ITERATIVE TEST AND DEVELOPMENT OF PHARMACEUTICAL PICTORIALS

Amy Barlow Magumo North Carolina State University Raleigh, NC, 27695-7801

Jill R. Kohake North Carolina State University Raleigh, NC, 27695-7801 Michael S. Wogaiter North Carolina **State University** Raleigh, NC, 27695-7801

Jennifer Snow Walf Georgia Institute of Technology Atlanta, GA, 30332

ABSTRACT

The current research tests a set of pictorials from the U.S. Pharmacopoeia Convention (USPC) plus a set of redesigned pictorials developed based on (a) error analyses of previously-tested subjects and (b) rough illustrations produced by focus-groups. The results showed that several of the revised designs were more successful in capturing the correct meaning than the originals. However, in other cases the revised pictorials were still unable to gamer an adequately large percentage of correct answers. The processes involved in the redesign of pictorials are discussed.

INTRODUCTION

The hazards of many kinds of pharmaceutical drugs are not commonly known by the public. Although information is available from a variety of sources (e.g., inserts, advertising, news media, physicians, and pharmacists), often the only educational printed materials that are directly aimed and available to users at the time they take medications are those printed on the label. However, this method of communication can be ineffective for certain populations of users. The print on the labels may be too small for persons without good vision (e.g., presbyiopics) or not understandable to persons unable to read the printed language (e.g., illiterates and some non-native speakers).

Besides printed language, another potentially beneficial method for alerting people to the proper use of medications is pictorials. Research has indicated that pictorial road signs can be identified at greater distances (smaller visual angle) than the associated-verbal message signs occupying the same surface area (e.g., Jacobs, Johnston, and Cole, 1975). Also, persons who do not understand the language of the printed label could potentially acquire the information from the illustrations. These benefits assume that the pictorials are sufficiently well designed to convey the appropriate information to the user.

The U.S. Pharmacopoeia Convention (USPC) has produced a set of label designs that combine pictorials and brief verbal descriptions that represent 30 different concepts (e.g., "Take at bedtime," "Place drops in ears").

Persons able to read the material can obtain that information from the printed verbal description, but other persons who are unable to read the text must rely on the pictorials to comprehend the instruction. Only one study (Wolff and Wogaiter, 1993) has examined whether these pictorials adequately communicate the intended meanings, and only a subset of the pictorials was evaluated. One purpose of the current research was to perform additional comprehension testing of the USPC pictorials.

Most research on pictorials has focused on comprehension testing of already-existing pictorials (e.g., Collins, Lerner, and Pierman, 1982; Laux, Mayer, and Thompson, 1989). However, there has been virtually no research on pictorial redesign. Indeed, virtually all prior work in this area shows that one or more of the concepts being tested were not adequately communicated by the pictorials under study. After pointing out that the pictorials did not reach some acceptable level, the research usually goes no further. The question left unanswered is whether the pictorial(s) can be redesigned for greater understandability.

One reason for the deficiency of research in this domain is that the testing process itself involves considerable cost (in terms of time, effort, and funding). Further work on the redesign of misunderstood pictorials involves evaluating the wrong answers from earlier testing, generating new ideas for the pictorials, drafting the alternative depictions, and testing them. Thus, the complete process can require a long period of systematic investigation and development. Because of the need for communicative pictorials, it is important to document the process and demonstrate that this set of procedures can produce improved pictorials. Thus, a second purpose of the present research is to describe one of the later phases in this ongoing process of pictorial redesign.

One of the major costs of testing pictorials is the collection of data from the relevant target populations (e.g., the elderly, illiterates, and non-English speakers). Iterative cycles of test and redesign using these populations could be prohibitively expensive for researchers and designers. As outlined in Wolff and Wogalter (1993), this cost can be reduced through preliminary iterative redesign and testing of deficient pictorials using readily-available "convenience" subjects. These procedures are performed under the reasonable working assumption that if educated individuals with good vision are not able to understand the pictorials, it probably indicates that the pictorial will not survive comprehension testing with more disadvantaged populations either.

Because of its iterative nature, the project involves several phases. The first six phases were described in a report by Wolff and Wogalter (1993). In that study, the pictorials were initially tested for comprehension using the International Standards Organization (ISO) criterion of 85% correct as a cutoff value for acceptable pictorials. This standard is arbitrary and, due to the importance of the label information for the safe use of pharmaceuticals, it was considered desirable to increase the comprehension beyond that level if possible. When an error analysis of participant responses indicated a high level of wrong answers and perhaps more importantly, confusion, pictorials were redesigned in an effort to clarify the pictorial with respect to the intended concept. Wolff and Wogalter (1993) presented an analysis of subjects' incorrect responses and described the use of focus groups to generate alternative images for the misunderstood pictorials. The present research describes the testing of the pictorials created subsequent to the Wolff and Wogalter (1993) study.

METHOD

Participants

Two hundred sixty-five individuals from North Carolina State University and the Raleigh, North Carolina community were tested. These individuals ranged in age from 11 to 74 (M = 26.8, SD = 11.1), were almost equally divided on gender (49% male, 51% female), and included students (54%), full-time working people (41%), and unemployed or retired individuals (3%). Ethnic backgrounds generally approximated the national distribution, with 80% Caucasian, 12% Afro-American, 5% Asian, 1.5% Hispanic, and 1.5% other. Participants' education levels were 11% high school or less, 62% technical training or some college, and 27% college graduate.

Materials and procedure

Thirty original USPC pictorials and 38 revised pictorials were tested. The original pictorials were retested in this study to further document available comprehensibility. Fifteen concepts were represented only by the original USPC pictorial. For the other 15 concepts, the original versions were tested as well as redesigns based on the earlier findings by Wolff and Wogalter (1993). Some revised versions were tested for concepts that had achieved 85% or greater comprehension in earlier testing but for which higher ratings were desired. The pictorials were randomly assigned to groupings and assembled into booklets with 30 randomly ordered pictorials in each booklet. Only one pictorial for a given concept was assigned to a booklet to avoid assisting subjects on subsequently answered pictorials, and thus, any one pictorial was seen by only a subgroup of participants. The number of subjects viewing any given pictorial ranged from 35 to 265 participants. Participants were instructed to write out the meaning of each pictorial on a numbered answer sheet.

RESULTS

Responses were scored by two judges. To be scored correct, answers had to indicate that the participant understood the basic meaning of the verbal descriptions that accompanied the original USPC pictorials. Criteria were established before the scoring procedure took place as to what constituted the conceptual elements necessary for a correct response. Inter-observer agreement (number of times the two judges agree divided by number of opportunities to agree) was .93.

Eighteen of the original USPC pictorials performed at or above 85% comprehension (ISO cutoff) in this study, confirming many of the findings of Wolff and Wogalter (1993). Five of these concepts were also tested in revised form in an effort to improve comprehensibility. Three of the redesigns were more successful in capturing the correct responses than the originals. For example, the original pictorial for the concept "Store medicine out of reach of children" scored at 89% comprehension in this study. The four revised versions for this pictorial were higher (see Figure 1), ranging from 93% to 100% comprehension.

Twelve of the 30 USPC pictorials did not perform above the ISO cutoff of 85% comprehension. Redesigns for four of these concepts (i.e., "Do not break or crush

tablets or open capsules," "This medicine may make you drowsy,""Insert into rectum,""Do not store near heat and light") resulted in correct responses better than 85%. However, in eight cases ("Do not take other medicines with this medicine,""Insert into vagina,""Take by mouth," "If you have questions, call this number," "Take I hour before meals,""Take 2 hours before meals," "Take 1 hour after meals," and "Take 2 hours after meals"), the revised pictorials were still unable to garner enough accurate definitions to reach the ISO criterion. Analyses of the responses for these pictorials were performed to determine why errors were made. For example, participants often misinterpreted the four pictorials "Take one (or two) hours before (after) eating" which suggested that alternative methods of indicating time should be used. These analyses provided input for revisions of these pictorials, to be tested in the next stage of the project.

DISCUSSION

The benefits of good pictorials are clear. They can assist individuals who are unable to read printed language, either because of poor eyesight or inadequate language skills. To be useful in this regard, they need to communicate their intended meaning to these persons. Thus testing is necessary to assure that the pictorials are able to convey the appropriate message, and where a pictorial fails to perform adequately, it needs to be redesigned so that it does. The present study is a demonstration of the process of testing, development, and retesting of a set of pharmaceutical pictorials and it serves as a description of the procedures that future pictorial development might take. In particular, the present project illustrates that low cost testing can be performed in which the preliminary iterative cycles can use "convenience" participants to point out poor depictions.

In doing so, there is greater assurance that the evaluation includes depictions of the desired concepts that are likely to pass criterion in subsequent testing.

The results of this study again show that some of the

original USPC pictorials were not well understood by participants (cf. Wolff and Wogalter, 1993). However, the results also show that several of the revisions were successful in capturing identifications that were better understood than the original, surpassing the 85% acceptability criterion. At the same time, a few of the revised pictorials were still unsuccessful at communicating the intended concepts. Analysis of response errors in this study suggests some ways that these pictorials could be improved.

The present research is part of a continuing study of pharmaceutical pictorials. The project is now near a point where it is appropriate to test the pictorials on a representative, random sampling of the target population, stratified according to age, language skills and cultural background. The present study demonstrates that preliminary testing can reveal those pictorials that are likely to fall below a comprehension criterion in testing that involves expensive sampling procedures. Information collected from preliminary testing allows for a way to make revisions of pictorials before formal testing is undertaken. Thus, the cost and number of test-andredesign iterations using samples of the target populations might be reduced because potentially better alternative pictorials have been designed in advance.

REFERENCES

Collins, B. L., Lerner, N. D. and Pierman, B. C. 1982. <u>Symbols for industrial safety</u>, (Technical Report NBSIR 82-2485, U.S. Department of Commerce, Washington, DC).

Laux, L., Mayer, D. L. and Thompson, N. B. 1989, Usefulness of symbols and pictorials to communicate hazard information, in <u>Proceedings of Interface '89</u> (Human Factors Society, Santa Monica, CA),79-83.

Jacobs, R. J., Johnston, A. W. and Cole, B. L. 1975, The visibility of alphabetic and symbolic traffic signs, <u>Australian</u> <u>Road Research.</u> 5 (7), May, 68-86.

Wolff, J. S. and Wogalter, M. S. 1993, Test and development of pharmaceutical pictographs, in <u>Proceedings of Interface</u> <u>193</u> (Human Factors Society, Santa Monica, CA), 187-192.



