Reading Grade Level and Readability of Printed Cancer Education Materials

Judy Singh, PhD

Purpose/Objectives: To analyze cancer brochures to estimate their reading level and assess their readability.

Design: Quantitative.

Sample: 10 cancer brochures published by various cancer organizations.

Methods: SMOG was used to estimate reading grade level of the brochures; the Readability Assessment Instrument (RAIN) was used to analyze the brochures in terms of 14 variables that affect comprehension. Interrater reliability was computed for reading grade level and readability level.

Main Research Variables: Reading grade level and readability.

Findings: Reading grade level of the brochures ranged from 9–15. The RAIN analysis showed that the number of variables incorporated across the 10 brochures ranged from 12–14, and the number of variables reaching readability criteria ranged from 6–8.

Conclusions: Cancer education materials are written at levels that may be too high for the average reader. These materials also may be difficult to understand because of the way they are written. Materials need to be written so that they match the reading levels of patients with cancer and the general public and incorporate more of the variables that affect comprehension so that readers can understand them easily.

Implications for Nursing: Nurses use written education materials to inform patients about their cancer diagnoses. They can conduct a comprehensive analysis of cancer brochures using SMOG and RAIN and then, if needed, use this information to revise the brochures so that they can be understood easily. If possible, patients who are going to be using the materials should be involved in the revision process.

Key Points . . .

- Cancer education materials are written at a level that is too difficult for the general population, and they do not incorporate all of the variables that facilitate comprehension.
- Information from a comprehensive analysis with SMOG and the Readability Assessment Instrument (RAIN) can be used to revise printed cancer education materials.
- Writers can use RAIN variables to guide preparation of new materials in collaboration with target audiences.

Cancer education materials often are written by healthcare professionals who work closely with patients with cancer and are aware of their information needs. In some instances, after writing a brochure or pamphlet, writers use one of the readability formulas, such as Flesch's (1948), Fry's (1968), or the Simple Measure of Gobbledygook (SMOG) (McLaughlin, 1969), to assess their work. They then print and disseminate the materials and assume that the target audience will be able to read and understand them. Results from research studies show that this assumption often is incorrect because the materials are too difficult for patients with low literacy skills to read and comprehend (Cooley et al., 1995; Glazer, Kirk, & Bosler, 1996). Some researchers have suggested that appropriate reading levels can be obtained by using shorter sentences and simpler words (Davis, Crouch, Wills, Miller, & Abdehou, 1990; Estey, Musseau, & Keehn, 1994). Materials prepared using this approach most likely would have a lower reading grade level when assessed by one of the previous formulas that use sentence and word length to determine reading level. However, lowering the reading level does not necessarily ensure that the materials will be readable. These formulas provide a reading grade level estimate for the material but they do not assess readability. Readability and reading level are equally important but entirely different concepts. Readability is the ease with which readers are able to understand the text. Thus, a person reading at the eighth-grade level may be able to recognize all the words in a brochure written at his or her level but may have difficulty understanding the content because of the way it is written.

Although formulas may be useful in providing an estimate of the reading grade level of written material, they do not incorporate the variables needed to assess readability. The Readability Assessment Instrument (RAIN) (Singh, 2003) was developed to determine the readability of texts in terms of 14 variables that affect comprehension. A number of studies have used RAIN to evaluate health education brochures about attention-deficit hyperactivity disorder (Singh, 1995), HIV and AIDS (Singh, 2000), patient medication leaflets (Kirkpatrick & Mohler, 1999), and behavioral treatment programs in mental health (Adkins & Singh, 2001; Adkins, Singh, McKeegan, Lanier, & Oswald, 2002). These studies found that many of the materials were unacceptable in terms of readability.

Judy Singh, PhD, is a consultant at ONE Research Institute in Midlothian, VA, and the developer of the Readability Assessment Instrument discussed in this article. *(Submitted June 2002. Accepted for publication October 7, 2002.)*

Digital Object Identifier: 10.1188/03.ONF.867-870

Previous studies have assessed only the reading grade levels of cancer-related educational materials. This study was designed to use SMOG to estimate the reading level of 10 cancer brochures and RAIN to assess their readability and provide a more comprehensive analysis of these brochures.

Methods

Materials

Cancer brochures available to the general population were selected for this study. A large sample was obtained from local clinics, hospitals, doctors' offices, and cancer organizations. The sample included brochures that were up to 12 pages in length and had at least 30 sentences, which was the minimum number of sentences required to apply the SMOG formula. Longer booklets and books and brochures written for children or teenagers were excluded. From the initial sample, 10 brochures were selected randomly for the study. A random selection ensured that the sample included brochures covering a variety of topics and published by different organizations.

Instruments

SMOG: The SMOG formula (McLaughlin, 1969) was used to determine the reading levels of the cancer brochures. This formula was selected because it is designed for noninstructional materials that readers can read independently without assistance from a teacher or instructor (Richardson & Morgan, 1994). It yields a score based on the reader understanding 90%–100% of the material independently and is expressed as a reading grade level.

RAIN: The 14 variables incorporated in RAIN (Singh, 2003) were used to assess readability. The variables were related to the characteristics such as cohesiveness of the text at the paragraph and sentence levels. The variables also assessed

1. Signaling devices (e.g., titles, subtitles, introductory paragraph, summary statements)
2. Structure
3. Pronoun references
4. Substitutions
5. Connectives
6. Unity
7. Audience appropriateness
8. Writing style
9. Illustrations
10. Adjunct questions
11. Print size
12. Print style
13. Color of print in relation to the background
14. Highlighting of titles and subtitles.

The *RAIN: Readability Assessment Instrument Manual* (Singh, 2003) provides a detailed description of each variable with examples. Scoring criteria for each of the variables were used to determine whether the brochures incorporated these variables at an acceptable level. The criterion level for each variable is specified in the manual.

Procedure

First, SMOG was used to assess the reading grade level of the cancer brochures. These brochures then were reassessed using RAIN to determine their readability in terms of the 14 variables that facilitate comprehension.

Interrater Reliability

Two brochures, *What You Need to Know About Cancer of the Stomach* (National Institutes of Health, 1990) and *Finding a Lump in Your Breast* (American Cancer Society, 1990), were selected randomly to determine interrater reliability. A second researcher used SMOG to rate the reading grade level of these two brochures and RAIN to rate their readability. Agreement on the reading grade levels was computed at 100%. Interrater agreement using RAIN was 94% and 97%, respectively.

Results

The reading grade level of the 10 cancer brochures when measured by SMOG ranged from 9–15 with a mean of 12.1 (see Table 1). All were written above the eighth-grade level, and readers would need a college education to comprehend half of the brochures.

Analysis of the 10 brochures using RAIN showed that differences existed in the extent to which writers used the 14 variables. Further, the amount that met the criteria varied among brochures. As shown in Table 2, the number of variables incorporated in each of the 10 brochures ranged from 12–14. However, the number of variables reaching readability criteria ranged only from 6–8. Variables in which all of the brochures achieved the criteria included pronoun references, connectives, unity, color, and highlighting of titles and subtitles. No brochures achieved the criteria for structure, audience appropriateness, writing style, and print size.

Discussion

Health education materials play an important role in the healthcare system, and they must be written at a level that is appropriate for the average reader. The 10 cancer brochures analyzed in this study were one to seven grades higher than

Table 1. SMOG Reading Levels of 10 Study Brochures

Title (Publisher, Year of Publication)	Grade Level
1. *About Cancer* (Channing, L., Bete Co. Inc., 1989)	9
2. *Why You Should Know About Melanoma* (American Cancer Society [ACS], 1992)	10
3. *Talking With Your Doctor* (ACS, 1987)	11
4. *About Medulloblastoma* (Association for Brain Tumor Research, 1985)	12
5. *About Meningioma* (American Brain Tumor Association, 1992)	12
6. *What You Need to Know About Cancer of the Stomach* (National Institutes of Health [NIH], 1990)	13
7. *Progress Against Cancer of the Skin* (NIH, 1985)	13
8. *Facts on Cancer of the Larynx* (ACS, 1987)	13
9. *Finding a Lump in Your Breast* (ACS, 1990)	13
10. *Chronic Lymphocytic Leukemia* (Leukemia Society of America, 1992)	15

Table 2. Summary of Readability Assessment Instrument Analysis of Study Brochures

Variables	Brochures									
	1	2	3	4	5	6	7	8	9	10
Signaling devices	no	no	yes	no	no	yes	no	no	yes	no
Structure	no	no	no	no	no	no	no	no	no	no
Pronoun references	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Substitutions	–	–	–	–	yes	–	yes	–	–	yes
Connectives	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Unity	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Audience appropriateness	no	no	no	no	no	no	no	no	no	no
Adjunct questions	yes	yes	yes	yes	no	no	yes	yes	no	no
Writing style	no	no	no	no	no	no	no	no	no	no
Illustrations	no	no	–	no	no	no	–	no	–	–
Print size	no	no	no	no	no	no	no	no	no	no
Print style	no	yes	no	yes	yes	yes	yes	yes	yes	yes
Color	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Highlighting of titles and subtitles	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Total number of incorporated variables (14 possible)	13	13	12	13	14	13	13	13	12	13
Total criteria reached	6	7	7	7	7	7	8	7	7	7

Note. The brochures are numbered as in Table 1. Entries of "–" indicate variables that were not present in brochures.

the level recommended by the U.S. Department of Education (1986), which means that they are too difficult for the average reader. The findings from this study are consistent with findings from other studies investigating the reading level of brochures for patients with cancer and their families.

Analysis of the cancer brochures using RAIN showed that, although they incorporated many of the variables identified as facilitating comprehension, very few brochures achieved criteria levels on each variable, which suggested that they were not written in a manner that assisted understanding. Similar results were found in four other studies in which RAIN was used to analyze patient-education materials in other content areas (Adkins & Singh, 2001; Kirkpatrick & Mohler, 1999; Singh, 1995, 2000). Meeting required standards on some of the variables does not make a brochure acceptable in terms of readability. Brochures must be written at reading levels that are appropriate for average readers and incorporate more of the variables that affect comprehension.

In a 2002 study, Adkins et al. demonstrated that, by manipulating both reading grade level and readability, materials could be revised so that they were easier to read and comprehend. The authors conducted a comprehensive analysis of 20 behavior treatment plans using SMOG and RAIN. Certified behavior analysts for adults with mental retardation and developmental disabilities developed these plans. The analyses showed that the plans' reading grade levels ranged from 12.6–15.2 and incorporated some of the variables. However, the number of variables reaching the criteria varied. Adkins et al. rewrote the plans in collaboration with the direct care staff, who implemented the plans until they were at the fourth-grade reading level and had reached the criteria on all 12 of the applicable RAIN variables. The two variables that were not applicable, adjunct questions and illustrations, were not relevant to the content of behavior treatment plans. The rewritten plans had positive treatment outcomes for the institutionalized adults. The authors attributed these results to staff being able to implement plans they could read and understand successfully. This study showed the importance of considering readability of written materials and reading grade level of target audiences.

Implications for Practice and Research

A comprehensive analysis can inform cancer brochure writers of the reading and readability levels of their materials, and they can use this information to revise cancer materials. Writers also can use RAIN variables to guide preparation of new materials. Whether revising old materials or preparing new ones, writer collaboration with targeted audiences is imperative. This approach would ensure not only that the information contained in the brochures is relevant to consumers but also that the audience can read and understand it. Future research should investigate the efficacy of this approach and whether providing readable materials creates positive outcomes for target audiences.

Author Contact: Judy Singh, PhD, can be reached at jsingh51@aol.com, with copy to editor at rose_mary@earthlink.net.

References

Adkins, A., & Singh, N. (2001). Reading level and readability of patient education materials in mental health. *Journal of Child and Family Studies, 10,* 1–8.

Adkins, A.D., Singh, N.N., McKeegan, G.F., Lanier, A.E., & Oswald, D.P. (2002). Behavior treatment programs, readability and treatment outcomes. *Research in Developmental Disabilities, 23,* 253–265.

American Brain Tumor Association. (1992). *About Meningioma.* Des Plaines, IL: Author.

American Cancer Society. (1987). *Facts on cancer of the larynx.* Atlanta, GA: Author.
American Cancer Society. (1987). *Talking with your doctor.* Atlanta, GA: Author.
American Cancer Society. (1990). *Finding a lump in your breast.* Atlanta, GA: Author.
American Cancer Society. (1992). *What you should know about melanoma.* Atlanta, GA: Author.
Association for Brain Tumor Research. (1985). *About medulloblastoma.* Des Plaines, IL: Author.
Channing Bete Co. Inc. (1989). *About Cancer.* South Deerfield, MA: Author.
Cooley, M.E., Moriarty, H., Berger, M.S., Selm-Orr, D., Coyle, B., & Short, T. (1995). Patient literacy and the readability of written cancer educational materials. *Oncology Nursing Forum, 22,* 1345–1351.
Davis, T.C., Crouch, M.A., Wills, G., Miller, S., & Abdehou, D.M. (1990). The gap between patient reading comprehension and readability of patient education materials. *Journal of Family Practice, 31,* 533–538.
Estey, A., Musseau, A., & Keehn, L. (1994). Patient's understanding of health information: A multihospital comparison. *Patient Education and Counseling, 24,* 73–78.
Flesch, R. (1948). A new readability yardstick. *Journal of Applied Psychology, 32,* 221–233.
Fry, E.B. (1968). A readability formula that saves time. *Journal of Reading, 11,* 513–516, 578.
Glazer, H.R., Kirk, L.M., & Bosler, F.E. (1996). Patient education pamphlets about prevention, detection, and treatment of breast cancer for low literacy women. *Patient Education and Counseling, 27,* 185–189.
Kirkpatrick, M.F., & Mohler, C. (1999). Using the readability assessment instrument to evaluate patient medication leaflets. *Drug Information Journal, 33,* 557–563.
Leukemia and Lymphoma Society of America. (1992). *Chronic lymphocytic leukemia.* White Plains, NY: Author.
McLaughlin, G.H. (1969). SMOG grading–A new readability formula. *Journal of Reading, 12,* 639–646.
National Institutes of Health. (1985). *Progress against cancer of the skin.* Bethesda, MD: Author.
National Institutes of Health. (1990). *What you need to know about cancer of the stomach.* Bethesda, MD: Author.
Richardson, J.S., & Morgan, R.F. (1994). *Reading to learn in the content areas.* Belmont, CA: Wadsworth.
Singh, J. (1995). The readability of educational materials written for parents of children with attention-deficit hyperactivity disorder. *Journal of Child and Family Studies, 4,* 207–218.
Singh, J. (2000). Readability of HIV/AIDS education materials. *AIDS Education and Prevention, 12,* 214–224.
Singh, J. (2003). *RAIN: Readability Assessment Instrument Manual* (2nd ed.). Midlothian, VA: ONE Research Institute.
U.S. Department of Education. (1986). *Digest of education statistics (1985–86).* Washington, DC: Office of Education Research and Improvement, U.S. Department of Education Center for Statistics.