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A qualitative analysis of the beliefs of Japanese anti-influenza vaccination website authors

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Abstract

Background: Influenza vaccine coverage among the Japanese population is less than optimal. Anti-vaccination sentiment exists worldwide, and Japan is no exception. Anti-influenza vaccination activists argue on the internet that influenza vaccine has little or no efficacy and a high risk of side effects, and they warn that people should forgo vaccination. We conducted a qualitative analysis to explore beliefs underlying the messages of anti-influenza vaccination websites, by focusing on the perceived value these beliefs provide to those who hold them. **Methods:** We conducted online searches in January 2017 using two major Japanese search engines (Google Japan and Yahoo! Japan). Targeted websites were classified as “pro”, “anti”, or “neutral” depending on their claims. We applied a dual analytic approach—inductive thematic analysis and deductive interpretative analysis—to textual data of the anti websites.

Results: Of the 113 anti websites, we identified two themes that correspond to beliefs: it is necessary to 1) protect others against risks and exploitation related to influenza vaccination, and 2) educate others about hidden truths and self-

determination. Authors of anti websites ascribed two values (people's "safety" and one's own "self-esteem") to their beliefs.

Discussion: Website authors may engage in anti-vaccination activities because they want to feel they are virtuous, saving people from harm caused by vaccination, and to boost their self-esteem, thinking "I am enlightening uninformed people." The anti-vaccination beliefs of website authors were considered to be strong. In promoting vaccination, it would be better not to target outright vaccine refusers, such as the authors of anti-vaccination websites; it is preferable to target vaccine-hesitant people who are more amenable to changing their attitudes toward vaccination. We discuss possible means of promoting vaccination in that target population.

Keywords: Psychology, Vaccines, Infectious disease, Evidence-based medicine

1. Introduction

Influenza vaccination is an effective choice for preventing illness [1]. High vaccination uptake is important to limit transmission, protect groups at high risk, reduce the number of severe outcomes, and prevent overburdening of health services. Accordingly, increasing the uptake of influenza vaccination is an essential issue to be addressed worldwide [2]. However, influenza vaccine coverage rates among adults not at high risk remain less than optimal in Australia, European countries, the United States, and Japan [3, 4, 5, 6].

Japan is the only country in the world to have adopted mass vaccination of school-children for influenza control [7]. However, influenza was excluded from the list of target diseases of the Preventive Vaccination Law in 1994 because of the anti-influenza vaccination movement that began in the 1980s [7]. Influenza vaccine is characterized by the need to vaccinate every year. Influenza vaccination becomes a contentious topic in the media and among people in Japan each winter. Thus, influenza vaccination is familiar to the Japanese population, among which both pro- and anti-vaccination sentiments exist.

Anti-vaccination sentiment, which includes doubt, fear, and opposition to vaccination, is present worldwide [8, 9] and has had a demonstrable impact on vaccination policies, individuals, and the health of communities [10]. Anti-vaccination messages are especially common on the internet, more so than for other forms of media [11]. The internet is cited as one of the main sources of information on immunization for individuals in different countries who are struggling with decisions about vaccination [12, 13, 14]. Studies have found that individuals often use a general search engine and easily produced search terms (e.g., "vaccination") [12], and these terms usually return anti-vaccination websites in the top 10 search results [15]. However,

individuals have difficulty assessing the accuracy and credibility of such information [12, 16]. Influenza vaccination messaging in Japan is no exception. Anti-influenza vaccination activists, who are mostly self-proclaimed specialists lacking specialized knowledge as well as unconventional health professionals, promote on the internet the idea that influenza vaccine has little or no efficacy but carries a high risk of side effects [7]. They also argue that influenza is not a serious disease for which preventive intervention is required [7].

Previous content analyses have revealed messages that are often present on anti-vaccination websites, such as that vaccines contain toxins, vaccines cause illness, vaccines are ineffective or are part of a medical/pharmaceutical/government conspiracy, and alternative treatments (e.g., homeopathy) are superior and preferable to vaccination [15, 17, 18]. However, to more precisely understand and counter the anti-vaccination movement on the internet, the beliefs underlying online anti-vaccination messages should be qualitatively explored; e.g., What beliefs are motivating website authors to propagate anti-vaccination messages? According to behavioral change theories that have been validated in many studies, individuals' beliefs are antecedents to their behaviors [19, 20, 21]. Understanding individuals' beliefs is essential to change beliefs and behaviors through communicating the risks and benefits of medical practice [22].

To explore the beliefs held by authors of anti-vaccination websites, Abelson's belief-possession theory [23] may provide clues. The theory proposes that individuals' beliefs are like possessions, such as houses or automobiles, and provide value to those who hold them [23]. According to this theory, the value of beliefs comes from the beliefs' functionality, its instrumental or expressive function (Table 1). When an instrumental belief that has an instrumental function is stated, there is an anticipated reward that is in an individual's self-interest; e.g., "I believe that this policy is wise

Table 1. Psychological sources of belief value.

Functionality	
Instrumental	What the belief promises, via mediation or wishfully.
Expressive	Who the belief says you are: your groups, experiences and Feelings.
Attributes	
Sharedness	Is the belief in favor with other people?
Uniqueness	Does the belief imply unusual taste?
Defensibility	Can the belief be justified as sound?
Extremity	Is the belief sharp, intense, "the most"?
Centrality	Does the belief fit with other beliefs?

Source: Abelson, R. P. (1986). Beliefs are like possessions. *Journal for the Theory of Social Behaviour*, 16(3), 223–250.

because it will result in improved patient safety”. When an expressive belief that has an expressive function is stated, there is self-definition of (and often an intent to imply) the belief holder’s good character and/or good judgment. Thus, instrumental or expressive functions of a belief provide the value basis of the belief. The degree of value, as per this theory, depends on attributes of the belief: sharedness (i.e., Is the belief favored by other people?), uniqueness (i.e., Does the belief imply unusual taste?), defensibility (i.e., Can the belief be justified as sound?), extremity (i.e., Is the belief sharp and intense?), and centrality (i.e., Does the belief fit with other beliefs about oneself?). The greater the degree of these attributes, the greater the value of the belief, and the more strongly the belief persists.

Based on Abelson’s theory [23], we hypothesized that beliefs underlying the messages of anti-influenza-vaccination websites have functionality and that the belief functions provide value to the authors of anti-vaccination websites. The present study used a qualitative approach to explore the beliefs of anti-influenza vaccination website authors, based on this hypothesis. First, we sought themes in terms of the functionality of beliefs and examined the perceived value that the belief function provided to those who held them. Then, we assessed the degree of belief value in terms of the beliefs’ attributes.

2. Methods

2.1. Material collection

We conducted online searches on January 10 and 11, 2017, using a formula for Japanese-language input entered into the two most popular search engines in Japan, Google (www.google.co.jp) and Yahoo! JAPAN (www.yahoo.co.jp), which respectively accounted for approximately 69% and 26% of all internet searches in December 2016 [24]. Although English speakers use such terms as “vaccine”, “vaccination”, and “immunization”, Japanese speakers only use the terms “*wakuchin*” and “*yobouseshu*”. *Wakuchin* corresponds to vaccine and *yobouseshu* corresponds to vaccination and immunization in English. Therefore, we performed the search using the terms “influenza AND (*wakuchin* OR *yobouseshu*)”, which in this study translated to: influenza AND (vaccine OR vaccination); influenza AND (vaccine OR vaccination) AND (receive OR not receive); (necessary OR unnecessary); (efficacious OR inefficacious); (important OR unimportant); (approval OR disapproval); (safe OR dangerous); (benefit OR advantage OR merit OR risk OR disadvantage OR defect). The top 100 results were reviewed according to each search formula by one of the authors (T.O.). Duplicate listings, bulletin board systems, Twitter, Wikipedia, videos, and sites exclusively discussing locations and/or expenses for influenza vaccination were excluded.

2.2. Material classification

Sentiments or claims expressed on websites were independently classified as “pro”, “anti”, or “neutral” by two raters, the first author and a trained rater. Websites recommending that readers receive influenza vaccination were classified as pro, and websites that opposed or objected to vaccination were classified as anti. Websites that referred to positions of both pro- and anti-influenza vaccination but did not make their own assertions were classified as neutral (for coding guidelines, see Table 2). Initially, two raters conducted a preliminary analysis by applying the coding guidelines to 10 randomly selected websites, to resolve any discrepancies in interpretation. The raters then independently classified all websites.

For the anti websites, the first author described the professional expertise of the website author or interviewee of each article (e.g., physician). If the professional expertise of the website author could not be identified (e.g., an anonymous author of a blog), they were labeled “citizen.”

2.3. Data analysis

Anti websites were qualitatively analyzed. We used thematic analysis with a hybrid approach, as proposed by Boyatzis [25]. In this approach, coding is conducted inductively, and then the codes are interpreted and the themes generated deductively. We applied Braun and Clarke’s approach, which involves a recursive six-phase process [26]. Initially, the first author thoroughly read the textual material to familiarize

Table 2. Coding guidelines.

Pro	<ul style="list-style-type: none"> ● The website concludes that individuals should receive influenza vaccination. ● Even if this conclusion is not stated, it is obvious that the author of the website recommends that individuals receive influenza vaccination.
Anti	<ul style="list-style-type: none"> ● The website concludes that individuals should not receive influenza vaccination or that influenza vaccination is not necessary. ● Even if this conclusion is not stated, it is obvious that the author of the website asserts that individuals should not receive influenza vaccination or that influenza vaccination is not necessary.
Neutral	<ul style="list-style-type: none"> ● The website includes assertions that are both pro- and anti-influenza vaccination (e.g., benefits and risks, necessary and not necessary). ● The website does not state their own conclusion or leaves the decision to receive influenza vaccination to readers.

himself with the data. The author then manually and inductively generated codes that captured interesting features of the data in a systematic fashion across the entire dataset, collating the data relevant to each code. In this phase of generating codes, Boyatzis' five elements of codes (labels, definitions, inclusion and exclusion criteria, and examples) were recorded in Microsoft Excel as a code book. These records were modified accordingly as the coding proceeded. This coding phase was followed by the phase of searching for themes, in which codes were collated into potential themes using the framework of Abelson's belief-possession theory [23]. During the analysis in this phase, attention was paid to the links between codes, themes, and functionalities of beliefs. Then, in the phase of reviewing themes, the generated themes were checked to determine if each theme was coherent and substantial, with clear boundaries and a distinct central organizing concept. In the next phase of defining and naming themes, specifics of each theme were refined, and clear definitions and names for each theme were generated. These phases of generating themes were conducted manually using Microsoft Excel to collate codes and record definitions and names of themes. Finally, the first author wrote a report of the overall analysis. The first and second authors discussed the generated codes and themes to reach a consensus. All terms were translated into English for the purpose of this report, after the research was completed.

3. Results

The interrater agreement was excellent (weighted kappa coefficient of 0.861). Of a total 334 websites evaluated, 201 (60.2%) propagated pro-influenza vaccination messages, 113 (33.8%) propagated anti-influenza vaccination messages, and 20 (6.0%) were neutral. Two themes were found among the 113 anti websites: (1) protect others against risks and exploitation related to influenza vaccination (subcategories: health risks associated with influenza vaccination, exploitation by the industry of influenza vaccination, distrust of influenza vaccination information), and (2) educate others about hidden truths and self-determination (subcategories: denial of influenza vaccination efficacy based on scientific evidence, denial of influenza vaccination efficacy based on the words and actions of health professionals, proposal of natural alternatives, recommendation of self-determination) (Table 3). In terms of Abelson's theory [23], theme (1) corresponded to an instrumental belief that had an instrumental function. The belief value that came from this instrumental belief was keeping people safe from increased health risks as a result of receiving influenza vaccination and from exploitation by the influenza vaccine industry. Theme (2) corresponded to an expressive belief that had an expressive function. The belief value that came from this expressive belief was self-esteem gained from thinking "I am a person with a conscience," "I am smarter than other naive people," and "I am enlightening naive, uninformed people." Thus, two beliefs ("I should

Table 3. Themes and subcategories.

Themes	Subcategories
Protect others against risks and exploitation related to influenza vaccination	Health risks associated with influenza vaccination Exploitation by the industry of influenza vaccination Distrust of influenza vaccination information
Educate others about hidden truths and self-determination	Denial of influenza vaccination efficacy based on scientific evidence Denial of influenza vaccination efficacy based on words and actions of health professionals Proposal of natural alternatives Recommendation of self-determination

protect” and “I should educate”) underlie the messages of anti-influenza vaccination websites, and authors of anti websites ascribe two values (“people’s safety” and “one’s own self-esteem”) to their beliefs (Table 4). Representative quotes are used to illustrate these findings.

3.1. Protect others against risks and exploitation related to influenza vaccination: Theme (1)

We found that authors of anti websites doubted the safety and integrity of influenza vaccination. They believed that individuals should take self-responsibility and should protect themselves against risks and exploitation involving influenza vaccination.

3.1.1. Health risks associated with influenza vaccination

Authors of anti websites warned that influenza vaccines include toxic ingredients such as thimerosal, aluminum, mercury, antifreeze, and formaldehyde. One physician wrote, “*Mercury and aluminum cause very serious damage to the brain.*” These authors claimed that the toxic ingredients in influenza vaccines could cause severe

Table 4. Beliefs and perceived belief values underlying the messages of anti-influenza vaccination websites.

Beliefs	Perceived values from beliefs
Instrumental belief: I should protect others against risks and exploitation related to influenza vaccination.	Instrumental value: People’s safety
Expressive belief: I should educate others about hidden truths and self-determination.	Expressive value: One’s own self-esteem through feeling “I am enlightening others”

side effects such as Guillain-Barré syndrome, acute disseminated encephalomyelitis, and liver dysfunction. One citizen author wrote, *“My mother collapsed with severe dizziness and malaise two days after influenza vaccination. Upon checking her into an emergency hospital, she was diagnosed with leukoencephalopathy due to a reaction from influenza vaccination ... her memory and judgment were greatly impaired, and she could no longer shop by herself.”* Another physician wrote, *“A serious side effect is said to occur once per every million inoculations. This is about the likelihood of hitting the lottery. However, since there are people who win the lottery, courage is needed to get a vaccination because you might be risking your life.”*

Some authors insisted that when individuals are inoculated with influenza vaccine, the immune system becomes suppressed and people are more susceptible to influenza and at higher risk of developing serious complications. One journalist wrote, *“Vaccine studies conducted at the Erasmus Medical Center in the Netherlands in 2011 concluded that children vaccinated periodically have experienced a worsening of their immunity to fight the influenza virus.”*

Thus, anti-vaccination activists argue that the disadvantages of influenza vaccination outweigh the benefits. Several physicians wrote, *“Should you accept the risk of shock, death, encephalomyelitis, or neurodeficit to prevent a slightly heavy cold?”* *“Let’s think, which is better: a risk of serious side effects with vaccination or resting in bed for a week with influenza.”* These authors insisted on the need for self-defense by taking self-responsibility for these risks. A citizen author wrote, *“Parents should keep children away from useless and dangerous vaccination. Parents need to have a strong will to protect their children themselves and not leave their safety to governments or schools.”*

3.1.2. Exploitation by the industry of influenza vaccination

Authors of anti websites expressed the belief that pharmaceutical companies and hospitals generate excessive profits through the industry of influenza vaccines and that naive citizens are exploited by these entities. A journalist stated, *“Pharmaceutical companies sell the vaccine, produced for an average cost of about 350 yen per dose, to the distributor at a price of about 600 yen; the distributor sells it to the wholesaler for about 750 yen, and the wholesaler sells it to the medical institution for about 1000 yen. Because influenza vaccination is not covered by health insurance, medical institutions freely decide the fee for vaccination. They set a single inoculation fee at about 3500 yen to 10,000 yen and thus gain large profits.”* A physician criticized, *“It could be tolerated if the efficacy rate were over 90%. However, physicians hide the fact that the efficacy is only from 20% to 30%; they set a high price, and the cost for one family could be more than 10,000 yen. Ethically, this should not be permitted.”* Unlike other vaccines, influenza vaccine is expensive because it is necessary to vaccinate every year and most Japanese people are

responsible for the cost of vaccination. The costs associated with influenza vaccination may be one reason for the anti-vaccination belief in financial exploitation.

Additionally, some authors pointed out that there is a conspiracy involving mass media and the Ministry of Health, Labor and Welfare that has to do with the influenza vaccine industry. One citizen wrote, "*The influenza vaccine market, including hospitals, is more than 150 billion yen. In the last 7 years, vaccine companies have made political donations of over 1.3 billion yen so that vaccination will be treated as a public expenditure. In autumn of each year, these companies put out mass media reports that influenza will rage this year; they distribute posters to government offices and hospitals, and strive to expand their sales of influenza vaccine. Bureaucrats in the Ministry of Health, Labor and Welfare are even more enthusiastic about expanding sales than vaccine companies, because they will be parachuted into these companies in the future. It is a dirty profit structure. Vaccine companies are poisoning people and reaping the benefits.*"

3.1.3. Distrust of influenza vaccination information

Along with the conspiracy theories described above, distrust of influenza vaccine information was expressed; a citizen wrote, "*I feel doubt and anger about the media coverage. The media seem to agitate people. 'Influenza is dreadful', 'You must get vaccinated or you may die'.*" Distrust of statistical evidence was also expressed, as another citizen wrote, "*I do not trust medical data because they may be secretly manipulated. Someone's story of their own experience is more credible.*"

3.2. Educate others about hidden truths and self-determination: Theme (2)

Authors of anti-influenza vaccination websites believed that only they knew the hidden truth that influenza vaccines are ineffective. They recommended that individuals determine for themselves whether they should receive influenza vaccination and to consider better alternatives.

3.2.1. Denial of influenza vaccination efficacy based on scientific evidence

Authors of anti websites denied the effectiveness of influenza vaccination by referring to epidemiological studies conducted both in Japan and abroad. A physician wrote, "*Randomized controlled trials conducted in Western countries concluded that influenza vaccine does not work. Also, in the Maebashi study conducted among tens of thousands of children for many years in Japan, the effectiveness of influenza vaccine was not proven.*" The Maebashi study was conducted in the 1980s in Japan and compared absence rates among elementary school students in three cities that

had mass influenza vaccination programs and two cities without such programs; the study findings showed no differences between the two cities [7].¹

Doubts were also raised about the epidemiological data referenced by influenza vaccine promoters. One citizen wrote, “*In the United States, it is estimated that 36,000 people die annually from influenza. In fact, there are only about 500 deaths per year. Furthermore, two leading medical journals – the American Journal of Public Health and the British Medical Journal – have reported that even 500 deaths annually is an overestimate.*”

Anti-vaccination authors also denied the effect of influenza vaccine based on virology. A pharmacist wrote, “*Because there are many types of influenza viruses and these viruses frequently mutate, it’s like gambling or playing the lottery trying to deal with influenza viruses using only three types.*” Further, it was stated out that the efficacy rates of influenza vaccination are low. A journalist wrote, “*According to research by the Japan Clinical Internal Medicine Association, the efficacy rate (showing how effective the vaccination is) is only about 20%, according to the latest data. That means that even if you receive vaccination, it will be ineffective for 80% of recipients.*”

3.2.2. Denial of influenza vaccination efficacy based on the words and actions of health professionals

Authors who were not health professionals on anti websites wrote cynically about the low influenza vaccination rate among health professionals. A citizen wrote, “*If influenza vaccination is so good, why do 60% of doctors and nurses refuse vaccination? The BBC reported that in the United Kingdom, only 40% of health professionals received the influenza vaccine last year.*” The remarks of health professionals who deny the effect of influenza vaccination were often quoted as grounds. Another citizen wrote, “*A doctor acquaintance confided that he absolutely will not get influenza vaccination, and will not let his family do so either, because influenza vaccine is ineffective as well as dangerous.*” Anti websites often quoted a book entitled “*Don’t get influenza vaccination*” [27], which was written by a Japanese anti-vaccination activist, Keiko Mori, the former head of an infectious disease laboratory at the National Institute of Public Health. A citizen quoted from the book,

1. The outcome of the *Maebashi* study was not morbidity but rather absence rate, which included reasons for absence other than influenza; this resulted in a skewed interpretation of the study results. Nevertheless, this report has often been referenced by anti-influenza vaccination activists as evidence of the ineffectiveness of influenza vaccination. The report of the *Maebashi* study was first published as printed matter, with a few issues in 1987. However, in 2004, the report was published on the internet by anti-vaccination activists, which spurred diffusion of the anti-vaccination messages in the *Maebashi* report.

“Influenza vaccine rarely works. This is common sense for those who have studied virology.”

3.2.3. Proposal of natural alternatives

We found that the authors of anti websites believe that something “natural” is inherently good or right whereas what is “unnatural” is bad or wrong. These authors claimed that vaccines are unnatural and therefore bad and acquiring immunity naturally through infection is therefore better. A citizen wrote, *“A huge, complex immune system is working from the moment we were born. This immunity should be invoked naturally without being blocked by the injection of toxic substances. . . Health does not come from injection needles.”* Based on a similar belief, a physician wrote, *“Influenza is just a cold, and catching a cold is good because our immunity is increased.”* An alternative therapist went further, saying, *“Catching a cold is a kind of purification. By catching a cold, we can eject poison out of our body. So, we should thank the influenza that induces the purification.”* Instead of vaccination, authors recommended a balanced diet, moderate exercise, good sleep, coping with stress, and yoga; taking vitamin D, omega-3 fatty acids, and lactic acid bacteria; and alternative therapies.

3.2.4. Recommendation of self-determination

Anti-vaccination website authors often despised and distrusted physicians, media, and the government. Therefore, these authors emphasized that individuals should not be manipulated by wrong information and should actively identify and gather correct information by themselves. Citizens wrote, *“The result will differ depending on whether you believe in the government, the doctor, or opinion of others, or whether you will decide by investigating for yourself,”* *“Most Japanese people naively believe that whatever physicians say is right. However, you should not believe anything without investigating it for yourself”*. Thus, these authors recommended that readers have self-determination. Citizens wrote, *“Before receiving vaccination, I strongly recommend that you investigate sufficient information to allow you to judge whether it is right or wrong.”* *“Only after exhaustively investigating and determining which information you should believe, and after being convinced or unconvinced of the efficacy and safety of vaccination, you should decide whether to be vaccinated.”* However, these authors did not mention how readers should correctly identify and examine such information; they only gave abstract advice. A citizen wrote, *“There is no choice but to develop your intuition and not be fooled by wrong information. The ability to feel instinctively that something is wrong goes beyond logic, that is, intuition is necessary.”* Authors rejected science and relied on subjectivity rather than objectivity.

4. Discussion

4.1. Beliefs and belief values

The messages of anti-influenza vaccination websites described in the present study, such as doubts about the safety and effectiveness of vaccines, were consistent with previous analyses of the content of anti-vaccination movement websites on the internet [15, 17, 18]. We qualitatively explored the beliefs underlying the anti-influenza-vaccination messages online and the perceived values that the belief functions provided to those who held the beliefs. We found two beliefs (“I should protect others against risks and exploitation related to influenza vaccination” and “I should educate others about hidden truths and self-determination”), and two values (“people’s safety” and “one’s own self-esteem”) that arose from the beliefs, according to Abelson’s belief-possession theory [23]. These beliefs and belief values may partly explain the motivation of anti-influenza vaccination activists on the internet. Website authors may engage in these activities because they want to feel they are being virtuous by saving people from the harm of vaccination, and they want to boost their self-esteem by thinking, “I am enlightening uninformed people.” The two beliefs (“I should protect” and “I should educate”) and one of the values (“people’s safety”) have been implied in previous studies reporting that anti-vaccination activists on the internet recommend readers to forgo vaccination based on the argument that vaccines are toxic and ineffective [15, 17, 18]. However, the belief value of a boost to anti-vaccination activists’ self-esteem may be a novel finding.

4.2. Degree of belief value

Abelson’s theory suggests the degree of value ascribed depends on the attributes of the following beliefs: sharedness (i.e., Is the belief favored by other people?), uniqueness (i.e., Does the belief imply unusual taste?), defensibility (i.e., Can the belief be justified as sound?), extremity (i.e., Is the belief sharp and intense?), and centrality (i.e., Does the belief fit with other beliefs about oneself?). Attributes of the studied authors’ beliefs can be inferred from our results.

Previous studies stated that the online content of anti-influenza vaccination websites can easily be shared among many individuals, owing to recent advances in online social media networks [15, 28]. Additionally, users can easily interact with like-minded individuals and can formulate the notion that many others share their beliefs, when in reality, there may only be a small and dedicated group of people with shared beliefs [15]. Therefore, the quality of sharedness in the beliefs of authors of anti-vaccination websites can be considered high.

Previous studies have indicated that anti-vaccination activists on the internet often present views that go against generally held views, such as the conspiracy theory that vaccination policies are motivated by profit [8, 9, 10, 11, 15, 18]; this is similar

to our findings for the websites analyzed in this study. Such views and beliefs are unusual and unique. Therefore, the level of uniqueness of these beliefs can be perceived as high.

Similar to our analysis in the present study, previous content analysis of anti-vaccination websites [15, 18, 29] has showed that health experts have expressed anti-influenza vaccination beliefs by quoting scientific data. These apparently scientific arguments seem sound to uninformed individuals. Therefore, the defensibility of these beliefs can be considered high.

As previous studies have showed, online anti-vaccination messages such as regarding toxicity and serious side effects of vaccines [9, 11, 15, 18, 29] were often sharp and intense. Therefore, the level of extremity in these beliefs can be considered high.

Finally, similar to the present study, previous studies [15, 18] have showed that authors of anti-vaccination websites often distrust modern medicine, and their anti-influenza vaccination beliefs seem to form part of this distrust (e.g., alternative medicine and naturopathy are often proposed). Therefore, the centrality of website authors' beliefs can also be perceived as high.

Thus, in the context of Abelson's belief-possession theory, the degree of these belief attributes can be considered high; accordingly, website authors' perceived value of anti-influenza vaccination beliefs can also be considered high. This high perceived value may serve to strengthen authors' anti-influenza vaccination beliefs.

4.3. Implications for vaccination promotion

Because the beliefs of anti-vaccination website authors were assumed to be strong, as mentioned above, their beliefs may be resistant to pro-vaccination persuasion and may not change easily. Therefore, as scholars have suggested with respect to the targets of online vaccine promotion, people who are vaccine hesitant rather than outright vaccine refusers, such as authors of anti-vaccination websites, are best targeted in vaccination promotion [9, 30, 31]. Vaccine-hesitant people account for a larger proportion of the poor rates of influenza immunization uptake; however, these people are also more amenable to changing their attitudes toward vaccination than the smaller proportion of outright vaccine refusers [9, 30, 31]. To counteract the online anti-influenza vaccination movement and promote vaccination among people who are vaccine hesitant, our findings as well as those of recent studies may be useful.

One study showed that people frequently obtain information about vaccination from online news and social media; however, they trusted government websites more than online news and social media [32]. To increase not only trust but also usability,

public health websites of the government, municipalities, research centers, and hospitals should be easier to use and more attractive in their presentation, especially targeting less knowledgeable individuals who need reliable information about vaccination risks and benefits [33]. Means to enhance the usability, attractiveness, and persuasiveness of pro-vaccination websites may include the following.

Regarding the contents of pro-vaccine websites, complex scientific arguments alone may not be understood by less knowledgeable individuals and will therefore not be persuasive to them [30]. To counter anti-vaccine websites that use personal stories and photographs of individuals who have allegedly been injured by vaccines, use of emotionally powerful stories as well as evidence-based vaccine information in vaccine promotion may be important [30, 34, 35]. Stories that describe people feeling relief at knowing that they and their loved ones are protected by vaccination during an outbreak or describing the grief of someone who lost a loved one who died of influenza, may enhance salience of the benefit of influenza vaccination and increase vaccination intention [33, 34, 35, 36].

Regarding the manner of writing online pro-vaccine information, studies indicate that anti-vaccine websites are easier to read than pro-vaccine websites [37, 38, 39]. According to psychological research on processing fluency, audiences tend to more readily accept suggestions and are more willing to undertake a suggested action when reading easy-to-read text than text that is difficult to read [40, 41, 42]. Therefore, the ease of readability of online anti-vaccination messages may contribute to readers' acceptance of the anti-vaccination position [38, 39]. To counter this, writing easy-to-read pro-vaccine information, using clear and plain language, is important.

As a potential device for vaccine promotion online, scholars have suggested the use of social media to learn more about knowledge gaps, lack of awareness, and potential misperceptions, so as to intervene effectively [43, 44, 45, 46, 47]. Additionally, owing to social networking, pro-vaccination contents have the potential to spread virally and contribute to fostering pro-vaccination attitudes among individuals. However, few studies to date have assessed the effectiveness of interventions that use social media to increase vaccination uptake [48]. More studies are needed on how to improve vaccination promotion online using social media.

4.4. Limitations

The present study has several limitations. Firstly, availability, means of access, and time limitations made it unfeasible to comprehensively examine all existing relevant anti-vaccination websites. Secondly, the present study analyzed only what was written on the websites. What authors write on websites is not necessarily their true

intention because people sometimes use the anonymity of the internet to present a public persona that is different from their private one. Additionally, because individuals' views may shift over time, what the author wrote on a website is their view at that time. Therefore, in future studies, interviews of anti website authors and individuals who use anti websites as sources of information should be conducted, to support the results of the present study. Thus, our findings should be interpreted as exploratory and with caution. Thirdly, annual vaccination against influenza is required, which can involve costs to vaccine recipients. This may be one of the reasons for anti-influenza vaccination sentiment. In-depth interviews may be useful to investigate whether this characteristic of influenza vaccination influences anti-influenza vaccination beliefs. Finally, Abelson's belief-possession theory [23] has not been empirically tested; however, the notion that individuals attach value to their beliefs "like possessions" is considered a valid perspective [49]. Therefore, the implications of the present study remain important.

4.5. Conclusions

In the present study, we found that authors of anti-influenza vaccination websites ascribed values to their beliefs, and that two beliefs and two belief values underlie the messages on anti-influenza vaccination websites. These beliefs and belief values may motivate the authors of these websites to engage in anti-vaccination activities. Their anti-vaccination beliefs are assumed to be strong. According to the findings of recent studies on vaccination promotion, online influenza vaccination promotion should target vaccine-hesitant people rather than outright vaccine refusers, such as anti-vaccination website authors.

Declarations

Author contribution statement

Tsuyoshi Okuhara, Hirono Ishikawa, Mio Kato, Masafumi Okada, Takahiro Kiuchi: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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The authors declare no conflict of interest.

Additional information

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