ORIGINAL RESEARCH

Recall of Pharmaceutical Pictograms by Older Adults

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ABSTRACT

Background: Low health literacy and high medication burden in the older adult population are contributing factors to the misunderstanding of medication instructions, leading to an increased risk of poor adherence and adverse events in this group of patients.

Objective: To evaluate the ability of older adults to recall the meaning of 13 pharmaceutical pictograms 4 weeks after receipt of feedback on pictogram meaning.

Methods: Older adults (aged 65 or older) were recruited from one community pharmacy in Canada. One-on-one structured interviews were conducted to assess the comprehensibility of 13 pharmaceutical pictograms from the International Pharmaceutical Federation's database of pictograms. Each participant was then told the meaning of each pictogram. Recall was assessed 4 weeks later.

Results: A total of 58 participants met the inclusion criteria and agreed to participate. The number of pictograms meeting the ISO threshold for comprehensibility of symbols increased from 10 at the initial comprehensibility assessment to 13 at the recall assessment. Analysis of demographic data showed no associations between initial comprehensibility of the pictograms and age, sex, education level, or number of medications taken.

Conclusions: The results of this study indicate that after being informed of the meaning of pharmaceutical pictograms, older adults were able to recall the pictogram meanings for at least 4 weeks.

Keywords: pharmaceutical pictograms, older adults, recall, and comprehensibility

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RÉSUMÉ

Contexte : Les faibles connaissances en matière de santé des personnes âgées et le lourd fardeau des médicaments qui pèse sur elles sont des facteurs qui contribuent à l'incompréhension des instructions relatives à l'administration des médicaments, ce qui entraîne un risque plus élevé de mauvaise adhésion au traitement et d'événements indésirables dans ce groupe de patients.

Objectif : Évaluer la capacité des adultes plus âgés à se souvenir du sens des 13 pictogrammes pharmaceutiques, quatre semaines après avoir été informés de leur sens.

Méthodes : Les adultes plus âgés (65 ans et au-delà) ont été recrutés dans une pharmacie communautaire du Canada. Des entrevues structurées en tête-à-tête ont été menées pour évaluer l'intelligibilité de 13 pictogrammes pharmaceutiques extraits de la base de données de la Fédération internationale pharmaceutique. Le sens de chaque pictogramme a ensuite été communiqué à chaque participant et, quatre semaines plus tard, leur capacité à s'en souvenir a été évaluée.

Résultats : Cinquante-huit participants répondaient au critère d'inclusion et ont accepté de participer à l'étude. Le nombre de pictogrammes répondant au seuil ISO d'intelligibilité des symboles est passé de 10 (au moment de l'évaluation d'intelligibilité initiale) à 13 (au moment de l'évaluation du rappel). L'analyse des données démographiques n'a indiqué aucune association entre l'intelligibilité initiale des pictogrammes et l'âge, le sexe, le niveau de formation ou le nombre de médicaments que prenaient ces personnes.

Conclusions : Les résultats de cette étude indiquent qu'après avoir été informés du sens des pictogrammes pharmaceutiques, les aînés étaient en mesure de s'en souvenir pendant au moins quatre semaines.

Mots clés : pictogrammes pharmaceutiques, aînés, rappel et intelligibilité

INTRODUCTION

Many older adults take numerous medications. Individuals 65 years of age and older account for approximately 15% of the Canadian population, yet they are responsible for nearly 40% of all spending on prescribed medications.[1] In 2012, nearly two-thirds of older Canadian adults using public drug programs had claims for 5 or more drug classes.[1] Older adults are also more likely than younger people to have limited health literacy.[2-6] Health literacy is important in the effective management of chronic disease because it affects the ability to understand the nature of one's medical condition[7] and the ability to perform self-care, especially among older adults.[8,9] This combination of lower health literacy and high prescription drug use likely contributes to the fact that older adults are at high risk for adverse drug events[10] and for misinterpreting medication instructions.[11,12] Misunderstanding of medication instructions may lead to poor adherence[13,14] and medication errors.[15] Cognitive aging further contributes to this process, which poses an additional risk for non-adherence and adverse events.[13] Therefore, it is important to develop tools to help older adults to understand the instructions for taking their medications. Although adherence with medication therapy is multifactorial,[16] improved comprehension may improve adherence and clinical outcomes, which will in turn reduce health care costs.[17,18]

Pharmacists generally provide counselling about prescription medications just once, when a prescription is initially filled,[19] even though some medications are taken for many months or virtually indefinitely. During these consultations, information is provided verbally and/or in written form. Medical information presented verbally may not be well retained.[20,21] In addition, much of this written material is not adapted to match the patient's education level, and the documentation can be long and complex,[15,22,23] which may be challenging, especially for older adults.[24] Nonetheless, numerous reviews have demonstrated that the communication of medication information by pharmacists can be very effective. Pharmacist-led educational interventions have improved adherence to medication in depression,[25] type 2 diabetes,[26] and chronic obstructive pulmonary disease,[27] and have improved clinical outcomes in patients with type 2 diabetes[28] and hypertension.[29] The association between medication adherence and health services utilization and cost is well established, with even moderate improvement in adherence being associated with reductions in utilization and cost.[17,18] Thus, finding effective interventions to improve adherence is worth the effort.

One step toward improving medication adherence is to improve patients' understanding of medication instructions. Implementation of pictograms depicting key counselling points during medication consultations may improve comprehension and retention of these key points. Pictograms, when added to patient information, represent an intervention that has been shown to improve patient comprehension of health information generally[30,31] and medication information more specifically.[32,33] Many studies of pharmaceutical pictograms have been conducted in various populations. Pharmaceutical pictograms have been tested for their ability to improve understanding and recall of medication instructions in individuals with low literacy,[31,34] those taking long-term medications,[32,35-56] older adults,[32,38] women,[39] and adults.[40,41] Results have been mixed. The variation in these results may be explained, at least in part, by whether the pictograms were first demonstrated to be comprehensible in the population of interest.[42]

We know from numerous published studies on the comprehensibility of pharmaceutical pictograms that at least a few pictograms in each trial will not be understood by participants and that the extent of pictogram comprehensibility depends greatly on the population in which they are tested.[42] Researchers have tested pharmaceutical pictograms for comprehensibility in individual ethnic, cultural, and language groups[43-48]; in older adults[49-51]; in patients with low literacy[52-56]; in children and youth[57,58]; and in adults.[59-63] A recent review of patient involvement in pictogram design indicated that studies using an iterative process of design and redesign based on patient feedback tend to produce pictograms that are well understood.[42]

The purpose of this study was to evaluate the ability of older adults to understand and recall the meaning of pharmaceutical pictograms used to convey key medication counselling points. Recall was measured after a 1-month (4-week) interval because this is a typical refill period for prescription medications. Recall was assessed because of the possibility that some pharmaceutical pictograms may not be recognizable, no matter how often they are redesigned. It may be possible, however, that older adults will remember the meaning of a pictogram after being informed of its meaning.

METHODS

Pictograms

The 13 pictograms used in this study were taken from the International Pharmaceutical Federation (FIP) database (https://www.fipfoundation.org/pictogram-project/using-pictograms/). They depict key counselling points related to indications, side effects, routes and frequencies of administration, and precautions. All of these pictograms were developed using a patient-centred approach, with participants drawn from the general population.[64] Thus, they were not initially developed specifically for use in older adults; however, they were subsequently tested in a sample of older adults[51] using the International Organization for Standardization (ISO) criteria for development of public information symbols.[65] According to the ISO 9186-1 standard,[65] in order to be considered comprehensible, the meaning of a pictogram must be correctly understood by at least 66.7% of participants. In the initial study with older adults, pictograms that were not well understood were modified by a graphic designer on the basis of participants' suggestions, when available, and were then retested.[51] Despite redesign, 47 pictograms (out of 76) remained poorly understood in this sample of older adults.[51] This result not only highlighted the importance of testing pictograms for comprehensibility among older adults, but also suggested the

importance of including a recall phase in the experimental design. The meaning of some pictograms may never be "guessable" by some populations, but if participants can recall the meaning after it has been provided, this suggests that the pictogram may be able to convey its intended meaning when paired with information about its meaning. For the current study, we chose 13 pictograms from the previous study with older adults,[51] representing medication instructions that we considered to be most useful for older adults. Notably, 10 of these 13 pictograms did not meet the 66.7% threshold when initially tested with older adults.[51]

Participants

Individuals aged 65 years or older who had prescriptions for at least 3 medications were recruited from a single community pharmacy in Ottawa, Ontario, Canada. Potential participants were excluded if they resided in an assisted-living facility, had self-declared functional impairment (e.g., blindness), or were taking a medication for cognitive impairment (e.g., dementia). Visual acuity was not assessed. However, it is likely that cognitive impairment would affect the results of any test of pictogram comprehensibility. Therefore, the Mini-Cog,[66] a 3-item test of cognitive abilities that is as sensitive and specific in testing for dementia as the Mini–Mental State Exam and the Cognitive Abilities Screening Instrument, was administered to all potential participants. A Mini-Cog score of less than 3 (out of 5) indicates impaired cognitive status.[66] Only participants with a score of 4 or 5 were included in the present study. To validate pictograms for use with older adults who have cognitive impairment, it would be necessary to select a sample consisting entirely of participants with cognitive impairment; however, this was not the purpose of the current study.

Potential participants who did not meet the inclusion criteria or who did not agree to participate continued to receive services as usual in the pharmacy.

Data Collection and Outcome Measures

Demographic data collected were sex, age, education level, language spoken at home, and number of long-term medications being taken.

The comprehensibility of the pictograms was determined by an assessment of transparency. The concept of transparency refers to how easily the meaning of a symbol can be guessed when the referent is not present.[67] Participants' responses on transparency testing were scored as correct or incorrect by 2 independent raters (B.P.M. and A.P.). Any disagreements among the raters were discussed with a third person, and a decision on scoring was reached by consensus.

Procedure

When a potentially eligible participant came to the pharmacy to fill a prescription, a pharmacist or pharmacy technician asked whether he or she was interested in participating in the study. A fully bilingual (English and French) pharmacy technician conducted one-on-one structured interviews with participants, both during the initial assessment and at follow-up. The ability to conduct these interviews in either English or French was important because almost 9% of the population of Ottawa and surrounding area speak only French,[68] and we did not wish to exclude such a large proportion of the population. During the initial assessment, the interviewer first administered the Mini-Cog test to screen for cognitive impairment, as described above. Only participants who passed the Mini-Cog test were asked to complete the remainder of the assessment.

The 13 pictograms, printed on 25-cm^2 cue cards, were shuffled before each session and presented sequentially. For each pictogram, the participant was asked what he or she thought the pictogram meant in the context of taking medication. The responses were transcribed verbatim by the interviewer. Immediately after presenting all 13 pictograms, the interviewer then informed the participant of the intended meaning of each pictogram. The demographic questionnaire was administered at the end of this interview.

Four weeks later, the participants were invited (via telephone call from a pharmacy technician) to complete the recall assessment. During the recall assessment, which was conducted in person in the pharmacy, the identical procedure was followed, with the technician presenting the pictograms and asking the participant what he or she thought each pictogram meant in the context of taking medication. No other assessments or questionnaires were administered at the recall assessment.

Approval for this study was obtained from the Research Ethics Board of the Children's Hospital of Eastern Ontario. All participants provided written consent to participate in the research process. Each participant received a $10 gift card redeemable at the pharmacy.

Analyses

All analyses were conducted with IBM SPSS Statistics version 24.0 (IBM Corp, Armonk, New York). Categorical variables were analyzed using frequencies and percentages. Normally distributed continuous variables were summarized using means and standard deviations (SDs). McNemar tests were performed to compare the number of participants who correctly understood the meaning of each pictogram during transparency testing with the number who correctly recalled the meaning 4 weeks later. A repeated-measures analysis of variance (ANOVA) was conducted to determine whether there was a difference between participants' comprehension of all pictograms before and after being told the meanings. Subgroup analyses were conducted using χ^2 analyses with the Fisher exact test to identify differences in pictogram comprehensibility in relation to highest level of education completed (middle/high school versus college, university, or postgraduate), sex, Mini-Cog test score (4 versus 5), and number of long-term medications being taken (3 or 4 versus 5 or more). Similarly, one-way ANOVAs were conducted to test for differences in pictogram comprehensibility by age. Given the large number of subanalyses carried out (n = 65), the threshold p value for significance in these analyses was set at 0.05/65 or 0.0007.

RESULTS

Demographic Characteristics

A total of 58 participants met the inclusion criteria and agreed to participate. This sample size was considered adequate because the ISO standard[65] states that pictograms should be tested with a minimum sample of 50 participants. Of the 58 participants who met the inclusion criteria and agreed to participate, 30 were women, 25 were men, and sex was not reported for 3 participants (Table 1). The mean age of participants was 74.2 (SD 6.1), with 26 (45%) being 75 years or older. There was no age difference between men (mean 74.8, SD 7.0) and women (mean 74.2, SD 5.5) ($t(53) = 0.38$, $p = 0.71$). Of those who provided information about their level of education, 98% (52/53) had completed at least high school. The mean number of prescription medications being taken by participants was 4.9 (SD 6.1), with 28% of participants taking 6 or more prescription medications. All 58 participants completed both the initial interview (transparency assessment) and the recall assessment.

Pictogram Comprehensibility

Of the 13 pictograms tested in this study, 10 reached the ISO standard for comprehensibility, with at least 66.7% of participants understanding the meaning during the transparency assessment, that is, upon initial presentation before being told the intended meaning (Table 2). The pictograms for "confusion" (52%), "diarrhea" (57%), and "take in the morning" (48%) did not meet the ISO comprehensibility threshold (Table 2). These 3 pictograms were also among those that did not meet the threshold in the previous study with older adults.[51]

During the recall assessment, 4 weeks after participants were told the meaning of the pictograms, all 13 pictograms reached the ISO standard for comprehensibility. Statistically significant differences in the proportions of participants comprehending the pictograms between the transparency and recall assessments were observed for 9 pictograms: "tremors", "confusion", "dizzy when getting up", "nausea", "diarrhea", "shake well", "do not crush", "take in the morning", and "seek medical assistance" (Table 2).

As an additional test of whether comprehension of the pictograms was better at the recall assessment than at the transparency assessment, a repeated-measures ANOVA was conducted, comparing the total number of pictograms understood correctly by each participant at the recall assessment with the total number understood at the transparency assessment. The result was statistically significant (Wilks $\lambda = 0.38$, $F[1,57] = 93.41$, $p < 0.001$), with the average number of pictograms understood correctly being higher at the recall assessment (mean 12.6, SD 0.8), than at transparency assessment (mean 9.9, SD 2.3).

Table 1. Demographic Characteristics of Participants

Characteristic	No. (%) of Participants (n = 58)
Age group (years)	
≥ 65 and < 75	32 (55)
≥ 75 and < 85	20 (34)
≥ 85	6 (10)
Sex	
Male	25 (43)
Female	30 (52)
Unknown	3 (5)
No. of medications	
3	11 (19)
4	13 (22)
5	8 (14)
≥ 6	16 (28)
Unknown	10 (17)
Language	
English	26 (45)
French	27 (47)
Bilingual	3 (5)
Other	2 (3)
Highest level of education completed	
Middle school	1 (2)
High school	19 (33)
College	8 (14)
University	18 (31)
Postgraduate	7 (12)
Unknown	5 (9)
Mini-Cog test score[66] (out of 5)	
4	24 (41)
5	34 (59)

Association between Characteristics and Comprehensibility

Our analyses indicated no statistically significant associations between pictogram comprehensibility and age, education level, sex, number of prescription medications, or Mini-Cog score (Table 3).

DISCUSSION

In this study, older adults could correctly recall the meaning of 13 pharmaceutical pictograms 4 weeks after initial assessment, even if they initially did not correctly understand the meaning of the pictogram. For 9 of the 13 pictograms tested—"tremors", "confusion", "dizzy when getting up", "nausea", "diarrhea", "shake well", "do not crush", "take in the morning", and "seek medical assistance"—more participants correctly stated the meaning at the recall assessment than at the initial presentation. In a previous study with older adult participants,[51] none of these pictograms met the ISO standard of 66.7% of participants being able to guess their meaning, but all participants in the current study met the standard at the recall assessment.

The 3 pictograms that met the ISO threshold for comprehensibility in the previous study with older adults study[51] ("take 1 tablet by mouth", "headache", and "do not mix with alcohol") also did so in the transparency assessment of the current study. The pictograms for "confusion", "diarrhea", and "take in the morning" did not meet the ISO threshold in either the previous study[51] or the transparency assessment of the current study. In

Table 2 (part 1 of 3). Comprehensibility and Recall Scores

Pictogram	No. (%) of Participants Who Correctly Identified Meaning (n = 58)		p Value*
	Transparency Assessment	Recall Assessment	
 Tremors	41 (71)	58 (100)	< 0.001
 Confusion	30 (52)	47 (81)	0.001
 Fatigue	51 (88)	56 (97)	0.13
 Dizzy when getting up	46 (79)	56 (97)	0.002
 Nausea	46 (79)	58 (100)	< 0.001

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*Tested by McNemar test for paired proportions. A p value less than 0.01 indicates that more participants understood the meaning of the pictogram at recall than at the transparency assessment.

continued on page 451

contrast to these similarities in results, 7 pictograms that were not understood by older adults previously[51] ("tremors", "fatigue", "nausea", "shake well", "do not crush", "seek medical assistance", and "dizzy when getting up") were guessed correctly by more than 66.7% of participants in the current study. There are some differences in the study samples that may explain why participants in the current study were able to understand the meaning of more of the pictograms. The mean age of participants in the current sample was 5 years younger than that of the sample in the previous study.[51] In addition, there was no screening for cognitive capacity in the previous study.[51] Thus, it is possible that the higher mean age in the previous study[51] was associated with age-related decline in cognitive capacity, which might have affected pictogram interpretability. Also, most participants in the previous study had fewer than 12 years of education, whereas the majority of the current sample had more than a high school education. It is likely that a sample with fewer years of education would also have lower health literacy. To understand the meaning of a pictogram within the context of taking medications, a person must draw upon health-related knowledge. Thus, it may be that participants in the current study had more knowledge upon which to draw when describing what they thought each pictogram meant in the context of taking medication.

The results of this study demonstrate the importance of counselling older adult patients to ensure they understand the meaning of the pictograms that accompany their

Table 2 (part 2 of 3). Comprehensibility and Recall Scores

Pictogram	No. (%) of Participants Who Correctly Identified Meaning (n = 58)		p Value*
	Transparency Assessment	Recall Assessment	
 Diarrhea	33 (57)	55 (95)	< 0.001
 Shake well	44 (76)	58 (100)	< 0.001
 Do not crush	42 (72)	57 (98)	< 0.001
 Take in the morning	28 (48)	55 (95)	< 0.001
 Seek medical assistance	44 (76)	58 (100)	< 0.001

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*Tested by McNemar test for paired proportions. A p value less than 0.01 indicates that more participants understood the meaning of the pictogram at recall than at the transparency assessment.

continued on page 452

prescription medications. Del Re and others[31] conducted a literature review to evaluate the effectiveness of pictograms to improve patients' recall of medication safety instructions. They speculated that older adults have increased difficulty in recalling pictograms because of an unclear understanding of the information presented.[31] These authors proposed that special consideration be given to older adults and that indeed all patients should be counselled when pictograms are used in a health care setting. Their recommendation reflects current standards set by the FIP, which state that "graphic symbols for patient instruction should not be used alone but should always be combined with written instructions".[69] The importance of using pictograms together with verbal or written information has been documented in other studies[31,54,70] and has been considered from a theoretical standpoint in the dual coding theory proposed by Paivio.[71] This author stated that information is processed by verbal and nonverbal coding systems.[71] Furthermore, pictures or images trigger the activation of both systems to a greater extent than words alone, leading to improved recall of information.[71] By extension, the recruitment of multiple senses through the use of verbal and written instructions together with pictograms will likely lead to improved recall.

Table 2 (part 3 of 3). Comprehensibility and Recall Scores

Pictogram	No. (%) of Participants Who Correctly Identified Meaning (n = 58)		
	Transparency Assessment	Recall Assessment	*p* Value*
 Take 1 tablet by mouth†	57 (98)	58 (100)	> 0.99
 Headache†	56 (97)	56 (97)	> 0.99
 Do not mix with alcohol†	57 (98)	58 (100)	> 0.99

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*Tested by McNemar test for paired proportions. A *p* value less than 0.01 indicates that more participants understood the meaning of the pictogram at recall than at the transparency assessment.
†Pictograms that met the ISO threshold of 66.7% of participants comprehending the meaning in a previous study with older adults.[51]

Table 3. Subanalysis of Initial Pictogram Comprehensibility in Relation to Demographic Characteristics

	Age†		Highest Education‡		Sex‡		No. of Medications‡		Mini-Cog Test Score‡	
Pictogram*	Test Value	*p* Value	Test Value	*p* Value	Test Value	*p* Value	Test Value	*p* Value	Test Value	*p* Value
Tremors	0.20	0.66	0.41	0.52	0.56	0.46	0.95	0.33	0.32	0.57
Confusion	0.99	0.33	0.29	0.59	0.02	0.88	0.34	0.56	0.72	0.40
Fatigue	0.08	0.77	2.41	0.12	0.44	0.51	2.01	0.16	0.82	0.37
Dizzy when getting up	1.70	0.20	0.21	0.65	0.46	0.50	0.00	1.00	0.46	0.50
Nausea	0.67	0.42	1.67	0.20	0.13	0.72	0.14	0.71	0.46	0.50
Diarrhea	1.25	0.27	1.76	0.19	0.79	0.37	4.15	0.04	0.03	0.85
Shake well	1.01	0.32	0.10	0.75	0.16	0.69	0.11	0.75	0.24	0.62
Do not crush	0.56	0.46	0.10	0.75	0.03	0.87	0.95	0.33	0.68	0.41
Take in the morning	0.82	0.37	1.05	0.31	0.20	0.66	0.34	0.56	0.05	0.83
Seek medical assistance	0.36	0.55	0.004	0.95	0.16	0.69	4.00	0.05	0.57	0.45
Take 1 tablet by mouth	0.02	0.90	1.68	0.20	0.85	0.36	1.02	0.31	0.72	0.40
Headache	0.56	0.46	1.26	0.26	2.49	0.12	2.09	0.15	0.06	0.80
Do not mix with alcohol	0.09	0.77	0.62	0.43	0.85	0.36	1.02	0.31	1.44	0.23

*See Table 2 for the pictograms.
†Tested by one-way analysis of variance.
‡Tested by χ^2 analysis with the Fisher exact test.

Limitations

Among the limitations of the current study is the fact that we did not assess participants' visual acuity. It is possible that some participants did not understand certain of the pictograms because of vision problems. In addition, we did not assess health literacy. Given that pictograms are often implemented to help people with low levels of health literacy to better understand their medication administration instructions, it will be important to investigate how well older adults with low health literacy understand these pictograms and recall their meanings. Potential participants with cognitive impairment were excluded from the current study. Thus, another limitation of the study is that the results can be generalized only to older adults without cognitive impairment.

Recommendations for Future Research

Given that the intended meaning of all 13 pictograms included in this study could be recalled by at least 66.7% of participants after 4 weeks, we recommend that future research in the development of pictograms with older adults should assess recall of pictogram meaning and not rely on transparency assessment alone. Given the low health literacy levels noted among older adults in other studies,[2-5] it may not always be possible for this age group to understand the meaning of pharmaceutical pictograms without explanation. They may, however, be able to recall pictogram meanings once they have been explained.

It would also be interesting to know whether use of these pictograms can increase adherence to medication regimens among older adults. Any future research on the effect of these pictograms on medication adherence among older adults should implement recently published guidelines for conducting effective research on medication adherence.[72]

Implications for Practice

Four weeks after being informed of the intended meanings of pictograms depicting medication instructions, older adults were able to recall the pictogram meanings. Thus, this set of pictograms may be used in practice with older adults to convey key counselling points, in combination with verbal and written instructions. As stated by FIP, "graphic symbols for patient instruction should not be used alone but should always be combined with written instructions".[69]

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