A readability comparison of anti- versus pro-influenza vaccination online messages in Japan

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ABSTRACT

Historically, anti-vaccination sentiment has existed in many populations. Mass media plays a large role in disseminating and sensationalizing vaccine objections, especially via the medium of the Internet. Based on studies of processing fluency, we assumed that anti-influenza vaccination online messages to be more readable and more fluently processed than pro-influenza vaccination online messages, which may consequently sway the opinions of some audiences. The aim of this study was to compare readability of anti- and pro-influenza vaccination online messages in Japan using a measure of readability.

Web searches were conducted at the end of August 2016 using two major Japanese search engines (Google.jp and Yahoo!.jp). The included websites were classified as "anti", "pro", or "both" depending on the claims, and "health professional" or "non-health professional" depending on the writers' expertise. Readability was determined using a validated measure of Japanese readability (the Japanese sentence difficulty discrimination system). Readability of "health professional" websites was compared with that of "non-health professional" websites, and readability of "anti" websites was compared with that of "pro" websites, using the *t*-test.

From a total of 145 websites, the online messages written by non-health professionals were significantly easier to read than those written by health professionals ($p = 0.002$, Cohen's $d = 0.54$). Anti-influenza vaccination messages were significantly easier to read than pro-influenza vaccination messages ($p < 0.001$, Cohen's $d = 0.74$). When health professionals prepare pro-influenza vaccination materials for publication online, we recommend they check for readability using readability assessment tools and improve the text for easy reading if necessary.

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1. Introduction

Influenza vaccinations are the most effective measure for reducing susceptibility and potentially serious influenza-related complications (World Health Organization, 2014). However, influenza immunization rates remain less than optimal in Japan (Nobuhara et al., 2014). Although receiving influenza vaccination is recommended by the Japanese government under the Preventive Vaccinations Law, influenza vaccination is not given at school or in the workplace. Individuals who seek influenza vaccination visit at doctors and pay one's own expense (excluding people over 65 years of age and disabled persons).

Additionally, anti-vaccination sentiment, which includes doubt, fear, and opposition to vaccination, has been in existence (Blume, 2006; Dubé et al., 2015); it had a demonstrable impact on vaccination policies, individuals, and community health (Poland and Jacobson, 2001). Anti-vaccination messages are especially more common on the Internet

than in other forms of media (Davies et al., 2002). Vaccination is one of the topics that individuals consult the internet for information and/ or advice. (Betsch et al., 2012). These individuals can easily encounter anti-vaccination online messages because search engines list not only pro-vaccination messages but also anti-vaccination messages (Betsch et al., 2012; Davies et al., 2002; Jones et al., 2012). Influenza vaccination in Japan is no exception. Anti-influenza vaccination activists, who are mostly self-proclaimed specialists lacking specialized knowledge and lay people, propagate on the internet that influenza vaccine has little or no efficacy but a high risk of side effects, and that influenza is not a serious disease for which preventive intervention is required (Hirota and Kaji, 2008).

Internet usage statistics show approximately 91% of Japanese, 92% of the British, and 87% of Americans are regular users of the Internet (Internet World Stats, 2001). Online health information seeking is becoming a recurrent activity in people's everyday lives (Fox and Duggan, 2013; Hesse et al., 2005; Lustria, 2007). Of the internet users, 70% say the information they encounter online influences their treatment decisions (Fox and Rainie, 2000). Further, over half (52%) of users believe "almost all" or "most" information on health websites is

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credible (Fox and Rainie, 2000). If these naïve individuals encounter anti-vaccination online messages, they may accept them and decide not to receive influenza vaccination. Thus, anti-vaccination online messages may increase the number of people not seeking influenza vaccination based on misleading online messages (Hesse et al., 2005).

In the present study, we focus on the readability of influenza vaccination online messages on the assumption that it plays an important role in their acceptability. "Readability" is defined as "the determination by systemic formulae of the reading comprehension level a person must have to understand written materials" (Albright et al., 1996). Text that is "readable" makes information more accessible and useful by improving comprehension, learning, and retention (Klare, 1963). Further, easy-to-read text is more liked and trusted (Schwarz, 2004; Alter and Oppenheimer, 2009), and generates a more favorable reader attitude (Claypool et al., 2015) than difficult-to-read text, according to studies of processing fluency. Processing fluency refers to the ease or difficulty with which new, external information can be processed (Schwarz and Clore, 2007). Human judgment is influenced by not only the content of thoughts but also the metacognitive experience of processing those thoughts (Flavell, 1979; Tversky and Kahneman, 1973). Processing fluency is one metacognitive cue that plays an important role in human judgment (Alter and Oppenheimer, 2009; Schwarz and Clore, 2007). Claypool et al. (2015) argued in their review of fluency studies that fluently processed stimuli make attitudes more favorable.

For example, Rennekamp (2012) created more readable and less readable versions of a financial report by manipulating such factors as sentence length, simplicity of terms, and ease of syntax. After reading the fluent or dysfluent report, participants answered that they were more likely to feel they could trust a fluent report than dysfluent one. Similarly, if vaccine-related online messages are easy to read with simple words, syntaxes, and short sentences, readers may trust them more, and may have more favorable attitude to them. The reverse also applies.

Regrettably, studies indicate that health-care professionals often use jargon that are unfamiliar to health-care users (Byrne and Edeani, 1984; Castro et al., 2007; Ley, 1998), and that health information is often written at readability levels that are too high for the majority of the intended recipients (Rudd et al., 2000); such information is assumed to be dysfluently processed. In such cases, more information may cause target subjects to feel distrust and disfavor rather than empowered, especially for those who have limited health literacy. The Healthy People 2010 report reminds public health communicators to pay special attention to health literacy, defined as "the degree to which individuals have the capacity to obtain, process, and understand basic health information" (U.S. Department of Health and Human Services, 2000). In the field of health literacy, accessibility and appropriateness of health communication have generally been discussed in terms of readability (Nielsen-Bohlman et al., 2004). Thus, paying attention to readability of health information is crucial.

We aimed to compare readability of anti- and pro-influenza vaccination online messages in Japan using a measure of readability. We proposed two hypotheses.

Hypothesis 1. Influenza vaccination related online messages written by non-health professionals are easier to read than those written by health professionals according to a measure of readability.

Hypothesis 2. Anti-influenza vaccination online messages are easier to read than pro-influenza vaccination online messages according to a measure of readability.

2. Methods

2.1. Material collection

Web searches were conducted at the end of August 2016 using the search formula in Japanese input into Google.jp and Yahoo!.jp (the

Japanese version of the search engine); influenza AND (vaccine OR inoculation); influenza AND (vaccine OR inoculation) AND (danger OR dangerous); (objection OR effect); (necessary OR unnecessary); (efficacious OR inefficacious); (approval OR disapproval); (receive OR "not receive"); (benefit OR risk). The terms such as "danger", "dangerous", "objection", "unnecessary" and "inefficacious" were included in these formulae for gathering anti-influenza vaccination online messages because only the term "influenza AND (vaccine OR inoculation)" did not gather a sufficient number of anti-messages for examination, and because individuals who doubt about the necessity of influenza vaccination seem to search online using those terms. Google and Yahoo! were chosen because they are the most popular search engines in Japan, accounting for approximately 66% and 29% of all Internet searches respectably (StatCounter Global Stats, 1999). Top 100 results were reviewed for each search formula.

After excluding duplication, results were included for analysis if they did not meet any of the following exclusion criteria: (1) bulletin board system or listserv or newsgroup pages or twitter; (2) pages solely containing brief notices about other website content; (3) video results; (4) non-Japanese websites; (5) inactive links; (6) online messages exclusively about veterinary vaccination; (7) online messages exclusively about vaccination other than influenza (e.g., combination vaccines for children, cervical cancer); (8) online messages without any claims of anti- or pro-vaccination (e.g., cites exclusively about expenses, side reactions and cautions). The URLs of the included materials were recorded in a Microsoft Excel 2016 spreadsheet.

2.2. Material classification

The included materials were independently classified as "pro", "anti" or "both" by two raters: one of the authors (T.O.) and a trained rater. Each was blinded to the other's ratings. Materials that recommended readers receive influenza vaccination were classified as "pro," and materials that opposed/objected were classified as "anti." Materials that referred to both claims of pro- and anti-HPV vaccination, but did not state their own assertion, were classified as "both" (see Appendix for coding guidelines). This classification generated six categories: identical classifications between raters (pro-pro, both-both, and anti-anti) and disagreeing classifications (pro-both, anti-both, and pro-anti). Then, pro-pro and pro-both materials were labeled as "pro"; anti-anti and anti-both as "anti"; and both-both as "both." Materials of seemingly disagreeing classifications, pro-anti, were set aside for discussion on agreement by the raters.

"Pro" and "anti" materials were classified into seven categories depending on the authors' professional expertise: "pro" materials written by individual physicians, nurses, pharmacists, or researchers; "pro" materials written by organizations such as the Ministry of Health, Labour and Welfare of Japan, research centers, pharmaceutical companies; "pro" materials written by authors of news sites; "pro" materials written by laypeople; "anti" materials written by individual physicians or pharmacists; "anti" materials written by authors of news sites; and "anti" materials written by laypeople and alternative therapists.

Then, these seven categories were classified as "health professional" or "non-health professional" depending on the authors' health expertise. We classified materials written by individual physicians, nurses etc. as "health professional". We also classified materials written by organizations such as the Ministry of Health, Labour and Welfare of Japan, research centers, pharmaceutical companies as "health professional" because those materials were usually under editorial supervision by health professionals such as physicians. We classified materials written by authors of news sites as "non-health professional" because the authors were not medical journalists but writers of general topics. We combined materials written by alternative therapists and laypeople, and classified them as "non-health professional" because we found only two materials by alternative therapists and they were self-proclaimed massager without any qualifications.