La legibilidad de los materiales educativos sobre la diabetes: Implicaciones para la educación de pacientes con materiales escritos

Readability of Diabetes Education Materials: Implications for reaching patients with written materials

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Resumen

Objetivo: *Determinar el nivel educativo necesario para comprender los materiales educativos suministrados a pacientes diabéticos por organizaciones gubernamentales y NGOs.*
Materiales y métodos: *Este es un estudio descriptivo que explora la legibilidad de 81 materiales de educación disponibles a pacientes con diabetes y distribuidos por proveedores de salud. Se utilizó 2 medidas para determinar los niveles de legibilidad de los materiales informativos para diabéticos, el SMOG Readability Formula y el Fray Graph. La muestra excluyó materiales educativos que no estuvieran en inglés y aquellos con objetivos comerciales. Para el análisis se utilizó medidas descriptivas y prueba t para muestras y se interpretó el valor de p.*
Resultados: *Los resultados muestran que aunque los materiales provistos por organizaciones no gubernamentales son más fáciles de leer, éstos están generalmente escritos a niveles de lectura más alta de la audiencia para la cual son desarrollados.*
Conclusiones: *Se concluye que los materiales educativos de educación en salud para diabéticos no permiten una comprensión total de su contenido, ya que están escritos utilizando vocabulario más complejo que el que posee la población que los recibe.*
Palabras clave: Diabetes Mellitus, educación en salud, alfabetismo en salud-

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Abstract

Objective: *To ascertain the health literacy levels of diabetes patient education materials distributed by government-funded or nonprofit organization.*
Methods: *This descriptive study explored readability levels of 81 written diabetes health education materials available from healthcare providers. The Simplified Measure of Gobbledygoop (SMOG) readability formula and the Fray Graph were utilized to determine readability levels of diabetes patient information materials. The sample size excluded materials not in English and those with commercial purposes. Data analysis included measures of central tendency. In adition used t test and p-value.*
Results: *Results from this study show that while education materials provided by nonprofit organizations are easier to read, they are still generally above the reading level of a large portion of the population they are intended to reach.*
Conclusion: *Results from this study suggest that the majority of diabetes patient education materials are not adequate to reach their intended population due to high readability levels.*
Keywords: diabete mellitus, health education,health literacy.

INTRODUCTION

Diabetes mellitus, a metabolic disorder related to the body's inability to produce or metabolize sugars, is increasing in the United States (1-2). According to the Centers for Disease Control and Prevention, diabetes was the sixth leading cause of death among Americans in 2006 (3) .The federal government estimates that some 23.6 million Americans are living with that condition in the US (4). Additional reports have stated that 1.5 million new cases of diabetes emerge each year within the U.S. population age 20 years or older with significant disparities observed by race/ethnicity. It is also estimated that 11.2% of men, 10.2% of women, and 23% of people over 60 have diabetes (5). In addition to the increasing number of diagnosed cases, the National Diabetes Education Program estimates that some 57 million Americans aged 20 and older are in the pre-diabetes stage (4). The American Diabetes Association (ADA) has estimated the economic burden caused by diabetes on the U.S. economy at about $336 billion per year including loss workplace productivity and some $117 billion in Medicare benefits (6). These projections take into account based on expected diabetes cases, but did not incorporate the expected impact on diabetes expenditures from expected higher obesity rates.

Noncompliance with diabetes treatment leads to chronic complications such as blindness among adults and end-stage renal disease. Similarly, 60% to 70 % of people with diabetes have some degree of nerve damage, 60% of amputations reported in the U.S. are diabetes related, and 15% to 20% of spontaneous abortions are due to poor control of diabetes during pregnancy(7). Non-compliance with diabetes treatment appears to be related to health literacy levels in some of the cases.

HEALTH LITERACY

Health literacy is defined as having the ability to read, write, understand, and apply health related information regardless of its source. Individuals use the health related information to improve their health status and follow medical instructions given by health care providers (8-9). People with inadequate functional health literacy or whose reading skills are below the basic literacy level confront several barriers when attempting to access medical care (10).

Studies have found that poor readers cannot find their way through hospitals, complete medical information forms, follow through with instructions from prescriptions, and/or understand the content in written health education materials, or even informed consent forms (11-14). Studies have also found that individuals with low health literacy skills are less likely to adhere to and comply with medication regimes (15-16). Patients with low health literacy skills are also more likely to make more medical errors that can reduce their quality of life and/or put their lives in danger (17-19).

Weiss and Palmer (2004) found that "persons with low-literate skills generate higher charges for health care than do persons with better reading skills". They estimated the costs of low literacy to vary from $50 billion to $73 billion annually in the form of health problems and unnecessary hospitalizations. Other estimates have placed the estimated expenditures related to the lack of adequate health literacy in the year 2001 from $32 to $58 billion excluding healthcare costs (13).
For years healthcare providers have erroneously utilized the patient's highest educational level as a proxy to ascertain their reading, writing, and comprehension skills (20). The literature suggests that using the number of years of school completed does not accurately reflect an individual's actual literacy level. In fact, some studies have found that participants' literacy level was two to several years below the equivalent of their last school year completed (21-22).

Data from the National Assessment of Adult Literacy in 2003 found that some 87 million Americans had basic or below basic health literacy levels. The same study found that women had higher health literacy levels than males and that almost two thirds (60%) of the elderly had basic or below basic health literacy (23-25). Unlike the flu, skin infections, or food poisoning, whose symptoms are easy to recognize, inadequate health literacy has been very hard to detect because, many people have hidden their problem from their healthcare providers. In fact, people have managed to hide it from their spouses, children, friends, and/or coworkers (25-27).

HEALTH EDUCATION AND HEALTH LITERACY

Research has found an inconsistency between the readability of health educational materials and the reading capabilities of more than 90 million adults in the United States (25, 28, 31). One study evaluating cancer educational materials for African Americans found readability levels to be higher than the target population's health literacy skills. Similar results were obtained when Internet brochures about children and adolescent mental health were tested for readability (32-33). Another study found that 40% of brochures and pamphlets about the risk factors of cardiovascular diseases targeting the African American popula-

tion and women did not match the literacy skills of those populations (34).

HEALTH LITERACY AND DIABETES

Studies have found a direct relationship between the treatment outcome of diabetes care and health literacy (35-36). Diabetes patients with inadequate health literacy were less likely to manage their sugar level, were more likely to have diabetes complications, and were more likely to report diabetic retinopathy. These findings supported the direct relationship between health literacy and health status reported by other researchers (21-35-38).

Written materials are often used to educate and to provide treatment related instructions to patients with diabetes (39-40). Despite their popularity as an education tool, written materials are seldom measured for their readability levels or to assure that the educational information matches the health literacy of their intended audience (41). This oversight may place the health status of some diabetes patients at risk and may account for a proportion of those patients who do not adhere to treatment regimes.

One way to ameliorate the consequences of low health literacy is to provide patients with written information they can read and understand. Readability formulas such as the SMOG formula, Flesch-Kincaid formula, or FOG index are commonly utilized in the literature.

Despite extensive research in the area of document readability (42-43) little has been done to evaluate recent print educational materials about diabetes; therefore, the purpose of this study was to assess the readability of selected written health information materials regarding diabetes. In this study, the Simplified Measure of Gobbledygoop (SMOG) Readability Formula and the Fry Graph method were used to determine the readability of the materials being analyzed.

METHODS

As the purpose of this investigation was to assess readability levels of printed diabetes education materials, the investigators randomly identified nonprofit healthcare organizations and federally funded medical centers which provide these materials to their patients as part of their diabetes management programs. The investigators contacted the health educators or health program managers of these medical centers and explained the purpose of this study.

Seven of the ten agencies contacted for this study agreed to provide copies of the written education materials they give their patients. Representatives from two organizations said that while they provided diabetes education they limited their education to an oral format and that in the few cases where diabetes written materials were provided the agencies they represented used the health education materials produced by the American Diabetes Association. Only one organization refused to provide sample education materials alleging that their materials were developed by the federal government and were likely already included in the sample.

Written materials from the Internet used in this study were those found in the websites for the California Diabetes Program (CDP), Diabetes Coalition of California (DCC), Food and Drug Administration (FDA), the

American Diabetes Association (ADA), the California Diabetes Program (CDP), and the National Diabetes Education Program (NDEP). Some of the materials were published through the collaboration of the previously mentioned agencies and the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), the National Diabetes Information Clearinghouse, and the U.S. Department of Health and Human Services (DHHS).

The criteria for inclusion as part of this readability assessment were as follows:

1. Education materials had to be written in English.
2. The content had to be relevant to diabetes.
3. Online materials had to have a publication date and/or list their publisher or sponsor.
4. Online materials had to be created by organizations or agencies that provide services in California.
5. Education materials produced by pharmaceutical companies were considered as acceptable due to their educational content except for the written materials distributed directly by pharmacies.
6. Written health education materials utilized solely for advertising a diabetes-care product or an agency, without educational content, were excluded from the sample.

MEASUREMENT METHODS

To measure readability, the researchers used the Readability Plus 2005 (version 7.0) computer program. This software contains seven of the most commonly used readability formulas: the Powers-Summer-Kearl formula, the Flesch Reading Ease formula, the Flesch Grade Level formula, FOG Index formula, SMOG, FORCAST, and the Fry Graph. These programs assesses text only, taking into account the number of words in each sentence, the number of syllables in each word, and the number of sentences in the sample entered. None of the programs have the ability to evaluate graphics or pictures which can be found in the printed materials.

ANALYSIS OF WRITTEN DIABETES EDUCATION MATERIALS

Research has suggested using a combination of different formulas to ascertain document readability increases the chance of producing valid and accurate results, therefore, the investigators utilized two formulas (40, 44). The two formulas utilized in this study to test the readability of the written diabetes education material sample were the SMOG readability formula and the Fry Graph. Although the purpose of this study is not to compare the effectiveness of readability formulas, the investigators compared the results from the two formulas. This gave two reading grades for each material, thereby increasing the likelihood of accurate and valid results.

Each item was tested by the SMOG formula and the Fry graph formula; these two formulas calculate the number of syllables per word and the number of words per sentence. Therefore, the first step in analyzing the writ-

ten material was to select the number of words or sentences needed by each readability formula. After selecting the sentences and/or words, the sample was entered in a Word document and saved as a text file. The text file was then analyzed with the Readability Plus software.

THE SMOG READABILITY FORMULA

To use the SMOG formula, the researcher does not have to evaluate the entire written document; a sample of 30 sentences is sufficient. The sample consists of 10 sentences from the beginning of the material, 10 from the middle, and another 10 from the end. Using this method any word with more than three syllables is circled. The circled words are tallied, and the nearest number that equals a perfect square root of this figure is found. Finally, the square root is added to a constant that is equal to three. The number that is the sum is the grade level required to understand the reading material (45). Therefore, the researchers chose 30 sentences from each of the written materials in the sample. Ten of the sentences were from the first pages, 10 sentences were from the middle of the written material (the "middle" is relative to the number of pages in each item), and 10 sentences were from the last page(s) of the diabetes education materials. When the materials contained fewer than 30 sentences, all the sentences in the document were used for readability analysis. It is also important to note that certain punctuation marks, such as hyphens and quotation marks, were omitted when the information was being inputted. Bold letters, bullets, visual aids, and other symbols that may enhance the reading ease of the materials were also omitted. Question marks and exclamation marks were retained as they serve the same purpose as periods; they separate sentences. The SMOG readability formula does not recognize different connotations or contexts given to certain words.

THE FRY GRAPH READABILITY FORMULA

The Fry Graph readability formula in the Readability Plus software requires three samples of 100 words from the written material; however, it is capable of analyzing hundreds of words effectively. In an effort to ensure an adequate comparison of materials tested by the two formulas, equal numbers of words were selected for testing. For instance, the 30 sentences selected for analysis by the SMOG formula varied in word count. One 30-sentence sample contained 480 words, another contained 340 words, and a third item contained 193. For each item, an equal number of words and sentences were selected for assessment by the Fry Graph formula.

As the data were entered in the program, symbols that may enhance readability were omitted to make data analysis easier. The symbols might be hyphens, quotation marks, bullets, asterisks, and visual aids. Hard breaks between paragraphs were also omitted to avoid program malfunctions. As with the SMOG formula, question marks, exclamation marks, and periods were retained.

RESULTS

A total of 140 written diabetes education materials were considered for inclusion in this study. Of the 140 items received 17 were rejected due their content including mostly tables, charts, and pictures; their content being written entirely in Spanish (46), and

12 were duplicates of materials that already formed part of the sample. Another five were excluded because their content was primary for commercial purposes and contained no educational content.

In the end, 90 publications met the criteria for inclusion in this research and were considered for readability analysis (see table 1). The diabetes education materials included in the sample were categorized by the type of information contained with the majority falling into the general information category (see table 2).

Table 1
Types of Materials Reviewed

Format	N	%
Booklets	32	35.5
Health educator produced handouts	18	20.0
Pharmaceutical companies produced handouts	14	15.5
Brochures	10	11.1
Websites	16	17.7

Source: Tabulated by authors.

Table 2
Categories of Diabetes Education Materials in the Sample

Category	N	%
General Information	37	41.1
Nutrition Information	22	24.4
Medical Instruction	7	7.7
Medicine Intake	5	5.5
Lifestyles Information	19	21.1
Total	**90**	**100.0**

Source: Tabulated by authors.

Information gathered from each written education material consisted of the title, publication date, publisher and/or information about who created or adapted the item, and whether the source was a government-funded or nonprofit organization or medical center. The materials were analyzed using the SMOG and Fry Graph methods to determine the reading levels assigned to each publication. The SMOG readability formula was used to assess all 90 written diabetes education materials; however, the Fry Graph was unable to calculate reading levels for nine of the materials. Therefore, the nine pairs of data were omitted from this analysis, leaving only 81 complete pairs of data (reading grades) to be tested in the data analysis. The grade levels for the materials according to the two formulas are shown in Table 3.

The highest mean reading grade, 11.8, was found for the sample of written materials produced by a collaboration of the U.S. Department of Health and Human Services, the National Institutes of Health (NIH), National Kidney Disease Education Program (NKEDP), and National Institute of Diabetes and Digestive and Kidney Disease (NIDDK). Materials created by the California Diabetes Program (CDP) and posted on its website also had a high reading grade: 11.5.

A comparison of readability levels revealed that the Fry Graph gives lower reading grade levels than the levels given by the SMOG readability formula. For instance, the Fry Graph gave a reading grade level of 6 for item 30 in Table 3, which was equivalent to the readability for materials used in 6th grade (elementary school). The SMOG method calculated a reading level of 8.5, which equaled the readability in materials used at a middle school level. In other words, when text was

Table 3
Grade Levels of Written Materials

Item	Title	Fry	SMOG
1	Diabetes: What you Need to Know	12	12.2
2	Take Control of your Diabetes	6	7.8
3	Complications of Diabetes	9	9.6
4	Understanding Type 2 Diabetes	8	10.1
5	Recipe and meal planner	7	10.1
6	Proper Footwear	6	7.6
7	The Facts about A1C	14	12.9
8	Diabetes and You: Your guide to living with diabetes	8	10.7
9	A Simple Start: Managing your meals around your meals	8	9.5
10	Avoiding Diabetes Complications: A guide to reducing your risk of problems	9	10.4
11	Diabetes and Stress: Coping with stress in your life	10	11.6
12	Introduction to Exercise: Staying Fit with Diabetes	9	10.9
13	What's your number?	7	9.2
14	Diabetes Care	13	11.8
15	Type 2 Diabetes & Cardiovascular Disease	*	10.9
16	Basic facts about diabetes	8	10.8
17	Handout 1- Leg Exercises for people with diabetes	4	6.4
18	Handout 1- Exercise	11	12.7
19	Handout 1 - No title p. 2	3	5.2
20	Handout 1 – No title p. 5	0	9.5
21	Handout 1-Food groups and serving sizes	12	11.2
22	Handout 2 - Exchange lists for meal planning	6	7.7
23	Handout 2 - How many grams is in a carbohydrate food? & The importance of fiber	8	9.4
24	Handout 2 – Exercise	*	9.6
25	Handout 3 – Sick day guidelines	9	9.8
26	Handout 3 – Foods for hypoglycemia & sick days	8	9.5
27	Handout 4 – Oral health tips for patients with diabetes	7	8.8
28	Type 2 diabetes: Facts	10	11.1
29	What you do today helps determine how diabetes impacts your tomorrow.	9	11.4
30	Right from the Start: How to get started	6	8.5
31	Avoiding Diabetes Complications	10	11.1
32	Healthy Eating with Diabetes	9	10.1
33	Getting Started: Diabetes & Exercises	7	9.2
34	Type 2 Diabetes: A Healthier Life for Adults with Diabetes	7	9
35	Testing Your Own Blood Sugar	8	9.7
36	Household Sharps Disposal Tips	*	9.9
37	4 Steps to Control Your Diabetes for Life	5	7.8
38	Heart Disease: A Guide to Understanding Key Risk Factors and Heart-Healthy Living	8	10.1
39	How to Prevent Diabetes Complications	10	11.1
40	Understanding Food Nutrition Labels	10	10.9
41	Why Controlling Diabetes Means Controlling More Than Glucose	8	9.6
42	Healthy Meals for Hurried Lives	8	9.6
43	The Low Fast Food Guide	11	12.5
44	Program Booklet for Achieving the Goal Recognizing Success	12	11.5

Item	Title	Fry	SMOG
45	My Pyramid	6	8.6
46	Guidelines for Eating	3	6.7
47	Cooking Instructions	6	7.8
48	Reading Food Labels	7	8.6
49	Introduction to Insulin: Your guide to taking insulin	10	11.6
50	Carb Counting and Exchange Lists: Tools to help you plan your meals	11	11.4
51	Introduction to Exercise: Staying Fit with Diabetes	10	11.3
52	Kids… Get Cookin'!	8	9.8
53	Severe Hypoglycemia can happen… are you prepared?	14	12.5
54	Getting Results in Diabetes Care: Take the Initiative	11	12.4
55	Exercise and Diabetes	7	9.4
56	Foot Care Dos and Don'ts	*	16.4
57	Site Selection	9	10.6
58	Travel, Vacations and Diabetes	9	10.6
59	Dining Out Guide	8	9.9
60	Planning Your Diabetes Care… During Disaster Conditions	12	12.2
61	Take Charge. Talk T.	13	13.1
62	Gestational Diabetes: All You Need to Know About You and Your Baby	7	9.2
63	Nutrition Tips For Women Who Breastfeed After Having Gestational Diabetes	4	7
64	My Baby Has Been Born… What Do I Eat Now?	6	8.5
65	Diabetes Prepregnancy Counseling	7	8.6
66	Eating Well to Keep Your Blood Sugar Normal	2	6.7
67	Action Plan	*	9.9
68	Self Management Goals	*	13
69	Take Charge of Your Diabetes: Basic Guidelines for Diabetes Care	*	11.3
70	Practical Tips for Healthful Eating	7	8.4
71	Fast Food Guide	7	9.6
72	Eating for Health	6	8.7
73	Using Insulin Pens and Pen Needles	5	8.4
74	The First Step in Diabetes Meal Planning	4	8.2
75	Quick Facts (1)	7	9.1
76	7 Principles	7	9.8
77	Diabetes Need Help? Numbers to Know	7	8.7
78	Taking Steps to Lower the Risk of Getting Diabetes	15	13.5
79	Know your Number?	7	8.5
80	Diabetes, Smoking and Your Health	16	10.3
81	ABCs of Diabetes	*	10.4
82	Control your Diabetes: Tips to Help you Feel Better and Stay Healthy for Life	5	7.4
83	Your Diabetes Care: What You Need to know and you should expect form your health care provider.	7	9.4
84	At Risk Weight Chart Body Mass Index	9	10.8
85	Understanding the Link Between Diabetes and Heart Disease in Hispanic Americans	14	12.8
86	Tips for Achieving a Healthy Weight for People with Type 2 Diabetes	15	13.5
87	Losing Weight Safely	6	8.3
88	The Power to Control Diabetes is in Your Hands	6	6.7
89	Take These Small Steps to Find out if you are at risk	8	10.4
90	A guide discussing the connection between diabetes , high blood pressure, and kidney disease at your family reunion	10	11.8
* Readability formula was unable to assess the readability level.			

Source: Tabulated by authors.

assessed using the Fry Graph, the readability appeared to be higher.

A Paired-Sample T-test to 81 pairs of data (see Tables 4 and 5), revealed statistically significant differences between the two formulas. The statistical analysis also showed that the standard deviation was greater (± 2.8872) for the Fry Graph results, in comparison to the standard deviation (± 1.7968) from the SMOG readability formula results.

Table 6 shows Readability Results by Source of Materials. According to the SMOG readability formula, materials obtained from government-funded organizations were easier to read than those made available by nonprofit organizations. On the other hand,

Table 4
Descriptive Statistics From Data Sample

Pair	Mean	N	Standard Deviation	Standard Error Mean
Fry	8.370	81	2.8872	.3208
SMOG	9.875	81	1.7968	.1996

Source: Tabulated by authors.

Table 5
Paired Sample Test

Pair 1	Mean	Paired Differences		95% Confidence Interval of Difference		t	df	Sig (2-tailed)
		Standard. Deviation	Standard Error Mean	Lower	Upper			
Fry & SMOG	-1.5049	1.4467	.1630	-1.8293	-1.1806	-9.235	80	.000

Source: Tabulated by authors.

Table 6
Readability Results by Source of Materials

Source	N	Mean	Standard Deviation
Fry Graph			
Government	28	8.143	3.6688
Nonprofit	53	8.491	2.4069
SMOG			
Government	29	9.552	1.9952
Nonprofit	61	10.226	1.7897

Source: Tabulated by authors.

the Fry Graph analysis showed that the materials used by the nonprofit organizations scored lower reading grades than the materials obtained from organizations that used government funds.

DISCUSSIONS

Health care providers, health educators, pharmacists, and even community lay educators often use written health materials to educate, reinforce, or expand health information and patient instructions following medical visits. The premise that written health materials will assist patients better understand information and adhere to treatment regimes is predicated on the assumption that patients posses sufficiently high health literacy levels to understand the materials. Given the stigma – and limited time– associated with asking patients to demonstrate health literacy it is not surprising that many providers and disease prevention specialists rely on the self-reported maximum number of school years completed to estimate patients' literacy. Studies, however, have shown that relying on years of education as proxy for measuring health literacy provides erroneous estimates (20, 47-50) which may result in unforeseen adverse treatment outcomes. In fact, an increasing body of evidence suggests that materials should be tailored to the target population's health literacy level.

Diabetes educators and health providers have developed many types of educational materials ranging from general information to medical instructions to lifestyles information to assist their patients better understand their condition, adhere to treatment regimes, and to improve quality of life. Results from this study suggest that many of the most commonly used materials' reading level may exceed their intended audience's health literacy level. The discrepancy between their purpose and the audience's ability to understand them may in fact render some of these materials useless and provide a false sense of security to the provider who thinks that their instructions are not only understood by the patient, but are also being followed. It is therefore, recommended, that written educational materials be evaluated periodically to ascertain not only their accuracy, but reading level as well.

The national health objectives enshrined in *Healthy People 2010* have identified improving health literacy as a priority in an effort to decrease problems associated with patient non-compliance. Given the increasing diabetes rates in the US population (1, 5), it is reasonable to identify the need to measure written education materials' readability level as a way to assist patients. Results from this study suggest the following recommendations with the goal of providing better quality of services to individuals who have been diagnosed with diabetes.

1. There is a need to increase awareness related to health literacy and its impact on the health status of diabetes patients.

2. Assessing patient's literacy level should be a priority to any health care provider, health educator, pharmacist, or community health educator working with diabetic patients.

3. Anyone working with diabetes patients' should know their health literacy level in addition to their overall literacy level. This information will be vital in

determining the appropriate reading level for written materials provided.

4. Health care providers, health educators, pharmacists, and community health educators should periodically assess the suitability as well as readability of printed education materials. Suitability includes font size, color, graphics, position of text, and position of graphics.

CONCLUSION

The purpose of this research was to assess the readability of selected printed diabetes education materials and as such did not measure cultural appropriateness or include materials in other languages. The readability assessment and statistical analysis showed that the majority of printed education materials provided by nonprofit medical centers and government-funded health organizations require a higher educational level. People receiving these materials should have attained an educational level of approximately 10th grade (the equivalent of *bachillerato* en Colombia) to read these materials. However, the National Assessment of Adult Literacy found that, in 2003, 14% of the US population read at a 5th-grade level (23) – or the equivalent of primary school in Colombia – indicating that many patients would not be able to read these materials. Although the purpose of this study was not to evaluate the effectiveness of the methods utilized to assess text readability, the investigators found that the SMOG readability formula appears to provide a more accurate measurement than the Fry Graph method.

One key implication from this study is that health care providers, health educators, and diabetes educators should be cautious about the written information they provide to their patients. The written education materials disseminated to patients (at healthcare facilities) and to the general public (at health fairs) are intended for recipients who can read English proficiently. However, this study has demonstrated that the text in written health education materials can be hard to read. Therefore, further and more comprehensive research in this area is needed.

Finally, while not a direct focus of this study, the literature suggests that health literacy should be considered along with cultural competency (51-52) in developing written diabetes education materials.

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