

Development of Pictographs Depicting Medication Use Instructions for Low-Literacy Medical Clinic Ambulatory Patients

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ABSTRACT

BACKGROUND: One approach to help elderly and low-literacy patients understand instructions for medication use is to use pictographs or pictorial diagrams. However, most of these pictographs are designed by medical professionals and may not be optimal for such patients.

OBJECTIVE: To compare low-literacy patients with medical staff in dimensions of preference and comprehension of pictographs intended to illustrate medication use instructions for medical clinic ambulatory patients.

METHODS: Following 2 pilot tests, the first with small samples (5 pharmacists and 5 patients) and the second with 100 patients with low literacy, a survey of pictograph understanding and preference was conducted between May and October 2008. The survey used a third version of 3 sets of pictographs in 4 medication instruction categories for 250 low-literacy patients and 250 members of the medical staff in a teaching hospital in southern Taiwan. The 4 medication instruction categories were (a) route of administration for external use; (b) time of day for medication administration; (c) medication administration before, after, or with meals; and (d) administration quantity. The measure of preference was which pictograph in each subset best described the instruction, and the measure of comprehension was the percentage of participants who understood the meaning of the pictograph. Differences between the 2 groups in pictograph choice and comprehension were calculated using Fisher's exact test.

RESULTS: All patients were considered low literacy (never attended school or grade 6 education or less). The preference of pictographs was significantly different between patients and medical staff for each of the 12 sets of pictographs. Comprehension was significantly different between patients and medical staff for pictographs in the categories of medication administration time of day and medication administration associated with meals. For pictographs representing "at bedtime," "after meals," and "with meals," the percentage of patients who chose "do not understand" was significantly higher than the percentage of medical staff choosing this item. The 3 patient age groups were 60 years or younger (43.2%), aged 61 to 70 years (26.4%), and aged 71 years or older (30.4%). Preference was found to be significantly different among the 3 patient age groups in pictographs for medication administration time "before meals" ($P=0.002$), "after meals" ($P=0.007$), "with meals" ($P=0.037$), and in the pictographs representing "half tablet" ($P=0.012$) in the category of administration quantity. Comprehension was found to differ among the 3 patient age groups in pictographs representing "at bedtime" ($P=0.040$), "before meal" ($P=0.022$), "after meals" ($P=0.025$), and "with meals" ($P=0.014$) and for "one, two, or three tablets" ($P=0.041$).

CONCLUSION: Patients and medical staff had significant differences in preference for all categories of medical instruction pictographs and had significant differences in comprehension for the pictographs in the categories of medication administration time of day and medication administration associated with meals. Patients' preferences for and comprehension

of the medical instruction pictographs were age-related. For successful development of a comprehensible prescription drug label, a diverse sample of patients should be consulted to ensure that the pictographs depicting medication use instructions are useful to all individuals, including those with low literacy.

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What is already known about this subject

- 40 million Americans cannot read general consumer health information, and 90 million have difficulty understanding and acting upon this information.
- Patients with poor literacy skills are often older adults, people with limited education, and those with limited native language proficiency.
- Low-literacy patients are often embarrassed to ask health care professionals for help with understanding instructions, and without help they are likely to misunderstand written medication use instructions, contributing to medical errors and noncompliance.
- Early work with pictographs found that patients recalled about 14% of verbal medical instructions, but correct recall improved to 85% when verbal instructions were enhanced with pictographs.

What this study adds

- This study involved more low-literacy patients than other studies in the literature.
- Significant differences were found between low-literacy patients and medical staff in preference for all 12 pictographs in 4 medication instruction categories.
- Low-literacy patients and medical staff had significant differences in comprehension of the pictographs in 2 categories, medication administration time of day and medication administration associated with meals.
- Patients' preference for and comprehension of the medical instruction pictographs were age-related. For some pictographs, the percentage of patients aged 71 years or older who chose "do not understand" was higher than for the younger age groups.
- Pictographs designed by medical professionals may not communicate well to low-literacy patients, suggesting that patients with low literacy should be consulted in the development of medication use instructions to achieve greater patient comprehension.

For effective medical treatment, ambulatory patients need to use medications as directed. Patients who are older or who have poor reading skills are more likely to misunderstand medication instructions and therefore be noncompliant.¹⁻³ The use of pictograms, as an adjunct to written instructions, should be particularly helpful in making medication instructions understandable for this group of patients. In the United States in the 1990s, 90 million adults with low-literacy skills struggled to understand essential health information such as discharge instructions, consent forms, oral instructions, and drug labels.³ For patients whose literacy skills are low, combining easy-to-read written patient education materials with oral instructions and culturally sensitive graphics may improve compliance with therapy.⁴

In addition, many patients, regardless of literacy skills, receive insufficient verbal or written instruction on the use of their medications.⁵⁻⁷ And in our experience, many high-volume clinic physicians are busy and may not follow up with their patients to ensure understanding and correct use of medications.

Taiwan has the same challenge to comprehensible and effective medical communication as exists in other developed countries. For example, in the southwestern region, approximately 30% of the population is elderly. In our experience at a teaching hospital in Taiwan, the most commonly asked questions from elderly patients when they collected their prescriptions were the following: How am I supposed to use this medication? How many times a day should I take it? How many tablets should I take? Such questions illustrate the need for improvement in medical communication with this patient group.

One approach to try to decrease adverse events arising from errors due to low literacy and poor medication compliance in elderly patients is to use visual aids such as pictographs.^{8,9} Studies have shown that pictographs may be important in improving patient's comprehension of drug warning labels in persons with low literacy, and patients may prefer local, culturally sensitive pictographs.^{10,11} However, most pictographs are designed by medical providers, and pictographs designed by these well-educated people may not meet the actual needs of relatively uninformed and uneducated patients. Therefore, a patient-centered approach to designing consumer medication information is required.⁹

The primary purpose of this study was to compare low-literacy patients with medical staff in dimensions of preference and comprehension of pictographs as a foundation for developing the most useful pictographs to improve the understanding of medical clinic ambulatory patients, especially those with low literacy. We hypothesized that there would be a gap between the pictograph choices of health care providers and the choices of low-literacy patients, so that further efforts would be necessary to produce the most comprehensible pictographs to facilitate the understanding of medication instructions by low-literacy patients.

Methods

Subjects

In this prospective study, participants were selected from a teaching hospital in southern Taiwan during May and October 2008 and were divided into 2 major groups: medical staff and patients. Participants in the medical staff group (n=250) were selected by convenience sample from the general ward (10 to 20 persons per unit), pharmacists in the pharmacy department, and staff in administrative offices. Participants in the patient group with low literacy (n=250) were sampled from the outpatient department and the waiting room of the pharmacy department during weekdays (Monday to Friday), 10 a.m. to 12 noon. Low-literacy patients are defined as those who have either no schooling or an education of grade 6 or less.

The desired sample size was calculated by considering the significance level $\alpha=0.05$, power=80%, anticipated population proportion=0.2, absolute precision=0.05, and population size=3,000. An estimated sample size for each group (patients and medical staff) was calculated as 228. Considering an expected 10% drop out rate, the authors calculated that 250 cases in each group would be necessary (i.e., $228 \times 1.10 = 250.8$).

Research Procedure

To allow comparison of low-literacy patients with medical staff in terms of each group's preference and comprehension of pictographs, we defined "preference" as referring to which pictograph in each subset was most compelling and was selected most often by survey participants from each group. The patient group was also studied for comprehension rate, which refers to the percentage of participants in each group who understood the meaning of pictographs.

Original pictographs were drafted based on the final report (in Chinese) of a project called "preliminary trial of using raised-dot and pictograph stickers on drug packages" conducted by the Taiwan Society of Health-System Pharmacists. Referring to the original draft of the pictographs, our pictographs were further redesigned into 3 alternatives for each medication instruction. In the first edition of the pictographs, 3 categories of medication instructions were used: (a) route for external use; (b) time of day for medication administration; and (c) medication administration before, after, or with meals. Each individual category was composed of 2 to 3 different sets of pictographs (Figure 1).

In order to develop more easily comprehensible pictographs, the pictographs used in the first edition were redesigned after conducting a pilot study and a preliminary evaluation. In the first pilot study, the first edition of pictographs was tested in a small group that included 5 pharmacists (for accuracy of instruction) and 5 patients (for preference and comprehension of pictographs) for consistency between

pharmacists and patients. The mean age and length of career for the pharmacists were 31.6 years and 6.6 years, respectively, and the patients were aged and low literacy. We found that there was an inconsistency between the 2 groups. In a second pilot study, 100 patients with low literacy were subsequently recruited to conduct a preliminary evaluation for preference and comprehension of the pictographs. The result of the preliminary evaluation indicated that respondents had relatively low levels of comprehension of all pictographs in all 3 categories, especially those for the time of day for medication administration. We subsequently redesigned a new pictograph edition, which included 4 pictograph categories of medication instructions: (a) route for external administration; (b) time of day for medication administration; (c) medication administration before, after, or with meals; and (d) administration quantity. Each individual category comprised 3 different sets of pictographs (Figure 2). The survey reported here was then conducted to identify differences in pictograph preference and comprehension between health care staff and patients in the revised edition of pictographs. The medical staff group was asked to return the pictographs and questionnaire within 3 days of receipt. Patients were asked to complete the questionnaire while present in the outpatient department or the waiting room of the pharmacy department, with assistance provided by research assistants. Individual patients required different amounts of time in which to complete the questionnaire.

Data Collection and Structured Patient Interview

Color copies (actual size) of each pictograph in the questionnaire were shown in the same order to each participant for review. In the medical staff group, participants completed the questionnaire without a personal interview. In the patient group, a trained research assistant was available to assist every patient with questionnaire completion as much as necessary. A standard approach was used for all interviews in the patient group. The research assistant first asked patients the meaning of each pictograph in order to ascertain their comprehension. For each set of 3 pictographs, patients were then asked to identify the pictograph that was most compelling and best described that instruction. After the patient had provided his or her preferred choices of pictographs, the research assistant recorded these responses on the questionnaire.

Statistical Analysis

Statistical analyses were performed using SPSS version 15.0 (SPSS Inc., Chicago, IL). Statistical differences between groups in pictograph preference and comprehension were calculated using Fisher's exact test because at least 1 cell in each analysis contained less than 5 cases. All statistical assessments were 2-tailed, and level of significance was set at 0.05.

FIGURE 1 First Edition of Pictographs^a

Category	Meaning of Pictograph	Pictograph #1	Pictograph #2	Pictograph #3
(I) Route for external use	(a) For ophthalmic use			
	(b) For otic use			
	(c) For nasal use			
(II) Medication administration time	(a) In the morning			
	(b) At noon			
	(c) In the evening			
	(d) At bedtime			
(III) Medication administration before, after, or with meals	(a) Before meal			
	(b) After meal			
	(c) With meal			

^aThis edition included 3 categories of medication instructions: (a) route for external use; (b) time of day for medication administration; and (c) medication administration before, after, or with meals. Each individual category was composed of 2 to 3 different sets of pictographs.

Results

Table 1 shows the characteristics of 250 patients and 250 medical staff who participated in the survey. All patients were considered low literacy in terms of education, including 154 patients (61.6%) who had never attended school and 96 (38.4%) who had received education at or below grade 6. The 250 medical staff members surveyed included 3 physicians, 37 pharmacists, 162 nurses, and 48 from other hospital departments. The survey completion rate for both groups was 100%. Of the 250 patients, 108 (43.2%) were aged 60 years or younger, 66 (26.4%) were aged 61-70 years, and 76 (30.4%) were aged 71 years or older.

The preference and comprehension of pictographs differed for patients compared with medical staff. The preference of pictographs was significantly different between patients and medical staff for all 12 instructions (Table 2). Comprehension was approximately 100% for both patients and medical staff for pictographs for route of administration and for administration time except that 9 (3.6%) of the medical staff did not understand the pictograph for "at noon" versus 1 patient (0.4%, $P=0.020$), and 42 (16.8%) patients did not understand "at bedtime" versus 2 medical staff (0.8%, $P<0.001$). Also, approximately 9% to 12% of patients did not understand the

FIGURE 2 Patient Version of Survey Instrument with Revised Pictographs

Dear Sir or Madame:

Please help us to provide the most clear instructions for medication use by answering the following questions. Your participation will help us serve you better, and help other patients, too. So that we can understand how people think about the instructions they receive with their medication, please completely fill out all information on the survey. Thanks for your time!

(1) Personal Information

- 1. Gender: Male Female
- 2. Age (yrs): ≤20 21-30 31-40 41-50 51-60 61-70 >70
- 3. Education: ≤Grade 6 Grade >6 to ≤9 >High School to College degree
 >College degree Other (please describe): _____
- 4. Occupation: Businessman Public Servant Retired Other (please describe): _____
- 5. Residence: Chiayi County Yunlin County Other (please describe): _____

(2) Please select one pictograph (put √ in the column with the pictograph) which best represents the category indicated.

Category	Meaning of Pictograph	Pictograph #1	Pictograph #2	Pictograph #3	Other	
					Any One Is Fine	Do Not Understand
(I) Route for external use	(a) For ophthalmic use					
	(b) For otic use					
	(c) For nasal use					
(II) Medication administration time	(a) In the morning					
	(b) At noon					
	(c) In the evening					
	(d) At bedtime					
(III) Medication administration before, after, or with meals	(a) Before meal					
	(b) After meal					
	(c) With meal					
(IV) Administration quantity	(a) Half tablet					
	(b) One tablet					
	(c) Two tablets					
	(d) Three tablets					

(3) Please give us your other thoughts about the pictographs in the space below. Thank you for your help!

pictographs for administration around meals, and these proportions were higher than for medical staff for 2 of the 3 pictographs (“after meal” and “with meal”).

Patient preference for pictographs varied significantly among the age groups for medication administration associated with meals (“before meal,” “after meal,” and “with meal”) and for the “half tablet” pictographs (Table 3). For comprehension, the oldest group of patients had higher proportions who reported not understanding 5 of 12 pictographs: for bedtime administration, for all 3 pictographs related to administration around meals, and a slightly higher proportion for the number of tablets.

Discussion

The 12 pictographs studied here, which were developed with substantial input from low-literacy patients, were associated with differences in preference and comprehension between patients and medical staff. The preference for pictographs differed significantly between low-literacy patients and medical staff for all 12 items, and there were differences in patient preference and comprehension among the 3 age categories. These results suggest that patients of varying ages and low literacy should be engaged in the development of pictographs that are intended to illustrate medication instructions. The significant difference in comprehension between low-literacy patients and medical staff for the pictographs for some of the medication instructions suggests that pictographs designed by medical professionals may not meet the needs of low-literacy patients. Our results and this conclusion are supported by previous research performed by Hwang et al. (2005) in which the type of illustration is important, and not all illustrations are associated with improved patient comprehension.⁵

The 2004 IOM Report on Health Literacy cited the discordance between the health care that is intended and the health care that is actually delivered, particularly among patients with chronic disease.¹² An estimated 90 million adults in the United States have trouble understanding and acting on health care information.¹² Studies of comprehension of warnings on prescription drug labels have shown that misunderstanding is associated with low literacy.^{2,13}

Numerous ways have been derived by which to enhance the comprehension of patients taking medication. Warning labels are one way of reducing medication consumption errors and should present information in as simple a form as possible, using clear, short sentences and “small” words whenever possible.^{3,13} However, many patients do not pay attention to warning labels, and those with low literacy are particularly likely to ignore or misinterpret medication warning labels.² Davis et al. (2006) found that most low-literacy patients self-reported that they did not pay attention to auxiliary warning labels, which may result in part because of inadequate attempts by physicians or pharmacists to counsel patients about the importance of these labels.³

TABLE 1 Characteristics of Patients and Medical Staff Participating in the Survey

Characteristics	Patients n = 250 % (n)	Medical Staff n = 250 % (n)
Age in years		
60 or younger	43.2 (108)	100.0 (250)
61 to 70	26.4 (66)	0.0 (0)
71 or older	30.4 (76)	0.0 (0)
Gender		
Male	45.6 (114)	8.0 (20)
Female	54.4 (136)	92.0 (230)
Educational level (grade)		
No schooling	61.6 (154)	
Elementary school (grades 1-6)	38.4 (96)	
High school (grades 7-12)		9.6 (24) ^a
College degree		86.0 (215)
More than college education		4.4 (11)
Medical service position		
Physician		1.2 (3)
Nurse		64.8 (162)
Pharmacist		14.8 (37)
Other		19.2 (48)


































^aHigh school graduates.

Placing simple, clear demonstrations of the correct use of medications on the drug package itself can provide a useful visual reminder for patients about how to take their prescribed medications. Illustrations, whether line drawings, pictures (pictographs), or pictorial diagrams (pictograms), improve patient comprehension and reduce the likelihood of misadministration of medications among those with low literacy, older adults, and the visually impaired.^{4,14,15} For example, Houts et al. (2001) found that pictographs enhanced patients’ recall of verbal medical instructions, improving recall from 14% for verbal instructions alone to 85% recall of medical instructions when accompanied by pictographs.¹⁴ Similarly, Austin et al. (1995) found that patients’ comprehension of discharge instructions improved if illustrations were included and that the effect was greater among patients with lower educational levels.¹⁵

However, even with these indications that illustrations improve patient comprehension, further study is still needed to determine what constitutes a good illustration for low-literacy patients. One intriguing result of our research was the pictograph set for medication administration time “at noon.” The number of medical staff who chose “do not understand” (n = 9, 3.6%) was higher than the number of patients (n = 1, 0.4%) who self-reported not understanding this set of pictographs.





































Age can be a factor that affects both preference and comprehension of the pictographic medical instruction. Gazmararian et al. (1999) found that age was strongly related to health literacy skills, even when adjusting for education and cognitive

TABLE 2 Pictograph Comprehension and Preference for Patients Versus Medical Staff

	Patients n = 250 % (n)	Medical Staff n = 250 % (n)	P Value ^a		Patients n = 250 % (n)	Medical Staff n = 250 % (n)	P Value ^a
(I) Route for external use				D. At bedtime			
A. For ophthalmic use				A. Before meal			
#1 	7.6 (19)	3.6 (9)	<0.001	#1 	22.0 (55)	20.8 (52)	<0.001
#2 	39.6 (99)	15.6 (39)		#2 	21.6 (54)	10.8 (27)	
#3 	46.0 (115)	79.6 (199)		#3 	34.8 (87)	60.8 (152)	
Any one is fine	6.4 (16)	1.2 (3)		Any one is fine	10.8 (27)	1.2 (3)	
Do not understand	0.4 (1)	0.0 (0)	1.000	Do not understand	10.8 (27)	6.4 (16)	0.110
B. For otic use				B. After meal			
#1 	7.6 (19)	2.8 (7)	<0.001	#1 	20.4 (51)	18.8 (47)	<0.001
#2 	52.0 (130)	30.8 (77)		#2 	21.6 (54)	12.0 (30)	
#3 	33.2 (83)	64.4 (161)		#3 	34.4 (86)	64.4 (161)	
Any one is fine	6.8 (17)	1.2 (3)		Any one is fine	11.6 (29)	0.8 (2)	
Do not understand	0.4 (1)	0.8 (2)	1.000	Do not understand	12.0 (30)	4.0 (10)	0.001
C. For nasal use				C. With meal			
#1 	8.4 (21)	3.6 (9)	<0.001	#1 	10.0 (25)	8.8 (22)	<0.001
#2 	40.8 (102)	21.2 (53)		#2 	12.8 (32)	12.4 (31)	
#3 	43.6 (109)	74.4 (186)		#3 	59.2 (148)	76.0 (190)	
Any one is fine	6.8 (17)	0.8 (2)		Any one is fine	9.2 (23)	0.4 (1)	
Do not understand	0.4 (1)	0.0 (0)	1.000	Do not understand	8.8 (22)	2.4 (6)	0.003
(II) Medication administration time				(IV) Administration quantity			
A. In the morning				A. Half tablet			
#1 	26.4 (66)	13.2 (33)	<0.001	#1 	13.6 (34)	15.6 (39)	<0.001
#2 	18.4 (46)	24.0 (60)		#2 	25.6 (64)	67.2 (168)	
#3 	46.4 (116)	59.6 (149)		#3 	50.4 (126)	15.2 (38)	
Any one is fine	8.0 (20)	2.0 (5)		Any one is fine	7.6 (19)	0.8 (2)	
Do not understand	0.8 (2)	1.2 (3)	0.686	Do not understand	2.8 (7)	1.2 (3)	0.222
B. At noon				B. One, two, or three tablets			
#1 	20.4 (51)	6.4 (16)	<0.001	#1 	16.4 (41)	11.2 (28)	0.012
#2 	24.4 (61)	42.0 (105)		#2 	44.4 (111)	56.0 (140)	
#3 	48.0 (120)	47.6 (119)		#3 	18.0 (45)	19.6 (49)	
Any one is fine	6.8 (17)	0.4 (1)		Any one is fine	17.6 (44)	12.4 (31)	
Do not understand	0.4 (1)	3.6 (9)	0.020	Do not understand	3.6 (9)	0.8 (2)	0.063
C. In the evening							
#1 	28.8 (72)	26.0 (65)	<0.001				
#2 	48.4 (121)	39.2 (98)					
#3 	10.8 (27)	29.6 (74)					
Any one is fine	10.8 (27)	4.0 (10)					
Do not understand	1.2 (3)	1.2 (3)	1.000				

^aP values calculated using Fisher's exact test.

TABLE 3 Pictograph Comprehension and Preference by Patient Age Group

	60 Years or Younger n = 108 % (n)	61-70 Years n = 66 % (n)	71 Years or Older n = 76 % (n)	P Value ^a		60 Years or Younger n = 108 % (n)	61-70 Years n = 66 % (n)	71 Years or Older n = 76 % (n)	P Value ^a				
(I) Route for external use					D. At bedtime								
A. For ophthalmic use					A. Before meal								
#1 	11.1 (12)	6.1 (4)	3.9 (3)	0.288	#1 	35.2 (38)	24.2 (16)	17.1 (13)	0.073				
#2 	42.6 (46)	37.9 (25)	36.8 (28)		#2 	25.0 (27)	21.2 (14)	30.3 (23)					
#3 	42.6 (46)	50.0 (33)	47.4 (36)		#3 	20.4 (22)	19.7 (13)	15.8 (12)					
Any one is fine	3.7 (4)	6.1 (4)	10.5 (8)		Any one is fine	9.3 (10)	15.2 (10)	13.2 (10)					
Do not understand	0.0 (0)	0.0 (0)	1.3 (1)	0.562	Do not understand	10.2 (11)	19.7 (13)	23.7 (18)	0.040				
B. For otic use					(III) Medication administration before, after, or with meals								
#1 	12.0 (13)	6.1 (4)	2.6 (2)	0.154	A. After meal								
#2 	49.1 (53)	53.0 (35)	55.3 (42)		#1 	35.2 (38)	10.6 (7)	13.2 (10)	0.002				
#3 	35.2 (38)	33.3 (22)	30.3 (23)		#2 	20.4 (22)	22.7 (15)	22.4 (17)					
Any one is fine	3.7 (4)	7.6 (5)	10.5 (8)		#3 	29.6 (32)	40.9 (27)	36.8 (28)					
Do not understand	0.0 (0)	0.0 (0)	1.3 (1)	0.562	Any one is fine	9.3 (10)	15.2 (10)	9.2 (7)					
C. For nasal use					B. After meal								
#1 	11.1 (12)	4.5 (3)	7.9 (6)	0.389	#1 	31.5 (34)	12.1 (8)	11.8 (9)	0.007				
#2 	38.0 (41)	39.4 (26)	46.1 (35)		#2 	21.3 (23)	19.7 (13)	23.7 (18)					
#3 	46.3 (50)	48.5 (32)	35.5 (27)		#3 	30.6 (33)	39.4 (26)	35.5 (27)					
Any one is fine	4.6 (5)	7.6 (5)	9.2 (7)		Any one is fine	10.2 (11)	16.7 (11)	9.2 (7)					
Do not understand	0.0 (0)	0.0 (0)	1.3 (1)	0.562	Do not understand	6.5 (7)	12.1 (8)	19.7 (15)	0.025				
(II) Medication administration time					C. With meal								
A. In the morning					#1 					15.7 (17)	6.1 (4)	5.3 (4)	0.037
#1 	23.1 (25)	27.3 (18)	30.3 (23)	0.297	#2 	13.0 (14)	13.6 (9)	11.8 (9)					
#2 	22.2 (24)	12.1 (8)	18.4 (14)		#3 	60.2 (65)	60.6 (40)	56.6 (43)					
#3 	49.1 (53)	51.5 (34)	38.2 (29)		Any one is fine	6.5 (7)	13.6 (9)	9.2 (7)					
Any one is fine	5.6 (6)	7.6 (5)	11.8 (9)		Do not understand	4.6 (5)	6.1 (4)	17.1 (13)	0.014				
Do not understand	0.0 (0)	1.5 (1)	1.3 (1)	0.329	(IV) Administration quantity								
B. At noon					A. Half tablet								
#1 	21.3 (23)	19.7 (13)	19.7 (15)	0.290	#1 	23.1 (25)	6.1 (4)	6.6 (5)	0.012				
#2 	30.6 (33)	18.2 (12)	21.1 (16)		#2 	26.9 (29)	25.8 (17)	23.7 (18)					
#3 	44.4 (48)	54.5 (36)	47.4 (36)		#3 	43.5 (47)	57.6 (38)	53.9 (41)					
Any one is fine	3.7 (4)	7.6 (5)	10.5 (8)		Any one is fine	5.6 (6)	7.6 (5)	10.5 (8)					
Do not understand	0.0	0.0	1.3 (1)	0.562	Do not understand	0.9 (1)	3.0 (2)	5.3 (4)	0.204				
C. In the evening					B. One, two, or three tablets								
#1 	30.6 (33)	24.2 (16)	30.3 (23)	0.303	#1 	17.6 (19)	18.2 (12)	13.2 (10)	0.496				
#2 	50.0 (54)	50.0 (33)	44.7 (34)		#2 	46.3 (50)	39.4 (26)	46.1 (35)					
#3 	10.2 (11)	16.7 (11)	6.6 (5)		#3 	18.5 (20)	19.7 (13)	15.8 (12)					
Any one is fine	7.4 (8)	9.1 (6)	17.1 (13)		Any one is fine	16.7 (18)	19.7 (13)	17.1 (13)					
Do not understand	1.9 (2)	0.0 (0)	1.3 (1)	0.788	Do not understand	0.9 (1)	3.0 (2)	7.9 (6)	0.041				

^aP values calculated using Fisher's exact test.

impairment. Among patients older than aged 65 years, the proportion of people with inadequate or marginal health literacy increased with age.¹⁶ In our study, comprehension was found to be lower for the older patient age group for 5 of the 12 sets of pictographs, compared with the 2 younger-age patient groups. It is therefore advisable to consult older adults in the development of pictographs for medication instructions.

Limitations

This study has several limitations. First, the characteristics of patients in terms of acute versus chronic disease were not investigated, which could affect the validity of the results, since those with chronic disease may have greater familiarity with their prescriptions (i.e., refill or new). Second, we focused only on low-literacy patients. The pictographic medical instruction might also benefit other patient groups, including elderly patients and patients with limited native language proficiency,^{16,17,18} which will be the subject of our next study. Third, we did not assess actual literacy but instead used self-reported level of formal education as the proxy for literacy. Fourth, the present study did not assess the value of pictographs in improving patient comprehension as compared with written or verbal instructions. Fifth, because low-literacy patients are the most likely to benefit from the use of pictographs, more focused research is needed with a subgroup of patients who do not understand certain pictographs or who may prefer another type of instruction such as a pill card with an illustrated medication schedule.¹⁹ Sixth, the effect of patient age as a factor in comprehension and preference for pictographs of medication administration may be culture-specific, and our findings may not be generalizable to other populations. Seventh, we measured both comprehension and preference in the same survey, and it is possible that respondents' viewpoints about one dimension affected how they responded to the other. Eighth, the study's convenience sampling method violated the assumptions of statistical hypothesis testing. Future research should use true random samples.

Conclusion

For the purpose of maximizing therapeutic benefits and safety, we should be aware that although illustrations can be a helpful tool, all medication instructions should be given so as to be readily understood by ordinary consumers, including those with little or no education. Our results reveal that pictographs are sometimes interpreted and preferred differently by medical staff and patients. Successful development of a prescription drug label for medication use instructions should include consultation with a diverse sample of patients to ensure that the pictographs, overall design, words, and format are understood and useful to all individuals, including those with low literacy.

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DISCLOSURES

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REFERENCES

1. Report of the National Work Group on Literacy and Health. Communicating with patients who have limited literacy skills. *J Fam Pract.* 1998;46:168-76.
2. Davis TC, Wolf MS, Bass PF 3rd, et al. Low literacy impairs comprehension of prescription drug warning labels. *J Gen Intern Med.* 2006;21(8):847-51. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1831578/pdf/jgi0021-0847.pdf>. Accessed May 21, 2010.
3. Davis TC, Wolf MS, Bass PF 3rd, et al. Literacy and misunderstanding prescription drug labels. *Ann Intern Med.* 2006;145(12):887-94. Available at: <http://www.annals.org/content/145/12/887.full.pdf+html>. Accessed May 21, 2010.
4. Mayeaux EJ Jr, Murphy PW, Arnold C, Davis TC, Jackson RH, Sentell T. Improving patient education for patients with low literacy skills. *Am Fam Physician.* 1996;53(1):205-11.
5. Hwang SW, Tram CQ, Knarr N. The effect of illustrations on patient comprehension of medication instruction labels. *BMC Fam Pract.* 2005;6(1):26. Available at: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1177941/pdf/1471-2296-6-26.pdf>. Accessed May 21, 2010.
6. Osborne ZP, Bryant SM. Patients discharged with a prescription for acetaminophen-containing narcotic analgesics do not receive appropriate written instructions. *Am J Emerg Med.* 2003;21(1):48-50. Available at: <http://download.journals.elsevierhealth.com/pdfs/journals/0735-6757/PIIS0735675702422395.pdf>. Accessed May 21, 2010.
7. Spandorfer JM, Karras DJ, Hughes LA, Caputo C. Comprehension of discharge instructions by patients in an urban emergency department. *Ann Emerg Med.* 1995;25(1):71-74.
8. Mansoor LE, Dowse R. Effect of pictograms on readability of patient information materials. *Ann Pharmacother.* 2003;37(7-8):1003-09.
9. Knapp P, Raynor DK, Jebar AH, Price SJ. Interpretation of medication pictograms by adults in the UK. *Ann Pharmacother.* 2005;39(7-8):1227-33.

10. Webb J, Davis TC, Bernadella P, et al. Patient-centered approach for improving prescription drug warning labels. *Patient Educ Couns*. 2008;72(3):443-49.
11. Dowse R, Ehlers MS. The influence of education on the interpretation of pharmaceutical pictograms for communicating medicine instructions. *Patient Educ Couns*. 2001;45(2):87-99.
12. Nielsen-Bohlman L, Panzer A, Kindig DA, eds. *Institute of Medicine. Health Literacy: A Prescription to End Confusion*. Washington, DC: National Academies Press; 2004.
13. Wolf MS, Davis TC, Tilson HH, Bass PF 3rd, Parker RM. Misunderstanding of prescription drug warning labels among patients with low literacy. *Am J Health Syst Pharm*. 2006;63(11):1048-55.
14. Houts PS, Witmer JT, Egeth HE, Loscalzo MJ, Zabora JR. Using pictographs to enhance recall of spoken medical instructions II. *Patient Educ Couns*. 2001;43(3):231-42.
15. Austin PE, Matlack R 2nd, Dunn KA, Kesler C, Brown CK. Discharge instructions: do illustrations help our patients understand them? *Ann Emerg Med*. 1995;25(3):317-20.
16. Gazmararian JA, Baker DW, Williams MV, et al. Health literacy among Medicare enrollees in a managed care organization. *JAMA*. 1999;281(6):545-51. Available at: <http://jama.ama-assn.org/cgi/reprint/281/6/545>. Accessed May 21, 2010.
17. Shea JA, Beers BB, McDonald VJ, Quistberg DA, Ravenell KL, Asch DA. Assessing health literacy in African American and Caucasian adults: disparities in rapid estimate of adult literacy in medicine (REALM) scores. *Fam Med*. 2004;36(8):575-81. Available at: <http://www.stfm.org/fmhub/fm2004/September/Judy575.pdf>. Accessed May 21, 2010.
18. Williams MV. Recognizing and overcoming inadequate health literacy, a barrier to care. *Cleve Clin J Med*. 2002;69(5):415-18. Available at: <http://www.ccm.org/content/69/5/415.full.pdf>. Accessed May 21, 2010.
19. Kripalani S, Robertson R, Love-Ghaffari MH, et al. Development of an illustrated medication schedule as a low-literacy patient education tool. *Patient Educ Couns*. 2007;66(3):368-77.