be the most proper assessment to represent the patients' satisfaction because it was also associated with the same results as WCM in reading each drug label.

The current study was subject to limitations. First, a control group and randomization method were not included in this quasi-experimental study. A randomized control trial is recommended for future research. Second, the limited sample size was recruited in the present study. To support these findings in future research, a larger sample size may be required. Finally, there are only three font types included in the present study. Further investigation should be considered for more different font types and sizes.

Conclusion

The present study found the size of 14 point or 0.26 cm of Angsana New and Microsoft San Serif were appropriate for use in drug labeling for elderly Thai patients. Moreover, bold characters and adequate letter spacing are also suggested to improve reading accuracy. The result of the present study could be applied to set up the recommendations for drug labeling for the Thai elderly population.

What is already known on this topic?

The Microsoft San Serif with a character size of 0.26 cm has been advocated for use in drug labelling along with less complex and more explicit wording instructions. However, no evidence reported the appropriate characters on drug labels for elderly people.

What this study adds?

To the best of the author's knowledge, this is the first study that investigated the appropriate characters for drug labeling conducted on elderly patients. The result showed the size of 14 point or 0.26 cm of Angsana New and Microsoft San Serif were appropriate to use in drug labeling for elderly Thai patients to improve reading accuracy. In addition, the boldface character and adequate letter spacing were also suggested for use in drug labels.

Acknowledgement

The authors would like to thank all participants for their great cooperation, and also Napakkawat Buathong, PhD for their helpful comments on the manuscript.

Funding disclosure

The fund from Faculty of Medicine, Prince of Songkla University is gratefully acknowledged.

Conflicts of interest

All authors declare no conflict of interest.

References

1. Mahidol University. Thailand: Thai's population prevalence in 2019 [Internet]. 2020 [cited 2020 Sep 20]. Available from: http://www.ipsr.mahidol.ac.th/ipsrbeta/th/Gazette.aspx.
2. Jingjit W, Komolsuradej N, Chumalee K. Factors influencing the quality of life among sub-urban older adults in southern part of Thailand. J Public Health Dev 2020;18:5-15.
3. Komiya H, Umegaki H, Asai A, Kanda S, Maeda K, Shimojima T, et al. Factors associated with polypharmacy in elderly home-care patients. Geriatr Gerontol Int 2018;18:33-41.
4. Kim J, Parish AL. Polypharmacy and medication management in older adults. Nurs Clin North Am 2017;52:457-68.
5. Sharma M, Loh KP, Nightingale G, Mohile SG, Holmes HM. Polypharmacy and potentially inappropriate medication use in geriatric oncology. J Geriatr Oncol 2016;7:346-53.
6. Scott IA, Hilmer SN, Reeve E, Potter K, Le Couteur D, Rigby D, et al. Reducing inappropriate polypharmacy: the process of deprescribing. JAMA Intern Med 2015;175:827-34.
7. Loh KY, Ogle J. Age related visual impairment in the elderly. Med J Malaysia 2004;59:562-8.
8. Meng Q, Wang B, Cui D, Liu N, Huang Y, Chen L, et al. Age-related changes in local and global visual perception. J Vis 2019;19:10.
9. Wangtongkum S, Sucharitkul P, Silprasert N, Inthrachak R. Prevalence of dementia among population age over 45 years in Chiang Mai, Thailand. J Med Assoc Thai 2008;91:1685-90.
10. Mehta KM, Yeo GW. Systematic review of dementia prevalence and incidence in United States race/ethnic populations. Alzheimers Dement 2017;13:72-83.
11. Lavan AH, Gallagher P. Predicting risk of adverse drug reactions in older adults. Ther Adv Drug Saf 2016;7:11-22.
12. Hedna K, Hakkarainen KM, Gyllensten H, Jönsson AK, Petzold M, Hägg S. Potentially inappropriate prescribing and adverse drug reactions in the elderly: a population-based study. Eur J Clin Pharmacol 2015;71:1525-33.
13. Gandhi TK, Weingart SN, Borus J, Seger AC, Peterson

J, Burdick E, et al. Adverse drug events in ambulatory care. N Engl J Med 2003;348:1556-64.
14. Young JWS, Shear NH. Cutaneous drug reactions in the elderly. Drugs Aging 2017;34:655-72.
15. Goh I, Lai O, Chew L. Prevalence and risk of polypharmacy among elderly cancer patients receiving chemotherapy in ambulatory oncology setting. Curr Oncol Rep 2018;20:38.
16. Cecile M, Seux V, Pauly V, Tassy S, Reynaud-Levy O, Dalco O, et al. Adverse drug events in hospitalized elderly patients in a geriatric medicine unit: study of prevalence and risk factors. Rev Med Interne 2009;30:393-400.
17. Yıldırım AB, Kılınç AY. Polypharmacy and drug interactions in elderly patients. Turk Kardiyol Dern Ars 2017;45:17-21.
18. Alhawassi TM, Krass I, Bajorek BV, Pont LG. A systematic review of the prevalence and risk factors for adverse drug reactions in the elderly in the acute care setting. Clin Interv Aging 2014;9:2079-86.
19. Davis TC, Federman AD, Bass PF 3rd, Jackson RH, Middlebrooks M, Parker RM, et al. Improving patient understanding of prescription drug label instructions. J Gen Intern Med 2009;24:57-62.
20. Davis TC, Wolf MS, Bass PF 3rd, Thompson JA, Tilson HH, Neuberger M, et al. Literacy and misunderstanding prescription drug labels. Ann Intern Med 2006;145:887-94.
21. Kniestedt C, Stamper RL. Visual acuity and its measurement. Ophthalmol Clin North Am 2003;16:155-70.
22. Dokuzlar O, Soysal P, Usarel C, Isik AT. The evaluation and design of a short depression screening tool in Turkish older adults. Int Psychogeriatr 2018;30:1541-8.
23. Plummer F, Manea L, Trepel D, McMillan D. Screening for anxiety disorders with the GAD-7 and GAD-2: a systematic review and diagnostic metaanalysis. Gen Hosp Psychiatry 2016;39:24-31.
24. Kakitsuba N. Comfortable indoor lighting conditions for LEDlights evaluated from psychological and physiological responses. Appl Ergon 2020;82:102941.
25. Xiong YZ, Calabrèse A, Cheong AMY, Legge GE. Reading acuity as a predictor of low-vision reading performance. Invest Ophthalmol Vis Sci 2018;59:4798-803.
26. The United States Food and Drugs Administration, USA. Prescription drug labeling resources [Internet]. 2020 [cited 2020 Sep 20]. Available from: https://www.fda.gov/drugs/laws-acts-and-rules/prescription-drug-labeling-resources.
27. Thienmongkol R. The study of fonts legibility for elders: A contextual of Thai Alphabets on tablet screen. Veridian E-J Sci Technol Silpakorn Univ 2017;10:1066-82.
28. Khaiman S, Buahom S, Mekasuwannadit S, Yeephu S, Potaros T. Outpatient and caregiver understanding of auxiliary instructions on medication labels at Ongkharak Hospital, Nakhon Nayok. J Health Sci Med Res 2019;37:269-76.
29. Smither JA, Braun CC. Readability of prescription drug labels by older and younger adults. J Clin Psychol Med Settings 1994;1:149-59.
30. Russell-Minda E, Jutai JW, Strong JG, Campbell KA, Gold D, Pretty L, et al. The legibility of typefaces for readers with low vision: a research review. J Vis Impair Blind 2007;101:402-15.
31. Macaya M, Perea M. Does bold emphasis facilitate the process of visual-word recognition? Span J Psychol 2014;17:E2.
32. Kemper S, Liu CJ. Eye movements of young and older adults during reading. Psychol Aging 2007;22:84-93.
33. Wang J, Li L, Li S, Xie F, Chang M, Paterson KB, et al. Adult age differences in eye movements during reading: The evidence from Chinese. J Gerontol B Psychol Sci Soc Sci 2018;73:584-93.
34. Liu R, Patel BN, Kwon M. Age-related changes in crowding and reading speed. Sci Rep 2017;7:8271.