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Readability, User-Friendliness, and Key Content Analysis of Newborn Hearing Screening Brochures

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Abstract

Readability, user-friendliness, and key content are important components of newborn screening brochure design. Health information at a sixth grade or below reading level, designed for ease of navigation, with easily identifiable "action steps" can help adults with limited literacy skills find, understand, and use health information. The purpose of this study was to quantify the readability, user-friendliness, and key content components of newborn hearing screening brochures. Five readability formulae (FRE, F–K GL, FOG, FORCAST, and SMOG) were used to estimate reading levels of English language EHDI brochures ($N = 48$). Twenty-three participants assessed brochures for user-friendliness. Three participants assessed brochures to determine if key content elements were included and if so, the ease of locating them. Readers are provided with simple steps to follow during brochure design to maximize the message in parent education materials. This study forms the framework for quality improvement efforts and research-to-practice initiatives in the fields.

Acronyms: ASL = Average Sentence Length; ASW = Average Number of Syllables per Word; EHDI = Early Hearing Detection and Intervention; FRE = Flesch Reading Ease; F–K = Flesch–Kincaid Grade Level; FOG = Gunning FOG Index; GL = grade level; N = Number of Monosyllabic Words in a sample text; PHW = Percentage of Hard Words; RE = Reading Ease; SAM = Suitability Assessment of Materials; SMOG = Simple Measure of Gobbledygook; TSEN = Total Sentences; TSYL = Total Syllables; TW = Total Words

Introduction

The rapidly changing demographic make-up of the United States and increasing diversity play important roles in guiding public policy and efforts to reduce healthcare disparities (Humes, Jones, & Ramirez, 2011; U.S. Department of Health and Human Services, 2006). To meet these needs, increased national attention has been focused on issues such as healthcare workforce diversity, cultural competence of healthcare providers, and health literacy education (Anderson, Scrimshaw, Fullilove, Fielding, & Normand, 2003; Betancourt, Green, Carrillo, & Park, 2005). Growing evidence suggests limited literacy skills may be linked to poorer health decisions and healthcare outcomes (Berkman, DeWalt, et al., 2004; Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; DeWalt & Hink, 2009). To maximize the likelihood of better health outcomes, health literacy is moving to the forefront of many healthcare conversations.

Literacy is the ability to use printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential (White & Dillow, 2005). In contrast, *health literacy*, as defined by the Institute of Medicine, is "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (Nielsen-Bohlman, Panzer, & Kindig, 2004, p. 32). Results reported from the 2003 National Adult Literacy Survey revealed that almost half of the adults in the United States have basic or below basic literacy skills (Kutner, Greenberg, & Baer, 2005; Kutner, Greenberg, Jin, Boyle, et al., 2007; Kutner, Greenberg, Jin, & Paulsen, 2006; Institute of Medicine, 2004; White & McCloskey, 2006), with more than 40 million people reading below the fifth grade level (Institute of Medicine, 2004; Yin, Johnson, Mendelsohn, Abrams, Sanders, & Dreyer, 2009). Despite evidence linking health literacy and health outcomes, readability levels for a large number of adult patient education materials (Stossel, Segar, Gliatto, Fallar, & Karani, 2012; Strachan et al., 2012; Wilson, 2009; Wolf et al., 2012) and patient-reported outcome measures (Atcherson, Zraick, & Brasseux, 2011; Zraick, Atcherson, & Brown, 2012; Zraick, Atcherson, & Ham, 2012) in a number of disciplines are consistently reported at the seventh grade level (GL) or higher. Studies assessing readability and user-friendliness of educational materials targeting parents and caregivers report similar findings (Arnold et al., 2006; Freda, 2005; Hendrickson, Huebner, & Riedy, 2006; Ross & Waggoner, 2012; Wallace & Lennon, 2004).

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Reading grade level estimates of patient education materials are commonly used to predict health literacy. Formulae used to estimate readability are readily accessible and add value by (a) providing information to reach the target audience, (b) enabling prediction of the ability of the target reader to understand the material, and (c) facilitating conversion of written material into plain language (Zamanian & Heydari, 2012). The primary disadvantage is the number of readability formulae available (more than 40) which produces significant variation on the same text (Wang, Miller, Schmitt, & Wen, 2013). For this reason, it is important to understand the purpose of each readability formula and the variables taken into account. Table 1 shows five common readability measures and the formulae used to estimate reading ease and grade level estimates.

Although readability levels are frequently used as a predictor of health literacy (U.S. Department of Health and Human Services, 2000), these measures fail to describe the ease by which an adult can consume and act on complex health information (Zamanian & Heydari, 2012). Arnold and colleagues (2006) developed a "User-Friendliness Checklist" consisting of 22 items grouped into five categories. This checklist takes additional variables impacting readability into account such as the layout, use of illustrations, management of information, clarity of message, and cultural appropriateness. Each of the categories on their checklist has three to five descriptors. For example, the layout descriptors include font size, font type, white space, paragraph size, and visual appeal. A graphic of the checklist categories and descriptors is shown in Figure 1.

Usability can be defined as the combined domains of user-friendliness and key content analysis. Key content analysis focuses on providing the target population with the information most valued. Recommendations for effective communication about newborn screening have been provided by researchers who have conducted focus groups with parents, providers, and content experts (Davis et al., 2006; Kim, Lloyd-Puryear, & Tonniges, 2003). Research shows that parents value the following information about screening: (a) infant will be screened, (b) screening is beneficial, (c) rescreening may be needed, (d) method of notification if rescreening is needed, (e) specific action steps, (f) the timeframe or need to act quickly if the infant fails screening, and (g) who to contact for more information (Davis et al., 2006). These findings support recommendations by the American Academy of Pediatrics (AAP, 2000) for content inclusion for newborn screening brochures and are shown in Table 2.

Research reports indicate that parents want to receive information orally from a trusted health care provider and as a take-home brochure (Davis et al., 2006; Kim et al., 2003; National Center for Hearing Assessment and Management [NCHAM], 2015). Parents are interested in relevant and practical information emphasizing what they need to know and do (Davis et al., 2006). Targeted health information, designed for ease of navigation, with easily identifiable action steps can help adults with limited literacy skills find,

Table 1. Readability Formulae Names and Descriptions

Formula Name	Formula Description
Flesch Reading Ease (FRE)	RE = 206.835 – (1.015 × ASL) – (84.6 × ASW) The higher the number, the easier the text is to read. The output is a number ranging from 0 to 100. The Flesch–Kincaid Grade Level (F–K) is applied to translate this value to an equivalent grade level.
Flesch-Kincaid Grade Level (F-K)	F–K = 0.39 (TW/TSEN) + 11.8 (TSYL/TW) – 15.59
Gunning FOG Index (FOG)	GL = 0.4 (ASL + PHW)
FORCAST	GL = 20 – (N/10)
Simple Measure of Gobbledygook (SMOG)	SMOG grade = 3 + Square Root of Polysyllable Count, Count 10 sentences in a row from the beginning, middle, and end of the text, for a total of 30 sentences. Then count every word with three or more syllables in each group, even if the word appears more than once. Calculate the square root of the number from the previous count of words, round off to the nearest 10, and then add three to the calculated number to find the SMOG grade level estimate.

Note. ASL = Average Sentence Length (i.e., number of words divided by the number of sentences); ASW = Average Number of Syllables per Word; GL = Grade Level; N = Number of Monosyllabic Words in a sample text; PHW = Percentage of Hard Words; RE = Reading Ease; TW = Total Words; TSEN = Total Sentences; TSYL = Total Syllables.

Figure 1. Twenty-Two Items Organized by Five Domains Defining User-Friendliness for Parent Educational Materials.

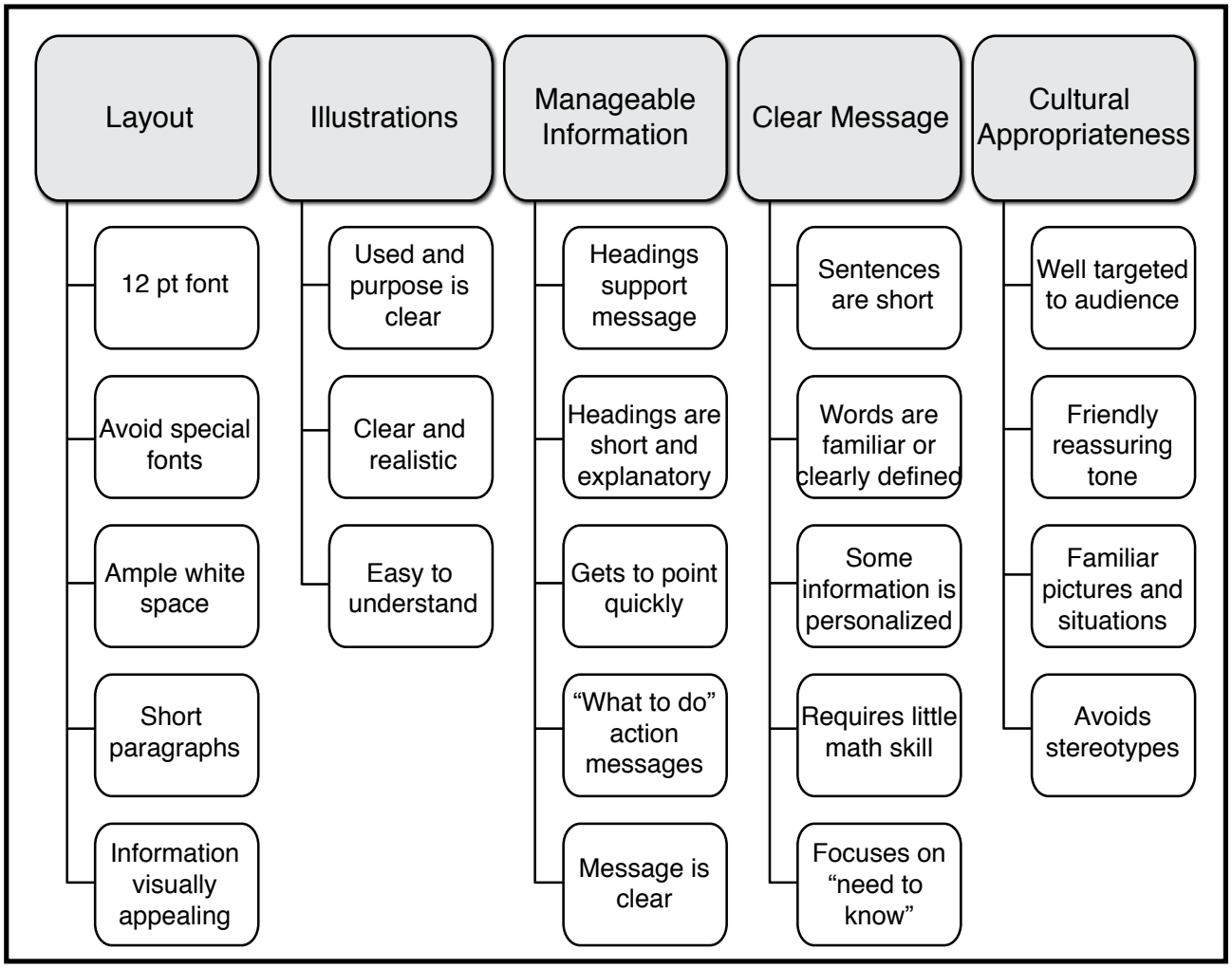


Table 2. Key Content Elements Recommended for Newborn Screening Programs

1. Why does my baby need newborn screening tests?
2. What are the benefits of newborn screening?
3. What if my baby needs rescreening?
4. How will I be notified if rescreening is needed?
5. What action steps do I need to take if rescreening is needed?
6. What is the timeframe to follow-up for rescreening?
7. Who do I contact for more information?

Note. Adapted from "Recommendations for Effective Newborn Screening Communication: Results of Focus Groups with Parents, Providers, and Experts," by T. C. Davis et al., 2006, *Pediatrics, 117*(5), S326-S340.

understand, and use health information. The concept of "action" is a vital element in the definition of health literacy. Few authors have explored these key content elements coupled with readability and user-friendliness (Arnold et al., 2006; Davis et al., 2006). Therefore, the purpose of this study was to quantify the readability, user-friendliness, and key content of newborn hearing screening brochures.

Method

This study was approved by the Institutional Review Board at the University of Arkansas at Little Rock (Protocol #12-065). All study procedures took place in the Department of Audiology and Speech Pathology at the University of Arkansas for Medical Sciences (UAMS)/University of

Arkansas at Little Rock (UALR). The study consisted of three separate analyses: (a) readability, (b) user-friendliness, and (c) key content analysis. Descriptions of these analyses are described in the Procedures section.

Participants

The readability analysis did not require human subject participation. Study participants for the user-friendliness and key content analyses were volunteers from Early Hearing Detection and Intervention (EHDI) stakeholder populations in Arkansas. Parents were recruited from the Arkansas Hands & Voices chapter. Hands and Voices is a parent/professional advocacy group for children with hearing loss and their families. In addition, students enrolled in the graduate Audiology and Speech Pathology programs at UAMS were invited to participate. Finally, audiologists and speech-language pathologists were volunteer professional staff from local health facilities or faculty from the university.

Twenty-three adults participated in the assessment of user-friendliness. Participants ranged in age from 22 to 58 years and included four parents of children with hearing loss (Parent Group, $n = 4$); five audiologists and two speech language pathologists (Professional Group, $n = 7$), five audiology students and three speech language pathology students (Student Group, $n = 8$), and four professionals not familiar with issues related to deafness (Other Group, $n = 4$). Seven were male and 16 were female; all were English speaking. Participants were taken from a convenience sample; six were African American and 17 were Caucasian. A sub-group of 3 volunteers (students) from the participant pool completed the Key Content Checklist.

Materials

All available U.S. state and territory newborn hearing screening brochures ($N = 48$) were downloaded from the NCHAM website (www.infanthearing.org), saved as electronic PDF documents and printed. The assumption was that these brochures were those in current use; therefore, no effort was made to check with state EHDI coordinators for current copies of brochures. Brochures downloaded were limited to the English version.

Procedures

Readability. Brochure text was copied from the PDF, pasted into a Microsoft Word document, and saved as an ASCII text file. Files were uploaded to readability software for analysis. Readability was assessed using the Windows-based software Reading Calculations, Version 7.5 (Micro Power & Light Co., Dallas, TX, 2008). This readability software provides automated scoring of written materials according to nine of the most popular readability formulae: Flesch–Kincaid Grade Level (F–K), Flesch Reading Ease (FRE), Gunning FOG Index (FOG), Simple Measure of Gobbledygook (SMOG), Powers-Sumner-Kearl Readability, FORCAST, Spache, Dale-Chall Readability, and Fry Graph. We chose five of the most common formulae used in the literature for assessment of patient health materials for this study: F–K, FRE, FOG, FORCAST, and SMOG. The readability calculations were completed via the automated software application.

User-Friendliness. User-friendliness refers to the organization and complexity of the content, the appearance of the format, and overall tone and cultural appropriateness (Kim et al., 2003). The User-Friendliness Checklist (Arnold et al., 2006) categories were layout, illustrations, clear message, manageable information, and cultural appropriateness (Figure 1). Randomized numbered brochures and rating forms with instructions were included in participant packets with the informed consent form. Participants were asked to rate each checklist item ($N = 22$) for each brochure ($N = 48$) in response to the following question: "How much work does this brochure need to be user-friendly?" Answer options were transferred to an Excel spreadsheet and coded as (a) *Little* = 1; (b) *Some* = 2; and (c) *Much* = 3. Participants were provided with a visual sample for each of these categories to help maintain consistency with ratings.

Key Content Checklist. A checklist (Table 3) was developed to assess inclusion of key content areas and ease of locating the information for 48 brochures. A simple rating paradigm of *yes, no,* and *not applicable* (N/A) was used to quantify (a) if key content evidence was present, and if so, (b) ease of locating the information. The simple checklist regarding the presence/absence of key content and ease of location was completed by the three student volunteers from the original participant pool. Answer options were transferred to an Excel spreadsheet and coded for inclusion of content (*Yes* = 1; *No* = 2) and ability to locate content easily (*Yes* = 1, *No* = 2, *N/A* = 3).

Results

Descriptive statistics were used to summarize the data. Means (M), standard deviations (SD), and confidence intervals (CI) were computed using Microsoft Excel. Readability, user-friendliness, and key content checklist results are presented.

Readability

Table 4 shows the descriptive statistics (columns) for five readability measures (rows). The average reading ease score for the FRE was 73 (row 1) and the corresponding average grade level estimate for the F–K was 5 (row 2). These results show that the F–K grade level estimate indicates 94% of the brochures can be easily read by students in the sixth grade and below. Average grade level estimates for other formulae include the FOG at 8 (row 3), FORCAST at 10 (row 4), and SMOG at 8 (row 5).

Figure 2 shows the percent of brochures by grade level for the F–K, FOG, FORCAST, and SMOG formulae. In general, the F–K formula returns the lowest estimate and

Table 3. EHDI Checklist for Key Content in Newborn Hearing Screening Brochures

EHDI Checklist for Key Content in Newborn Hearing Screening Brochures	Content Included?		Easy to Find?		
	Yes	No	Yes	No	N/A
1. Why does my baby need newborn screening tests?					
2. What are the benefits of newborn screening?					
3. What if my baby needs rescreening?					
4. How will I be notified if rescreening is needed?					
5. What action steps do I need to take if rescreening is needed?					
6. What is the timeframe to follow-up for rescreening?					
7. Who do I contact for more information?					

Note. EHDI = Early Hearing and Detection Intervention; N/A = Not Applicable.

Table 4. Mean, SD, and Confidence Interval for Readability Formulae Used to Assess Newborn Hearing Screening Brochures (*N* = 48)

Readability Formula	*M (SD)*	95% CI	Criterion or Grade Level	Number	Percentage
Flesch Reading Ease Level (FRE)	72.98 (7.75)	[70.79, 75.17]	90 – 100 70 – 89 60 – 79 < 59	1 31 15 2	2% 65% 31% 4%
Flesch-Kincaid Grade Level (F-K)	5.05 (1.45)	[4.76, 5.33]	1.0 – 2.9 3.0 – 4.9 5.0 – 6.9 ≥ 7.0	1 24 20 3	2% 50% 42% 6%
Gunning FOG Index (FOG)	7.52 (1.4)	[7.38, 8.38]	4.0 – 5.9 6.0 – 7.9 8.0 –9.9 ≥ 10.0	9 21 15 3	2% 44% 31% 6%
FORCAST	10.09 (.66)	[9.91, 10.28]	4.0 – 5.9 6.0 – 8.9 9.0 – 10.9 ≥ 11.0	3 17 23 5	6% 35% 48% 10%
Simple Measure of Gobbledygook (SMOG)	7.78 (1.02)	[7.49, 8.07]	6.0 – 6.9 7.0 – 7.9 8.0 – 8.9 ≥ 9.0	11 20 10 7	23% 42% 20% 15%

Figure 2. Percent of Brochures by Grade Level Estimate for Four Readability Formulae: Flesch-Kincaid Grade Level (F–K), Gunning FOG Index (FOG), FORCAST, and Simple Measure of Gobbledygook (SMOG).

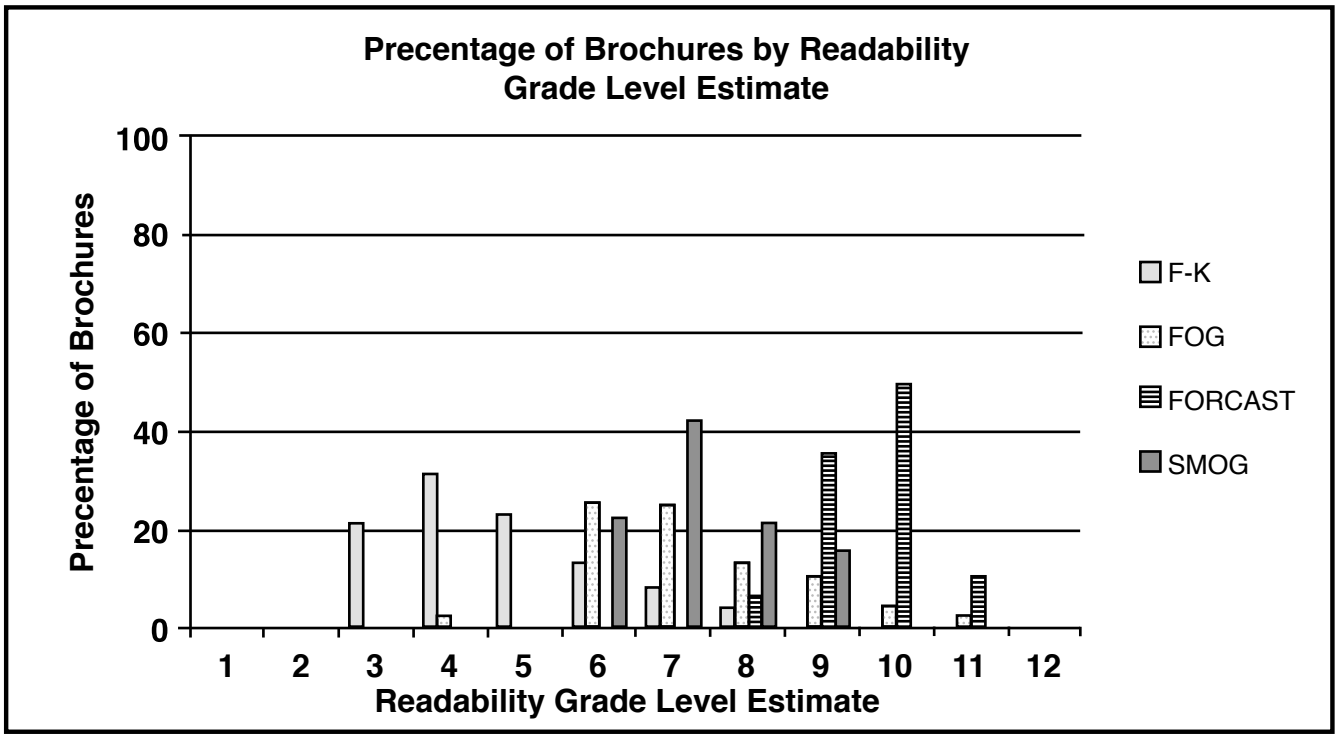


Table 5. Percentage of Responses (*N* = 23) for 22 Items in Five Categories to the Question: "How Much Work Does This Brochure Need to be User-Friendly?"

Specific Characteristics			
Layout makes it easier to read	Little	Some	Much
1. Font is > 12 points	61%	25%	14%
2. Avoids all capital letters, italics, and specialty fonts	73%	20%	7%
3. Ample white space	64%	28%	8%
4. Short Paragraphs (4-5 lines)	56%	27%	17%
5. Information well organized (e.g., bullets and boxes)	64%	22%	14%
Illustrations	Little	Some	Much
6. Used and serve purpose	39%	34%	27%
7. Clear and realistic	56%	20%	24%
8. Easy to understand	56%	20%	24%
Clear Message	Little	Some	Much
9. Cover, title, and headings support message	74%	15%	11%
10. Headings are short and explanatory	77%	15%	8%
11. Gets to point quickly	62%	27%	11%
12. Action Messages (what to do) are presented first	48%	38%	14%
13. Message is likely clear	67%	22%	11%
Manageable Information	Little	Some	Much
14. Sentences are short	61%	28%	11%
15. Words are familiar or defined	70%	22%	8%
16. Personalizes some information	61%	28%	11%
17. Requires little math skill	90%	5%	5%
18. Focuses on need to know	67%	22%	11%
Cultural appropriateness	Little	Some	Much
19. Well targeted to audience	74%	18%	8%
20. Friendly, reassuring tone	70%	22%	8%
21. Familiar pictures, words, and situations	64%	22%	14%
22. Avoids stereotypes	84%	8%	8%
Overall Mean Percent	65%	22%	13%

the FORCAST returns the highest equivalent grade level. The FOG and the SMOG are distributed more centrally, with the SMOG showing the tightest distribution.

User-Friendliness

Results of user-friendliness ratings (n = 23) for 48 brochures are shown in Table 5. Overall mean results suggest the majority (65%) need *little work*, a smaller proportion need *some work* (22%), and a few need *much work* (13%). The illustration category was rated as needing the most work. Figure 3 shows the percentages of user-friendliness ratings by the rater role (i.e., parent, professional, student, and other). Percentage refers to the number of brochures rated as needing *some* or *much* improvement.

Key Content Component Checklist.

Results of the checklist for key content components were analyzed for 48 brochures (Table 6). Percentage of brochures with inclusion of key content and the percentage of brochures in which key content was easy to locate are shown in Figure 4.

Discussion

Consideration of reading level, user-friendliness, and key content components helps maximize the potential for comprehension and use of health information. Although a substantial body of literature exists on readability measures (Atcherson et al., 2011; Freda, 2005; Hendrickson et al., 2006; Stossel et al., 2012; Strachan et al., 2012; Wallace & Lennon, 2004; Wang et al., 2013; Wilson, 2009; Wolf et al., 2012; Zamanian & Heydari, 2012; Zraick & Atcherson, 2012), few authors have assessed user-friendliness (Arnold et al., 2006) and key content (Davis et al., 2006). This study provides evidence and demonstrates how these three factors used together form best practice methodology when designing or revising patient education brochures for newborn screening.

Readability

The National Work Group on Literacy and Health (1998) recommends patient education materials to be written at or below the sixth-grade level to increase the likelihood that health information can be read and understood. Our results show considerable variability by formula, with 88% of the brochures evaluated meeting the sixth grade or lower criteria using the F–K formula (100% at the 8th grade reading level or below), 48% meeting the sixth grade or lower criteria using the FOG, 23% meeting the sixth grade or lower criteria using the SMOG, and 0% meeting the sixth grade or lower criteria using the FORCAST. This variability emphasizes the need to understand and choose appropriate readability measures (Table 5). For example, the F–K formula was designed to estimate U.S. grade level comprehension for children (using a 85% criterion), and the SMOG was developed to estimate U.S. grade level comprehension for adults (using a 100% criterion; Wang et al., 2013; Zamanian & Heydari, 2012). As such, SMOG estimates tend to be one to two grade levels higher than the F–K. In contrast, the FOG was designed to estimate years of formal education adults needed to understand the text on a first reading. As a result, this formula generally predicts scores higher than the F–K, but lower than the SMOG, which places more weight on complexity (multi-syllabic words) than other formulas (Wang et al., 2013; Zamanian & Heydari, 2012).

The F–K and SMOG measures are widely used to assess education and health literature (Wilson, 2008). These measures have a high correlation with performance on reading comprehension tests (.88 to .91; DuBay, 2006). In contrast, the FORCAST, which is based on number of monosyllabic words and is designed for use with bulleted text and non-narrative documents, correlates poorly with reading comprehension. Copying and pasting text into an on-line readability calculator can assist brochure design by calculating the F–K, FOG, and SMOG grade level estimates (Adamovic, 2009).

User-Friendliness

The 22-item checklist highlights important factors not taken into account by readability measures alone (Arnold et al., 2006). Focus on aspects to ensure a visually appealing well-formatted brochure increases the likelihood that information will be read, understood, and used. Mean ratings for this study shows similar responses for four of the five categories in this study with the majority of brochures (65%) needing little work, while 22% needed some work, and 13% needed much work. Ratings for EHDI brochures were better overall than for newborn screening brochures (Arnold et al., 2006). Application of the User-Friendliness instrument adds value to the revision of existing written parent education materials and serves as a guideline in the design of new materials.

Layout. Overall, the layout for the EHDI brochures was rated comparably among stakeholder groups. Most brochures (61%) used an appropriate font size and minimized the use of capital letters, italics, and specialty fonts (73%). In addition, the majority of brochures needed little improvement in ample white space (64%) and/or organization of information (64%). Seventeen percent of the brochures were rated as needing much improvement in shortening paragraphs to four or five sentences. Layout items for the EHDI brochures were rated higher than ratings reported for the newborn screening brochures reviewed by Arnold and colleagues (2006).

Illustrations. Illustrations are an important consideration to enhance visual appeal and reinforce the message. For the EHDI brochures, category of illustrations indicated a greater need for improvement than other categories and also showed greater variability by stakeholder group. Raters who were intimately familiar with the content (i.e., audiologists and speech pathologists) were less critical of illustrations than parents, students, and other raters. Fifty-

Figure 3. Percentage of Response Ratings to Brochures Indicating Some or Much Need for Improvement by Group (i.e., Parents, Professionals, Students, Other) and by User-Friendliness Category.

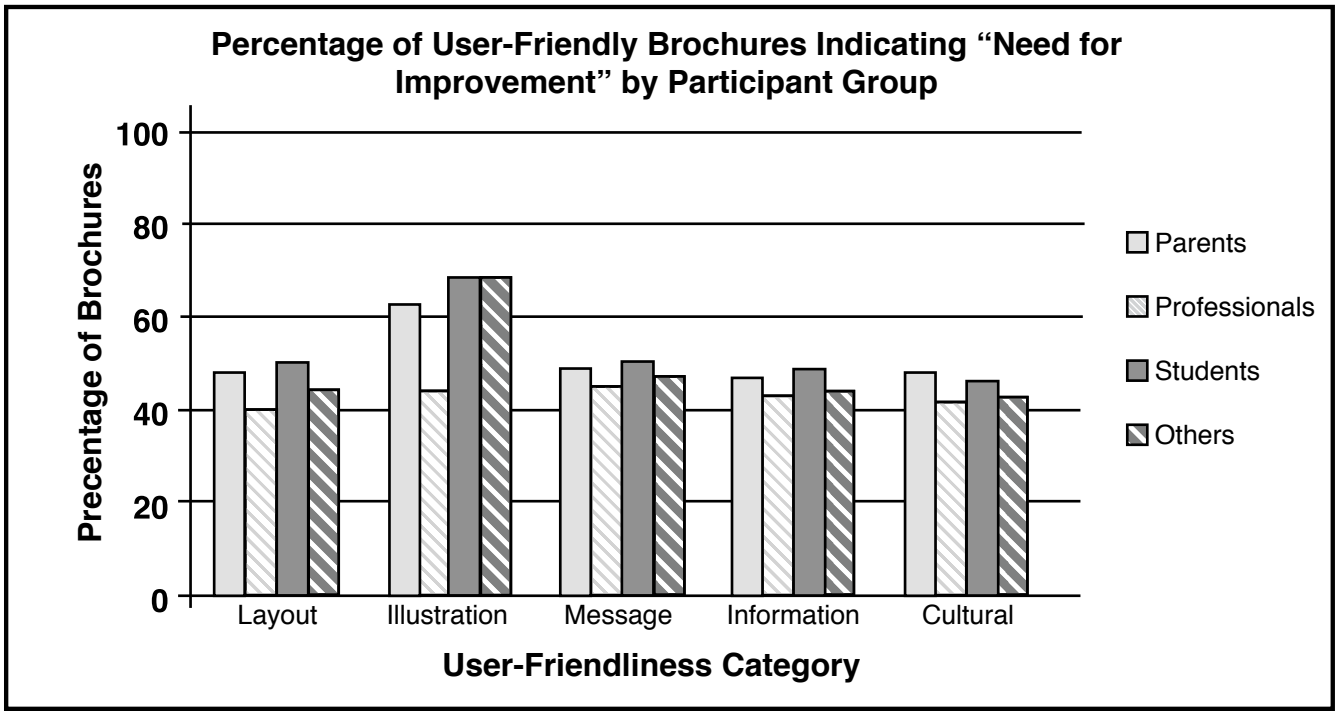


Table 6. Percentage of responses (*N* = 23) for 7 Items on the EHDI Key Content Checklist in Response to Two Questions: (a) Is Key Content Present? And (b) if so, is it Easily Located?

	Key Content Present?		Easily Located?		
	Yes	No	Yes	No	N/A
1. Infant will receive a birth hearing screening?	94%	6%	75%	19%	6%
2. Benefits of birth hearing screening?	88%	13%	88%	0%	13%
3. Possibility of the need for rescreening?	85%	15%	83%	2%	15%
4. Notification of need for rescreening?	73%	27%	40%	2%	58%
5. Action steps if rescreening needed?	67%	33%	63%	8%	29%
6. Motivation to act quickly?	40%	60%	29%	10%	60%
7. Who to contact for more information?	90%	10%	90%	0%	10%

Note. EHDI = Early Hearing and Detection Intervention.

six percent of the brochure illustrations were rated as clear, realistic, and easy to understand; 27% as needing much improvement in use and purpose of illustrations, while 24% were rated as needing much improvement for clarity and understanding relative to the text. These results emphasize the value of varied stakeholder group perspectives when designing or revising EHDI brochures.

Clear Message. EHDI brochures were rated similarly across stakeholder groups. Seventy-seven percent used short explanatory headings, with 74% supporting the message. Sixty-two percent needed little work in getting to the point quickly, and 67% were rated as providing a clear message. Only 48% presented action messages first, with 52% needing some or much work on content regarding next steps. In comparison to the newborn screening brochures reviewed by Arnold and colleagues (2006), the EHDI brochures included more information about action steps, although they were still rated as needing more attention to detail.

Manageable Information. Ninety percent of EHDI brochures were rated as needing minimal math skills. Sixty-one percent needed little improvement in the use of short personalized statements, 70% used familiar words, and 67% focused on the need to know. Ratings were similar across stakeholder groups with only 5% to 11% rated as needing much work. Overall, the information was rated higher for the EHDI brochures than the newborn screening brochures reviewed by Arnold and colleagues (2006).

Cultural Appropriateness. Stakeholder groups rated the cultural appropriateness similarly. Eighty-four percent of the brochures were rated as avoiding stereotypes with only 13% indicating the need for much improvement. Seventy-four percent were rated as well-targeted to the audience, 70% as using a friendly, reassuring tone, and 64% as using familiar pictures, words, and situations. Fourteen percent of the brochures were rated as needing much improvement in the use of familiar words, pictures, and situations. Overall, the cultural appropriateness of EHDI brochures was rated higher than the newborn screening documents reviewed by Arnold and colleagues (2006).

Key Concept Components

Davis and colleagues (2006) identified seven key content components that parents want to know. In this study, each brochure was rated to determine if (a) there was evidence that the key component was present, and (b) if so, the ease of locating that component. Overall, the results of this study showed 40% of the EHDI brochures included all seven key content components; with 30% of this content easily located (refer to Table 4 and Figure 4). Although the majority of EHDI brochures included content about the birth hearing screening (94%), benefits of screening (88%), need for rescreening (85%), and who to contact for more information (90%); fewer included information about how parents would be notified of the need to rescreen (73%), specific action steps to take (67%), and motivational language indicating the need to act quickly (40%). In some cases, if the latter of this information was included, it was not easily located. For example, motivational language was present in 40% of the brochures and it was easy to locate in 29% of these brochures. Use of the evidence-based checklist when developing or revising brochures for newborn hearing screening programs provides a simple tool that can be used to ensure critical content components are included in the design and that the information can be easily located. We are unaware of any published reports regarding content analysis of these components in newborn hearing screening brochures.

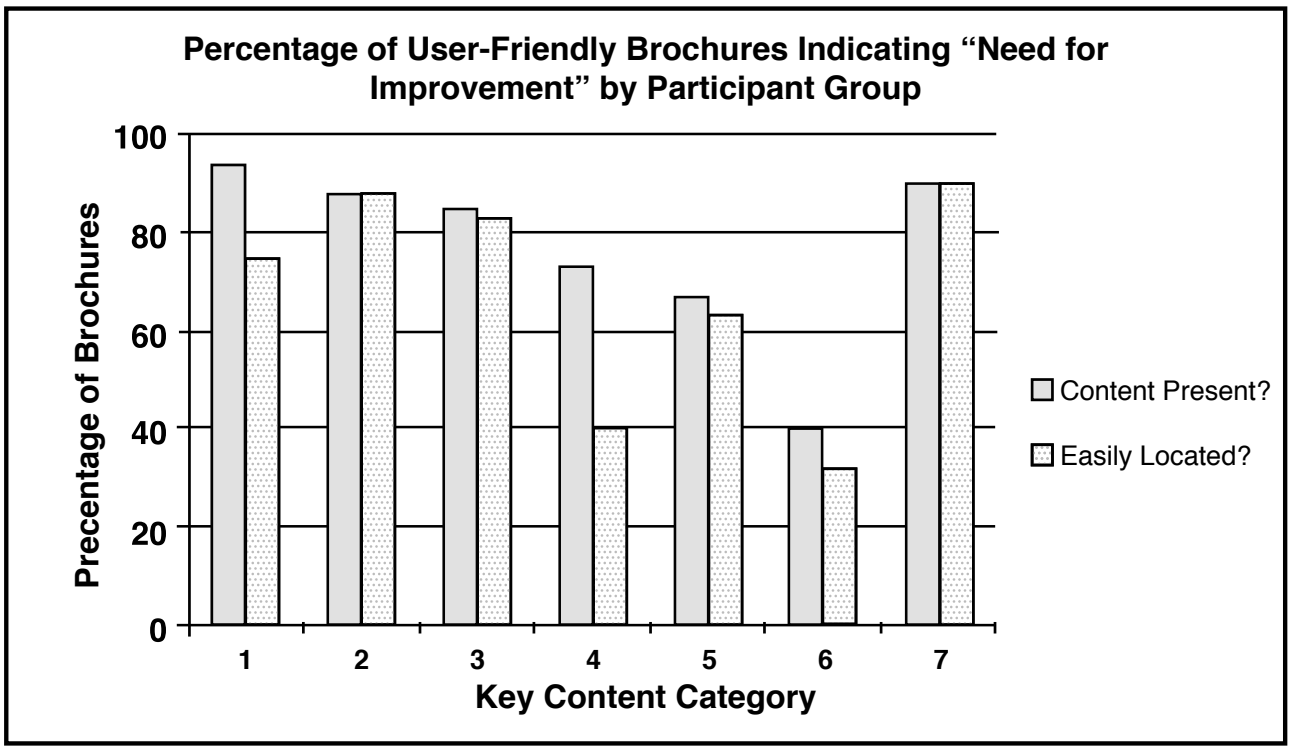
We would be remiss if we did not mention other resources and tools for evaluation of health-related information. One such tool used to assess user-friendliness and content is the Suitability Assessment of Materials (SAM; Doak, Doak, & Root, 1996). Domains included in this instrument are: (a) content, (b) literacy demand, (c) graphics, (d) layout and type, (e) learning stimulation and motivation, and (f) cultural appropriateness. Each of these factors is rated as superior, adequate, or not suitable based on objective criteria and assigned a point value. However, the SAM does not address inclusion of specific key content items. A number of other resources are available to assist in the development of written materials for the purpose of patient and parent education (Centers for Medicaid and Medicare Services, 2012; Joint Commission, 2010; Office of Disease Prevention and Health Promotion, 2010; Pleasant, McKinney, & Rickard, 2011; Ross & Waggoner, 2012). The Centers for Medicaid and Medicare Services (CMS) offers an online Toolkit for the Development of Written Materials that provides comprehensive information about a reader-centered approach to the development and assessment of written information (CMS, 2012). In addition, the NCHAM Resource Guide for Early Hearing Detection and Intervention provides additional guidance and information for parent information (NCHAM, 2015).

Conclusions

Significant variation in readability estimates was found depending on the formula used. For example, the majority of EHDI newborn hearing screening brochures (88%) met the sixth grade or lower reading level criteria recommended by National Literacy Work Group on Literacy and Health when using the F–K Grade Level estimate. In contrast, only 48% met this criterion when the FOG was used and only 23% when the SMOG estimate was used. For this reason, we recommend readability assessment with at least two formulae when designing or revising parent educational material. The F–K and SMOG are recommended as they are the most widely used formulae to estimate grade level for health information. Use of readability software or an online calculator for readability estimation is recommended (Adamovic, 2009).

The checklist developed by Arnold et al. (2006) was valuable in assessing layout, use of illustrations, message,

Figure 4. Percentage of Evidence for Presence and Ease of Location for 7 Key Content Components Recommended by the American Academy of Pediatrics (2000) for Newborn Screening Brochures.



Note. 1= Infant will Receive a Birth Hearing Screening; 2= Benefits of Birth Hearing Screening; 3= Possibility of Need for Rescreening; 4= Notification of Need for Rescreening; 5= Action Steps if Rescreening Needed; 6= Motivation to Act Quickly; 7= Who to Contact for More Information.

information management, and cultural appropriateness of these materials. Our results demonstrated the majority of EHDI newborn hearing screening brochures could benefit from limited improvement (65%) to make them more user-friendly. Use of this checklist during the design and revision of materials can help ensure efforts are focused. In addition, our results support the use of parent reviewers to ensure materials and illustrations meet the needs of the target population.

Of particular importance is the inclusion of key content components that can be easily located in the parent education materials. Davis and colleagues (2006) advocate for inclusion of parents as critical stakeholders in the development stages of program development as do other authors (Ross & Waggoner, 2012). We developed a simple checklist to assist in the review of newborn screening materials to make sure that the information parents want to know is readily available. Specific attention should be paid to the action steps included in the brochure. Readily available resources for use in the development process are also included in the CMS Toolkit for Development of Written Information (CMS, 2012) and the NCHAM Resource Guide for Early Hearing Detection and Intervention (NCHAM, 2015).

Recommendations

As a beginning point, readers are provided with the subsequent simple steps as best practice to follow during brochure design to maximize the message in parent education materials when designing or revising patient education brochures for newborn hearing screening programs.

1. Develop draft test of newborn hearing screening brochures following established guidelines (i.e., readability, user-friendliness, and key content).
2. Use two automated readability calculations (software or free online applications) to estimate grade level. Adjust text accordingly so as not to exceed the recommended sixth grade reading level.
3. Ask parent stakeholders (or a parent stakeholder focus group representative of your target population) to use the User-Friendliness Checklist and Key Content Analysis Checklist to evaluate the brochure content, layout, illustrations, message, information, and cultural appropriateness.
4. Evaluate stakeholder input and make suggested improvements in the brochure text, layout, and illustrations.
5. Maintain a record of quality improvement efforts in brochure development and revision to include in reports to grant agencies and state advisory boards.

Inclusion of parents who are representative of the cultural

and ethnic groups in the target audiences will facilitate effectiveness of the health information. EHDI programs should make every effort to establish a routine of periodic review of parent information materials.

Limitations

Our study provides a comprehensive view of readability, user-friendliness, and key content analysis for EHDI newborn hearing screening brochures published by 48 U.S. states and territories; however, it is not without limitations. First, brochures were downloaded from those available on the NCHAM website, which does not guarantee the most recent version. In the future, it is recommended that researchers check with the state EHDI coordinator to obtain the most recent brochure or to verify that the brochure is current. Second, only English language brochure versions were evaluated; studies in Spanish or other languages could result in different findings. In addition, the criteria used to assess user-friendliness and key content were not clearly defined and were not assigned a point value based on specific features, but left to the discretion of the rater. Lastly, reading skills of the parents receiving these brochures was not tested; assumptions about readability were based on extrapolations from other studies (Hauser et al., 2005; Kutner et al., 2005, 2006, 2007).

Future Research

Evidence supporting the use of readability, user-friendliness, and key content analysis in the development of patient education information is important in the field of early hearing detection and intervention. Future research should include a comparison of the Arnold et al. (2006) User-Friendliness Checklist and the SAM (Doak, Doak, & Root, 1996). More research is needed to determine the validity, reliability, and efficiency of the User-Friendliness Checklist and Key Content Checklist in comparison to SAM.

The inclusion of parents in stakeholder assessment groups cannot be over emphasized, particularly with regards to cultural appropriateness as well as language implications. Inclusion of diverse ethnic and cultural groups in stakeholder populations might increase the efficacy of brochure dissemination. In addition, brochures with strong action steps clearly stated and targeted to specific populations could improve loss to follow-up/documentation rates. Furthermore, readability estimates of EHDI brochures written in Spanish would be very informative. There are a few readability formulae designed specifically for this purpose available as free online calculators. Lastly, future research should include parent focus groups to help professionals evaluate, assess, and confirm the presence of key content components as well as the ease in which this critical information can be located.

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