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Exploring the role of health literacy on attention to and recall of text-illustrated health information: An eye-tracking study

Corine S. Meppelink [*],[1], Nadine Bol [1]

Amsterdam School of Communication Research/ASCoR, University of Amsterdam, Amsterdam, The Netherlands

A B S T R A C T

Although the use of illustrations is often recommended for audiences with limited health literacy, it is unclear how health literacy impacts the use of different online formats. The aim of this paper is therefore to investigate how health literacy influences attention to text and illustrations in online health information, and whether such attention is related to recall of information. Sixty-one participants were exposed to either text-only or text-illustrated information. Using eye tracking, we recorded attention patterns on a health webpage after which recall of information was assessed. Results showed that health literacy influenced the attention–recall relationship. For people with limited health literacy, attention to the illustrations was positively related to recall, whereas attention to the text improved recall of information in the adequate health literate group. As attention to different parts of online health information leads to different information processing routes for people with different levels of health literacy, effective health communication should consider both text and illustrations that attract attention and improve understanding of the health message.

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1. Introduction

The effectiveness of health information largely depends on people's ability to understand and use information. For instance, understanding and acting upon important health information, such as medication prescriptions, is highly important for adequate disease management. However, almost half of the medical information is immediately forgotten (Kessels, 2003; Bol et al., 2015), suggesting that mere information provision does not mean that individuals are able to deal with health information. Especially people with limited health literacy are often not able to adequately use health information. Health literacy is "the degree to which individuals can obtain, process, understand, and communicate about health-related information needed to make informed health decisions" (Berkman, Davis, & McCormack, 2010, p. 16). Moreover, having limited health literacy skills is associated with several health-related drawbacks, such as increased hospitalization rates, more chronic conditions, and less participation in preventive health services (DeWalt et al., 2004). Providing comprehensible

health information to people with limited health literacy is therefore vital to scale down these health-related drawbacks.

Online sources are becoming increasingly important for finding health information: The Internet is often cited as the second most important source of health information after the health care provider (Eysenbach, 2003). As people are increasingly expected to take responsibility for their own health, availability of online health information is a positive development. Moreover, the use of online health information empowers people to use online health services (Mano, 2014). Unfortunately, not everyone benefits from the abundance of such information because selecting, understanding, and applying health information requires sufficient health-related knowledge and skills (Fransen, Van Schaik, Twickler, & Essink-Bot, 2011). People with limited health literacy often lack such knowledge and skills. Moreover, the majority of online health information is difficult to read and understand, which is in particular a problem for people with limited health literacy (McInnes & Haglund, 2011).

To improve understanding of health materials, adding explanatory illustrations to a text can be useful. Illustrations are often used in health information, for example in materials about cancer (King, 2014). Using illustrations is found to positively influence individuals' attention to the health message (Delp & Jones, 1996) and understanding of information presented in the message (Brotherstone, Miles, Robb, Atkin, & Wardle, 2006). Especially people with limited

health literacy have shown to benefit from illustrated messages (Meppelink, Smit, Buurman, & van Weert, 2015), and the use of illustrations is strongly recommended for this target group (Doak, Doak, & Root, 1996; National Cancer Institute, 2003). Moreover, research has shown that people generally learn better from text-illustrated information compared to text only (Mayer, 2002). Despite the proposed benefits of adding illustrations to health messages, it is unknown how people with different levels of health literacy attend to such health messages and whether attention to the message actually improves recall of information.

The aim of this study is therefore to gain insight into how people with limited or adequate health literacy attend to online health information, and how attention to such information leads to adequate recall of information. We use eye tracking to explore whether attention to certain parts of the health message (i.e., text and illustrations) varies across different levels of health literacy, and whether attention to these parts of the message influences information recall. By using this knowledge, health communicators are better able to create messages that accommodate an important and vulnerable group of health care consumers.

1.1. Health literacy and attention to health information

As people with limited health literacy skills often struggle with online health information, it is important to gain insight into how health literacy influences attention to health information. Yet, studies that focus on both health literacy and attention are lacking. Despite the lack of studies on specific health literacy groups, research conducted in domains other than health literacy, such as literacy, could provide some insight in the possible differences between health literacy groups. For instance, people with limited literacy skills have different attention patterns: On the one hand, they tend to spend more time to the text to make sure not to miss important information, whereas, on the other hand, they are also characterized by skipping large parts of the text due to being distracted by other elements on the webpage (Colter & Summers, 2014).

Nevertheless, studies on attention differences across health literacy levels are scarce, and testing effective formats of health information has not yet been done. Only two recent eye-tracking studies explored attention patterns with regard to health information. These studies revealed that health literacy influences the way in which people attend to nutrition labels (without considering differences in format) (Mackert, Champlin, Pasch, & Weiss, 2013), and that adding illustrations influences how text information is read (without considering differences in health literacy levels) (Morrow et al., 2012). However, none of these studies have provided valuable insights into how people with different levels of health literacy attend to text-only compared to text-illustrated messages. Although previous studies have suggested that illustrated health information is better attended than non-illustrated information (Arora et al., 2014; Delp & Jones, 1996), it is unclear whether the same applies to online health materials. We therefore explore how health literacy influences attention to text and/or illustrations (RQ1).

1.2. Health literacy, attention, and recall

Information processing starts with message encoding, in which the reader attends to information that he or she considers to be relevant (Lang, 2000, 2006). All elements of the message that are not encoded will be lost. Consequently, health information can only be recalled if the relevant content is attended to in the first place. Generally, attention and recall are positively related. The more time people spend on textual information, the better the information is recalled (Bol et al., 2015). However, health literacy could possibly influence the attention–recall relationship. If new information is poorly attended, processed, or understood, the information will not be stored in long-term memory nor correctly remembered (Lang, 2000). As people with limited health literacy often have difficulties with reading and understanding health information, it could be expected that more attention time does not necessarily lead to more information recall among this group. In contrast, people with adequate health literacy skills are expected to read and understand online health information more easily and thus recall more information when attention increases.

Even though research suggests that the attention–recall relationship might differ for people with different levels of health literacy, little is known about how these people attend to either text or text-illustrated health information, and how such attention, in turn, influences information recall. By exploring the role of health literacy in the relationship between attention to text and/or illustrations and recall of health information, guidelines for limited health literate audiences can be improved and adapted. Since this evidence is still limited, we explore the role of health literacy in the relationship between attention to text and/or illustrations and recall of health information (RQ2).

2. Method

2.1. Participants

The ethical committee review board of the Amsterdam School of Communication Research (reference number 2012-CW-48) approved the study protocol, and all participants provided written informed consent. The data used in the current study were part of a larger eye-tracking study in which data of 97 individuals were collected. Healthy adults between the age of 21 and 88 were recruited via mailings and panels to create a heterogeneous sample in terms of age, gender, and education level. In the experiment, participants were exposed to information about Radio Frequency Ablation (RFA) treatment, which is a relatively unknown treatment for lung cancer involving a needle attached to a generator to destroy tumorous cancer cells. We selected an unknown topic as we wanted to ensure that participants had no prior knowledge to validly measure recall of information. Participants were randomly assigned to one of three experimental conditions: text-only condition, text with text-relevant illustrations conditions, or text with text-irrelevant illustrations condition (for description of the full experiment, see Bol et al., 2015).

To explore the research questions proposed in this study, we focused on the participants who had been exposed to the text-only information or text with text-relevant illustrations, resulting in a sample of 67 people. Of the 67 individuals who had been exposed to the text-only information or text with text-relevant illustrations, data of only 62 individuals were available because of missing health literacy (SAHL-D) data ($n = 5$; due to, e.g., missing audiotapes). Furthermore, one participant was identified as an outlier based on the Mahalanobis Distance method, which exceeded the critical value at $p < .001$ (Pallant, 2001; Tabachnick & Fidell, 2007). This participant was therefore omitted from the analyses, leaving a total of 61 participants ($M_{age} = 56.26$, $SD_{age} = 17.95$, range = 24–88) for our analyses. Most participants were female (60.7%), and used the Internet for at least two hours per week on average ($M = 15.52$, $SD = 10.24$). Most participants had finished a higher level of education (45.9%), followed by a middle level of education (32.8%), and lower level of education (21.3%). An overview of participant characteristics is presented in Table 1.

2.2. Procedure

Participants were invited and informed about the eye-tracking experiment through email, and completed an online screening questionnaire. Upon giving their informed consent to participate in the