Use of pictorial aids in medication instructions: A review of the literature

MARRA G. KATZ, SUNIL KRIPALANI, AND BARRY D. WEISS

Purpose. The effects of pictorial aids in medication instructions on medication recall, comprehension, and adherence are reviewed.

Summary. Many patients depend on medication labels and patient information leaflets for pertinent drug information, but these materials are often difficult for patients to understand. Research in psychology and marketing indicates that humans have a cognitive preference for picture-based, rather than text-based, information. Studies have shown that pictorial aids improve recall, comprehension, and adherence and are particularly useful for conveying timing of doses, instructions on when to take medicine, and the importance of completing a course of therapy. Other research has compared various techniques for using picture-based information and supports the use of integrative instructions, a combination of textual, oral, and pictorial communication, to promote comprehension and adherence. While pictures have generally proven useful for improving patient comprehension and adherence, not all picture-based interventions have produced successful results. Some icons, particularly clock icons, have been found to be too complex to enhance understanding and could not overcome the advantage provided by the familiarity of the text-based format, suggesting that patients be trained to use pictorial medication information before they are expected to use icons as an aid for medication administration. In addition to enhancing understanding, pictorial aids have been found to improve patients' satisfaction with medication instructions.

Conclusion. The use of pictorial aids enhances patients' understanding of how they should take their medications, particularly when pictures are used in combination with written or oral instructions.

Index terms: Compliance; Comprehension; Labels; Patient information; Patients; Pictograms; Prescriptions

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Approximately 75% of patients adhere to their prescribed medication regimens.[1] According to the U.S. Pharmacopeia, nonadherent behavior most frequently takes the form of using more or less than the prescribed dosage (36%), completely omitting one or more prescribed medicines (28%), taking an extra dose (12%), using an unauthorized drug (8%), or taking medication at the wrong time (7%).[2] Similar problems are found with nonprescription medications.[3] Nonadherence prohibits optimal management of a variety of acute and chronic medical conditions, ranging from bacterial infections to hypertension.[4] Improper medication use is also associated with increased rates of hospitalization,[5-9] higher health care costs,[7,9] permanent disability,[2] and death.[6]

Patients' lack of understanding of their disease condition and treatment regimen may affect their medication adherence.[10-12] Specifically, patients who express confusion about their medication regimen, do not understand their disease, or are uncertain about the reasons for taking their prescribed regimen are significantly less likely to be adherent to treatment.[11]

Many interventions designed to improve patients' understanding have led to better adherence.[4] However, while many of these interventions—including education programs and distribution of detailed written instructions and calendars—prove helpful, they are often labor-intensive

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and therefore not feasible in typical clinical settings.[13] For this reason, patients are often forced to rely on readily available pharmaceutical information, namely drug labels and the patient information leaflets that accompany their medications. Unfortunately, these materials are often difficult to interpret due to their small print size and complex information.[14]

The National Quality Forum (NQF)[15] and the U.S. Surgeon General[16] have called for improving the readability of consumer drug information. In addition to suggesting a decrease in the complexity and reading level of patient information materials, NQF recommended adding pictorial aids to drug labels and patient information leaflets. The objectives of this review are to summarize the shortcomings of traditional consumer drug information, synthesize published evidence evaluating the use of pictorial aids in patient education materials, and highlight the use of such aids in high-risk populations, including patients with limited literacy skills. The discussion that follows is limited to the role of pictures in patient information leaflets and other pharmaceutical information, as the broader applications of pictures in health education have been previously reviewed.[17]

Shortcomings of traditional consumer drug information

Although many patients depend on medication labels and patient information leaflets for pertinent drug information, these materials are often difficult for patients to understand. The small print size that appears on many product labels necessitates a visual acuity of at least 20/50, making it hard for many individuals, especially the elderly, to read the labels.[14]

Also, drug labels and patient information leaflets are often written at a reading level that is too advanced for most consumers. According to a recent national study, 40–60% of adult Americans have basic or below basic literacy skills, meaning that they may have difficulty performing simple, everyday activities, such as using a television guide to look up a program or finding a certain topic within a text.[18] Other research shows that the average adult American reads at an 8th-grade level.[19] In contrast, one study of prescription drug patient information sheets found that only 2% had readability scores at or below the 8th-grade level; 69% scored in the 9th–12th-grade level, and 29% scored above the 12th-grade level.[20] This problem is not unique to the United States, as an Australian study found that only about 40% of patient information leaflets were appropriate for their target population.[21]

The mismatch between reading skills and consumer drug information exposes the inherent difficulties that low-literacy patients face when trying to interpret medication information. Indeed, in a large study of patients from two urban public hospitals, 42% of patients could not understand directions to take medication on an empty stomach, 33% could not interpret the correct dosage of a medication, 23% were unable to determine the number of refills remaining, and 13% could not understand directions to take medication four times a day.[22] Other studies have shown that patients have difficulty understanding administration directions for antibiotics and heart failure medications.[23,24]

Use of pictorial aids in medication instructions

Research in psychology and marketing indicates that humans have a cognitive preference for picture-based, rather than text-based, information, the so-called "picture superiority effect."[25] Further evidence suggests that pictures aid in the development of a mental model that aids in problem-solving. In this manner, pharmaceutical pictograms, such as standardized graphic symbols that depict medication-taking behaviors, can help patients to comprehend medication information.

We conducted a MEDLINE search for 1966–2005 using the following terminology: illustration, picture, pictograph, graphics, chart, image, photos, cartoon, and drawings. These terms were combined with the following search terms: medication, medicine, pill, drug, pharmacy, and prescription. English language studies examining the effect of pictorial images on recall, comprehension, satisfaction, medication adherence, or health outcomes were included. References of pertinent articles were hand searched to retrieve additional pertinent articles. The studies we found substantiate the usefulness of pictures in medication instructions and raise important issues for the design and implementation of pictorial aids in pharmacy settings.

Pictorial aids improve recall, comprehension, and adherence

Dowse and Ehlers[26] assessed comprehension and adherence using either text-only (control) or text-plus-pictogram (experimental) labels for prescribed antibiotics in a mostly female (93%), low-literacy population ($n = 87$). Comprehension was measured through structured interviews; adherence was evaluated only once via pill counts three to five days after enrollment. Pictograms enhanced comprehension by patients in the experimental group, who achieved a 95% average rate of understanding, compared with 70% in the control group ($p < 0.01$). The pictograms proved particularly useful for conveying timing of doses, instructions to take the medicine on an empty stomach, and the importance of completing the antibiotic course. In addition, medication adherence was greater in the group that saw text plus pictograms (90% versus 72% in the control group) ($p < 0.01$).

Comparable results were found in a smaller study ($n = 60$) that com-

pared comprehension of labels and patient information sheets that contained text only versus text plus pictograms.[27] Subjects enrolled had less than seven years of schooling, and 65% were women. Pictograms improved comprehension of both labels and patient information sheets, with 93% of the participants demonstrating full understanding of pictogram-containing labels, compared with 40% of those receiving text-only labels ($p = 0.001$). Participants receiving information leaflets with pictograms also showed a higher level of understanding compared with those who received text only (73% versus 53%, respectively) ($p = 0.005$).

Morrow and colleagues[28] investigated whether a daily pictorial timeline, which depicts time of day via corresponding numerical and pictorial images, improved comprehension of medication instructions. Seventy-two adults participated in a comparison of text-only and text-plus-pictorial timelines. Participants were familiarized with the timeline format before the assessment. Both younger (age 20–30 years) and older (age 64–90 years) adults answered questions about dose and time more quickly and accurately when using the text-plus-pictorial timeline ($p < 0.05$). This effect was most pronounced for regimens with higher complexity ($p < 0.05$). The combined format also tended to improve memory compared with the text-only format.

Patel et al.[29] assessed 40 Kenyan mothers' comprehension of instructions for oral rehydration therapy. Participants ranged in age from 19 to 35 years, and 55% had received less than 6 years of schooling. A set of pictures depicting steps for preparing oral rehydration regimens and additional written instructions were given to the mothers who were then asked to answer questions about the procedure. The women only recalled steps portrayed by the picture sequence and did not recall the supplementary information presented in text form. The authors suggested that pictures and written instructions should correspond to promote user comprehension.

Finally, Hämeen-Anttila and colleagues[30] investigated the effect of pictograms on children's understanding of medicine leaflet information. Sixty-two Finnish elementary school children (age 7–13 years) were given a leaflet about penicillin with either easy-to-read plain text or the same text plus pictures. The rate of comprehension was high in both groups of children (97% and 95%, respectively), with little room for improvement in the control group.

How to best use pictorial aids in medication instructions

Several studies[25,31-35] and a review[36] emphasized the importance of using pictures in conjunction with written or oral instructions to avoid misinterpretation of picture-only instructions. In contrast to the studies previously discussed, these reports explicitly compared various techniques for using picture-based information and support the use of integrative instructions, a combination of textual, oral, and pictorial communication, to promote comprehension and adherence.

Sojourner and Wogalter[35] assessed the effect of pictures on patients' comprehension of simulated medication schedules. A mixed population of undergraduate students, adults, and elders ($n = 216$) received a drug information sheet in one of the following formats: text alone, pictures alone, fully redundant text and pictures, text with only some pictures, and no instructions at all (control). Participants recalled significantly more medication information when presented with the redundant text and pictures than with any other format ($p < 0.05$); participants who saw text alone and incomplete pictures had the next highest recall rates, followed by pictorials alone.

Sansgiry et al.[25] simulated labels for commonly used nonprescription products and compared participants' comprehension of drug information across label designs. Similar to the Sojourner and Wogalter[35] study, labels were classified as text only, pictures only, congruent picture–text, or incongruent picture–text. Ninety-six subjects reviewed the labels and completed a questionnaire that assessed understanding, satisfaction, certainty, perceived confusion, and purchase recommendations. Label design was a significant factor to participants' understanding of medication instructions ($p < 0.001$), with the congruent picture–text design scoring highest, followed by the text-only design. In contrast to the findings of Sojourner and Wogalter, in this analysis the difference between congruent picture–text and text-only formats was not significant. Understanding was not improved by the incongruent picture–text or picture-only designs.

Ngoh and Shepherd[33] evaluated the effect of culturally sensitive visual aids on comprehension of and adherence to antibiotic drug regimens in 78 female patients in rural Cameroon. Experimental groups either received visual aids or visual aids plus an advanced organizer, a tool that facilitates learning of new information by linking it to participants' prior knowledge and existing mental schemas (e.g., comparing medication use to farming practices). The experimental aids were explained orally. Comprehension was quantified by patients' ability to recount multiple aspects of the drug regimen during a home visit on or after the fourth day of treatment. Both interventions significantly improved comprehension compared with patients who did not receive any drug information (control group) ($p < 0.05$). In addition, patients who received the advanced organizer plus the visual aids scored significantly higher than those who received visual aids alone

($p < 0.05$). Adherence was assessed via a pill count. Both intervention groups fared better than the control group ($p < 0.05$), with no significant difference between the two intervention groups.

Sata et al.[34] provided 60 elderly patients with medication instructions in one of the following formats: (1) oral explanation, (2) oral explanation and drug package text, or (3) oral explanation and an information leaflet with photographs of the prescribed medication. Patients who received the leaflets containing pictures demonstrated significantly better understanding than did the other two groups ($p < 0.05$). Six months later, patients who had kept the leaflet had significantly better understanding than those who had lost it ($p < 0.05$).

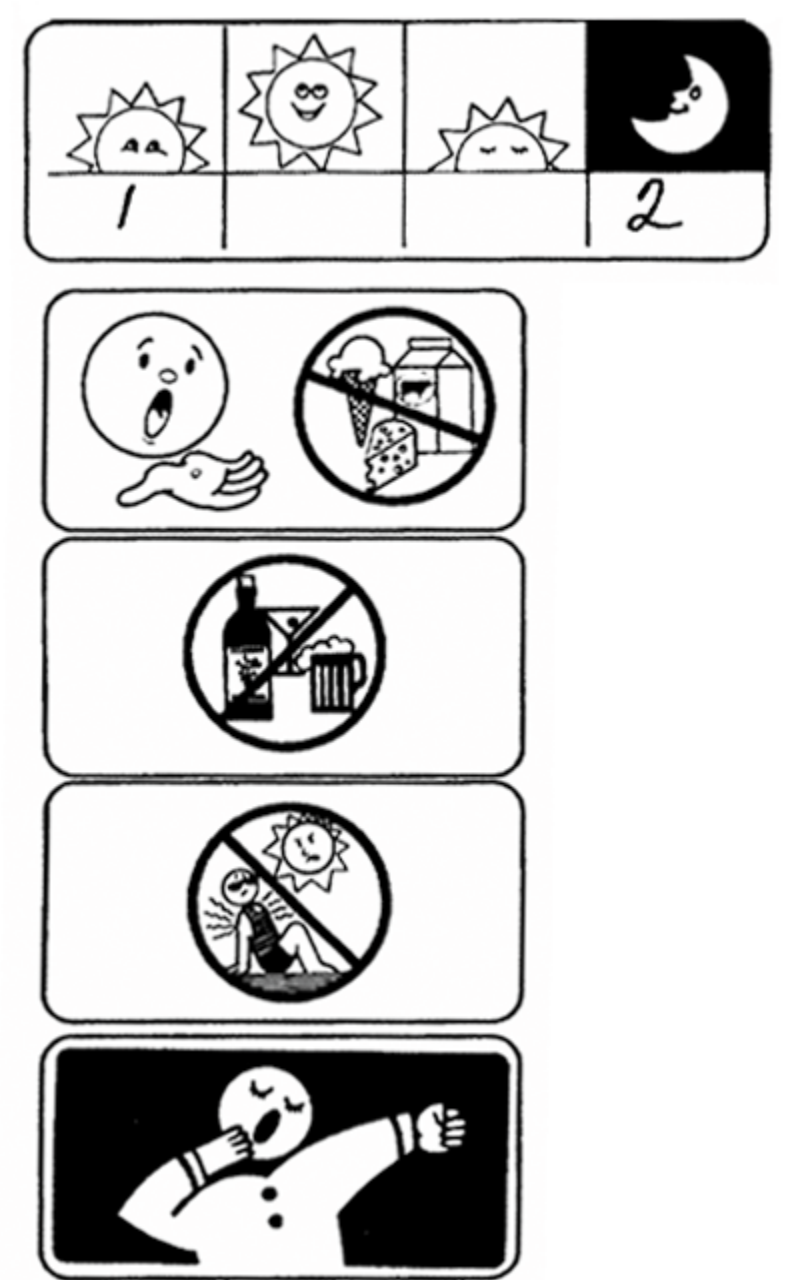
Two pharmacy-based studies tested patient-centered pictorial instructions.[31,32] Hanson[31] targeted low-literacy and visually impaired patients. The predominately female population consisted of 258 middle-aged patients, most of whom had a high school diploma. The pictorial labels included simple black-and-white images depicting time of daily administration, dosage, and special warnings or instructions (Figure 1). Participants completed the comprehension assessment 7–10 days after receiving traditional care or the patient-centered instructions. The pictorial materials significantly improved comprehension among low-literacy patients ($p < 0.05$), but not among those considered to have adequate literacy based on their ability to read a typical prescription label.

More recently, Morrow and colleagues[32] conducted a pilot comparison of patient-centered versus traditional medication instructions among 32 patients with congestive heart failure. The patient-centered instructions had pictorial icons and a larger print size, better readability scores, and less text overall, compared with the traditional instructions, which contained only text. Patient-centered instructions significantly improved both recall and comprehension, primarily with unfamiliar medications. The greatest effect was seen in the domains represented by pictorial icons (drug name, dose, and timing). Interestingly, traditional instructions were better understood for familiar medications ($p < 0.05$). In multivariable models, patients' literacy was significantly associated with information recall.

Limited success with unexplained or complex pictorial aids

While pictures have generally

Figure 1. Examples of pictorials indicating to take one tablet in the morning and two at bedtime, not take the medication with dairy products, not to drink alcoholic beverages when taking the medication, to avoid excessive sun exposure, and that the medication may cause drowsiness. Reprinted from reference 31, with permission.



proven useful for improving patient comprehension and adherence, not all picture-based interventions have produced successful results. Morrell and colleagues[37] randomized 64 subjects to receive either text or mixed (i.e., text plus pictorial) instructions for a simulated drug regimen and then tested participants' recall of drug information. For adults age 18–22 years, recall was improved by providing mixed instructions ($p < 0.05$). However, this effect was not seen among participants age 59–85 years, perhaps due to difficulty with the organization of the material or assimilating the pictorial and text instructions. Of note, the meaning of pictures and organization of information were not specifically explained as part of the intervention.

Similarly, Morrow et al.[38] tested the ability of 28 adults (age 61–81 years) to recall medication schedule information for several simulated drug regimens. Dosing schedule information was presented via text or with one of three icons: (1) a 24-hour clock, (2) a pair of 12-hour clocks (one for a.m. and one for p.m.), or (3) a daily timeline. Overall, subjects recalled more of the text-based information than any of the icon-based material. The authors concluded that the icons, particularly the clock icons, were likely too complex to enhance understanding and could not overcome the advantage provided by the familiarity of the text-based format. They suggested that patients should be trained to use pictorial medication information before they are expected to use icons as an aid for medication administration.

Pictures are helpful additions to pharmaceutical information materials, having the potential to improve patients' recall, understanding, and adherence to both prescription and nonprescription medication instructions. However, it is important to avoid complex images and provide additional text and oral instructions to ensure proper interpretation.

Patients prefer pictures

In addition to enhancing understanding, published studies have found that pictorial aids improve patients' satisfaction with medication instructions.[25,27,28,31,35,39,40] Two studies indicated a preference for combined text and picture information over incomplete pictorials, text alone, pictorials alone, or no instructions at all.[25,35] Three studies specifically examined preferences among high-risk groups, including elderly, low-literacy, and visually impaired individuals, with participants showing a preference for integrated text and picture information.[27,31,39]

In terms of specific uses for picture-based information, patients found pictures most helpful for obtaining information about medication name, daily dose, and times to take the medication but found them less useful for portraying drug interactions.[40] Furthermore, both pharmacy practitioners and students found pictograms fairly easy to use and beneficial for counseling low-literacy and elderly individuals. However, they did report minor limitations: the pictogram labels were often too large, and some of the images were confusing.[31] In addition, one report found a patient preference for text-only messages, perhaps due to the confusing nature of the images in that study.[38]

Discussion

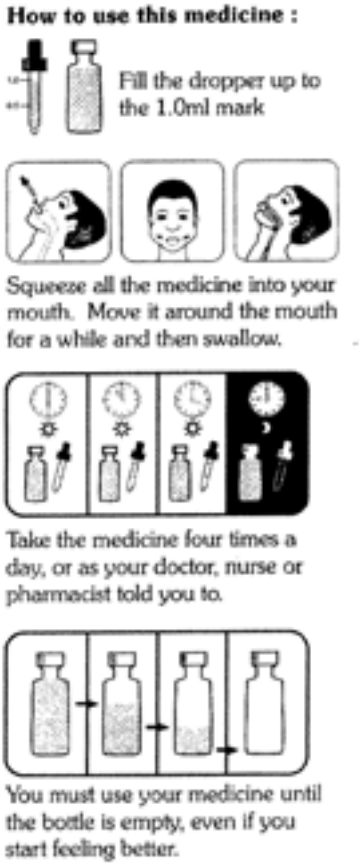
The majority of current pharmaceutical education material is presented in a format that is too complex for most patients to fully understand. To improve patient comprehension and adherence, it is necessary to adapt this information to serve patients' needs and preferences. In both simulated and clinical settings, pictorial aids have proven to enhance patients' recall, comprehension, and adherence to their medication regimen. Furthermore, combined methods of instruction using complementary textual and pictorial instructions appear to be more effective than using one format alone.[25,31-35]

Several of the reviewed studies indicate that, due to the potential for misinterpretation, pictures should not replace text-based instructions or oral counseling but rather supplement them[31,38,41-45] (Figure 2). To maximize the success of pictorial aids, it is essential to use simple, realistic pictures that convey a clear, singular meaning. Based on results from successful picture-based interventions, Dowse and Ehlers[36] have made the following suggestions for pictorial design: (1) apply realistic colors, (2) draw images to scale, (3) use appropriate magnification, and (4) maintain an uncluttered background to retain focus on the intended message. In addition, providers should be cautious about using abstract symbols, symbols depicting motion, and images requiring a specific perspective, as well as images conveying multiple steps in a process.

While a pictogram database is available,[46] some research has shown that the images are easily misinterpreted and that patients prefer locally developed illustrations over stock images.[44,47] Whether using existing images or creating new ones, it is imperative to pilot test pictures to maximize their relevance and clarity,[36] particularly when applying a set of images across multiple cultures.[43,47] Orienting instructions are important in this scenario and when patients are first introduced to the images.[28,37,38]

Incorporation of pictures into drug labels and patient information sheets has particular promise for helping individuals who have difficulty reading and interpreting textual instructions, namely patients with limited literacy skills or limited English proficiency. For the majority of low-literacy patients, text-based pharmaceutical labels and leaflets can be difficult to understand,[14,18,20,21] and this could lead to medication errors and adverse outcomes. In ad-

Figure 2. Example of complementary text and pictorial information for administration of nystatin suspension. Reprinted from reference 27, with permission.



dition, many patients with limited literacy feel ashamed of their reading difficulties, reducing their tendency to seek further instructions from their pharmacist or health care provider.[48,49] Evidence indicates that pictorial aids have the potential to improve comprehension and adherence among these patients.[26,27,29,31,33,34] Moreover, patients of all literacy levels actually prefer picture-based information.[27,31,35,39,40]

Many elderly patients struggle to understand and adhere to their medication schedule, perhaps due to cognitive decline or impaired visual acuity.[14,50,51] Picture-based instructions bear promise because they may direct attention to important details and reduce the reliance on finely printed, complex textual information.[14,25,28,32,36,39] However, implementation of picture-based instructions has produced mixed results among the elderly; for pictures to be helpful among this population, they must be clear and accompanied by oral explanations or complementary text.[28,32,34,37,38,40,52]

Limitations of published studies

Our review revealed several limitations to the published literature, and these limitations should be addressed through additional research. First, most studies involved simulated dosing instructions, usually for a single treatment rather than one or more actual medications prescribed to the study participants. Because patients with chronic diseases typically take multiple medications, we do not know how the findings of published studies apply to these patients.

Second, most investigations had fewer than 100 participants and were conducted among selected patient populations. Large clinical trials with diverse patient populations, in which patients receive pictographic instructions for their own medication regimens, were nearly absent.[31]

Third, most of the published studies examined the effect of pictorial aids on patient recall, comprehension, and satisfaction with instructions. Only two reports assessed medication adherence.[26,33] We could not find any completed studies that reported clinically meaningful outcomes, but we are aware of two such ongoing trials. Murray and colleagues[53] are assessing, among patients with congestive heart failure, the effect of icon-based instructions on adherence and clinical outcomes, including ejection fraction, brain natriuretic peptide concentrations, and health-related quality of life. Kripalani et al.[54] are conducting a randomized controlled trial to examine the effect of an illustrated medication schedule and refill-reminder postcard on medication adherence and cardiovascular risk factor control among patients with coronary heart disease. Additional research is needed to more rigorously examine the effect of pictorial aids on medication adherence and health outcomes.

Conclusion

The use of pictorial aids enhances patients' understanding of how they should take their medications, particularly when pictures are used in combination with written or oral instructions.

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