Health Literacy Demands of Written Health Information Materials: An Assessment of Cervical Cancer Prevention Materials

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Background: *Health literacy requires reading and writing skills as well as knowledge of health topics and health systems. Materials written at high reading levels with ambiguous, technical, or dense text, often place great comprehension demands on consumers with lower literacy skills. This study developed and used an instrument to analyze cervical cancer prevention materials for readability, comprehensibility, suitability, and message design.*

Methods: *The Suitability Assessment of Materials (SAM) was amended for ease of use, inclusivity, and objectivity with the encouragement of the original developers. Other novel contributions were specifically related to "comprehensibility" (CAM). The resulting SAM + CAM was used to score 69 materials for content, literacy demand, numeric literacy, graphics, layout/typography, and learning stimulation variables. Expert reviewers provided content validation. Inter-rater reliability was "substantial" ($\kappa = .77$).*

Results: *The mean reading level of materials was 11th grade. Most materials (68%) scored as "adequate" for comprehensibility, suitability, and message design; health education brochures scored better than other materials. Only one-fifth were ranked "superior" for ease of use and comprehensibility.*

Conclusions: *Most written materials have a readability level that is too high and require improvement in ease of use and comprehensibility for the majority of readers.*

Introduction

Research continues to reveal the association between literacy and health. Literacy is defined as "using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential."[1] Relationships between literacy levels and heart disease, physical health, and rates of hospitalization have been documented.[1-3] Evidence demonstrates that patients with lower health literacy incur higher health care costs,[1,4] and health literacy has been linked to lower use of preventive services such as Pap tests, mammograms, and dental care.[5,6] The Institute of Medicine and *Healthy People 2010* define health literacy as the "degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions."[7] Functional health literacy requires complex, multidimensional skills, including reading, writing, listening, numeric literacy, oral and visual communication, and decision-making abilities. It also calls for an understanding of health topics (such as cervical cancer) and the ability to navigate health systems.[8,9]

Written health education materials and forms, which the health system

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Abbreviations used in this paper: SAM = Suitability Assessment of Materials, CAM = Comprehensibility Assessment of Materials, HPV = human papillomavirus, IRR = inter-rater reliability.

most often relies on to convey information and treatment procedures, place certain "demands" on their users or readers. These demands compel health consumers to use their functional health literacy skills to read (at different levels), interpret, comprehend, analyze, and apply the information they gain from these written materials. These demands may be substantial if materials are written at a high reading level, if text and format are too dense, or if concepts are ambiguous and nonmotivating.

Thus, health literacy is not a one-sided issue, limited to the capacity or capabilities of the patient/client. Indeed, the health system itself places complex demands on health consumers. These demands include requiring people to self-manage their health care, read difficult texts, and understand their health rights, as well as obliging them to find their way (navigate) in confusing clinic/hospital settings with technical medical signs or without conveniently placed or easy to read maps.[10]

National Literacy Assessments

In 2003, the National Assessment of Adult Literacy (NAAL) was conducted in the United States with more than 19,000 adults. The NAAL included a separate literacy component intended to measure adults' ability to use literacy skills to read and understand health-related information. The results indicated that most (53%) adults had intermediate health literacy, and 12% scored in the proficient range. The remaining 36% of US adults had basic (22%) and below basic (14%) literacy on health-related items in the NAAL. Those performing in the two lowest literacy levels were more likely to be poor, be elderly, have a disability, or be a member of a minority group, such as those for whom English is a second language. The individuals from these groups are generally those who are identified as most at risk for health problems and health disparities.[11]

Mismatch Between Health Literacy Function and Demand

People with poorer abilities to read or understand written materials face specific barriers in attempting to understand health issues, prevent disease, or access health services or insurance. Researchers have described the serious "mismatch" that occurs between the "the literacy levels of the intended audience and the materials that have been created for that audience."[12] Most patient education materials and health system forms — including cancer-related materials — are written at an unacceptably high reading level.[13-15]

To further assess whether a mismatch exists between "average" user skills and commonly available materials, we developed a tool to examine the literacy demands of health information materials such as newspaper and magazine articles, health education brochures, insurance forms, and test result notifications. Many instruments (such as Fry,[16] SMOG,[17] and Flesch-Kincaid[18]) have been developed to examine readability, but few examine constructs of format (organization, layout, structure and/or programming type), tone (mood created by writing style), accuracy of content, or use of terms such as medical phrases.

Cervical Cancer Prevention Focus

Cervical cancer was diagnosed in more than 11,000 women in 2008 in the United States, and approximately 3,870 women died of the disease.[19] Routine provision of Pap testing has resulted in a significant drop in cervical cancer mortality over the past 50 years, and in the last 20 years, the putative cause of cervical cancer, the human papillomavirus (HPV), was discovered.[20] In June 2006, a vaccine has been licensed that is 100% efficacious against two strains of HPV, 16 and 18, that are found in 70% of cervical cancer cases.[21] The excitement over the release of the vaccine and continued emphasis and clarification on Pap testing recommendations have led to the development and dissemination of a plethora of publications including newspaper and magazine articles, health education brochures, and revised insurance and health system forms. We took the opportunity of this renewed attention to cervical cancer prevention to examine a sample of materials from the vast array of cervical cancer prevention publications that are now commonly available to the public.

Methods

One instrument that has often been cited as comprehensive and useful for materials review is the *Suitability Assessment of Materials* (SAM) by Doak et al.[22] "Validation [of the SAM] was conducted with 172 health care providers from several cultures. The cultures included Southeast Asians, Native Americans, and African Americans…" among others.[22]

Given the relative strengths of the SAM, we set out to use it as an assessment tool. However, we soon recognized that important concepts were not addressed in the SAM, such as numeric literacy factors, persuasive techniques, behavioral theory, and communication assessment. Numeric literacy factors include whether numerals are present in a form other than fractions, percentages or probabilities, whether percentages (other than 100%) are minimally used, whether words like "same as, more/less than" are used to help the reader determine the meaning of numbers (eg, "…types of HPV cause *more than* 90% of cervical cancers"), and whether frequencies are used instead of probabilities (eg, "3 out of 10,000" vs ".0003"). Persuasive techniques include the use of purposive repetition, testimonials, and audience-relevant values or symbols. Communication and behavioral theory elements include whether the text clearly stated the benefits of taking a particular action (other than the traditional "because it's good for

you"), described ways to overcome barriers to changing behaviors, presented content or messages in an unusual or novel manner to attract attention (such as comic book format),[23] or presented information using a gain or loss frame.[24] We also found it inefficient to use the original SAM scoring sheet because it was separate from the SAM evaluation criteria. Coders had to use two information forms, constantly referring back to the description of scoring criteria for each variable, then finding their place again on the scoring sheet to fill in the appropriate rating. Placing the scoring criteria on the same form as the scoring sheet made the coding process less time-consuming.

The team determined to use the SAM as a framework, but they incorporated scoring criteria and explanations into one comprehensive form, added missing components, and clarified and added examples to basic SAM variables. This allowed for better evaluation of necessary features found in written materials, beyond those contributing to readability and basic suitability, that contribute to barriers in understanding and using text.

Instrument Design

Following the process developed by Chatterji[25] for designing or selecting an assessment tool, the research team first determined that the *population* to be studied would be a variety of commonly available, text-based materials (newspaper/magazine articles, brochures, health system forms) about cervical cancer prevention. The *constructs* to be examined were readability, comprehensibility, and use of relevant communication and behavioral theory in message design. The two *purposes* of the instrument were to evaluate text-based materials on variables related to each construct and to identify constructs that could be improved to reduce the demands materials place on low-literacy users.

Original SAM Scoring Criteria Provided in Book Chapter
(Variable: Interaction Included in Text and/or Graphic)

Explanation: When the patient responds to the instruction — that is, does something to reply to a problem or question — chemical changes take place in the brain that enhance retention in long-term memory. Readers/viewers should be asked to solve problems, to make choices, to demonstrate, etc.

Superior: Problems or questions presented for reader response.

Adequate: Question-and-answer format used to discuss problems and solutions (passive interaction).

Not Suitable: No interactive learning stimulation provided.

Original Separate SAM Scoring Sheet
(Variable: Interaction Used)

2 points for superior rating
1 point for adequate rating
0 points for not suitable rating
N/A if the factor does not apply to this material

Factor to Be Rated	Score	Comments
Learning Stimulation, Motivation **Interaction used**	____	____

Revised SAM + CAM Scoring Criteria and Scoring Sheet Combined
(Variable 19: Reader Interaction)

Evaluation Criteria	Category	Score	Comments
Superior: Depending on length of material, employs **at least 2** interaction techniques* (unless very short text-then 1 technique), like: ☐ Questions to which reader responds (quiz) ☐ Provides examples of info/questions for reader to tell/ask (as of doctor); encourage to write own questions ☐ Asks reader to compare/contrast visuals (before/after) ☐ Presents cases and have reader pick best solution ☐ Uses story to convey message ☐ Has reader complete a story ☐ Has things reader can cut out (coupons) **Adequate:** Material uses *only 1* of the above, OR a question/answer technique in which answers are already given. (Example: headings are questions, and section following answers the question.) **Not Suitable:** *No* interaction techniques used.	Variable 19: Reader Interaction	☐ Same scoring as in SAM	Interaction fosters interest, learning and memory. * Interaction does **NOT** mean people interacting in a picture. Examples of interactivity: Quiz: Do you smoke? ☐ Yes ☐ No Info to give doctor: • HPV symptoms you have (genital warts) and time of last Pap test. Write the questions that you want to ask doctor. Look at two pictures — one of normal cervix, one of dysplasia) and select the one you think is healthy. Stories can be short paragraph told in person's words/experience.

Fig 1. — Comparison of one SAM variable criteria and the corresponding revised SAM + CAM criteria. This demonstrates how review criteria in SAM + CAM were made more specific and quantifiable.

The SAM was modified as follows: (1) the assessment criteria and scoring sheet were combined into one form, (2) variables that address comprehensibility (factors making written material more understandable), numeric literacy (knowledge and skills needed to apply arithmetic operations using numbers found in printed material), theoretical and message design factors (eg, using positive role models to demonstrate appropriate behaviors, or loss-framed messages to promote Pap screening) were added, and (3) instrument objectivity and instrument reliability were improved through quantification of scoring criteria. Fig 1 provides an example of one such adaptation. To more completely assess comprehensibility demands, criteria were added to evaluate communication factors such as attention-getting features, message tone and framing, use of persuasive appeals, inclusiveness and relevancy, and numeric literacy (simple numeric presentation and calculation). The final instrument included six categories of variables (content, literacy demand, numeric literacy, graphics, layout/typography, and learning stimulation/motivation) and was named the SAM + CAM (*Suitability and Comprehensibility Assessment of Materials*), reflecting its ability to assess both the suitability and added compre-

SAM + CAM Categories	Category Operational Definition	SAM + CAM Variables
Content	*Content* (actual subject matter) is better understood if the text provides clues to help readers (1) easily grasp the intended goal or purpose of the material, (2) find a synopsis/re-telling of key points covered, (3) find information to help them practice behaviors that may solve their problem, and (4) trust the accuracy and reliability of information they are being given.	1. Purpose 2. Summary/Review 3. Desired Reader Behavior 4. Credibility
Literacy Demand	Beyond the reading grade level at which texts are written, materials place demands on or challenge users' comprehension in other ways. To decrease these *literacy demands* of materials, one can (1) use a writing style that is active, personal and easy to understand, (2) use common, explicit, non-technical terms, (3) provide explanations, analogies, or other techniques to reduce confusion, (4) place new information within a relevant context or provide background, and (5) keep the scope of the text concise, organized, and related to the stated purpose.	5. Writing Style 6. Vocabulary Helpers 7. Confusion Reducers 8. Context 9. Scope and Length
Numeracy (Numeric Literacy)	*Numeric literacy* entails having the ability to apply arithmetic operations using numbers found in printed material. To make it easier to understand numbers in text, (1) use numerals other than fractions, percents, or probabilities, (2) use helper words such as less/more than, and (3) do not require the reader to do calculations, such as estimating costs.	10. Numeric Presentation 11. Calculation
Graphic Material	*Graphics* includes both illustrations (pictures, photographs, borders) and charts, tables, maps, and graphs. Factors that make documents easier to understand include (1) limited use of graphs, tables, etc, or making them easier to comprehend with explanatory captions or "how to" instructions, and (2) use of illustrations that are familiar to viewers, are placed in context, are adjacent to related text, and have explanatory legends and other cues for better recognition.	12. Document Clarity 13. Illustrations
Layout/Typography	How text in materials is physically presented, arranged, and organized can influence the readers' comprehension. Careful *layout/typography* of materials can make them easier to understand by incorporating (1) short sentences and high contrast between paper and type, (2) larger type size that employs both upper- and lower-case letters, and (3) headings, lists, bullets, and logically sequenced sentences to guide the readers from beginning to end.	14. Layout and Organization 15. Typography 16. Subheading or Advance Organizers
Learning Stimulation/Motivation	If materials can stimulate or inspire readers' interest, prompt trial of certain behaviors, and/or help them accept the relevance of what they read, understanding and learning occur more easily. *Learning stimulation/motivation* is aided by (1) presenting content in unusual ways to gain attention, (2) addressing cultural differences and beliefs, (3) using techniques such as solving problems or answering questions in order to actively engage the reader in the content, (4) applying proven theoretically based learning concepts such as the use of models to demonstrate positive behaviors, (5) framing messages to promote self-efficacy, and (6) using certain persuasive techniques such as familiar values in message design.	17. Motivators to Attend to Text 18. Inclusion 19. Reader Interaction 20. Theory Application 21. Tone 22. Persuasion Techniques

Fig 2. — Operational definitions of the SAM + CAM categories.

hensibility aspects of materials. Fig 2 provides a list of these six categories and their operational definitions.

Validation

Several different activities were implemented to undertake reliability and validity assessment of the tool, including content validation, inter-rater reliability (IRR), and empirical validation. *Empirical validation* was undertaken by using the new tool to assess available health promotion and health education materials. To generate the sample of materials to be analyzed, the team utilized a lexicon presented by Rudd et al[1] that distinguishes among five health-related activity areas in which people take part and for which they need to access information. These five areas include health promotion (maintain one's health), health protection (learn about products or practices to preserve one's health), disease prevention (understand prevention and screening measures), health care and maintenance (seek health care, comply with treatment regimens) and systems navigation (how to access health services, understanding one's rights). For the sample, we selected a variety of commonly available materials relevant to each area; newspaper and magazine articles, brochures, book chapters, and even product advertisements, for example, provide health promotion, health protection and disease prevention information, while insurance application forms, informed consents, and medicine labels exemplify health care and maintenance and systems navigation materials. Web-based materials were selected if their format could be clearly read when printed and if they did not contain hypertext.

To help in developing assessment specifications and to implement *content validation* for the SAM + CAM, the team conferred with experts in health literacy. These expert reviewers were provided with versions of the new instrument, and their input and feedback with regard to format, content, and indicators were integrated into the final version of the SAM + CAM used.

Inter-rater Reliability

IRR was assessed using the Cohen's kappa (κ) statistic, as it is a conservative statistic that corrects for agreement that may occur by chance among raters.[26] Strength of agreement using the Cohen's κ ranges from "poor, slight, fair, moderate, substantial, to almost perfect." Substantial agreement (κ score between .61 and .80) was chosen as the lowest acceptable range for the raters to achieve for all SAM + CAM variables.[27]

Empirical Validation: Materials Review

To implement empirical validation, we collected a sample of 69 prevention-related written materials that focused on cervical cancer. As the purpose was to validate the SAM + CAM tool, we purposely chose materials that ranged from apparent low to high levels of complexity. The sample included 26 health education brochures, nine Web-based fact sheets, five magazine articles, two advertisements, eight health system forms, and seven chapters from books found in a local library. Because more recent information on HPV and the vaccine was found in the news, through a LexisNexis® (Reed Elsevier Inc, New York, New York) search, we also selected eight newspaper articles and four newspaper op-ed pieces. The Fry formula[16] was used to test the readability level of the materials as it was the method recommended for use with the SAM.

Three raters, all with Masters' level training in health education, used the new instrument to assess each text in terms of individual variables relevant to each of six SAM + CAM categories. The categories included (1) *content* (purpose, summary/review, desired reader behavior, credibility), (2) *literacy demand* (writing style, vocabulary helpers, confusion reduction, context, scope/length), (3) *numeracy* (numeric presentation, calculation), (4) *graphics* (table/graph/illustration clarity), (5) *layout/typography* (organization, typography and font, subheadings/organizers), and (6) *learning stimulation/motivation* (motivators to attend to text, inclusion, reader interaction factors, theoretical application, tone, and persuasion techniques). The raters scored each variable as "superior," "adequate," or "not suitable," added these scores to give each category a ranking, then averaged the category scores to provide an overall rating for the material. This overall rating, still in the context of superior, adequate, or not suitable, became the gauge of the level of health literacy demand the materials place on a user. Thus, a "superior" material placed *less* demand on readers, in that the material was easier to use and understand and was more relevant, attention-getting, and motivational than other texts. Data from the assessments were entered into an SPSS database (SPSS Statistics V13, SPSS Inc, Chicago, Illinois), and frequency statistics were run.

Results

Content Validation

The research team made revisions to the SAM + CAM based on the input and feedback of experts. In particular, Doak et al,[22] authors of the original SAM, approved the amplification of the scoring and explanation of the criteria as well as the structuring of them on the same sheet for easier use. They corrected certain guidelines — for example, pointing to research showing that "cartoons" can be highly effective in reader comprehension and recall — and the team also agreed with their assessment that the "using theory" variable was too complicated to score, given its current configuration.

Our expert reviewers recommended that the team replace semantic categories (a lot, some, none) with objective criteria (eg, 3 or more, 1–2, none). Reviewers also encouraged us to consider whether terminology used in the text was difficult for a reader to interpret or

whether it reflected or incorporated consumer health vocabulary.[28] Finally, they encouraged us to consider as part of our assessment of "suitability" and "comprehensibility" whether the information provided in the materials was factually correct.

Inter-rater Reliability

After each reviewer completed independent analysis of the first sample set of materials using the SAM + CAM, a κ statistic was calculated for each of the 22 variables, for each category of variables, and as an overall average for total score, using SAS (Statistical Analysis System 9.1.2, 2006, SAS Institute Inc, Cary, North Carolina). In the first review, an acceptable IRR for rater pair 1–2 was achieved on 14 of the 22 SAM + CAM variables and on four of the six SAM + CAM categories, providing an overall low "substantial" IRR (κ = .67). To improve IRR, the researchers examined the instrument for particular weaknesses, such as whether certain variables were clear in terms of rating instruction and quantification of criteria. Adjustments were made to the SAM + CAM to clarify guidelines and make rating criteria more specific. The raters and researchers continued an iterative process of rating materials, discussing differences in how the SAM + CAM criteria were interpreted, and then adjusting criteria to provide precision in scoring.

Based on the results of the inter-rater agreement analysis, IRR was established based on one-third of the study sample using the SAM + CAM. IRR was calculated for each of the 22 variables, for each category of variables (*category-specific)*, and as an overall average. In the final independent rating by two raters, the *variable-specific* IRR was "substantial" to "almost perfect" for 19 of the 22 variables on the instrument (κ = .61 to 1.0). The *category-specific* IRR was "substantial" to "almost perfect" across all six categories on the SAM + CAM (κ = .79 to 1.0). Finally, the overall average IRR on the SAM + CAM was "substantial" (κ = .77). Just three variables, *desired reader behavior* (κ = .53), *writing style* (κ = .58), and *context* (κ = .59), were those for which only "moderate" IRR was achieved by the raters.

Materials Review

Readability of all the materials ranged from grade 2 to 17+, with the mean, median, and mode reading level of materials at grade 11. SAM + CAM results indicate that 14 (20%) of the materials were rated as "superior," 47 (68%) were "adequate," and 8 (12%) were "not suitable." Health education brochures and Web-based health fact sheets, which are often designed for the general public and used for health promotion and protection as well as disease prevention purposes/ activities, ranked in the superior category more often than other types of informational material. Because the materials sampled are developed for different audiences and purposes (or health activity areas), Table 1 provides a list of the health activity areas for which each particular text material is appropriate.

Sub-Analysis of Health Education Brochures

Of particular interest is the analysis of print health education materials as a group in itself since these are, in general, designed to promote patient compliance or aid readers to take preventive steps to avoid HPV infection and cervical cancer. Although the mean reading level of these materials was at 8th grade, approximately 46% of these materials were written at a 10th grade or higher level — much higher than that of the average reader in the United States. The only health education material to be written at the 2nd grade level was done in comic book format. As shown in Table 1, in terms of the complete SAM + CAM analysis, 96% of the health education brochures scored in the adequate or above range, thus placing a lower level of demand on users than any other material type reviewed. Only one health education material was rated "not suitable," 65% were scored as "adequate," and 31% were "superior."

Table 1. — SAM + CAM Scores by Type of Material Reviewed (N = 69)

Material Type	Health Activity	No. of Materials Per Type	SAM + CAM Scores		
			"Superior" (2)	"Adequate" (1)	"Not Suitable" (0)
Newspaper Article	H, HP, DP	8	0	7	1
Newspaper Op Eds	HP, DP	4	0	2	2
Magazine Articles*	H, HP, DP	5	0	4	1
Print Advertisements	HP, DP, HC	2	0	2	0
Health System Materials (insurance, consent forms)	HC, SN	8	1	5	2
Book Chapters	H, HP, DP	7	1	6	0
Health Education Brochures/Flyers	H, HP, DP, HC, SN	26	8	17	1
Web-based Health Education Materials	H, HP, DP, SN	9	4	4	1
Total		**69**	**14 (20%)**	**47 (68%)**	**8 (12%)**

* Magazines reviewed were not professional or academic journals, but those meant for lay readers, such as *Ebony* or *Newsweek*. H = health promotion, HP = health protection, DP = disease prevention, HC = health care and maintenance, SN = systems navigation.

Approximately 70% to 80% of the health education materials ranked "superior" in the *literacy demand, numeracy,* and *layout/typography* categories, while categorical analysis indicates that "not suitable" scores were given to 23% of the materials for *content*, 27% for *graphics*, and 35% for *learning stimulation.* Although these educational brochures were, overall, superior to other health information materials in credibility of information and in multiculturality, as well as more positive in message tone, they also tended to score "not suitable" in providing summaries or reviews of key messages or points (helpful in retaining learning), in using behavioral or communication theory constructs shown to enhance learning or decision-making, and in making materials more "reader interactive."

Discussion

Similar to findings of Brandt et al,[29] this evaluation of selected cervical cancer prevention-related materials found that most are written at too high a readability level for those with low literacy skills. Of interest, since newspapers are generally said to be written at a 5th- to 8th-grade level, this study found the newspaper articles sampled to be written between 11th- and 16th-grade levels. While much research has shown that readability and suitability levels of written educational materials need to be improved, more than half of the cervical cancer prevention brochures reviewed were written at levels too difficult for most consumers. While use of some less commonly used medical terminology does contribute to decreased readability, many of the materials, especially health system forms, as well as book chapters and newspaper articles, made little use of plain language or made attempts to explain complex concepts in simpler terms.

On a positive note, analysis of the SAM + CAM data did indicate that 68% of all materials and 65% of patient education brochures scored in the "adequate" range for suitability and comprehensibility for readers with low literacy skills. However, less than 31% of patient education brochures and only 20% of all materials scored achieved an overall "superior" ranking. Approximately 70% of the materials reviewed were classified as informational (straightforward presentation of facts and data) in nature vs only 14% defined as educational (in addition to facts, these provided some motivational or instructional content to assist in positive health decision-making). The materials reviewed rarely provided a clear statement of purpose or a summary of key points covered — techniques that greatly assist comprehension for those with low literacy skills. Common problems with illustrations included anatomical drawings not placed in the context of the entire body, too many images on a page, several of which were irrelevant to the text content, and few that included a label or legend explaining the picture or figure.

Learning Stimulators

Motivators to read or attend to the text — eg, unusual or catchy titles and interactive techniques to involve readers in their learning, such as using stories or short quizzes and asking readers to jot down questions to ask a health care provider (which can also build self-efficacy) — were relatively absent. None of the materials showed the application of behavior change theory in its entirety. Research has shown that there are challenges in applying health behavior theory, but health education materials would be more effective if they had theoretical constructs to guide their development.[30]

Table 2. — SAM + CAM Scores by Category*

SAM + CAM Assessment Category	No. of Materials Assessed on Each Category	Percent of Materials Scoring As: Superior (2)	Adequate (1)	Not Suitable (0)
Content (Purpose, Summary, Credibility Desired Reader Behavior)	65	20% n = 13	51% n = 33	29% n = 19
Literacy Demand (Writing Style, Vocabulary Helpers, Confusion Reducers Context, Scope/Length)	66	50% n = 33	38% n = 25	12% n = 8
Numeracy (Number Presentation, Calculation)	51	73% n = 37	16% n = 8	12% n = 6
Graphics (Clarity of Tables/Graphs, Illustrations)	38	24% n = 9	55% n = 21	21% n = 8
Layout/Typography (Layout, Typography, Sub-headings/Organizers)	59	66% n = 39	25% n = 15	8% n = 5
Learning Stimulation (Motivators to Attend, Tone, Inclusion, Reader Interaction, Theory Application, Persuasion)	10	10% n = 1	30% n = 3	60% n = 6

* Percentages are based on number of materials to which each category is applied. For example, only 38 of all materials reviewed contained graphics. Thus, the percentage shown is based on the denominator of 38 rather than on the total of 69 materials reviewed.

Communication research indicates the value of some simple persuasion techniques such as use of testimonials, repetition, symbols, or cultural values, yet reviewers found little evidence of these being used in the materials, including health education brochures. Cultural appropriateness — as well as general inclusiveness — was rare, except in those materials specifically aimed at particular groups, such as African or Native Americans. These findings indicate that even those health information materials that received an overall ranking of "adequate" or "superior" still need improvement in many areas to diminish the demands they place on users with low literacy skills, especially if their purpose is to promote cervical cancer and HPV prevention.

Assessing materials with the SAM + CAM provides not just an overall "suitability" score in terms of how demanding the material is to a user with low literacy skills. By examining the category and individual variable scores, developers can gain specific information on those areas that need improvement. For example, as seen in Table 2, most of the cervical cancer prevention materials scored as "adequate" to "superior" for *content, literacy demand, numeracy,* and *layout/ typography*. On the other hand, only 10 materials out of the total sample of 69 used techniques to stimulate learning on the part of the reader/user, and 54% of these materials were considered "not suitable" in helping to stimulate learning. The *learning stimulation* category includes such factors as presenting content in an unusual way to gain attention, making attempts to address cultural beliefs or being inclusive of particular audiences, or using stories, quizzes, or contrasting visuals to get readers to interact with the text to better retain learning and promote decision-making. In addition, 29% of the materials were scored poorly on content factors such as stating the purpose of the text in advance, summarizing or repeating key messages, promoting self-efficacy, and demonstrating how to overcome barriers (for example, getting Pap tests).

Limitations

This study had several limitations. The sample of materials reviewed was small, but it was representative of cervical cancer prevention-related educational materials currently available at the time of the review and also commonly used, text-based sources of health information (newspapers, magazines, the Internet, health care forms). While the materials reviewed were similar in number to those analyzed in other evaluations of educational materials, this study did not focus solely on specific health education materials, such as brochures. Given this, the actual numbers of materials in certain categories, such as newspaper articles (n = 8) and magazine articles (n = 5), were quite small. The number of educational brochures (n = 26) did correspond to that evaluated in other studies, so this group of materials was analyzed separately.

Future research with this instrument, especially in using it to rate other sets of diverse health materials, will include improvements to some of the newly developed SAM + CAM categories and their variables. The theoretical application variable, for example, is currently too broad in nature; key behavioral or communication theoretical concepts should be identified and examples of how they can be applied in text message design provided for efficient scoring. Most materials also scored fairly high on the numeric literacy variable, primarily because few numbers, percentages, or proportions were used, and there were few explicit or implicit requirements for readers to make calculations, such as estimating their personal risk of being infected with HPV. The criteria for assessing the numeric literacy of materials would benefit from further clarification.

In this study, a substantive IRR was established between experienced raters. While the research team believes that the SAM + CAM will be a useful public health literacy instrument, it is important to assess IRR with less experienced users, such as those in community-based programs who need tools to help them develop or select materials that place a low level of health literacy demand on their audiences.

Practical Implications

The findings from this study indicate that many of the cervical cancer informational materials available to the public, especially people with low literacy abilities, place great demands on their users that make it difficult for them to understand the text. The particular utility of the SAM + CAM is that its individual variable analyses can provide material developers with specific predesign guidance and ongoing feedback when creating written materials. Since the SAM + CAM has been used successfully in assessing a variety of text formats (Web fact sheets, book chapters, health insurance forms) in addition to educational brochures, the instrument can be employed either by individuals or in training groups to (1) review or learn key factors essential to writing and designing materials for audiences with low literacy skills to enhance understanding, retention, and application of the information, and/or (2) pre-test materials to determine whether and how well those factors are being included in the final product.

For example, to enhance comprehensibility by being more "inclusive," text can gain a higher rating by (1) using plain language common and relevant to a broad audience, (2) using visuals that show a variety of genders, ethnicities, ages, disabilities, etc, in a positive manner, and (3) addressing cultural beliefs, logic, and experience when appropriate. If text being developed does not meet the superior level of SAM + CAM guidelines, it can be improved by revising or addressing inadequate areas. SAM + CAM-based training can help health educators and material designers recognize the

disconnect between health literacy demands of materials currently produced and the skills of most readers to comprehend materials. The theoretical basis of many of the SAM + CAM concepts should also be useful to health educators to enhance their training in message design. This tool offers those producing or selecting health education materials a simple yet effective means of identifying specific strengths and shortcomings — the health literacy demands — of written materials related to the suitability, comprehensibility, and utility for their selected audiences.

Conclusions

Most previous studies assessing the "health literacy" or "literacy" demand of written materials have relied on readability formulas alone. Relying on reading level standards alone causes researchers and material designers to miss critical elements in "health literacy" assessments. In particular, this study indicates that although print materials may be moving up to the "adequate" level in such technical areas as layout, typography, format, and use of plain language and active sentences, they are weak in terms of applying message design and communication techniques shown to be effective in promoting positive decision-making and motivating behavior change. The SAM + CAM provides a useful tool to evaluate a variety of other suitability, comprehensibility, and communication factors, all of which are necessary in determining if health literacy demands are appropriate to the user audience.

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References

1. Rudd R, Kirsch I, Yamamoto K. *Literacy and Health in America: Policy Information Report.* Princeton, NJ: Educational Testing Service; April 2004. http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1b/b1/ba.pdf. Accessed July 30, 2008.

2. Weiss BD, Palmer R. Relationship between health care costs and very low literacy skills in a medically needy and indigent medicaid population. *J Am Board Fam Pract.* 2004;17(1):44-47.

3. Parker RM, Ratzan SC, Lurie N. Health literacy: a policy challenge for advancing high-quality health care. *Health Aff (Millwood).* 2003;22:147-153.

4. Pfizer Inc. *Eradicating Low Health Literacy: The First Public Health Movement of the 21st Century.* Overview White Paper. New York, NY: Partnership for Clear Health Communication Steering Committee; March 2003. http://www.healthpowerforminorities.org/specific/EradicatingLowHealthcareLiteracy.pdf. Accessed July 30, 2008.

5. Agency for Healthcare Research and Quality (AHRQ). *Literacy and Health Outcomes. Number 87.* AHRQ Publication No. 04-E007-2; 2004. http://www.ahrq.gov/downloads/pub/evidence/pdf/literacy/literacy.pdf. Accessed July 28, 2008.

6. Vastag B. Low health literacy called a major problem. *JAMA.* 2004; 291(18):2181-2182.

7. Institute of Medicine of the National Academies. *Health Literacy: A Prescription to End Confusion.* Washington, DC: National Academies Press; 2004.

8. National Network of Libraries of Medicine. *Consumer Health: An Online Manual.* http://nnlm.gov/outreach/consumer. Accessed July 28, 2008.

9. Dubow J. *Adequate Literacy and Health Literacy: Prerequisites for Informed Health Care Decision-Making* (No. 70). Washington, DC: AARP Public Policy Institute; 2004. http://assets.aarp.org/rgcenter/health/ib70_literacy.pdf. Accessed July 30, 2008.

10. Anderson JE, Rudd R. Navigating healthcare: both educators and medical professionals have roles to play in making healthcare more accessible to all. *Focus on Basics.* 2006;8(C):16-18. http://www.ncsall.net/fileadmin/resources/fob/2006/fob_8c.pdf. Accessed July 30, 2008.

11. US Department of Education. National Center for Education Statistics. *National Assessment of Adult Literacy (NAAL).* 2006. http://nces.ed.gov/NAAL/index.asp?file=FAQ/General.asp&PageId=133. Accessed July 30, 2008.

12. McCray AT. Promoting health literacy. *J Am Med Inform Assoc.* 2005;12(2):152-163. Epub 2004 Nov 23.

13. Alexander RE. Readability of published dental educational materials. *J Am Dental Assoc.* 2000;131(7):937-942.

14. Freda MC. The readability of American Academy of Pediatrics patient education brochures. *J Pediatr Health Care.* 2005;19(3):151-156.

15. Hoffmann T, McKenna K. Analysis of stroke patients' and carers' reading ability and the content and design of written materials: recommendations for improving written stroke information. *Patient Educ Couns.* 2006; 60(3):286-293. Epub 2005 Aug 10.

16. Fry E. Fry's readability graph: clarifications, validity, and extensions to level 17. *J Reading.* 1977;21(3):242-252.

17. *Making Health Communication Programs Work.* U.S. Department of Health and Human Services. Washington, D.C.: National Institutes of Health. National Cancer Institute; December 2001. http://www.cancer.gov/PDF/41f04dd8-495a-4444-a258-1334b1d864f7/Pink_Book.pdf. Accessed July 30, 2008.

18. Flesch R. A new readability yardstick. *J Appl Psychol.* 1948;32:221-233.

19. National Cancer Institute. *Cervical Cancer.* http://www.cancer.gov/cancertopics/types/cervical/. Accessed July 30, 2008.

20. Muñoz N, Castellsagué X, de Gonzalez AB, et al. Chapter 1: HPV in the etiology of human cancer. *Vaccine.* 2006; 24(suppl 3):S1-S10. Epub 2006 Jun 23.

21. Koutsky LA, Harper DM. Chapter 13: current findings from prophylactic HPV vaccine trials. *Vaccine.* 2006;24(suppl 3):S114-S121. Epub 2006 Jun 23.

22. Doak CC, Doak LG, Root JH. *Teaching Patients with Low Literacy Skills.* 2nd ed. Philadelphia, PA: JB Lippincott Co; 1996:49.

23. Parrott RL. Motivation to attend to health messages: presentation of content and linguistic considerations. In: Maibach EW, Parrott RL, eds. *Designing Health Messages: Approaches from Communication Theory and Public Health Practice.* Thousand Oaks, CA: Sage Publications Inc; 1995:7-23.

24. Meyerowitz BE, Chaiken S. The effect of message framing on breast self-examination attitudes, intentions and behavior. *J Pers Soc Psychol.* 1987;52(3):500-510.

25. Chatterji M. *Designing and Using Tools for Educational Assessment.* Boston, MA: Allyn & Bacon; 2002.

26. Neuendorf KA. *The Content Analysis Guidebook.* Thousand Oaks, CA: Sage Publications Inc; 2002.

27. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics.* 1977;33(1):159-174.

28. Zeng QT, Tse T. Exploring and developing consumer health vocabularies. *J Am Med Inform Assoc.* 2006;13(1):24-29. Epub 2005 Oct 12.

29. Brandt HM, McCree DH, Lindley LL, et al. An evaluation of printed HPV educational materials. *Cancer Control.* 2005;12(suppl 2):103-106.

30. Helitzer D, Peterson AB, Thompson J, et al. Development of a planning and evaluation methodology for assessing the contribution of theory to a diabetes prevention lifestyle intervention. *Health Promot Pract.* 2008;9(4): 404:414.