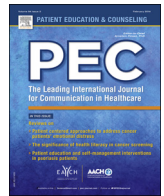




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Review article

Understanding online health information: Evaluation, tools, and strategies

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ABSTRACT

Objective: Considering the status of the Internet as a prominent source of health information, assessing online health material has become a central issue in patient education. We describe the strategies available to evaluate the characteristics of online health information, including readability, emotional content, understandability, usability.

Methods: Popular tools used in assessment of readability, emotional content and comprehensibility of online health information were reviewed. Tools designed to evaluate both printed and online material were considered.

Results: Readability tools are widely used in online health material evaluation and are highly covariant. Assessment of emotional content of online health-related communications via sentiment analysis tools is becoming more popular. Understandability and usability tools have been developed specifically for health-related material, but each tool has important limitations and has been tested on a limited number of health issues.

Conclusion: Despite the availability of numerous assessment tools, their overall reliability differs between readability (high) and understandability (low). Approaches combining multiple assessment tools and involving both quantitative and qualitative observations would optimize assessment strategies.

Practice implications: Effective assessment of online health information should rely on mixed strategies combining quantitative and qualitative evaluations. Assessment tools should be selected according to their functional properties and compatibility with target material.

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1. Introduction

As Internet-based digital media have become more integrated into everyday life, popular information consumption behavior and strategies have shifted from a traditional model to a digital model [1]. In contrast to the traditional model in which information was

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obtained through direct contact with reliable information sources, such as teachers, professionals, or printed material, information retrieval in the online era is characterized by indirect connections, multiplicity of sources, and low levels of reliability [1–4].

While this shift has occurred in every domain of human knowledge, it has particular implications for the dissemination of health-related information. Online sources of health-related information require particular oversight to ensure that they provide accurate, appropriate and understandable content that meets the unique needs of various populations of patients. In other words, the publication of online materials is not useful if they are not beneficial for patients. Furthermore, in the context of online resources such as forums and blogs – and despite the involvement of the community of users and moderators – information can be uncontrolled and sometimes poorly moderated, leading to the risk of spreading potentially harmful information [5].

Health literacy can be defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions [6]. This concept of health literacy not only implies the ability of patients to seek and understand health information, but also involves the capacity to evaluate and to use the information in order to make sound decisions about health-related issues [6,7]. While essential in the context of traditional media, health literacy is obviously also central to the construction of Internet-based health resources and interventions [8]. Of particular concern is evidence suggesting that health literacy is relatively low in the general population [9–11], which is associated with poorer use of health care services and poorer health outcomes [12,13]. This also contributes in part to health disparities [14]. Not surprisingly, the majority of patient health education materials, including those found online, surpass the recommended readability level suggested by the US National Institutes of Health [5,15–19]. When confronted with non-adapted materials, patients might shift to sources which they would consider understandable, without these sources being necessarily endorsed by public health authorities. For instance, numerous patients consider websites such as Wikipedia as a primary source of information regarding their medical status or the different treatment options [20].

Although the health literacy of a given population can be measured, evaluating the appropriateness and understandability of online health-related material poses a challenge. Online material is composed of multiple elements that need to be considered. Some of these elements are shared with offline material, such as the validity and reliability of the information itself, the characteristics of the text (e.g., readability), the semantic complexity, and the way the content is organized and presented. In contrast, other elements are specific to online communication modes, such as the emotional tone (which is considerably more salient in user-generated content) and the use of multimedia materials. All of these elements contribute to the overall understandability and potential usability of the content. The need for evaluation of the appropriateness of online content has been recognized early on and a number of tools to evaluate online

informational materials have been developed over the past two decades. However, given the complexity of the online material, there is currently no single tool that can be used to evaluate all of the various elements of health-related online content. Therefore, evaluation of online health material requires a combination of various methodologies, ranging from classical readability tools to more experimental medical content assessment questionnaires. This paper describes the available tools for assessment of online content and proposes that combined (quantitative and qualitative) approaches could be successfully used to evaluate online health information based on several complementary dimensions including readability, emotional tone, understandability and usability, connectivity and multimodality of content.

2. Readability: the ease of reading of online health information

When attempting to assess any form of text-based information, the first and obvious parameter to evaluate is whether the text is linguistically understandable – in other words, its readability. Quantifying readability is not a novel issue: over the last half-century, numerous tools have been developed and are available to assess the level of readability of text [21]. These tools have been used abundantly in order to evaluate professionally generated online medical materials [5,15–19]. In general, the results of readability assessment using different tools are heavily co-variant as they are typically based on the same theoretical framework for literacy [21,22]. Nonetheless, most studies evaluating Internet-based content tend to use several tools simultaneously in order to obtain a broader range of results [15–17,19,23–25].

When it comes to the biomedical field, the six most commonly used readability analysis tools are the Flesch Kincaid Grade Level (FKGL), the Flesch Reading Ease (FRE), the Simple Measure of Gobbledygook (SMOG), the Fry Readability Graph (FRG), the Gunning Fog Index (GFI), and the New Dale-Chall (NDC) [22], as well as two other tools that are often used in studies of oto-rhino-laryngology related websites, the Coleman-Liau Index (CLI) and the FORCAST [16]. However, while all of these instruments are considered as highly reliable and have been thoroughly validated, they are not all equally useful for analysis of materials in the particular context of online health information. The first issue is related to the very nature of health information and applies both to offline and online media. For instance, in the context of medical terminology, familiar words added together can result in meanings which are far more complex or unfamiliar than the individual words themselves (e.g., “white”, “blood”, “cell”, and “count” are considered easy words for fourth grade students when used individually, while “white blood cell count” refers to a concept far more complex). Thus, instruments such as the NDC, which are based on word difficulty lists (in this case the Dale-Chall modified list of 3000 words considered as familiar), are likely to substantially minimise the real difficulty of text pertaining to a health-related topic [22]. Second, while most of these instruments were initially developed to evaluate printed material, the mathematical formulas used to generate scores might not be

Table 1
Suggested battery of readability assessment tools to evaluate online health material.

Assessment tool	Formula
Flesch Reading Ease	$206.835 - (1.015 \times \text{average sentence length}) - (84.6 \times \text{syllables/word})$
Flesch-Kincaid grade level	$(0.39 \times \text{average sentence length}) + (11.8 \times \text{syllables/word}) - 15.59$
SMOG	$3.1291 + 1.043 \sqrt{(30 \times \text{no. of polysyllable words/no. of sentences})}$
Gunning Fog Index	$0.4 (\text{average sentence length} + 100 / (\text{no. of polysyllable words/no. words}))$

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