Readability, suitability, and health content assessment of web-based patient education materials on colorectal cancer screening

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Background: Colorectal cancer (CRC) screening rates in the Unites States are still below target level. Web-based patient education materials are used by patients and providers to provide supplemental information on CRC screening. Low literacy levels and patient perceptions are significant barriers to screening. There are little data on the quality of these online materials from a health literacy standpoint or whether they address patients' perceptions.

Objective: To evaluate the readability, suitability, and health content of web-based patient education materials on colon cancer screening.

Design: Descriptive study.

Setting: Web-based patient materials.

Interventions: Twelve reputable and popular online patient education materials were evaluated. Readability was measured by using the Flesch-Kincaid Reading Grade Level, and suitability was determined by the Suitability Assessment of Materials, a scale that considers characteristics such as content, graphics, layout/typography, and learning stimulation. Health content was evaluated within the framework of the Health Belief Model, a behavioral model that relates patients' perceptions of susceptibility to disease, severity, and benefits and barriers to their medical decisions. Each material was scored independently by 3 reviewers.

Main Outcome Measurements: Flesch-Kincaid Reading Grade Level score, Suitability Assessment of Materials score, health content score.

Results: Readability for 10 of 12 materials surpassed the maximum recommended sixth-grade reading level. Five were 10th grade level and above. Only 1 of 12 materials received a superior suitability score; 3 materials received inadequate scores. Health content analysis revealed that only 50% of the resources discussed CRC risk in the general population and $<25\%$ specifically addressed patients at high risk, such as African Americans, smokers, patients with diabetes, and obese patients. For perceived barriers to screening, only 8.3% of resources discussed embarrassment, 25% discussed pain with colonoscopy, 25% addressed cost of colonoscopy, and none specifically mentioned the need to get colonoscopy when no symptoms are present. No material discussed the social benefits of screening.

Limitations: Descriptive design.

Conclusion: Most online patient education materials for CRC screening are written beyond the recommended sixth-grade reading level, with suboptimal suitability. Health content is lacking in addressing key perceived risks, barriers, and benefits to CRC screening. Developing more appropriate and targeted patient education resources on CRC may improve patient understanding and promote screening. (Gastrointest Endosc 2014;80:284-90.)

(footnotes appear on last page of article)

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Despite effective screening tests such as the fecal occult blood test (FOBT), flexible sigmoidoscopy, and colonoscopy, colorectal cancer (CRC) remains the second leading cause of cancer death in the United States.[1] Although rates of colon cancer screening have steadily increased from 38% in 1990 to about 65% in 2010, screening rates for patients with low literacy (less than high school level) remain under 50%.[2] Inadequate literacy is a pervasive epidemic,

estimated to involve 43% of Americans.[3] Recent studies show that patient literacy and perceptions about screening tests are significant barriers to colon cancer screening, and literacy-targeted patient education increases screening rates.[4,5]

Print and web-based materials are widely used to supplement patient education because of ease of distribution, accessibility, and low cost, but their efficacy may be limited if they cannot be read or understood. Readability and suitability are literacy tools designed to evaluate the appropriateness of written material. Readability refers to the reading difficulty based on word and sentence length. Suitability measures how well material can be understood and accepted by the reader. It is recommended that the education materials meant for the general population be written at a sixth grade reading level.[6]

According to the Health Belief Model (HBM), people are more likely to engage in preventative health behavior when their beliefs and perceptions are adequately addressed.[7] HBM has been used to help us understand patients' behavior about colorectal screening.[8,9] HBM also has been applied in a recent randomized trial to show that materials tailored to patients' perceptions about CRC screening (risks, barriers, and benefits) can increase screening rates in younger patients (aged 50-59 years).[10]

There is abundant web-based patient information about colon cancer screening; however, no study to date has analyzed the appropriateness of these materials from a health literacy standpoint. We aimed to assess the readability, suitability, and health content of online patient materials and hypothesized that these materials do not consistently have the desirable characteristics of effective patient education material; hence, they may not lead to the intended effect of increasing CRC screening.

Take-home Message

- The Internet is widely used by patients to get information about colorectal cancer screening, but the information available on the web is difficult to read and does not adequately address the benefits or the perceived barriers to colon cancer screening.
- More appropriate and targeted web-based patient education resources on colon cancer screening should be developed, and physicians should use them to promote screening.

METHODS

Twelve websites from various reputable societies and references providing patient-focused education on colon cancer screening were selected to provide a spectrum of online patient information. Of note, websites with information targeting patients rather than healthcare providers were selected. Societies included American Society for Gastrointestinal Endoscopy, American Gastroenterological Association, National Cancer Institute, Centers for Disease Control and Prevention, American College of Gastroenterology, American Society of Colon and Rectal Surgeons, Colon Cancer Alliance, and American Cancer Society. Popular references derived from Google (Mountainview, CA) searches included UpToDate Basics, MedlinePlus, and Mayo Clinic. These websites were also among the top search results obtained by use of common search terms such as "colon cancer screening" (see Supplementary Appendix for full list of web addresses; Appendix 1, available online at www.giejournal.org). All materials were accessed between September 2013 and October 2013. All resources except UpToDate Basics are available for free via the internet.

Websites on colon cancer screening were evaluated for readability, suitability, and health education content. Readability was assessed by applying the Flesch-Kincaid readability test.[11] The Flesch-Kincaid test is a validated and reliable language readability formula used widely across many fields. The test can be automatically calculated by using Microsoft Word (Redmond, Wash) word-processing software. To minimize potential inflation of scores due to pronouns, readability was measured after removing all disease and procedure names, medication names, and all forms of *gastroenterology*. We prepared the text further for readability analysis by removing headings, web links, footnotes, captions, illustrations, and tables.

Suitability was measured by using the Suitability Assessment of Materials (SAM). This systematic tool was created by Doak et al[6] to assess health-related educational resources in a short amount of time. SAM has been validated and successfully used in multiple prior studies of health information both printed and online.[12-15] This tool evaluates 6 areas: content (eg, purpose is explicitly stated), literacy demand (eg, common, explicit words are used), graphics (eg, simple, line drawing/sketches are used), layout and typography (eg, bold, size, color emphasize key points), learning stimulation and motivation (eg, problems or questions presented for reader response), and cultural appropriateness (eg, central concepts/ideas of material appear to be culturally similar to target culture). The questions are included in Appendix 2, available online at www.giejournal.org.

All 12 materials were scored independently by 3 reviewers who were trained in SAM scoring techniques. The reviewers were not blinded to the source of reading materials. The mean SAM scores were used in the analysis. SAM consists of 22 questions, with each question rated as 0 (not suitable), 1 (adequate), or 2 (superior). *Not applicable* (N/A) can be given for materials that lack certain areas such as graphics. The total possible score is 44, from which 2 points per *not applicable* can be deducted. The given score is divided by the total possible score to obtain a percentage. Material with a score of 0% to 39%

is considered not suitable, 40% to 69% adequate, and 70% to 100% superior.[6]

Health education content was assessed within the framework of the HBM, an approach to content analysis that has been used successfully in the past.[16] A coding guide was developed to assess the presence or absence of specific messages related to HBM constructs of perceived severity, perceived susceptibility, perceived benefits of screening, perceived barriers addressed, and cues to action. Perceived benefits and barriers to screening were coded separately for each of the 3 screening options (FOBT, flexible sigmoidoscopy, and colonoscopy). For all 12 materials, 3 coders independently assessed materials for the presence or absence of each message. For cases in which coding was not unanimous, a majority rule guideline determined the final coding to be used for analysis.

RESULTS

Readability

The Flesch-Kincaid readability scores[11] were high, except UpToDate Basics and Medline Plus (Table 1). American Society for Gastrointestinal Endoscopy's patient information website Screen4coloncancer had the highest reading grade level of 13, whereas UpToDate Basics had the lowest grade level of 6.6. Only UpToDate Basics and Medline Plus met the recommendation of sixth grade reading level (Fig. 1). For comparison purposes, we calculated readability scores by using 2 other recommended readability tools—the Fry readability formula and Simplified Measure of Gobbledygook. There was no statistically significant difference in the calculated scores (data not included).

Suitability

The mean SAM percentage score for Screen4coloncancer, American Gastroenterology Association, and American Society of Colon and Rectal Surgeons were <40%, placing them in the unsuitable category (Table 1, Fig. 2). The Centers for Disease Control and Prevention had the highest percentage score (81%) and was the only superior resource. The rest of the materials fell in the adequate range. The 6 individual evaluation criteria, which make up the total SAM score, were analyzed separately to determine whether 1 criterion contributed most to differences in scores. The presence or absence of graphics as well as the quality of graphics varied significantly between resources but was not the main factor in scoring difference. Rather, compared with the inadequate resources, the superior resource was more consistent in addressing all evaluation criteria.

For 1 of the 12 resources, 2 of the 3 readers disagreed on SAM scores by a wide margin—inadequate (score 0%-39%) versus superior (score 70%-100%).

TABLE 1. Readability and suitability scores

Material	Readability score (grade level)	Mean suitability score (%)
ASGE	11.4	52
Screen4coloncancer	13	24
AGA	10	36
UpToDate Basics	6.6	48
NCI	8	69
CDC	7.2	81
ACG	11.5	63
ASCRS	11.6	33
CCA	7.7	60
ACS	8.7	47
Medline Plus	6.9	51
Mayo Clinic	8.5	61

ASGE, American Society for Gastrointestinal Endoscopy; *AGA,* American Gastroenterological Association; *NCI,* National Cancer Institute; *CDC,* Centers for Disease Control and Prevention; *ACG,* American College of Gastroenterology; *ASCRS,* American Society of Colon and Rectal Surgeons; *CCA,* Colon Cancer Alliance; *ASC,* American Cancer Society.

Health content

For content on perceived susceptibility to colon cancer, 50% of the materials failed to discuss risk of colon cancer in the general population (Table 2). Although 83.3% of materials contained statements regarding risk in patients with family history of colon cancer, few discussed risk in other subgroups (25% discussed African Americans, 16.7% mentioned smokers, and 8.3% addressed diabetic patients). For perceived severity of disease, 11 resources (91.7%) discussed medical and clinical consequences of colorectal cancer, but none addressed social consequences.

For perceived benefits of screening, the medical and clinical benefits of each screening test (FOBT, flexible sigmoidoscopy, and colonoscopy) were discussed in almost all resources. However, no material mentioned how screening may benefit a patient's family or the broader social benefits of screening.

For perceived barriers to undergoing screening tests, only one resource (8.3%) addressed the need for screening FOBT even if patients felt healthy. No resources addressed the need for screening flexible sigmoidoscopy or colonoscopy in patients without symptoms. Sigmoidoscopy cost was discussed in 16.7% of resources, whereas colonoscopy cost was discussed in 25%. A minority of resources (41.7%) addressed potential pain associated with sigmoidoscopy; fewer (25%) discussed pain with colonoscopy. Only one resource discussed the potential difficulty of preparing for a colonoscopy. A majority of materials (75%) urged

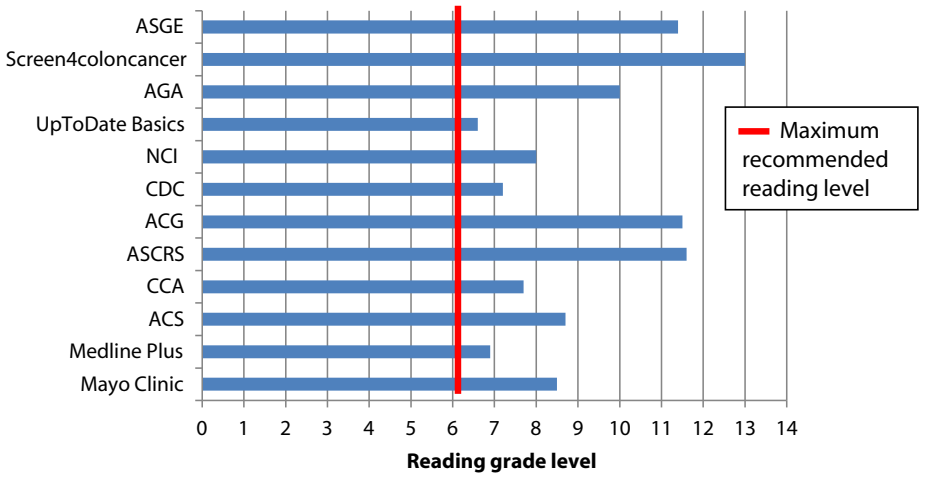

Figure 1. Comparison of readability scores. *ASGE;* American Society for Gastrointestinal Endoscopy; *AGA,* American Gastroenterological Association; *NCI,* National Cancer Institute; *CDC,* Centers for Disease Control and Prevention; *ACG*; American College of Gastroenterology; *ASCRS,* American Society of Colon and Rectal Surgeons; *CCA,* Colon Cancer Alliance; *ASC,* American Cancer Society.

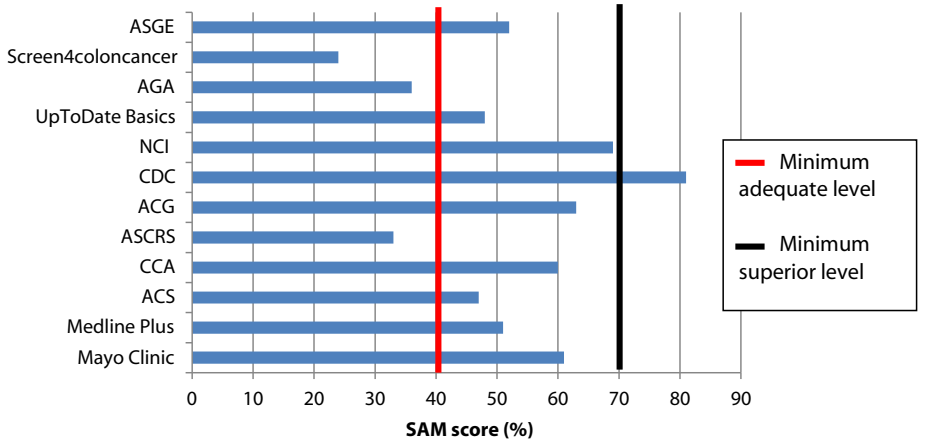

Figure 2. Comparison of suitability (SAM) scores. *ASGE;* American Society for Gastrointestinal Endoscopy; *AGA,* American Gastroenterological Association; *NCI,* National Cancer Institute; *CDC,* Centers for Disease Control and Prevention; *ACG,* American College of Gastroenterology; *ASCRS,* American Society of Colon and Rectal Surgeons; *CCA,* Colon Cancer Alliance; *ASC,* American Cancer Society; *SAM,* Suitability Assessment of Materials.

patients to discuss FOBT with their physicians, and 83.3% asked patients to discuss endoscopy with their physicians.

For cues to undergo CRC screening, only 41.7% and 33.3% mentioned bleeding or weight loss as red flags, respectively. No resource addressed anemia as a trigger for screening.

DISCUSSION

Web-based patient education materials provide a convenient source of information on CRC screening, even for patients with low literacy levels.[17] According to a recent survey, 6 of 10 people rely on the Internet when seeking information about colonoscopy screening.[18] Given the importance of information on the internet, our study evaluated reputable, commonly used, web-based patient education resources on colon cancer screening from a readability, suitability, and health-content standpoint.

The readability analysis showed that health information, especially from medical societies, is pervasively written at higher than the recommended sixth grade reading level.[6,19,20] This finding is especially important because most gastroenterologists and colorectal surgeons are very familiar with these organizations and are more likely to direct their patients to these websites. Our results are consistent with other studies showing that health information on the Internet is too advanced to be optimally effective for low-literacy populations.[13,21] Our suitability analysis showed a couple of areas of weakness across all resources, including a paucity of simple and relevant graphics and a general lack of reader interaction and learning stimulation.

We also analyzed the health content of materials by using the HBM. Readable and suitable material may not spur a patient to get a screening examination if the person's perceptions are not addressed. Concerns such as *what is the risk of getting colon cancer, what are the chances of*

TABLE 2. Summary of health content within the framework of the Health Belief Model

Category	% and frequency
Perceived susceptibility	
Statements regarding risk of CRC in the general population	50.0 (n = 6)
Statements regarding risk in specific populations	
African American	25.0 (n = 3)
Family history of CRC	83.3 (n = 10)
Smokers	16.7 (n = 2)
Diabetes	8.3 (n = 1)
Obesity	8.3 (n = 1)
Perceived severity	
Statements regarding outcomes if CRC screening is not performed	91.7 (n = 11)
Statements regarding the social consequences of the disease	0.0
Perceived benefits	
Medical benefits of screening with specific procedures	
FOBT	91.7 (n = 11)
FS	91.7 (n = 11)
Colonoscopy	100 (n = 12)
Will be following doctor's advice	
FOBT	8.3 (n = 1)
FS	16.7 (n = 2)
Colonoscopy	25.0 (n = 3)
Will set a good example for the family	
FOBT	0
FS	0
Colonoscopy	0
Will be better able to take care of family by remaining healthy	
FOBT	0
FS	0
Colonoscopy	0
Social benefits of treating the condition/symptoms	
FOBT	0
FS	0
Colonoscopy	0
Perceived barriers to FOBT	
Embarrassment	8.3 (n = 1)
Asymptomatic or "I am healthy"	8.3 (n = 1)
Lack of discussion with physicians (eg, "please discuss with your physician")	75.0 (n = 9)
Need for repeated "annual" testing	66.7 (n = 8)
Not very accurate (false positives)	33.3 (n = 4)

CRC, Colorectal cancer; *FOBT,* fecal occult blood test; *FS,* flexible sigmoidoscopy.
The percentage (%) is the cumulative data on the performance of all 12 resources, and frequency (n) is the number of resources discussing the particular category.

dying from colon cancer, and *how easy would it be to get screening* may be important in the decision process. The HBM analysis showed that only 50% of resources addressed the risk of CRC in the general population despite a previous study showing that never-screened patients have less understanding of the incidence of CRC compared with screened patients.[8]

Furthermore, although most resources included a statement regarding risk in patients with family histories of colon cancer, other established risks (African American heritage,[22] smoking,[23] diabetes[24]) were mentioned less frequently. Importantly, these risk groups make up a significant portion of patients eligible for screening and are disproportionately represented in the low screening population.

CRC has a profound impact on the social and family life of patients; yet, no resource discussed social consequences, change in quality of life, and family life. Patients with a diagnosis of CRC have more anxiety and depression,[25] potentially affecting job performance and interpersonal relationships. It has been shown that "setting a good example for family" is the most commonly reported perceived benefit to CRC screening among African American people.[9]

Embarrassment, concern about pain, lack of discussion with physicians, and cost are the most commonly cited perceived barriers to colonoscopy.[8,9] Our analysis revealed that only 1 of 12 resources (8.3%) discussed embarrassment as a perceived barrier to FOBT, sigmoidoscopy, and colonoscopy. Likewise, pain with colonoscopy was not discussed in 75% of materials. Importantly, embarrassment and pain were found in a recent study to have odds ratios of 10.72 and 3.43, respectively, for unwillingness to undergo CRC screening.[26] Cost was mentioned in only 16.7% of materials for sigmoidoscopy and 25% of materials for colonoscopy, yet, cost is a significant barrier in the under-screened, African American population.[9] Research shows that individuals, including the insured, are less likely to seek health

services when they have to pay out-of-pocket costs.[27] The new Affordable Care Act mandates that preventive health services and screening should be covered with no cost-sharing, but the lack of clarity in some cases has meant that coverage does not work as expected. These concerns are therefore important to address.

Another barrier to screening is the common misconception among patients that screening is not necessary unless they are symptomatic.[28] This is important because CRC is diagnosed in roughly 10% of asymptomatic patients who get screened.[29] However, our results showed that screening despite lack of symptoms or "feeling healthy" was addressed in only one resource (8.6%) in the context of FOBT and not addressed for the other two screening options (sigmoidoscopy and colonoscopy).

This study has several strengths. It is the first study assessing quality from a health literacy perspective in gastroenterology patient literature. Although previous studies in other fields have evaluated readability and suitability of patient education materials, this study is unique in applying the HBM framework to analyze the education content and identify the presence or absence of key information that may impact patient behavior.

The main limitation is the descriptive design of this study. To assess readability, we used mainly the Flesch-Kincaid readability formula,[11] and compared it with other commonly used readability tools. Although, we did not find any significant difference between different methods, it is suggested that Flesh-Kincaid scores tend to be 2 to 3 grades lower than scores calculated by other methods. If true, this would mean that we overestimated the number of web-based resources that actually comply with the recommended reading levels, further supporting our conclusions. We detected major areas of improvement for current patient literature, but future studies need to assess whether these changes improve patients' understanding of CRC screening and ultimately their impact on CRC screening rates.

In conclusion, patient education is a key component to increasing colon cancer awareness and screening. Current online patient education materials for colon cancer screening are written at higher than recommended reading levels, with variability in suitability, thus limiting the intended audience. The content is also lacking in key information on perceived risks, benefits, and barriers that may prompt patients to action. Systematic design and revision of current education materials are needed to capture a broader audience in hopes of increasing attention to colon cancer screening and improving screening rates.

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Abbreviations: CRC, colorectal cancer; FOBT, fecal occult blood test; HBM, Health Belief Model; SAM, Suitability Assessment of Materials.

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APPENDIX 1

Web-based patient education materials used in this study:

1. ASGE http://www.asge.org/patients/patients.aspx?id=8074
2. www.screen4coloncancer.org
3. AGA http://www.gastro.org/patient-center/digestive-conditions/colorectal-cancer
4. UpToDate Basics http://www.uptodate.com/contents/colon-and-rectal-cancer-screening-the-basics?source=see_link
5. NCI http://www.cancer.gov/cancertopics/pdq/screening/colorectal/Patient
6. CDC http://www.cdc.gov/cancer/colorectal/pdf/Basic_FS_Eng_Color.pdf
7. ACG http://d2j7fjepcxuj0a.cloudfront.net/wp-content/uploads/2011/07/institute-ACG_CRC_Brochure.pdf
8. ASCRS http://www.fascrs.org/patients/treatments_and_screenings/assess_your_risk_for_colorectal_cancer/screening/
9. CCA http://www.ccalliance.org/screening/methods.html
10. ACS http://www.cancer.org/cancer/coloN/Andrectumcancer/moreinformation/coloN/Andrectumcancerearlydetection/colorectal-cancer-early-detection-screening-tests-used
11. MedlinePlus http://www.nlm.nih.gov/medlineplus/ency/article/002071.htm
12. Mayo Clinic http://www.mayoclinic.com/health/colon-cancer-screening/MY00935

SAM Scoring Sheet

Material being evaluated:		
Points		
2 points for a superior rating	0 points for a not suitable rating	
1 point for an adequate rating	N/A if the factor does not apply to this material	
Factor to be rated	Score	Comments
1 Content		
(a) Purpose is evident		
(b) Content is about behaviors		
(c) Scope is limited		
(d) Summary or review included		
2 Literacy		
(a) Reading grade level		
(b) Writing style–active voice is used		
(c) Vocabulary uses common words		
(d) Context is given first		
(e) Learning aids via road signs		
3 Graphics		
(a) Cover graphic shows purpose		
(b) Type of graphics		
(c) Relevance of illustrations		
(d) List, Tables, etc. explained		
(e) Captions used for graphics		
4 Layout and Typography		
(a) Layout factors		
(b) Typography		
(c) Subheads are used		
5 Learning Stimulation / Motivation		
(a) Interaction is used		
(b) Behaviors are modeled and specific		
(c) Motivation–self-efficacy		
6 Cultural Appropriateness		
(a) Match in logic, language, experience		
(b) Cultural image and examples		