

Readability of Cervical Cancer Information

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It is important to provide information on HPV vaccination and on early detection and early treatment for cervical cancer. Readability is a key aspect in the success of cervical cancer communication using written health information.

Keywords: HPV vaccination ; cervical cancer ; health literacy ; readability ; patient education ; written health information

1. Introduction

More than 570,000 new cases of cervical cancer are diagnosed and approximately 311,000 women die from the disease annually worldwide [1]. The main cause of cervical cancer is infection with human papillomavirus (HPV). Most cervical cancers can be prevented by vaccination against HPV infection and are curable if detected early in the precancerous stage via screening. It is therefore important to provide people with the information that cervical cancer is a preventable and curable disease and that measures are available for its prevention and early detection. Such HPV vaccination and cervical cancer-related information is often provided as written text in print [2] and as digital media [3]. However, such health information is often written at a level of readability that is difficult for many target audiences to read [4].

Health literacy is “the degree to which individuals have the capacity to obtain, process, and understand basic health information” [5]. A lower level of health literacy is associated with lower vaccination adoption rates and cancer screening adoption rates owing to difficulty with comprehension of the information and complex procedures that are needed to adopt vaccination and screening [6][7]. In the study of health literacy, accessibility and understandability of health information are generally discussed in terms of readability [8]. Health information should be readable to all individuals, regardless of their literacy level. It is recommended that patient educational materials should be written at a fifth- to sixth-grade level or lower [9].

Readability is the reading comprehension level required for a person to understand written materials [10]. Some existing readability assessment tools in English include the Simple Measure of Gobbledygook Grade Level (SMOG), Flesch–Kincaid Grade Level (FKGL) test, Flesch–Kincaid Reading Ease (FRE) test, Fry Readability Graph (FRG), and Gunning Fog Index (GFI) [11][12]. Validated readability assessment tools are also available in other languages such as French [13], German [14], and Spanish [15]. These tools can be used to assess the readability of written text based on factors such as the number of words in a sentence and word difficulty level.

Studies indicate that the readability of information can influence individuals’ understanding and behavior regarding prevention, early detection, and early treatment of cervical cancer. For example, one intervention study showed that participants who were given easy-to-read vaccine information had significantly higher scores of comprehension and recall than those who were given standard materials to read (16.6 vs. 13.9, $p < 0.001$, 15.1 vs. 11.3, $p < 0.001$, respectively) [16]. Another intervention study showed that participants who received materials that were rated easier to read using a readability assessment tool had higher rates of undergoing gynecologic cancer screening than those who received materials that were rated less easy to read (29.4% vs. 14.2%, $p = 0.007$) [17]. Thus, readability is considered an essential quality in the evaluation of HPV vaccination and cervical cancer-related information.

2. Study Characteristics

Table 1 provides an overview of the included studies. Seven studies were conducted in the United States [18][19][20][21][22][23][24], three in Canada [25][26][27], one in China [28], and one in Japan [29]. Ten studies conducted in the United States and Canada assessed materials in English; the other two studies assessed materials in Chinese or Japanese language. Regarding content, eight studies assessed HPV vaccination information [18][20][21][22][26][27][28][29], four assessed cervical cancer information [19][23][24][25]. Regarding format, eight studies assessed online information and websites [18][19][20][22][25][26][28][29], one assessed printed HPV vaccination counseling materials [21], one assessed patient consent forms for radiation therapy for cervical cancer [23], one assessed newspaper articles regarding HPV vaccines [27], and one study

assessed written materials on cervical cancer prevention [24]. Regarding providers, eight studies reported on informational materials provided by commercial websites [25][28] governments [20][26], gynecologic oncology groups [23], health professionals and non-health professionals [29], national newspapers [27], and multiple sources [24]. The number of materials evaluated in the included studies ranged from 4 to 4928.

Table 1. Studies assessing readability level of HPV vaccination and cervical cancer-related information.

Reference	Year	Country	Language	Readability Formula	Material (n)	Provider of Material	Main Results	Assessment of Factors Other than Readability
Wang et al. [28]	2021	China	Chinese	Calculated using word levels and character numbers in sentences	HPV vaccine-related online messages (294)	Most (92%) messages were from commercial websites.	The readability level of 71% of messages were rated at doctoral level, and 20% were undergraduate level.	There were biases in the content of the message. Only 55% of messages had no errors. Regarding the DISCERN scores, only one message (<1%) had good quality.
Dawson et al. [25]	2020	Canada	English	SMOG, FKGL,	Cervical cancer-related online information (100)	42% of websites were commercial, followed by those of non-profit organizations, government, and academic centers.	More than 95% of websites were at a high school reading level (8th grade) or higher.	Many lacked accountability or recent updates. Usability and interactivity were high. Important topics such as prognosis and staging were underrepresented.
MacLean et al. [18]	2019	United States	English	SMOG, FKGL, FRE, GFI, CLI,	HPV vaccination websites (100)	Not reported	75% of websites rated difficult to read (>10th grade). Only a few websites were rated easy to read (<6th grade).	None
Martin et al. [19]	2019	United States	English	SMOG, FKGL, GFI, DC	Cervical cancer patient education online materials (4928)	Not reported	Mean grade-level readability was 8.9, i.e., a high school reading level.	None
Tulsieram et al. [26]	2018	Canada	English	SMOG, GFI	Provincial department/Ministry of Health HPV information websites (7)	Provincial governments	Most (six of seven provinces) websites were rated as difficult to read (>12th grade).	Text coherence was not adequate for lay individuals to understand.
Calo et al. [20]	2018	United States	English	SMOG, FKGL, GFI, CLI, ARI	HPV vaccination messages online (267)	Government, medical association, Medscape, medical journals, educational clearinghouses	The readability level of most materials (62%) was ≥9th grade. Only 12% were easy to read (≤6th grade).	None

Reference	Year	Country	Language	Readability Formula	Material (n)	Provider of Material	Main Results	Assessment of Factors Other than Readability
Chhabra et al. [21]	2018	United States	English	SMOG, FKGL, FRE, GFI, FRG	HPV vaccination counseling print materials (38)	State government	Four documents (10.5%) were at a 6th-grade reading level or lower, and 15 documents (39.5%) at a 10th-grade or higher reading level.	68% of materials were categorized as “unsuitable” with the SAM. Mean PEMAT score was 42%, which was much lower than the threshold for high understandability.
Okuhara et al. [29]	2017	Japan	Japanese	jReadability	Pro-and anti-HPV vaccination online messages (270)	Health professionals and non-health professionals	Pro-vaccination messages were difficult to read. Anti-vaccination messages were significantly easier to read than pro-vaccination messages.	None
Fu et al. [22]	2016	United States	English	FKGL	Critical and noncritical HPV vaccination web pages (116)	Not reported	Most web pages required a 12th-grade reading level.	None
MacDougall et al. [23]	2012	United States	English	SMOG	Patient consent forms for radiation therapy for cervical cancer (4)	Gynecologic oncology group	Readability ranged from grades 12.18 to 16.13; required at least a high school education.	Three of four consent forms scored in the lower portion of the “adequate” range, and one consent form was “not suitable” using the SAM.

Abbreviations: HPV, human papillomavirus; SMOG, Simple Measure of Gobbledygook, Grade Level; FKGL, Flesch–Kincaid, Grade Level; FRE, Flesch–Kincaid Reading Ease; FRG, Flesch–Kincaid Grade; GFI, Grade-Finding Fog Index; DC, Dale–Chall formula; CLI, Coleman–Liau Index; ARI, Automated Readability Index; SAM, Suitability Assessment of Materials; PEMAT, Patient Education Materials Assessment Tool.

3. Readability Assessment

As **Table 1** shows, the 10 studies assessing English materials used the SMOG, FKGL, FRE, GFI, FRG, Dale–Chall formula, Coleman–Liau Index, and the Automated Readability Index to assess readability. Six of ten studies assessing English materials used multiple readability assessment tools. The most frequently used readability formulas were the SMOG and FKGL, which were used in eight and six studies, respectively. Japanese texts were assessed using a readability formula called the jReadability. Readability of Chinese texts was assessed using word levels and character numbers in sentences.

All 10 studies from the United States and Canada reported that most of the information assessed was higher than eighth-grade reading level [18][19][20][21][22][23][24][25][26][27]. These studies showed that there was little information on HPV vaccination and cervical cancer written at the recommended fifth- to sixth-grade level or lower. A study from China reported that 71% of HPV vaccine-related messages were rated at a doctoral readability level and 20% were at undergraduate level [28]. A study from Japan reported that pro-HPV vaccination messages were significantly more difficult to read than anti-HPV vaccination messages [29].

4. Other Factors

As **Table 1** shows, six studies reported the characteristics of informational materials, other than readability levels [21][23][24][25][26][28]. Three studies used the Suitability Assessment of Materials (SAM) [21][23][24]. One of those three studies used the SAM to evaluate patient consent forms to receive radiation therapy for cervical cancer; that study reported that three of the four consent forms scored within the lower portion of the “adequate” range, and one consent form was deemed “not

suitable" [23]. One of those three studies evaluated HPV vaccination counseling print materials using the Patient Education Materials Assessment Tool (PEMAT) in addition to the SAM. That study reported that 68% of materials were categorized as "not suitable" using the SAM, and the average PEMAT score was 42%, well below the threshold for high understandability [21]. One of those three studies evaluated comprehensibility of written cervical cancer prevention materials combined with assessment using the SAM. That study reported that 20% of materials were rated "superior," 68% were "adequate," and 12% were "not suitable" [24]. One study conducted content evaluation and used the DISCERN score to evaluate HPV vaccine-related online messages: that study reported biases and inaccuracies in content and less than 1% of messages were ranked of good quality [28]. One study evaluated accountability, site interactivity and organization, content coverage, and content accuracy of cervical cancer-related online information. That study reported that much of the evaluated information lacked accountability or recent updates and that important topics, such as prognosis and staging, were underrepresented [25]. One study evaluated text coherence of HPV information websites and reported that HPV vaccine information had a lower level of coherence than that needed for the general public [26].

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