RESEARCH ARTICLE

Assertions of Japanese Websites for and Against Cancer Screening: a Text Mining Analysis

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Abstract

Background: Cancer screening rates are lower in Japan than in Western countries such as the United States and the United Kingdom. While health professionals publish pro-cancer-screening messages online to encourage proactive seeking for screening, anti-screening activists use the same medium to warn readers against following guidelines. Contents of pro- and anti-cancer-screening sites may contribute to readers' acceptance of one or the other position. We aimed to use a text-mining method to examine frequently appearing contents on sites for and against cancer screening. **Methods:** We conducted online searches in December 2016 using two major search engines in Japan (Google Japan and Yahoo! Japan). Targeted websites were classified as "pro", "anti", or "neutral" depending on their claims, with the author(s) classified as "health professional", "mass media", or "layperson". Text-mining analyses were conducted, and statistical analysis was performed using the chi-square test. **Results:** Of the 169 websites analyzed, the top-three most frequently appearing content topics in pro sites were reducing mortality via cancer screening, benefits of early detection, and recommendations for obtaining detailed examination. The top three most frequent in anti-sites were harm from radiation exposure, non-efficacy of cancer screening, and lack of necessity of early detection. Anti-sites also frequently referred to a well-known Japanese radiologist, Makoto Kondo, who rejects the standard forms of cancer care. **Conclusion:** Our findings should enable authors of pro-cancer-screening sites to write to counter misleading anti-cancer-screening messages and facilitate dissemination of accurate information.

Keywords: Cancer screening- internet- content analysis- text mining

Asian Pac J Cancer Prev, **18 (4)**, 1069-1075

Introduction

Cancer is the leading cause of death in Japan. A total of 865,238 new cases of cancer and 370,346 deaths from cancer were estimated in 2012 and 2015 (National Cancer Center, 2017). Screening is a key strategy for reducing mortality from cancer worldwide. However, Cancer screening rates in Japan are lower than those in some Western countries. The 2013 screening rates for breast cancer in women aged 50–69 years and for cervical cancer in women aged 20–69 years were 80.8% and 84.5%, respectively, in the United States, and 75.9% and 78.1% in the United Kingdom, yet only 41.0% and 42.1% in Japan (OECD.Stat, 2013). Other cancer screening rates in Japan are similarly low: for gastric cancer 39.6%, lung cancer 42.3%, and colorectal cancer 37.9% in men and women aged 40–69 years (National Cancer Center, 2017).

To encourage individuals to obtain cancer screenings, Japan's Ministry of Health, Labour and Welfare (MHLW), cancer research centers, municipalities, and individual physicians publish messages on the Internet advocating for people to obtain cancer screening. That is because approximately 91% of Japanese regularly access the Internet (Internet World Stats, 2015), which is also the one of main sources of cancer screening information in Japan (Tokyo Metropolitan Government Bureau of Social Welfare and Public Health, 2013). The Internet is a now vital form of media for disseminating cancer-related information and education (Shahrokni et al., 2014; Mohammadzadeh et al., 2015). However, regrettably, anti-cancer-screening activists, who can be either health professionals or self-proclaimed specialists who nevertheless lack specialized knowledge, propagate on the Internet that cancer screening has little or no efficacy, and has a high risk of side effects via radiation exposure. They warn audiences to forgo cancer screening (e.g., Kondo, 2015; Funase, 2016; Utsumi, 2016). Considering that over half of Internet users believe that "almost all" or "most" information on health websites is credible (Rice, 2006), the anti-cancer-screening messages online can be a barrier to promoting cancer screening.

We previously assessed the readability of pro- and anti-cancer-screening sites, and found that anti-cancer-screening messages were easier to read than their pro-screening

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counterparts (Okuhara et al., 2017). We discussed that ease of readability of messages may contribute to their ease of acceptance by some audiences, and we recommended that health professionals make efforts to write easier-to-read pro-cancer-screening messages online (Okuhara et al., 2017). However, in addition to readability, contents of pro- and anti-cancer-screening sites may also contribute to readers' acceptance of one or the other position. We aimed to use a text-mining method to examine frequently appearing contents in pro- and anti-cancer-screening sites. We addressed three research questions: What were the most frequently appearing contents in pro- and anti-cancer-screening sites? What were the distributions of those contents? Who disseminated those contents?

Material and Methods

Material collection

We conducted Internet searches on 22 December 2016 using keyword combinations input in Japanese text (and translated herein), entered into Google Japan (google.co.jp) and Yahoo! Japan (yahoo.co.jp); "cancer screening"; "cancer screening" AND (meaningful OR meaningless); "cancer screening" AND (effective OR ineffective); "cancer screening" AND (obtain OR "not obtain"); "cancer screening" AND (danger OR dangerous); "cancer screening" AND ("do not obtain" OR "better not obtain"); "cancer screening" AND "must not obtain". The terms "danger", "dangerous", "do not obtain", "better not obtain", and "must not obtain" were included in these formulae for gathering anti-cancer-screening online messages because the first three formulae alone did not yield a sufficient number of "anti-" messages for examination. The Japanese versions of Google and Yahoo! were chosen because they are the most popular search engines in Japan, accommodating approximately 67% and 27%, respectively, of all the country's Internet searches in November 2016 (StatCounter GlobalStats, 2016).

For each search formula the top 100 results were reviewed and duplicate results were excluded. Results concerning prostate cancer screening and positron emission tomography were excluded because the MHLW does not officially recommend them as public health services. Results on gastric, lung, colorectal, breast, and cervical cancer screening were included for analysis if they did not meet any of the following exclusion criteria: (1) bulletin board system, listserv, newsgroup page, or Twitter content; (2) pages solely containing brief notices about other website content; (3) video; (4) non-Japanese website; (5) inactive link; (6) online message exclusively explaining cancer screening (e.g., Wikipedia); (7) online message with no claims either anti- or pro-cancer-screening (e.g., exclusively about time, place, and/or expense for cancer screening). URLs of the included materials were recorded in a Microsoft Excel 2016 spreadsheet.

Material classification

Included materials were classified as "pro" or "anti" depending on their claims. Materials that recommended readers obtain cancer screenings were classified as "pro", and that opposed readers obtaining one or more of gastric, lung, colorectal, breast, and cervical cancer were classified as "anti". Materials that contained claims both for and against, but did not indicate their own assertion, were classified as "neutral".

Additionally, materials were classified as authored by a "health professional" if physicians, nurses, pharmacists, or researchers wrote them, or they were published by pharmaceutical companies, research centers, hospitals, or municipalities. "Mass media" indicated materials were written by journalists or writers of newspapers, magazines, or news sites. "Layperson" was used of they were written by none of the aforementioned professionals. When materials were published a layperson but their content was exclusively referenced from health professionals, they were classified as authored by a "health professional".

Coding procedure

We analyzed the materials by a text-mining method using KH Coder (Higuchi, 2012), a software program for quantitative content analysis which supports Japanese text. It depends on ChaSen Morphological Analyzer and R statistical software environment. The ChaSen mounts IPADIC as a Japanese dictionary. KH Coder successfully applied for public health studies both in and outside of Japan (Goto et al., 2014; McNeill et al., 2016). KH Coder conducts a morphological analysis, lists frequently appearing terms, analyzes the hierarchical and co-occurrence relations among terms, and extracts paragraphs or sentences into which coding rules fit.

Coding rules are combinations of terms and logical operators, such as "and", "or", "and not", and "or not". For example, a coding rule to extract paragraphs including a message of "benefit and risk" of medical practice could be: "(benefit or advantage or merit or gain) and (risk or disadvantage or demerit or loss)". In this study, to investigate frequently appearing contents in pro- and anti-cancer-screening sites, we created coding rules by combining frequently appearing terms and logical operators; accordingly, our coding procedure began by investigating the most frequently appearing terms in the materials.

Before the investigation, for clarity of analysis, we excluded terms frequently appearing because of their generality (e.g., "this", "it", "think"). The total of terms analyzed was 124,953, and total unique terms analyzed was 9,030.

To investigate the most frequently appearing terms, we extracted the top 100 terms in their order of higher probability of appearance in all, pro, and anti materials.

We then analyzed those terms by hierarchical cluster analysis (Ward method). The calculation unit was one paragraph; the same applies to the following. Analytical results were presented using a dendrogram, within which lines were drawn to show clusters of terms close in the appearance pattern. This analysis helped with exploring how the terms were used in the materials.

Additionally, we conducted analysis of co-occurrence of terms, a common method in content analysis (Osgood, 1959). Analytical results were presented in the figure of a network, within which the terms of the great degree of co-occurrence relation were linked with each other. The

degree of co-occurrence relation was determined using the Jaccard similarity coefficient. This analysis helped with exploring the contents that the linked terms represented.

Finally, we created coding rules that represented specific contents by combining frequently appearing co-occurring terms. To reduce researcher bias we sought to create as many codes as possible to exhaustively examine frequently appearing contents. We conducted trial analyses and revised the coding rules for greater accuracy; i.e., to exhaustively select relevant paragraphs and avoid irrelevant paragraphs. Finally, we defined 13 codes (Table 1). We calculated distribution of paragraphs that fit into each code. To investigate who disseminated the contents, we also calculated distribution of the code-fitted paragraphs by category depending on the authors' professional expertise (health professional, mass media, or layperson). We translated all terms into English for the purpose of this report after the research was completed.

Statistical analysis

A chi-square test was applied for assessing the significance of differences of distribution of the code-fitted paragraphs by the pro and anti categories using KH Coder, Version 2.00f (Higuchi, Ritsumeikan University, Kyoto, Japan). Statistical significance was set at $p<0.05$.

Results

Characteristics of materials

Collected materials comprised websites or blogs and three independent Facebook pages. Of the 169 total materials evaluated, the numbers of websites by cancer type were as follows: gastric cancer screening, 3; colorectal cancer screening, 9; gastric and colorectal cancer screening, 2; breast cancer screening, 21; cervical cancer screening, 17; breast and cervical cancer screening, 3; breast and colorectal cancer screening, 1; gastric, lung, colorectal, breast and cervical cancer screening, 113.

Distribution by category

Table 2 shows the distribution of sites by category. Up to 75 sites (44.4%) propagated pro-cancer-screening messages, 88 (52.0%) propagated anti-cancer-screening messages, and six (3.6%) were "neutral". Of the 75 pro-cancer-screening sites, 51 were by health professionals. Of the 88 anti-cancer-screening sites, 31 were by health professionals and 48 were by laypeople.

Distribution of paragraphs codes fitted into

Table 3 and Figure 1 provide the distribution of paragraphs that codes fitted into. Paragraphs referring to "effect" most frequently appeared in pro sites (6.89%); the second most frequent was "early detection" (4.42%), and the third was "detailed examination" (3.29%). Paragraphs referring to "radiation exposure" most frequently appeared in anti sites (6.60%); "effect" was second (i.e., inefficacy, 3.73%), "early detection" was third (i.e., unnecessity of early detection, 3.25%), and "Dr. Kondo" (explained later) was fourth (3.15%).

Paragraphs referring to "early detection", "effect", "before it's too late", "regular screening", "detailed examination", "benefits and risks", and "scientific basis" were significantly more frequent in pro than anti sites (the first six codes: $p<0.01$, "scientific basis": $p<0.05$). Conversely, paragraphs referring to "radiation exposure", "Dr. Kondo", and "life span" were significantly more

Table 1. Code Definitions

Codes	Contents	Examples of terms used in coding rules*
Early detection	References to early detection of cancer	early, detection
Effect	References to effect of reducing mortality by cancer screening	death, mortality, decrease, effect
Before it's too late	References to it already being too late by the time one experiences a cancer symptom	symptom, too late, tumor progression
Regular screening	References to obtaining cancer screening regularly	regularly, obtain
Detailed examination	References to obtaining a detailed examination when required	detailed examination, obtain
Scientific basis	References to scientific basis of cancer screening	science, research, basis
Benefits and risks	References to benefits and risks of cancer screening	benefit, merit, risk, demerit
Susceptibility	References to cancer incidence and mortality rate	annually, people, get cancer, die from cancer
Radiation exposure	References to risk of radiation exposure in cancer screening	radiation exposure, mSv, radial ray, CT scan
Dr. Kondo	References to well-known Japanese radiologist Makoto Kondo, who refutes the standard care for cancer and cancer screening	Kondo
Gan-modoki theory	References to Kondo's noted *gan-modoki* theory recommend to untreat cancer	*gan-modoki*
Overdiagnosis	References to disadvantage of overdiagnosis through cancer screening	overdiagnosis
Life span	References to influence on life span by cancer screening	life span, shorten, lengthen

*Terms were translated into English by the authors for the purposes of this report

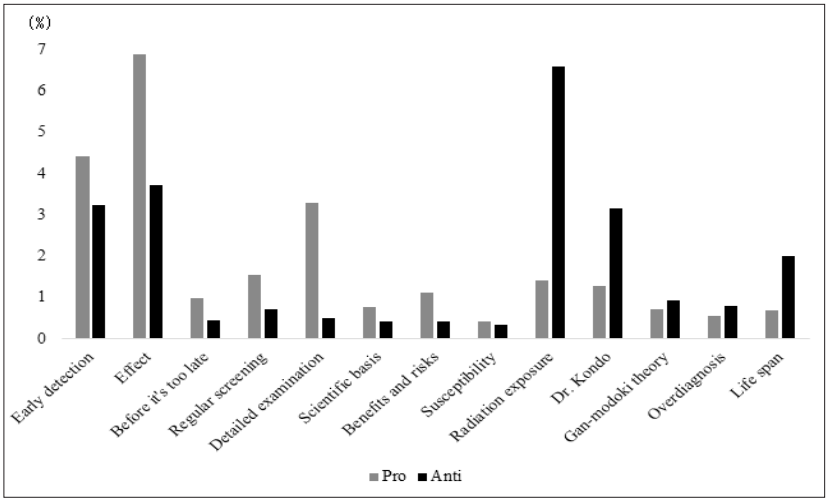

Figure 1. Distribution of Paragraphs that Codes Fit Into by Category of Pro or Anti

Table 2. Distribution of Sites by Category

Category	n (%)
Pro-cancer-screening	75 (44.4)
Health professional	51 (30.2)
Mass media	9 (5.3)
Layperson	15 (8.9)
Anti-cancer-screening	88 (52.0)
Health professional	31 (18.3)
Mass media	9 (5.3)
Layperson	48 (28.4)
Neutral	6 (3.6)

frequent in anti than pro sites ($p<0.01$). Distribution of paragraphs referring to "susceptibility", "gan-modoki theory", and "overdiagnosis" did not significantly differ between pro and anti sites.

Figure 2 illustrates the distribution of the code-fitted paragraphs by category based on the author's professional expertise (for data, see Appendix 1). Square size indicates appearance probability: the larger the square, the more frequent the code-fitted paragraphs. The shade of squares indicates the appearance probability in comparison with other author expertise categories and based on Pearson residuals: the darker the square color, the more frequent the code-fitted paragraphs than in other categories. Figure 2 indicates "radiation exposure" was most frequently referred to in anti sites by health professionals; "Dr. Kondo" was most frequently referred to in anti sites by mass media. This is discussed in greater detail in the next section.

Discussion

We showed 13 frequently appearing contents in pro- and anti-cancer-screening sites, and their distribution and disseminators.

In pro sites, the effects of cancer screening were most frequently referenced (see Figure 1). This result was

Table 3. Distribution of Paragraphs That Codes Fit Into By Category of Pro or Anti (N (%))

	Pro	Anti	Total	Chi-square value
Early detection	188 (4.42%)	173 (3.25%)	361 (3.77%)	8.723**
Effect	293 (6.89%)	199 (3.73%)	492 (5.14%)	47.834**
Before it's too late	42 (0.99%)	24 (0.45%)	66 (0.69%)	9.231**
Regular screening	66 (1.55%)	39 (0.73%)	105 (1.10%)	13.963**
Detailed examination	140 (3.29%)	27 (0.51%)	167 (1.74%)	105.650**
Scientific basis	33 (0.78%)	22 (0.41%)	55 (0.57%)	4.861*
Benefits and risks	47 (1.11%)	22 (0.41%)	69 (0.72%)	14.932**
Susceptibility	18 (0.42%)	18 (0.34%)	36 (0.38%)	0.264
Radiation exposure	60 (1.41%)	352 (6.60%)	412 (4.30%)	153.637**
Dr. Kondo	54 (1.27%)	168 (3.15%)	222 (2.32%)	36.148**
Gan-modoki theory	31 (0.73%)	49 (0.92%)	80 (0.84%)	0.813
Overdiagnosis	24 (0.56%)	43 (0.81%)	67 (0.70%)	1.661
Life span	29 (0.68%)	107 (2.01%)	136 (1.42%)	28.731**
All codes	842 (19.81%)	1,022 (19.17%)	1,864 (19.46%)	0.573
Total paragraphs	4,250	5,330	9,580	-

*p<0.05; **p<0.01

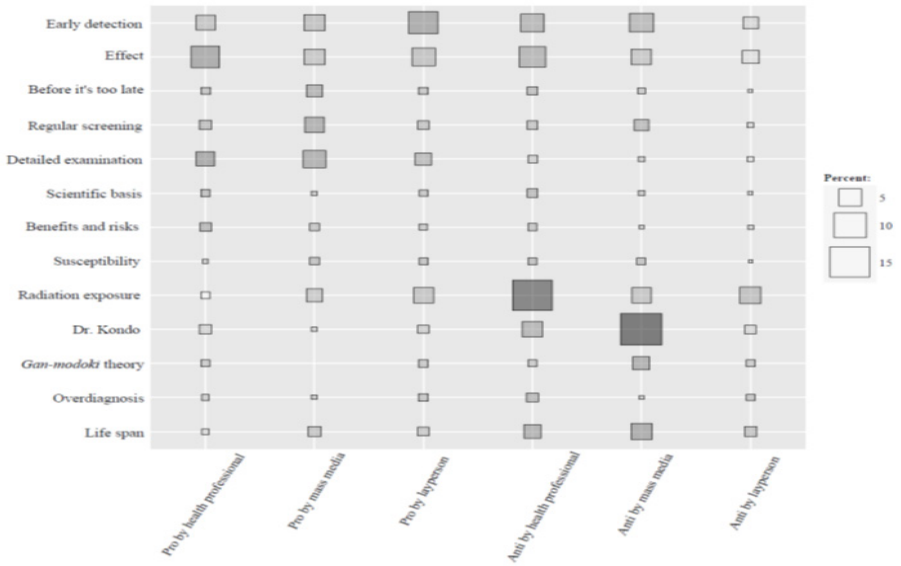

Figure 2. Distribution of Paragraphs that Code Fit Into by Category Depending on the Authors' Professional Expertise

consistent with a previous content analysis of municipal Japanese newspapers (Okuhara et al., 2015), and was not surprising because the combined efficacy and benefit of cancer screening is a main factors associated with intent to obtain screening, based on the protection motivation theory (Rogers, 1975; Hassani et al., 2014; Taymoori et al., 2014) and Health Belief Model (Janz and Becker, 1984; Ghobadi et al., 2015; Park and Kang, 2016). In this study, health professionals referred to the effects of cancer screening most frequently (see Figure 2). This was a useful finding because health professionals' knowledge and explanations were considered influential over individuals' decisions regarding cancer screening (Galal et al., 2016). Anti sites also frequently referred to effect, the second most frequently appearing content in such sites. They mostly asserted that cancer screening was ineffective by referring to negatively leaning scientific reports (e.g., Prasad et al., 2016). We found it regrettable that in anti sites health professionals were the main parties alleging inefficacy (Figure 2).

Necessity and benefit of early detection of cancer is a standard message in advocacy of cancer screening (Lee et al., 2014). Early detection was the second most frequent content in pro sites in this study, and laypeople were its foremost disseminator. That may have been because early detection was a well-known benefit of cancer screening among such people. Anti sites also frequently referred to early detection; it was the third most frequent content in such sites. By commonly referring to Makoto Kondo's gan-modoki theory (Kondo, 2000; 2012) they asserted that early detection was meaningless. Kondo is a Japanese radiologist well known for his absolute refusal of standard care for cancer and cancer screening. His theory asserts there are two types of tumor: truly cancerous and pseudo-cancerous (gan-modoki). The theory asserts that a cancerous tumor metastasizes and deprives life even if it is detected at an early stage; therefore, early detection is meaningless. It also asserts that pseudo-cancerous tumors do not metastasize; therefore, they should be left undetected and untreated. Regrettably, Kondo and his theory are widely regarded and influential in Japan (Matsuoka, 2007). They reportedly have contributed to a generation of anti-cancer-screening sites.

Detailed examination was the third most frequent content in pro sites. This was evidently because response rates to detailed examination were unjustifiably low in Japan (gastric cancer, 79.8%; lung cancer, 78.6%; colorectal cancer, 64.4%; cervical cancer, 69.6%; breast cancer, 84.6%) (Ministry of Health, Labour and Welfare, 2013). Our results indicated that mass media contributed to disseminating recommendations for obtaining detailed examination.

The MHLW recommends biennial cervical cancer screening for women ages 20 years or older, biennial breast cancer screening for women aged 40 years or older, annual colorectal and lung cancer screening for people aged 40 years or older, and biennial gastric cancer screening for people aged 50 years or older. Accordingly, to some extent recommendation of regular screening was referred to in pro sites. Mass media also contributed to disseminating recommendations of obtaining regular screening.

Studies indicate that lack of symptoms serves as a barrier to obtaining cancer screening (Khazaee-pool et al., 2014; Galal et al., 2016). In the present study, messages of "before it's too late" were to some extent referred to in pro sites, though not many. An increase of such content in pro sites can be expected to lower this barrier.

Benefits/risks and scientific basis of medical practice are commonly referred to in medical contents; they were also referred in pro sites to some extent in this study. Susceptibility to cancer was also to some extent referred to in pro sites in the present study, though it was the least common content and the distribution of "susceptibility" did not significantly differ between pro and anti sites. However, studies indicate that individuals underestimate the morbidity and mortality associated with cancer (Khazaee-pool et al., 2014; Morimoto et al., 2015). Perceived susceptibility is one concept of the Health Belief Model, and studies indicate this is associated with obtaining cancer screening (Ghobadi et al., 2016). Considering these, messages of susceptibility to cancer should be increased in pro sites.

In anti sites, radiation exposure was the most frequently referred to content. Again, regrettably, health professionals were the main disseminators. Fears of side effects from cancer screening, such as carcinogenicity from radiation exposure, are a barrier to obtaining cancer screening (Khazaee-pool et al., 2014). To further aggravate this situation, health professionals' explanations have strong influence on individuals' decision making regarding obtaining of cancer screening (Galal et al., 2016). Therefore, our findings present a matter of great concern in efforts to promote cancer screening.

Inefficacy of cancer screening and unnecessity of early detection were the second and third most frequent contents in anti sites, as mentioned earlier. The fourth was Kondo, and mass media were the main disseminators. This shows that mass media and general public popularly accept Kondo and his theory. Kondo may therefore influence individuals' decisions to avoid cancer screening and treatment, though pro sites to some degree objected to him and his theory.

Life span was also frequently referred to in anti sites, with warning that side effects from radiation exposure in cancer screenings could shorten one's life span. Anti sites also referred to the disadvantages of overdiagnosis through cancer screening.

Anti-cancer-screening contents can be easily and uncritically be shared online among many individuals owing to the advances in social distribution brought about by so-called Web 2.0. Users can interact with like-minded individuals and easily formulate illusions that many others share their beliefs, when in reality those others may only be a small and dedicated group (Kata, 2010). Thus, anti-cancer-screening online messages may spread widely, contribute to shaping negative public opinions of cancer screening, and consequently be a barrier to promoting screening.

The present study has some limitations. Although a considerable number of sites (n=169) were selected for analysis, the availability, means of access, and time limitations made it unfeasible to comprehensively examine all existing sites. Although we systematically analyzed text data using a text mining method, creation of coding rules may have reflected author bias. To generalize the results of the study to other countries, the study should be replicated and adapted for websites in languages other than Japanese. Despite these limitations this is, to our knowledge, the first study to examine frequently appearing contents in pro- and anti-cancer-screening sites, and this has significant implications.

Information and education regarding cancer screening are important for facilitating and advancing such screening (Park and Kang, 2016). Authors of pro-cancer-screening sites, especially health professionals such as physicians who authored content on 70% of the pro sites, are expected to much more frequently write in opposition of misleading anti-screening messages to clear up misunderstandings (e.g., harm from radiation exposure, Kondo's assertions). There is an information war between pro- and anti-cancer-screening messages on the Internet. Accurate information can help prevent the war from expanding.

Funding sources

This study was supported by a Japan Society for the Promotion of Science KAKENHI grant (number 167100000384).

References

Funase S (2016). Funase HP all over the world. Available from: http://funase.net/. Accessed 20 January 2017.

Galal YS, Amin TT, Alarfaj AK, et al (2016). Colon cancer among older Saudis: Awareness of risk factors and early signs, and perceived barriers to screening. *Asian Pac J Cancer Prev*, **17**, 1837-46.

Ghobadi DK, Noroozi A, Tahmasebi R (2015). Factors predicting fecal occult blood testing among residents of Bushehr, Iran, Based on the health belief model. *Asian Pac J Cancer Prev*, **17**, 17-22.

Goto A, Rudd R, Lai A, et al (2014). Leveraging public health nurses for disaster risk communication in Fukushima City: a qualitative analysis of nurses' written records of parenting counseling and peer discussions. *BMC Health Serv Res*, **14**, 129.

Hassani L, Dehdari T, Hajizadeh E, et al (2014). Development of an instrument based on the protection motivation theory to measure factors influencing women's intention to first pap test practice. *Asian Pac J Cancer Prev*, **15**, 1227-32.

Higuchi K (2012). Analysis of free comments in a questionnaire survey: Quantitative analysis by KH Coder. *Shakai to Chosa*, **8**, 92-6.

Internet World Stats (2001). Available from: http://www.internetworldstats.com. Accessed 20 January 2017.

Janz NK, Becker MH (1984). The health belief model: a decade later. H*ealth Educ Q*, **11**, 1-47.

Kata A (2010). A postmodern Pandora's box: Anti-vaccination misinformation on the Internet. *Vaccine*, **28**, 1709-16.

Khazaee-pool M, Majlessi F, Foroushani AR, et al (2014). Perception of breast cancer screening among Iranian women without experience of mammography: a qualitative study. *Asian Pac J Cancer Prev*, **15**, 3965-71.

Kondo M (2000). Patients, Don't fight against cancer. Tokyo: Bungei Shunju.p, 227-62

Kondo M (2012). Cancer untreated therapy. Tokyo: Bungei Shunju.

Kondo M (2015). Health checkup and cancer screening are useless! The famous Dr. Kondo warns. Shu pre news. Available from: http://wpb.shueisha.co.jp/2015/02/20/43779/. Accessed 20 January 2017.

Lee HY, Tran M, Jin SW, Bliss R, Yeazel M (2014). Motivating underserved Vietnamese Americans to obtain colorectal cancer screening: Evaluation of a culturally tailored DVD intervention. *Asian Pac J Cancer Prev*, **15**, 1791-6.

Matsuoka R (2007). Study on the influence that the claims of Dr. Makoto Kondo and Dr. Toru Abo have on modern medicine. *Ann Jp Assoc Phil Ethic Res Med*, **25**, 61-70.

McNeill A, Harris PR, Briggs P (2016). Twitter influence on UK Vaccination and antiviral uptake during the 2009 H1N1 pandemic. *Front Public Health*, **4**, 26.

Ministry of Health, Labour and Welfare (2013). Report on regional public health services and health promotion services 2013. Available from: http://www.mhlw.go.jp/toukei/saikin/hw/c-hoken/13/. Accessed 20 January 2017.

Mohammadzadeh Z, Davoodi S, Ghazisaeidi M (2015). Online social networks - opportunities for empowering cancer patients. *Asian Pac J Cancer Prev*, **17**, 933-6.

Morimoto A, Ueda Y, Egawa-Takata T, et al (2015). Effect on HPV vaccination in Japan resulting from news report of adverse events and suspension of governmental

recommendation for HPV vaccination. *Int J Clin Oncol*, **20**, 549-55.

National Cancer Center, Japan. Cancer statistics in Japan, center for cancer control and information services. Available from: http://ganjoho.jp/reg_stat/statistics/dl/index.html. Accessed 20 January 2017.

OECD.Stat. Health status. Available from: http://stats.oecd.org/Index.aspx?DatasetCode=HEALTH_STAT#. Accessed 20 January 2017.

Okuhara T, Ishikawa H, Okada H, Kiuchi T (2015). Readability, suitability and health content assessment of cancer screening announcements in municipal newspapers in Japan. *Asian Pac J Cancer Prev*, **16**, 6719-27.

Okuhara T, Ishikawa H, Okada M, Kato M, Kiuchi T (2017). Readability comparison of pro- and anti-cancer screening online messages in Japan. *Asian Pac J Cancer Prev*, **17**, 6137-42.

Osgood, CE (1959). The representational model and relevant research methods, in Pool I de S. (ed.), Trends in content analysis. Urbana, IL: University of Illinois Press, pp 33-88.

Park K, Kang J (2016). Health beliefs associated with cancer screening intentions in Korean workers. *Asian Pac J Cancer Prev*, **17**, 3301-7.

Prasad V, Lenzer J, Newman DH (2016). Why cancer screening has never been shown to "save lives"-and what we can do about it. *BMJ*, **352**, h6080.

Rice RE (2006). Influences, usage, and outcomes of Internet health information searching: Multivariate results from the Pew surveys. *Int J Med Inform*, **75**, 8-28.

Rogers RW (1975). A protection motivation theory of fear appeals and attitude change. *J Psychol*, **91**, 93-114.

Shahrokni A, Mahmoudzadeh S, Lu BT (2013). In whom do cancer survivors trust online and offline?. *Asian Pac J Cancer Prev*, **15**, 6171-6.

Stat Counter Global Stats (2017). Top 5 search engines in Japan. Available from: http://gs.statcounter.com/search-engine-market-share/all/japan/#monthly-201611-201611-bar. Accessed 5 February 2017.

Taymoori P, Moshki M, Roshani D (2014). Facilitator psychological constructs for mammography screening among Iranian women. *Asian Pac J Cancer Prev*, **15**, 7309-16.

Tokyo Metropolitan Government Bureau of Social Welfare and Public Health (2013). Tokyo cancer prevention and examination factual survey report, 2013.

Utsumi S (2016). Facebook page of Utsumi Satoru. Available from: https://www.facebook.com/satoru.utsumi. Accessed 20 January 2017.