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Review

The role of pictures in improving health communication: A review of research on attention, comprehension, recall, and adherence

Peter S. Houts [a,*], Cecilia C. Doak [b], Leonard G. Doak [b], Matthew J. Loscalzo [c]

[a] *Pennsylvania State University College of Medicine, 500 University Drive, Hershey, PA 17033, USA*
[b] *Patient Learning Associates, 4 Chilham Court, Potomac, MD 20854, USA*
[c] *Rebecca and John Moores UCSD Cancer Center, 9500 Gilman Dr. MC 0658, La Jolla, CA 93093, USA*

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Abstract

Objective: To assess the effects of pictures on health communications.
Method: Peer reviewed studies in health education, psychology, education, and marketing journals were reviewed. There was no limit placed on the time periods searched.
Results: Pictures closely linked to written or spoken text can, when compared to text alone, markedly increase attention to and recall of health education information. Pictures can also improve comprehension when they show relationships among ideas or when they show spatial relationships. Pictures can change adherence to health instructions, but emotional response to pictures affects whether they increase or decrease target behaviors. All patients can benefit, but patients with low literacy skills are especially likely to benefit. Patients with very low literacy skills can be helped by spoken directions plus pictures to take home as reminders or by pictures plus very simply worded captions.
Practice implications: Educators should: (1) ask ''how can I use pictures to support key points?'', (2) minimize distracting details in pictures, (3) use simple language in conjunction with pictures, (4) closely link pictures to text and/or captions, (5) include people from the intended audience in designing pictures, (6) have health professionals plan the pictures, not artists, and (7) evaluate pictures' effects by comparing response to materials with and without pictures.

Keywords: Patient education; Pictures; Pictographs; Attention; Comprehension; Recall; Memory; Adherence

Contents

* Corresponding author. Present address: 70 Hillymede Road, Hummelstown, PA 17036, USA. Tel.: +1 717 566 1610; fax: +1 717 566 2546.
E-mail address: psh2@psu.edu (P.S. Houts).

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1. Introduction

Communication between health professionals and patients is inherently problematic. Professionals want to communicate clearly, but tend to use technical terminology because it is precise, because it is familiar, and often because there are no exactly equivalent non-technical words available. Furthermore, they often try to communicate more information than patients can process. Patients, even those with well developed language skills, find it difficult to process medical information because they are unfamiliar with medical terminology, because they are preoccupied with their symptoms, and because they are upset which makes concentration difficult.

While people at all literacy levels have problems understanding and using health information, people with limited literacy skills are especially in need of help. They need help in understanding written information and, because they place more reliance on spoken explanations, they need help in remembering what they hear.

This paper discusses how combining pictures with spoken or written text affects health communication. Four aspects of health communication will be discussed: (1) drawing attention to the materials or message, (2) helping people comprehend the information being presented, (3) increasing recall of the message, and (4) increasing the likelihood that people will act in accordance with the message (adherence). This paper reviews research on how pictures combined with text can affect each of these aspects and also makes recommendations for how health educators can use pictures most effectively.

Our work is closely related to McGuire's information processing theory [1] in which he proposed a matrix to explain the communication/persuasion process. His matrix consists of five input variables (source, message characteristics, channel, receiver and response target) and thirteen output variables (exposure, attention, liking, comprehension, cognitive elaboration, skill acquisition, agreement, memory, retrieval, decision making, acting on the decision, cognitive consolidation, and proselytizing). Pictures fall within McGuire's second input variable ''message characteristics,'' while four of McGuire's output variables, attention, comprehension, memory, and acting on the decision relate directly to our four presentation elements (attention, comprehension, recall, and adherence.) McGuire's model is a useful conceptual framework for our literature review because it positions pictures within the persuasion process. It also suggests directions for future research on how pictures can contribute to health education. For example, his list of output variables points to additional ways in which pictures could contribute to health education that have not been studied by health education researchers. The theory also calls attention to possible interactions among output variables. In the discussion section of this paper we will utilize McGuire's theory in discussing future research directions.

In addition to reviewing published studies, we will propose hypotheses to guide both researchers and practitioners in planning future programs. At the end of this paper we also make recommendations for how health educators can make optimum use of pictures. These hypotheses and recommendations are based on the literature review and the authors' experiences in developing and reviewing illustrated health education materials.

Our goals are to:

(1) provide quantitative data on how the addition of pictures to text affects health communication;
(2) provide quantitative data on how pictures affect different populations, especially minority and people with low literacy skills;
(3) identify areas where more research is needed;
(4) make recommendations for how health educators can make optimal use of pictures in combination with text.

2. Methodology

For each possible use of pictures (to facilitate attention, comprehension, recall and adherence), we reviewed studies that compare response to just text (written or spoken) with response to text plus pictures representing information in the text. We also reviewed studies comparing different types of pictures and studies comparing responses to pictures by different populations. Data bases of research publications in education, (ERIC) medicine (PUBMED), psychology (PsycINFO), and marketing (ABI/INFORM) have been surveyed with the following key words: ''pictures,'' ''visuals,'' ''pictographs,'' ''cartoons,'' and ''pictorial stimuli'' in combination with ''attention,'' ''understanding,'' ''comprehension,'' ''recall,'' ''memory,'' ''behavior,'' and ''adherence.'' There was no limit placed on the time period searched. Reference lists from articles that were relevant to our purposes were studied to identify additional studies and, where the database included an option of identifying ''related studies,'' these were explored as well. Only studies published in peer reviewed journals were considered. Both reports of research as well as literature reviews were examined.

For each topic we will first discuss why the topic is a problem for health educators and then review studies in health education followed by related studies in education, psychology, and marketing. We identified nineteen studies in health education that investigated the effects of adding pictures to written or spoken text. In addition, we identified several hundred studies in education, psychology, and marketing that asked similar questions. Where there are large numbers of studies, we relied primarily on literature reviews for information that can elaborate and/or qualify findings in health education.

Our criteria in selecting studies from the health education literature was that there had to be a comparison between written text and written text plus pictures. As a result, the studies included in this review are primarily experimental–control group designs with random assignment to groups. Outcome measures were largely self-report which raises the possibility of respondents biasing reports to please investigators. In some cases investigators reported trends without statistical test results and, where this happened, we have noted this in our review. The small number of studies on some topics limits the generalizations that can be made from the findings as does the fact that not all findings are consistent with each other. As a result, we have proposed hypotheses rather than conclusions from this review. More research is needed on all the topics discussed here, especially on the conditions that maximize pictures' effects.

3. ''Attention''—can pictures increase the likelihood that people will notice and read a health message?

3.1. Problem statement

Not all health communications are read by people who could benefit. Racks of informational brochures in doctors' offices are often ignored and, even when brochures are given to patients by health professionals, not all are read. Even spoken instructions by health professionals are not always attended to by patients or families because they are stressed, distracted, or confused. One contribution of pictures to health education is to attract the attention of patients and families and to stimulate them to attend to the information.

3.2. Do pictures draw attention to health education materials?

We located one study in health education that compared attention given to just text with attention given to text plus pictures. This study, by Delp and Jones [2], studied 234 patients coming to an emergency room with lacerations. After receiving treatment, but prior to discharge, patients were given printed instructions for caring for their wounds at home. Half were randomly given just text and the other half received the same text plus pictures that illustrated the information in the text. Fig. 1 shows examples of the text and pictures they used.

Subjects were interviewed by phone three days later and asked if they had read the instructions (attention). If they had, they were asked a series of questions about information in the handout (recall) and also about what they had done to care for their wounds (adherence). (While Delp and Jones refer to their findings as ''comprehension,'' they were, in fact, recall since respondents were only asked to restate what they read.) We summarize all three results here and will refer to the findings on recall and adherence in our discussions of those topics later in this paper.

As seen in Table 1, patients receiving handouts with pictures were significantly more likely to read the handouts and, among those who read the handouts, patients receiving

Fig. 1. Example of picture and text given to emergency room patients for wound care at home: $N = 234$. (From Delp and Jones [2], used with permission).

the illustrated versions were significantly more likely to remember what they read and to follow the instructions than those who read just text. Delp and Jones also reported a trend (but without statistical support) for a greater difference in adherence between experimental and control for patients with less than a high school education suggesting that people with lower literacy skills may have been especially helped by the addition of pictures to text.

The Delp and Jones findings are important for understanding the relationship between pictures and attention, but

Table 1
Effects of text alone vs. text plus cartoons on patient attention, recall, and adherence: $N = 234$ (from Delp and Jones [2])

	Text plus cartoons (%)	Text only
Read instructions (attention)	98	79[b]
Answer all four wound care questions correctly (recall)[a]	46	6[b]
Adherence to wound care instructions[a]	77	54[b]
Subset analyses of patients with less than high school education		
Adherence to wound care instructions[a]	82	45[b]

[a] Analyses only included patients who had read instructions.
[b] Differences between groups statistically significant $p < .05$.

they also raise other important questions. Was their success in drawing attention due to the cartoon format they used or would photographs or other types of drawings been as successful? Should the drawings be of people similar to the reader? There is evidence that people prefer pictures in health messages that are culturally sensitive and include representations of people like themselves [3,4] suggesting that they are more likely to notice such messages. However, we could locate no experimental studies that compared attention given to culturally targeted and generic health messages.

3.2.1. Other research on how pictures affect attention

We could not locate any studies in marketing or in the general field of education on whether pictures affect students' attention to education materials. However, there are studies on student preferences. Levie and Lentz, [5] and Levie [6] in reviewing research on pictures in education cite research showing that children prefer stories with pictures to ones with no pictures and that audio–visual presentations are rated as more enjoyable and interesting if accompanied by pictures. They also cite research showing that children prefer realistic pictures although there are interactions with type of subject matter and learner characteristics. Other picture characteristics that they review include color, complexity, and ambiguity. This research shows that picture preferences are complex and influenced not only by the picture characteristics, but also by cultural factors and personal characteristics of the viewers. As a result, it is difficult to predict in advance how a particular audience will respond to certain pictures. Therefore, pictures used to attract attention to health educational materials should first be field tested with the intended audience.

3.3. Hypothesis for future research on how pictures affect attention to health education materials

Findings in the Delp and Jones study [2] as well as research on student preferences suggest that the addition of pictures to health education text will increase the likelihood that the text will be read. The simple and effective design of the Delp and Jones study shows that it is feasible to conduct such research in clinical settings. Health education researchers should, therefore, include, in their evaluations of health education materials, questions on whether the materials were read or attended to by patients and their family care givers and investigate the kinds of pictures that are most effective in drawing attention to the materials.

4. "Comprehension"—can pictures increase the likelihood that people will understand a message?

4.1. Problem statement

Patients sometimes have difficulty understanding health care information. Studies by Ley [7] and others have shown that health information is often unfamiliar to patients and contains complex concepts and words. This is, in part, caused by the tendency of health professionals to use the same technical terminology and complex sentence structures in communicating with patients that they use in communicating with their professional peers. Another reason is the inherent complexity and uncertainties involved in the topics being discussed. As a result, health professionals may qualify statements and speak in broad generalizations to patients who want specific information that applies to them, personally. At the same time, patients are in a stressful environment where there is a power imbalance, educational imbalance, and where they are fearful of appearing stupid and fearful of rejection or abandonment. As a result, they are hesitant to admit that they do not understand directions or the reasons for medical interventions.

Table 2
Percent of populations with low literacy skills reported by the United Nations Development Program [8]

Country	Percentage with low literacy skills
United Kingdom	21.8
The United States	20.7
Japan	16.8
The Netherlands	10.5
Sweden	7.5

Comprehension problems can be especially acute for people with low literacy skills. The World Health Organization estimates that, even among industrialized countries, there are large numbers of people with low literacy skills as shown in Table 2 [8].

Gazmararian et al. [9] reported, in a study of 3260 enrollees in a national managed care organization in the United States, that 23% of the English-speaking and 34% of the Spanish-speaking respondents could not adequately read and comprehend medical information in their spoken languages. They also found that these problems were especially prevalent among minority, low income and low education populations.

The reading skill level of the average adult citizen of the United States is estimated to be the 8th to 9th grade level [10]. Contrast this with the fact that more than half the written health care instructions recently surveyed have readability levels at 10th grade or higher [11–13]. Thus, even people with average reading skills have a comprehension gap when reading most health materials. Many health instructions are even more difficult. Surgical consent forms are often written at a college graduate level [14] and a recent survey of the readability levels of 31 draft HIPPA privacy notices showed them all to be at college levels [15].

An important step in addressing this problem is simplification of language in written health education materials [16]. Recently, health educators have been paying more attention to simple language and significant progress has been made in reducing readability levels. However,

research by Davis et al. [17] indicates that easy-to-read instructions are of more help to good readers than poor readers. Davis reported that, with simplified instructions, good readers showed improved understanding, but that poor readers were helped only marginally. Thus, while easy-to-read health instructions do help, it is only a partial solution to helping people with low literacy skills comprehend written health education materials.

4.2. Do pictures affect comprehension of health education materials

We located six studies in health education that evaluated the effects of pictures with text on comprehension of health information. Comprehension is the process of interpreting the meaning of words or pictures to understand their collective meaning. It is different from recall which is the process of retrieving individual words or picture elements from memory. People may remember information without, necessarily, understanding it. Therefore, for a study to qualify as evaluating comprehension, the outcome measure had to go beyond simple recall and ask respondents to explain or do something with the information presented. We did find several studies that purported to assess comprehension but, in fact, studied recall since they only asked respondents to repeat information they heard or read. These studies are discussed in the recall section of this paper.

Austin et al. [18], using an experimental design similar to Delp and Jones, studied 101 patients receiving treatment for lacerations in an emergency department of a rural trauma center. Subjects were randomly given discharge instructions with or without pictures. A blinded interviewer later asked subjects questions designed to assess their comprehension of the instructions. The median number of correct responses was five. Patients who received text plus pictures were 1.5 times more likely to give 5 or more correct responses than those who received just text (65% versus 43%), $p = .033$. In addition, they found that this effect was especially pronounced among nonwhites, patients with no more than a high school education, and women.

Michielutte et al. [19] studied the effects of pictures on 217 women's comprehension of information on cervical cancer prevention. Half their subjects read a health education brochure with pictures and half read the same brochure without pictures. Comprehension was measured by responses to eight questions dealing with the content of the pamphlet. Their outcome measure was the percent who answered at least seven of the eight comprehension questions correctly. The results in Table 3 showed a higher percent with seven or eight correct responses in the illustrated handout group (65% versus 53%.). Table 3 also shows the results separately for low and high literacy subjects (as measured by the wide range achievement test-R (WRAT-R) word recognition test). There was a large difference among women with low WRAT-R scores (61% versus 35%) and only a small difference among women with high WRAT-R scores (70% versus 72%). The authors conclude that the data support the hypothesis that low literacy adults will benefit more than high literacy adults from the use of pictures in health education materials. They also reported that all subjects combined rated the brochures with pictures more positively than brochures with just text.

Table 3
Comparison of women's comprehension of illustrated vs. a non-illustrated pamphlet on cervical cancer: $N = 217$ (from Michielutte et al. [19])

Comprehension score (percentage with 7 or 8 correct out of 8)	Illustrated pamphlet	Not illustrated pamphlet
Total sample (%)	65	53[b]
Low WRAT-R[a] literacy scores (%)	61	35[b]
High WRAT-R[a] literacy scores (%)	70	72

[a] Differences between groups statistically significant $p < .05$.
[b] WRAT: wide range achievement test.

Mansoor and Dowse [20] assessed the effects of incorporating pictures on understanding medication instructions among 60 low-literate respondents in South Africa. Subjects were randomly assigned to experimental and control groups and asked to read a medicine label and an accompanying patient information leaflet. The experimental group's label and leaflet included pictures while the control group's did not. Subjects were later asked questions about what they read. They were also asked about the acceptability of the materials. Subjects receiving the materials with pictures had significantly more correct responses to two comprehension questions: ''How must you take this medicine'' 47% correct for text only versus 93% correct for text with pictures; and ''What are the actual times'' 3% correct for text only versus 73% correct for text plus pictures. In addition, there was a clear preference for the illustrated materials.

Hammeen-Anttila et al. [21] studied whether pictures improved children's understanding of medicine leaflet information. They asked 62 Finnish elementary school children 7–13 years old to read an easy to read booklet about penicillin-V. Half the children read booklets illustrated with pictograms developed by the United States Pharmacopeia while the other half read the same text, but without pictograms. They found no significant difference in the two groups' accuracy in answering questions about what they read: 94% accuracy with pictograms and 97% with just text. But there is a ceiling effect here. Since the control group had 97% accuracy, there was very little room for an additional effect of the pictograms. In discussing their findings, the authors state ''Even well-understood pictograms did not help the children understand the leaflet information ...''. But since there was so little room for the experimental group to improve, this conclusion seems unwarranted.

Leiner et al. [22] compared a four page non-illustrated leaflet with a video tape of animated cartoons explaining the need for a polio vaccine. The information contained in the videotape was the same as in the leaflet. Both versions were available in English and Spanish. Subjects were 192 parents

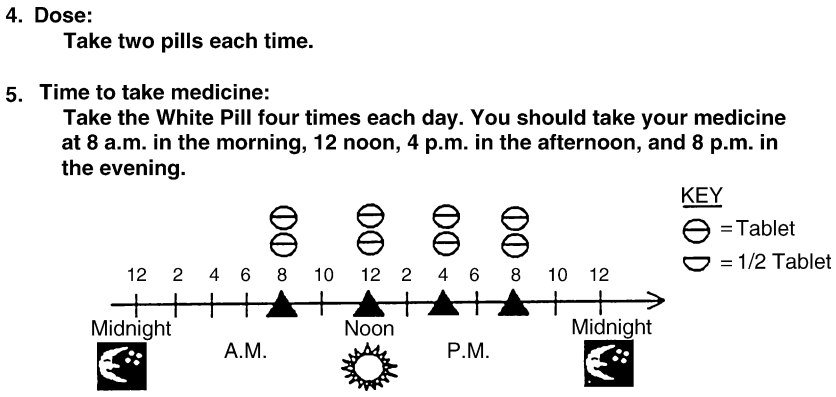

Fig. 2. Example of integrated picture plus text explaining when to take pills: $N = 72$. (From Morrow et al. [21], used with permission).

or caretakers (predominately women and Hispanics) of children receiving polio vaccines in a pediatric clinic. Results showed statistically significant higher post knowledge scores for the animated cartoon group. Furthermore, 30% of the animated cartoon group responded to all questions correctly while none of the printed group did so (Fig. 1).

Morrow et al. [23] conducted two experiments to assess how pictures affect comprehension of medication instructions. Both experiments assessed comprehension by asking subjects to make an inference beyond the information they read. In the first experiment, 72 subjects read two sets of instructions about a medicine including how many pills to take at a time and when to take the pills. One of the instruction sets was just words and the other was words plus a drawing that integrated the pill taking instructions. The content and order of the two presentations was counterbalanced across subjects. An example of the instruction plus text is shown in Fig. 2.

Later, subjects were asked a comprehension question that went beyond what was in the text, namely, the total number of pills taken in a 24-h period. Ninety percent of the responses to the text plus picture condition answered correctly compared to 81% of responses to just the text. The authors concluded that the picture integrated the key information that helped subjects to use the information in making an inference about total number of pills to be taken. To test this interpretation, the authors conducted a second experiment with 81 subjects utilizing the same design, but adding a third condition with a picture that did not integrate the information. This new picture included all the elements of the first, except that the pills were not placed over the marks for times when they were to be taken. An example of such a drawing is shown in Fig. 3.

Results of the second experiment replicated those of the first by showing better comprehension with the integrated drawing but also found that comprehension to the non-integrated drawing was no better than for the control condition with just text. The authors concluded that the integration function of the drawing was what aided comprehension.

4.2.1. Other research on how pictures affect comprehension

The relationship between pictures and comprehension has been studied extensively outside of health education. A total of 220 studies were identified in a literature search using the terms pictures and comprehension. Since there are a large number of studies conducted under a wide range of conditions with varying populations, we have relied primarily on literature reviews by Fillippatou and Pumfrey [24], Levie and Lentz [5], Levie [6] and Carney and Levin [25] in making generalizations that relate to the needs of health educators. All of these reviews agree that the weight of evidence indicates that pictures can facilitate comprehension. However, the relationship between pictures and comprehension is complex.

Levie and Lentz [5], in their 1982 review of 155 experimental studies comparing text plus pictures with text alone, concluded that comprehension was consistently better

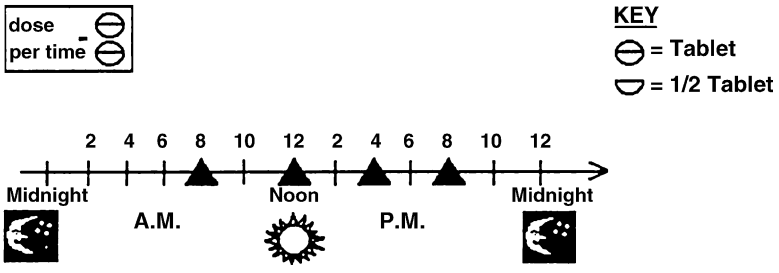

Fig. 3. Example of picture that does not integrate information on when to take pills: $N = 81$. (From Morrow et al. [21], used with permission).

when pictures related to information in the text. However, pictures that are unrelated to text have no beneficial effect on comprehension. On average, students reading materials with pictures learned one-third more, an improvement equal to one-half a standard deviation of groups reading without pictures. They also found that the average learning gain due to the presence of pictures was five times greater in delayed recall than in immediate recall; that learning gain from pictures was more pronounced for poor readers than for good readers; and that pictures facilitate understanding spoken information more than they help in understanding written prose. Levie and Lentz also cite research indicating that pictures aid comprehension by providing a context for organizing information in the text—which is consistent with Morrow et al.'s [23] study of comprehension of medication instructions discussed above. In discussing the use of complex pictures, they recommend prompts and guidance to help the reader process the picture correctly. For example, magnify the key action or correct procedure, draw a circle around the key point, add arrow(s) to point to what to look at, and use bright, contrasting colors for key points. And, finally, they point out that pictures can sometimes be effective substitutes for words when the information to be conveyed is primarily visual.

More recent reviews by Fillippatou and Pumfrey [24] as well as Carney and Levin [25] conclude that research conducted in the 1990s continues to confirm that pictures can enhance comprehension. In addition, they cite findings that pictures are most helpful with complex text and that students with low prior knowledge are especially likely to be helped by pictures. They also point to the importance of proximity between text and pictures and/or the use of captions to help students interpret pictures and in guiding viewers to the most important parts of pictures. And, finally, they cite research showing that cognitive style plays a role. Students who are ''imagers'' profited more from the addition of pictures than did students who were primarily ''verbalizers.''

However, all of these reviews, and especially the 1996 review by Fillippatou and Pumfrey [24], also point out that, while pictures are almost always helpful, there are situations, where pictures can interfere with comprehension, especially among beginning or very poor readers. Fillippatou and Pumfrey note that, when a picture is used to integrate information, but the reader does not understand the information being integrated, the picture will be meaningless. Readers may then use the picture to guess the intended meaning, often incorrectly, and think that they understand the message, thereby interfering with their comprehension. They also cite evidence that the pictures may distract attention away from printed words, especially among poor readers who, research has shown, are more likely to attend to irrelevant aspects of the pictures. Their overall conclusion is that pictures that represent concepts that are beyond the reader's ability to understand may interfere with their comprehension. On the other hand, pictures that integrate information that they do understand, facilitate comprehension. Simple pictures without distracting, irrelevant details used with easy to read captions will minimize these problems for everyone and especially for people with low reading skills.

4.3. What kinds of pictures facilitate comprehension

Moll [26] investigated the effects of different kinds of pictures on comprehension of health information with 637 subjects. He compared different ways of illustrating a booklet on osteoarthritis and reported that the version with cartoon drawings had the highest comprehension scores followed by the one that used ''matchstick'' drawings, and, finally by the version that used photographs. Readance and Moore [27], in a review of education research on the effect of adjunct pictures on reading comprehension, concluded that ''line drawings seem to facilitate comprehension more than do shaded drawings or photographs and color photographs seem to have a greater effect than black and white pictures.''

Both papers suggest that simple drawings are most effective in facilitating comprehension. The advantage of simple drawings over more complex pictures may be due to their minimizing distracting details. Research has shown that people with low reading skills are more likely to attend to irrelevant details in illustrations than are people with higher reading skills [24].

4.3.1. Cultural relevance of the pictures

Cultural relevance of the pictures can play an important role in comprehension. Levie [6], in his review of research on pictures in education, pointed out that: ''Because we acquire our ability to interpret pictures largely without intent or awareness, we may be misled into supposing that our mode of picturing is truly the universal language. In fact, pictures are heavily laden with culture-bound conventions that must be learned if they are to be understood.'' Studies in health education have borne this out. Dowse and Ehlers studied responses by black Africans to standardized pharmaceutical pictures developed by the United States Pharmacopoeia [3]. They compared response to these pictures and to pictures representing the same actions but developed in close consultation with Black groups with high rates of illiteracy in South Africa. Interviews with a sample of 46 people with low literacy skills in South Africa showed significantly higher comprehension of the locally developed pictures in comparison to the standardized pictures. They also reported a strong preference for the African-based pictures. Examples of the two sets of pictures are shown in Fig. 4. It is interesting that the differences in the pictures appear to be small. Yet, these small differences were important to the people viewing the pictures. In order to capture these subtle, but important culturally relevant differences, Dowse and Ehlers recommend a multistage, iterative process in

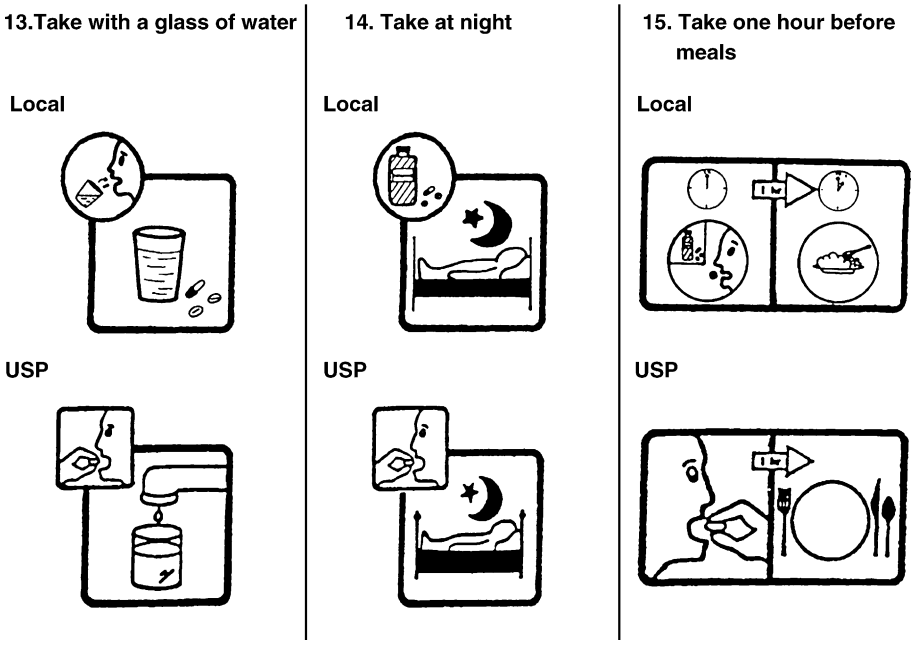

Fig. 4. Examples of drawings made locally and from the US Pharmacopeia: $N = 46$. (From Dowse and Elders [3], used with permission).

which the target population is involved at all stages of design and evaluation.

4.3.2. The role of captions in facilitating comprehension

Pictures can often be interpreted in multiple ways. The text that accompanies the picture usually guides the interpretation but, as was pointed out above, people with limited reading skills may by-pass the text and try to understand a message by guessing the meaning of the pictures. In addition, when the text includes abstract language, pictures may be interpreted differently even by people with high literacy skills. This problem is illustrated in Fig. 5 showing the many interpretations that a group of children give to one child's pose.

One way to deal with this problem is to include captions that explain the intended meaning of the picture and/or prompts within pictures such as labels or arrows within the pictures. Levie and Lentz [5] cite studies showing that instructing students on what to look for in a picture increased comprehension. Pettersson [28] showed that pictures typically generate a great variety of associations. He concluded that "pictures used in information and instructional

Fig. 5. An image can be interpreted in many ways. (From *The New Yorker Magazine*, used with permission).

materials should always have captions to guide the understanding of the content.''

An example of how captions can be used in health education is The American Geriatrics Society's Eldercare at Home booklets instructing family members how to care for older people at home [29]. The booklets' text is largely written at a tenth grade reading level. However, each action that a family caregiver should take is accompanied by a drawing showing a person carrying out that action along with a caption written at a second grade reading level. As a result, people who can understand writing at a second grade level can understand the actions being depicted and therefore generalize to actions that they should take. Since actions to be taken are the most important part of what is being communicated, people with only minimal reading skills are able to understand this key part of the message without being able to understand the more complex explanatory text. An example, from the Eldercare at Home materials, of the text written at a tenth grade reading level, accompanying picture and caption is shown in Fig. 6.

4.4. Hypotheses for future research on how pictures can facilitate comprehension of health-related information

The complexity of research on comprehension suggests that studies in and outside of health education can be an important source of hypotheses for health educators rather than a source of conclusions that can be applied directly to health education for adults. Based on our literature review, we propose five hypotheses for how pictures can facilitate comprehension of health-related information.

Research by Morrow et al. [23] as well as reviews by Levie and Lentz [5] suggest that pictures will add to comprehension of medical information beyond what is conveyed by words when the pictures show relationships among facts or ideas that the reader already understands. Common examples are: showing changes over time, how a medicine affects the body, how behavior affects health, or how parts of the body function in relationship to each other. But, at the same time, it is important that the person understand the facts or ideas that the picture is relating which further suggests that language simplification plays an important role by helping people understand facts and ideas that are represented in pictures.

Research by Moll [26] as well as Readance and Moore's review of education research [27] suggest that simple line drawings will maximize comprehension of health information, especially for people with low literacy skills.

Dowse and Ehler's research [3] and Levie's literature review suggest that culturally relevant pictures will facilitate comprehension more than pictures that are not culturally relevant to the viewing audience. It is likely that this will be especially important for people in cultures that have had little contact with western medicine.

Levie and Lentz's literature review of research in education [5] suggests that close proximity of pictures and related text or the use of captions with pictures will facilitate comprehension, especially among people with low literacy skills.

Levie and Lentz's review [5] also suggests that pictures will be especially helpful in enhancing comprehension of mechanical and spatial relationships. In health education, pictures are frequently and effectively used to show, for example, the steps in giving an injection or where the liver is located in the body and do so more easily and efficiently than words alone. However, words are still important in explaining the implications of the pictures and in explaining what is happening in the pictures. This hypothesis includes the same qualification as the first one, namely that the viewer must first understand the elements being related in the picture. So, for example, to understand a series of pictures showing steps in giving an injection requires prior understanding of what a syringe is and what it is used for. While this may seem obvious in industrialized countries where people are exposed to injections from early childhood, it cannot be assumed in many under-developed countries.

5. ''Recall''—can pictures help people remember information in health education materials?

5.1. Problem statement

Once a health message is understood, people must remember the message in order to use it. Health professionals frequently give important information by speaking, but usually only once. Studies show that patients remember from 29 to 72% of what doctors tell them, and the more information the doctor presented, the lower the recall rate [7]. And even with written instructions, most people read them only once and then rely on their memories when taking health actions. Even if they do refer back to the original document, they must first remember the type of information available and where to find it. Therefore, improving patients' recall of medical instructions can play an important role in helping them cope with illness.

Recall can be assessed in two ways: as ''free recall'' or as ''cued recall.'' In free recall subjects are asked to repeat what they read or heard without any cues or prompts. In cued recall (also referred to as paired associate learning) information is first presented in conjunction with some other stimulus and, when testing recall, the other stimulus is presented as a cue to stimulate recall. In the context of health education, free recall occurs when a patient reads or hears information about a health problem and, later, without any pictures or cues, remembers that information in deciding what actions to take or to tell to other people. Cued recall occurs when a patient reads or hears health information with an accompanying picture and later views the same picture to help remember the information. Since these two ways of assessing recall have different uses in health education, we will discuss them separately.

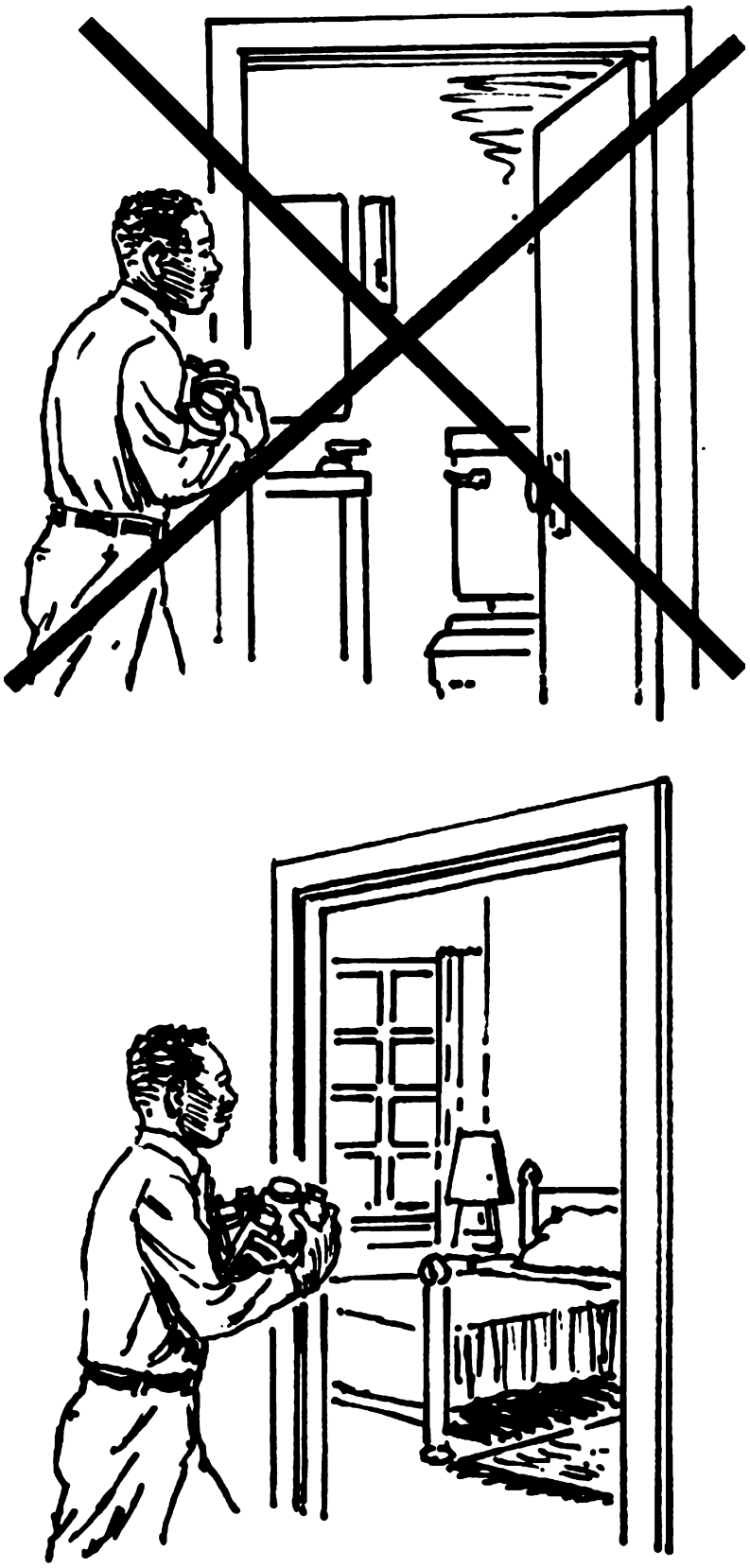

Fig. 6. Example of picture with text and caption from American Geriatrics Society's Eldercare at Home booklet on managing medications. (From Houts (Ed.) [29], used with permission).

5.2. Do pictures affect free recall of health communications?

We located five studies in health education that evaluated the effects of pictures on free recall. Three found higher recall when pictures were paired with text, one found no effect, and one found a positive effect for one group and a negative effect for another.

The Delp and Jones study [2] described earlier, reported a significant difference (46% versus 6%) in the percent of people who answered all wound care questions correctly when comparing patients who read an illustrated handout on managing lacerations at home and those who read just text. Similar findings were reported by Sojourner and Wogalter [30] who compared recall of medication information presented as just text, just pictures, and text with pictures where the text and pictures presented the same information ($N = 216$). They found that free recall was higher for the text with picture condition than for either of the other conditions. The text with picture format was also rated more positively than the others. Their study also compared responses of young group (mean age of 19) to older group (mean age 68). While the older group had lower recall in general, the picture/text condition had superior recall for both age groups.

Patel et al. [31] studied the effects of pictures and text on mothers' recall of instructions for preparing and administering a solution for the treatment of dehydration in children. Subjects were 40 mothers in rural Kenya with limited reading skills. Their study was designed to evaluate two versions of the text accompanied by the same pictures. While they found no differences in recall between text groups, they did find that mothers recalled information in the pictures at a much higher rate than information in either form of text.

Moll et al. [32] reported negative results comparing recall of information about gout in booklets with and without cartoons ($N = 50$). They found no difference in recall between the two versions of the booklet. In discussing their findings, they pointed to the high interest level of the readers, all of whom had gout, as a possible reason for the lack of differences between the groups as well as page layout issues. The fifth study, by Morrell et al. [33] compared recall of spoken prescription instructions with spoken plus pictorial representations. They compared responses of 64 young and elderly subjects and found that younger subjects' memory was facilitated by the addition of pictures, but that the pictures hampered the elderly subjects' memory. This is in contrast to the Sojourner and Wogalter's [30] findings, discussed above, that showed that both young and old people's memory was facilitated by pictures.

5.2.1. Other research on how pictures affect free recall

The effects of pictures on free recall has been studied extensively in both education and psychology. A literature search using the terms ''pictures and recall'' in ERIC, an education data base, yielded 216 references almost all of which reported that written or spoken text plus pictures are better remembered than just text alone. This is called the ''pictorial superiority effect'' in education research. There is speculation among researchers that the greater brain activation with pictures is responsible for the pictorial superiority effect [6].

The pictorial superiority effect has been demonstrated with a wide range of populations and, while the addition of pictures to written or spoken text enhances recall of diverse groups, it does not make their recall equal. Thus, for example, Winograd et al. [34] compared recall of 127 college students and 95 people over 50 years of age with and without pictures. While both groups showed the pictorial superiority effect, the college student group remembered more than the over 50 years of age group both with and without pictures. (Note also that these findings support Sojourner and Wogalter's [30] conclusion that pictorial superiority occurs for both young and older people.) Studies have also shown that the pictorial superiority effect is especially prominent with recall over a longer period of time [4,35] and there is some research suggesting that people who are more adept at visually representing their experiences will show a greater recall effect of pairing pictures with text [25]. We could find no studies reporting that the pictorial superiority effect was greater for certain kinds of content or pictures. More research is needed here.

5.3. Do pictures affect cued recall of health communications?

In cued recall, pictures are present during both learning and recall. A clinical example would be a health professional telling a patient or family caregiver how to treat a bed sore while viewing matching pictures and then giving them copies of the pictures to take home to serve as reminders of what was said. This use of pictures could be especially helpful to patients with very limited reading skills who have to rely entirely on memory of spoken instructions in managing their symptoms. We located two studies in health education that tested how cued recall compared to recall with just spoken text. Houts et al. [36] studied recall of spoken instructions for managing illness symptoms when pictures representing those instructions were present during both learning and recall. In their study, 21 subjects listened to two lists of instructions for managing symptoms followed by a distracting task, followed by recall testing. One list was read while subjects viewed pictures that represented each of the instructions while the other list was read without pictures. The instructions without pictures were tested using free recall while the lists of instructions with pictures were tested using cued recall where subjects saw the pictures. The order in which the lists were presented as well as which list was accompanied by pictures were counterbalanced in the study design. Since each subject was tested in both

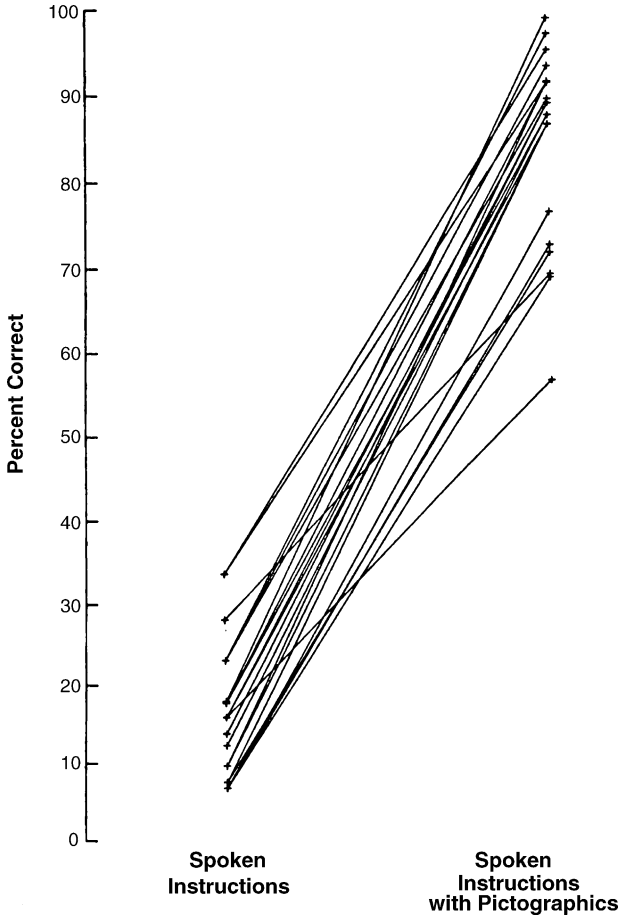

Fig. 7. Recall of spoken health instructions with and without accompanying pictures. Each subject was tested under both conditions with lines connecting their scores: $N = 21$. (From Houts et al. [34], used with permission).

conditions, it was possible to compare each person's recall with and without pictures. The results in Fig. 7 showed a recall mean of 15% with just spoken instructions and a recall mean of 85% with spoken instructions plus pictures. This difference was statistically significant ($p < .001$).

A follow-up study by Houts et al. [37] showed that 21 people with less than fifth grade reading skills could, on average, remember 72% of 192 medical instructions for a month with the help of pictures. These findings suggest that cued recall could be a practical way to help people with low reading skills manage complex illnesses. It would give them access to information that, otherwise, would only be available to people who can read.

5.3.1. Other research on how pictures affect cued recall

The pictorial superiority effect has been demonstrated with cued recall (paired associate learning) outside of health education [6]. The effect appears to be as robust as with free recall. As with studies of pictorial superiority in free recall, we did not locate any studies indicating that pictorial superiority was greater for different kinds of pictures or topics.

5.4. Hypotheses for future research on how pictures affect recall of health-related information

The large number of studies reporting greater recall of text when accompanied by pictures (the pictorial superiority effect) leads to the hypothesis that the addition of pictures to health education written or spoken text will increase free recall for almost everyone and for almost all types of information, but especially for spoken information. An important area of future research should be to identify exceptions to this generalization including the possibility that elderly patients and patients with a high degree of knowledge of the subject matter may not show pictorial superiority [32,33].

Houts et al.'s research in cued recall [36,37] suggests that spoken medical instruction accompanied by pictures which patients take with them will significantly improve care at home of people with low literacy skills because it will reduce their need to rely on printed text for health instructions.

6. "Adherence"—will pictures influence people's intentions and behavior in response to medical instructions?

6.1. Problem statement

Behavior or ''adherence'' is the final and most important outcome for health education. It is not enough to notice, understand, and remember a message. The person must carry out the recommended actions. Adherence involves two steps: accepting the message as something the person should act on and then actually carrying out the recommended actions. We consider these steps (intending and acting) separately.

6.2. Do pictures affect health intentions and behavior?

Three studies have investigated whether pictures affect the intention to carry out recommended health behaviors. In the first of these studies Whatley et al. [38] studied 196 patients over age 65 with joint pain and randomly assigned them to three groups to evaluate three versions of a patient information leaflet describing a hypothetical pain medication. One version of the leaflet was just text, but without numerical information about expected benefits and side effects. The other two had the same text plus icons and graphs showing expected benefits and side effects numerically. After reading the booklets, they asked all patients about their willingness to take pain medicines in general and then about their willingness to take the medicine described in the information leaflet that they read. They found that patients receiving the version with just text were less likely to take the new medicine than pain medicines in general. On the other hand, patients who saw numerical information with icons and graphs were just as likely to take the new medicine

as to take pain medicines in general. Interpretation of this study is difficult because the icons and graphs showed numerical information that the control group did not have. Therefore the differences among groups could be due to the amount of information and/or to the icons and graphs.

The second published study by Roter et al. evaluated the effects of a photo novel that dealt with asbestos hazards [39]. A photo novel tells a story in comic book-like format, but uses photographs in place of drawings. Copies of a photo novel about asbestos hazards or an NCI asbestos pamphlet were mailed, with an evaluation questionnaire, to a random sample of 500 members of a building trades union. There was a 21% response rate with approximately equal numbers in each group. The authors reported that "almost 60 percent of the photo novel respondents (compared to 40% of the NCI booklet respondents) indicated that, after reading the booklet, they thought they would become more active in union health and safety activities." However, the authors did not report statistical test results and there is a possible confound: the readability level of the NCI booklet was higher than for the photonovel (fifteenth grade versus eighth grade). In discussing these findings, Roter et al. emphasized the importance of using people from the intended audience in developing the materials to help insure that the photos and their accompanying stories are culturally relevant and meaningful for the audience as discussed in Section 4.3.1 above.

In the third study, Labranche et al. [40] reported on the effects of illustrated and non-illustrated brochures about breast self examination on 61 women's intentions to perform breast self examination (BSE) in the next month. The illustrations were photographs of women receiving a breast examination from a male physician. They found no difference in intentions for the two groups. However, they did find that women who were upset by erotic materials responded differently to the pictures than did women who were not phobic about erotic materials. Specifically, the phobic women felt they were less competent in doing BSE if they saw the photographs while the non-phobic women felt that BSE was a more important procedure if they viewed the photographs and that the information was easier to understand. These relationships between patient characteristics and attitudinal responses to pictures in health education indicates the complexity of patient responses to pictures and suggests that, while different types of pictures may not affect stated intentions, they may still have different effects on behavior of different audiences.

We located two studies showing that pictures can affect health behavior. As explained earlier in this paper, The Delp and Jones study, where 234 emergency room patients were given written instructions with and without pictures for managing lacerations, found that, not only were instructions with pictures more likely to be read and remembered, they also found that people who received the illustrated instructions were more likely to do what was recommended in the instructions (77% versus 54%.) This difference was statistically significant. They also reported a trend for a greater experimental control group difference among patients with less education. The second study, by Ngoh and Shepherd [41], investigated the effects of giving illustrated instructions to 78 non-literate women in rural Cameroon. After receiving spoken instructions about taking medications, experimental group women were given pictures to take home showing when to take the medicines. The pictures showed women similar to themselves taking the medicines in settings similar to those where they lived. Control group women received nothing beyond the initial spoken instructions. Adherence to the recommended procedures for taking medicine was assessed four or more days later, but within the time period of the prescription. Adherence was assessed during a home visit by counting pills remaining from the prescription. Results showed that patients in the picture group took, on average, 90% of the pills prescribed for the time period as compared to 78% for the control group. This difference was statistically significant. Ngoh and Shepherd developed their drawings in close consultation with people in the population who would use them. They concluded that, for pictures to be effective, they must be meaningful to people in the audience (i.e. culturally relevant) and must be tied to simple, understandable words. Examples of pictures used in the Ngoh and Shepherd study are shown in Fig. 8.

6.2.1. Other research on how pictures affect intentions and behavior

We also located three studies in marketing research on how pictures affect behavior. Gueguen and Legoherel [42] studied the effects on tipping of a barman of drawing a sun on the bottom of the customer's checks. They found that both frequency and size of tips was larger when the picture was present. Perrine and Heather [43] compared the effects of including a picture of puppies in appeals for anonymous donations to a humane society. They found that more money was donated when the appeal contained the puppies picture as compared to appeals with just text. However, Isen and Noonberg [44] reported opposite results. They compared face-to-face requests for March of Dimes contributions with and without a picture of a handicapped child. They found that people who were shown the picture contributed less than people who were not shown the picture. Perrine and Heather discussed the differences between theirs and Isen and Noonberg's study and hypothesized that people may have perceived the picture of a handicapped child as deliberate attempt to manipulate their emotions and, therefore had a negative response to the request. Another explanation is that uncomfortable feelings from seeing a handicapped child generalized to an uncomfortable feeling about the program.

6.3. Hypotheses for future research on how pictures affect adherence

Research on relationships between pictures and behavior suggests a complex relationship. We propose three hypotheses based on the findings summarized above.

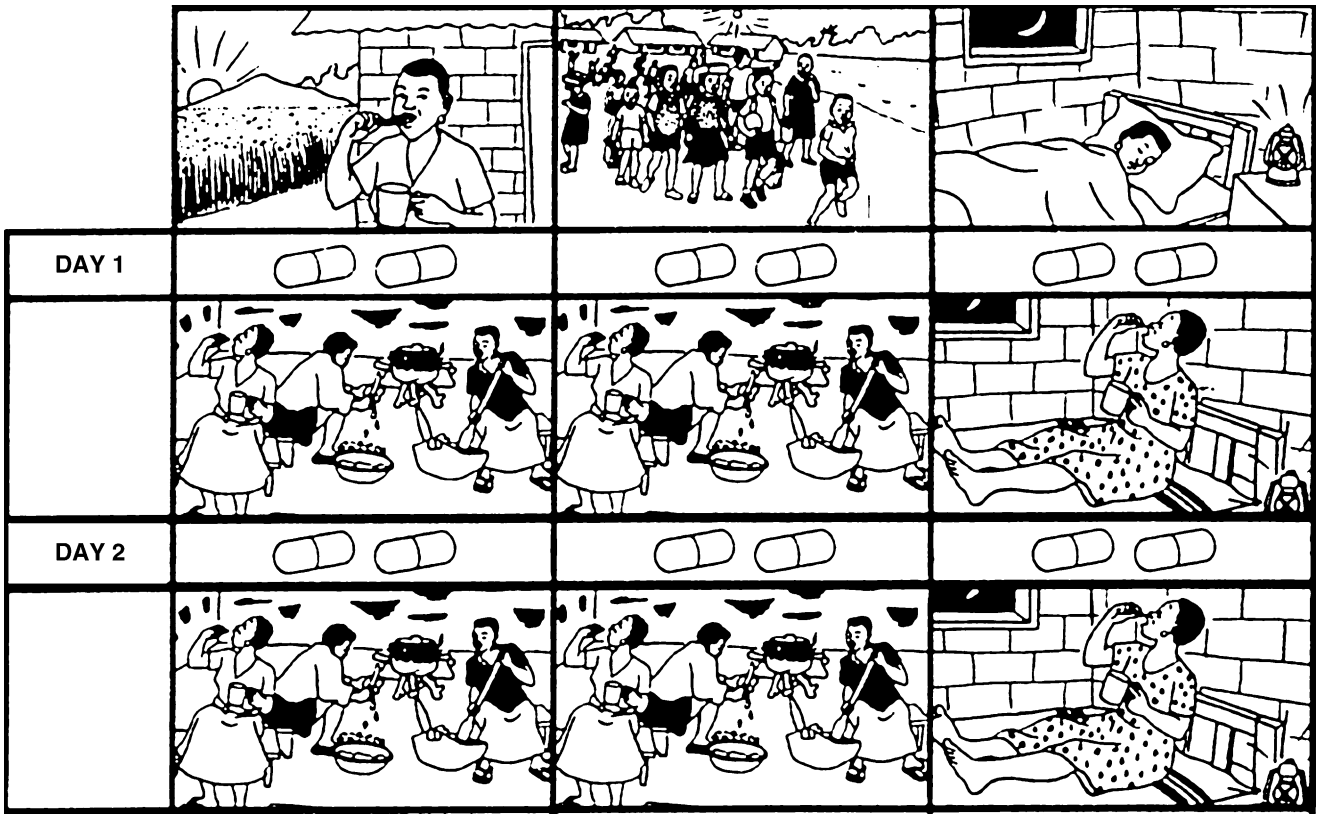

Fig. 8. Examples of pictures given to nonliterate women in rural Cameroon to explain when to take pills: $N = 78$. (From Ngoh and Shepherd [39], used with permission).

Research in both health education and marketing suggest that the addition of pictures to health education materials will change both intention and behavior, but whether the change is positive or negative depends on the audience's emotional response to the picture. Positive emotional responses will increase the target behavior while negative responses will decrease the behavior. How people respond emotionally depends on both the nature of the picture and the audience's predisposition in responding to the picture content. Some picture content will elicit similar responses from most people, such as an icon [21], a picture of puppies [41] or humorous cartoon characters [2], and therefore, can be expected to influence most people in the same way. Some pictures, such as photographs of a male doctor examining women's breasts [40], will elicit different responses from different people and, therefore, may have variable effects on behavior.

Studies by Dowse and Ehlers [3] and Roter [39] showing the importance of cultural sensitivity suggest that pictures of people who are similar to the viewer will have a greater effect on behavior than pictures of unfamiliar, different people. This is especially important when explaining medical issues to people who are unfamiliar with western medicine as demonstrated in the Ngoh and Shepherd study. [41].

The Delp and Jones study [2] suggests that the addition of pictures will have a greater effect on the behavior of people with low literacy skills than on people with high literacy skills. People who have difficulty reading may be more influenced by material with pictures because they are accustomed to making inferences from pictures and because they are unable and/or uncomfortable reading words.

7. Discussion

The research cited in this paper shows that adding pictures to written and spoken language can increase patient attention, comprehension, recall and adherence. In many cases these benefits were large. The effectiveness of health communications can be significantly increased by including pictures in the design of new health education materials. Furthermore, many existing health education materials could be improved by the judicious addition of pictures. More research is needed, but the potential for enhancing health education is clearly established.

Our review also suggests that pictures can be especially helpful to patients with low literacy skills. Understanding health information, recalling health instructions and adhering to health instructions are the areas where research results have been promising. Specifically, research suggests that pictures can help low literacy people understand relationships, provided that they under-

stand the elements being related. Research also suggests that spoken information can, with the help of pictures, be recalled to a high degree by people with low literacy skills. This could enable people with low literacy skills to make optimum use information spoken by medical staff. And finally, two studies [2,41] suggested that people with less education are especially likely to adhere to medical instructions accompanied by pictures. While pictures are not a panacea, they can play an important role in helping people with low literacy skills to understand and use health information.

7.1. Theoretical context

McGuire's communication/persuasion theory [1] is helpful in providing a framework for identifying important future research directions. As explained in the Introduction of this paper, McGuire proposes 13 ''output variables'' of which four directly relate to the presentation elements discussed here. Several others, especially skill acquisition, cognitive elaboration, and cognitive consolidation are also ways that pictures may affect the communication/persuasion process. Research on these topics could significantly expand our understanding of the role that pictures can play in health communications. McGuire's theory also calls attention to possible interactions among output variables. For example, realistic photographs may be effective in drawing attention, but because the camera captures so many details, the details may interfere with comprehension. If this was the case, then health educators would have to decide which was most important for a given project—attracting attention or maximizing comprehension—and choose between them. Research on such interactions can make important contributions to further understanding the contribution that pictures can make to patient care and quality of life.

8. Practice implications: a summary of recommendations for using pictures in health education

The following recommendations combine research findings discussed above with the authors' experiences in working extensively with pictures in health education—both in creating and evaluating printed materials. We also draw on recommendations by Dowse and Ehlers [45] and by Rohret and Ferguson [46] in their earlier reviews of the role of pictures in health education. We offer seven recommendations.

8.1. Health educators should look for ways to include pictures in their health communications

Think visually and ask ''how can I use pictures to support key points.'' This literature review has shown that pictures can improve the effectiveness of health education materials. It is now for educators who create those materials to become visually oriented and to link pictures with text frequently and creatively.

8.2. Use the simplest drawings or photographs possible

This especially helps viewers with low literacy skills to understand the intended message without being distracted by irrelevant details. Dowse and Ehlers [45], in their review of pictograms in pharmacy, also recommend using simple, realistic pictures with limited content, using whole body images as reference for body parts, and minimize using abstract symbols. When using a sequence of pictures, explain the sequence with simple words because people with low literacy skills may see no connection between sequential pictures.

8.3. Simplify language used with pictures

If the text, which the pictures represent, is unclear to the reader, the meaning of the pictures may be unclear as well. Effective use of pictures builds on a foundation of clear language. Pictures will be more easily understood when the accompanying text is clear.

8.4. Guide how pictures are perceived and interpreted by the viewer

Without guidance in how to interpret a picture, viewers will develop their own interpretations that may be different or even inconsistent with those intended by the authors. One of the simplest ways to link pictures and text is through picture/text proximity. If the information is spoken, it is important to point to related pictures during the explanation. Captions that describe what is happening in a picture can often be written at a low literacy level thereby helping people with limited reading skills understand the intended meaning of the pictures.

8.5. Be sensitive to the culture of the intended audience in creating or selecting pictures for use in health education materials

This is especially important when communicating with people who have had little exposure to western medicine. While not formally tested, it is likely that cultural sensitivity will play a role in whether people attend to education materials as well. Cultural sensitivity includes using familiar objects and symbols, as recommended by Dowse and Ehlers in their review of pictograms in pharmacy [45]. People from the target audience should be involved in creating the pictures as was done in studies by Ngoh and Shepherd [41], Roter et al. [39] and by Dowse and Ehlers [2].

8.6. The sixth recommendation, which we share with Dowse and Elhers [45], is that health professionals should be actively involved in creating the pictures

Health professionals should explain the intended message to the artists as well as the outcomes they desire. It is a mistake to ask artists, who do not have the background to fully understand the intended message, to create images without guidance from professionals who do have that understanding.

8.7. Evaluate the effects of pictures

Research in all four areas (attention, comprehension, recall, and intention/adherence) showed that pictures can, in most instances, provide significant benefits. However, since results were not always consistent, one cannot predict with certainty how people will respond to pictures in every health communication. This is why we have proposed hypotheses for future research rather than conclusions in this review. As you plan to use pictures in health education materials, be sure to include systematic evaluation of their effects. Evaluation consists of follow-up interviews that assess attention, understanding, remembering, and adherence. This design can also be used to evaluate the effects of different kinds of pictures as was done by Morrow et al. [23]. The best way to evaluate pictures is to use them in a clinical setting. The Delp and Jones research design [2] is simple and easily implemented. All patients receive the same written text but only some receive pictures to accompany the text.

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