

# Information sources and changes in health behaviour in Japan: a cross-sectional online survey

Hironobu Nonomura, Kyoko Imamura

## Abstract

**Background:** Although health-related information has been assumed to promote consumers' health behaviour, there is insufficient evidence to define effective methods of health promotion in Japan. In order to change consumers' health behaviour, it is important to identify potential promoters. This study aims to explore various sources of information from the viewpoint of promoting health behaviour in Japan based on the association between consumers' health information seeking behaviour and the changes in health behaviour.

**Methods:** We conducted a cross-sectional web-based questionnaire survey using the platform "Seikatsu-Kojo web" from 5 February 2018 to 6 March 2018. We examined health information seeking behaviour, changes in health behaviour in the preceding year, health-related factors (under medical treatment, level of health consciousness), and socio-demographic factors (age and sex). Multivariable logistic regression analysis was conducted to determine the association between health information seeking behaviour and the change in health behaviour. Further analysis was conducted using multivariable logistic regression to find the association between online health information seeking behaviour and the change in health behaviour.

**Results:** We obtained responses from a total of 2388 respondents, 2366 of which were analysed. Consulting pharmacists was found to be associated with using health products (OR: 2.01,  $p = 0.002$ ), along with reducing alcohol consumption (OR: 2.27,  $p < 0.001$ ) and tobacco cessation (OR: 2.91,  $p < 0.001$ ). Consulting doctors, on the other hand, was associated with health screening only (OR: 1.58,  $p = 0.001$ ). The choice of the internet was associated with increased odds of improving sleep habits (OR: 1.37,  $p = 0.001$ ), improving dietary habits (OR: 1.47,  $p < 0.001$ ), using health products (OR: 2.90,  $p < 0.001$ ) and reducing alcohol consumption (OR: 1.63,  $p < 0.001$ ).

**Conclusions:** This study showed that health information seeking behaviour was associated with various health behaviours. Although seeking via the internet is common, healthcare providers such as pharmacists are expected to play a role in health promotion. Further studies are required to explore the role played by information sources with respect to health care promotion in Japan.

**[Keywords]** 健康行動、ヘルスコミュニケーション、医療従事者、インターネット、web調査  
health behaviour, health communication, healthcare provider, online sources, a web-based survey

## 1. Background

Along with the changes to global social structures that have taken place over the past 20 years, non-communicable diseases (NCDs) and their resultant disabilities have become the dominant cause of health loss all over the world.<sup>1</sup> In particular, the population in East Asia and Pacific regions has been aging more rapidly than any other region, forcing the countries to face a rapid epidemiological transition toward NCDs.<sup>2</sup> NCDs are known to be caused by a combination of genetic, physiological, environmental and behavioural factors (e.g. tobacco use, physical inactivity,

an unhealthy diet and the harmful consumption of alcohol); hence, focused effort aimed at reducing the risk factors could be important in terms of controlling NCDs.<sup>3</sup> Health communication is seen as critical to the provision of information and improving health outcomes by modifying knowledge, attitude and behaviour.<sup>4-6</sup> Various studies have shown that mass media campaigns and healthcare-provider counselling are effective in promoting health behaviours, such as tobacco cessation and physical activity behaviour.<sup>7-12</sup> As the internet usage in Asia has grown to approximately 20 times for two decades,<sup>13</sup> the internet is expected as a low-cost and effective source of health promotion interventions.<sup>14</sup> Internet-delivered interventions are also found to be effective in promoting health behaviours.<sup>15-17</sup> These studies indicated, however, that health-promoting interventions have latent uncertainty, including long-term sustainability of the promoting effect.<sup>7,16</sup> Therefore, further support for the effectiveness of health communication has still been required.

Although the information alone cannot guarantee health behaviour, having enough related information can cause positive changes in consumer's health behaviour.<sup>18-20</sup> One of the attributes to make health communication campaigns more effective is identifying information channels and sources that are considered credible and influential by the target of campaigns.<sup>6</sup> Health information seeking behaviour, the ways in which consumers obtain information about their health, health risk, illness, and health promotion activities, is identified theoretically and empirically as a significant factor influencing the extent to which consumers decide to engage in healthy lifestyles and preventive health behaviours.<sup>18</sup> Although studies have shown that various information sources, such as mass media and online communications, can influence consumers' health literacy, attitudes and information seeking behaviours,<sup>21-23</sup> difference in culture, race, ethnicity, language and other regional characteristics has a great impact on health information seeking behaviour and health behaviour.<sup>19,24</sup> In Japan, several surveys have been conducted to explore the association between the use of information source and change in health behaviour.<sup>25-27</sup> These surveys, however, focused on physical activity,<sup>25,26</sup> eating behaviour,<sup>26</sup> and informed choice of over-the-counter medications<sup>27</sup> only, and none of these studies considered differences in information providers or methods used as online sources. Regardless of the achievement of the longest life expectancy in the world, further efforts in health behaviour change, such as smoking cessation and a healthier lifestyle, are required for decreasing adult mortality from chronic diseases and injuries in Japan.<sup>28</sup> Therefore, it is essential to discover critical factors to promote health behaviour with effectiveness in Japan. This study aims to explore information sources from the viewpoint of promoting health behaviour in Japan based on the association between consumers' health information seeking behaviour via information sources and changes in health behaviour.

## 2. Methods

### (1) Participants

The target population was adults aged 18 years or older in Japan. We used the "Seikatsu-Kojo web" (<https://www.seikatsu-kojo.jp/>) to conduct an online survey for this study. This website has a cumulative total of over 0.8 million registrants from which to recruit potential subjects for clinical trials and health or beauty product tests. We conducted a cross-sectional web-based questionnaire survey using its platform from 5 February 2018 to 6 March 2018. The link to the questionnaire was posted on the main page of the service so that all registrants could read and answer the question.

### (2) Ethics approval and consent to participate

Ethics approval and the requisite consent were granted by the Research Ethics Committee of the Graduate School of Pharmaceutical Science, the University of Tokyo. The details of this survey were notified in writing with a link to the information posted at the top of the questionnaire. Consent to participate was implied through the return of the completed questionnaire, and the Ethics Committee approved this means of obtaining informed consent.

### (3) Variable

The questionnaire contained questions related to information seeking behaviour and changes in health behaviour. The health information seeking behaviour via the various information sources was captured through

the respondents' choices with regard to seeking health information. The respondents were asked to choose information sources from the internet, television (including radio), newspapers (including magazines, advertisements, and flyers), books, brochures and lectures, doctors, pharmacists and friends, and family. In addition, those respondents who cited the internet as their information source were further asked to choose the type of sources they consulted on the internet. Their choice was either the content provided by companies (including shops), online advertisements, online mass media and blogs, social networking services (SNS) (including internet discussion boards), governmental and medical institutions, or journal articles. The respondents were also asked about the actions relating to changes in health behaviour that they had taken in the preceding year, such as improving sleep habits, improving dietary habits, using health products (including over-the-counter drugs (OTCs)), reducing alcohol consumption, tobacco cessation, health screening and exercise.<sup>29-31</sup> The socio-demographic variables of the respondents included were age, sex, under medical treatment or not, and the level of health consciousness (high, medium-high, medium-low, and low).

#### **(4) Statistics**

The descriptive statistics were presented as proportions according to the respondents' socio-demographic characteristics, the health information seeking behaviour via information sources, and the changes in health behaviour. All variables except age and health consciousness were categorical; hence, they were replaced by a dummy variable (sex: male = 1, female = 0; receiving medical treatment: yes = 1, no = 0; each of the information sources and health behaviour: selected = 1, not selected = 0). Health consciousness was converted into an integer variable (high = 4, medium-high = 3, medium-low = 2, low = 1).

Multivariable logistic regression was conducted to identify the association between the health information seeking behaviour and the changes in health behaviour. The analyses were conducted separately using each of the health behaviours as the dependent variable. Prior to the analysis, seeking via each of the information sources as the independent variable was filtered with univariable logistic regression. The P-value threshold was less than 0.1. The state of medical treatment and the level of health consciousness were filtered likewise. In contrast, the age and sex variables were applied as the forced entry.

Another multivariable logistic regression was conducted to find the association between seeking via online sources and the changes in health behaviour. The responses from those who answered that they used the internet as an information source were included in this analysis. The dependent variables were limited to the health behaviours found to be associated with seeking via the internet as a result of the preceding analysis between health information seeking behaviour and the changes in health behaviour. The independent variables employed, except socio-demographic factors, were seeking via each of the online sources. Prior filtration of independent variables was performed as a univariable logistic regression as described above. In the multivariable logistic regression, a P-value of less than 0.05 was considered to be statistically significant. Multicollinearity was tested using the Variance Inflation Factor (VIF). The odds ratios (OR) and 95% confidence intervals (95%CI) were reported. R (version 3.5.1, 64bit) on Rstudio (version 1.1.456) was the software used for the statistical analyses.

### **3. Results**

#### **(1) Sample characteristics**

We obtained responses from a total of 2388 respondents. Twenty-two responses were found to be invalid due to error in answer registration (two respondents), age criteria violation (four respondents), and inconsistent answer in health information seeking behaviour or change in health behaviour (sixteen respondents) and were subsequently excluded from the analysis (Valid response rate: 99%).

The characteristics of the 2366 respondents used in the analysis are summarised in Table 1. The valid respondents consisted of 47% men ( $n=1102$ ) and 53% women ( $n=1264$ ), ranging in age from 19 to 88 years, with a mean age of 49.3 years (SD: 12.6). A majority of the respondents were middle-aged or older compared to the general age distribution in Japan<sup>32</sup>. Many of them were receiving Specific Health Checkups and Specific Health Guidance<sup>33</sup> and resided in urban areas (data not shown). Of these valid respondents, 29% ( $n=687$ ) were receiving

medical treatment, and most of them reported that their level of health consciousness was 'high' ( $n=843$ , 36%) or 'medium-high' ( $n=1142$ , 48%). More than half of the respondents reported seeking health information via the internet ( $n=1506$ , 64%), and they also reported seeking health information the websites of companies ( $n=587$ , 57%), online mass media and blogs ( $n=617$ , 41%), SNS ( $n=535$ , 36%), online advertisements ( $n=444$ , 30%), governmental and medical institutions ( $n=403$ , 27%) and journal articles ( $n=98$ , 7%). As for other information sources, the respondents reported seeking health information via television ( $n=1272$ , 54%), newspapers ( $n=690$ , 29%), friends and family ( $n=561$ , 24%), doctors ( $n=382$ , 16%), books ( $n=359$ , 15%), medical brochures and lectures ( $n=171$ , 7%) and pharmacists ( $n=113$ , 5%). Regarding the choice of health behaviours that they had commenced in the preceding year, the respondents selected improving sleep habits ( $n=991$ , 42%), improving dietary habits ( $n=936$ , 40%), exercise ( $n=687$ , 29%), health screening ( $n=645$ , 27%), reducing alcohol consumption ( $n=418$ , 18%), using health products ( $n=410$ , 17%) and tobacco cessation ( $n=212$ , 9%).

Table 1. Sample characteristics of this survey

Variables	N (%) <sup>a</sup>
Total	2366
Age; Mean (SD)	49.3 (12.6)
Sex	
Male	1102 (46.6)
Female	1264 (53.4)
Under Medical Treatment	
Yes	687 (29.0)
No	1679 (71.0)
Health Consciousness	
High	843 (35.6)
Medium High	1142 (48.3)
Medium Low	291 (12.3)
Low	90 (3.8)
Changes in Health Behavior	
Improving sleep habits	991 (41.9)
Improving dietary habits	936 (39.6)
Using health products	410 (17.3)
Reducing alcohol consumption	418 (17.7)
Tobacco cessation	212 (9.0)
Health Screening	645 (27.3)
Exercise	687 (29.0)
Use of Information Sources	
Internet	1506 (63.7)
Television	1272 (53.8)
Newspapers	690 (29.2)
Books	359 (15.2)
Medical brochures and Lectures	171 (7.2)
Doctor	382 (16.1)
Pharmacist	113 (4.8)
Friends and Family	561 (23.7)
Use of Online Information Sources (N=1506)	
Companies	857 (56.9)
Online advertisements	444 (29.5)
Online mass media and Blogs	617 (41.0)
SNS	535 (35.5)
Governmental and Medical institutions	403 (26.8)
Journal articles	98 (6.5)

<sup>a</sup> No. (%), except where otherwise indicated.

## (2) Association between health information seeking behaviour and changes in health behaviour

As regards the association between seeking via information sources and the changes in health behaviour, the results of the multivariate logistic regression analyses are shown in Table 2. In this adjusted model, pharmacists were found to be associated with using health products (OR: 2.01,  $p = 0.002$ ), reducing alcohol consumption (OR: 2.27,  $p < 0.001$ ), and tobacco cessation (OR: 2.91,  $p < 0.001$ ). Doctors, on the other hand, were associated with health screening only (OR: 1.58,  $p = 0.001$ ). The choice of the internet was associated with increased odds of improving sleep habits (OR: 1.37,  $p = 0.001$ ), improving dietary habits (OR: 1.47,  $p < 0.001$ ), using health products (OR: 2.90,  $p < 0.001$ ) and reducing alcohol consumption (OR: 1.63,  $p < 0.001$ ).

From a socio-demographic viewpoint, the male participants were more likely to start reducing alcohol consumption (OR: 1.65,  $p < 0.001$ ), pursue tobacco cessation (OR: 2.13,  $p < 0.001$ ) and exercise (OR: 1.64,  $p < 0.001$ ), whereas the females were more likely to start improving sleep habits (OR: 0.82,  $p = 0.034$ ) and improving their dietary habits (OR: 0.74,  $p = 0.002$ ). The younger respondents were more likely to start improving their sleep habits (OR: 0.98,  $p < 0.001$ ), improving dietary habits (OR: 0.98,  $p < 0.001$ ) and exercise (OR: 0.99,  $p = 0.001$ ), while the older respondents were likely to begin health screening (OR: 1.03,  $p < 0.001$ ). Self-reported health consciousness had a significantly positive association with all of the health behaviours. In contrast, receiving medical treatment had a significantly negative association with improving dietary habits (OR: 0.66,  $p < 0.001$ ) and exercise (OR: 0.64,  $p < 0.001$ ).

Table 2. Association between health information-seeking behaviour and the changes in health behaviour

	Improving sleep habits		Improving dietary habits		Using health products		Reducing alcohol consumption	
	Adjusted ORs (95% CI)	P-value	Adjusted ORs (95% CI)	P-value	Adjusted ORs (95% CI)	P-value	Adjusted ORs (95% CI)	P-value
Sex (Male: reference Female)	0.82 (0.68-0.99)*	0.034	0.74 (0.62-0.90)*	0.002	0.95 (0.76-1.21)	0.694	1.65 (1.31-2.07)*	<0.001
Age	0.98 (0.98-0.99)*	<0.001	0.98 (0.97-0.99)*	<0.001	1.00 (0.99-1.01)	0.593	0.99 (0.98-1.00)	0.061
Under Medical Treatment	-	-	0.66 (0.53-0.81)*	<0.001	1.24 (0.96-1.59)	0.096	-	-
Health Consciousness	2.01 (1.76-2.29)*	<0.001	2.46 (2.13-2.83)*	<0.001	1.71 (1.43-2.05)*	<0.001	1.59 (1.35-1.88)*	<0.001
Internet	1.37 (1.13-1.66)*	0.001	1.47 (1.20-1.79)*	<0.001	2.90 (2.18-3.87)*	<0.001	1.63 (1.26-2.11)*	<0.001
Books	1.37 (1.06-1.76)*	0.015	1.34 (1.03-1.73)*	0.027	0.76 (0.55-1.04)	0.087	1.45 (1.09-1.94)*	0.012
Pharmacist	1.02 (0.66-1.57)	0.935	1.04 (0.66-1.62)	0.880	2.01 (1.30-3.10)*	0.002	2.27 (1.43-3.59)*	<0.001
Friends and Family	1.32 (1.08-1.62)*	0.008	1.16 (0.94-1.43)	0.174	1.08 (0.83-1.40)	0.559	1.14 (0.89-1.48)	0.304
Newspapers	1.04 (0.84-1.28)	0.735	1.39 (1.12-1.73)*	0.003	1.22 (0.95-1.57)	0.124	0.91 (0.71-1.18)	0.494
Doctor	0.96 (0.74-1.23)	0.726	1.29 (0.99-1.69)	0.058	-	-	0.97 (0.71-1.33)	0.866
Television	1.13 (0.94-1.37)	0.197	1.05 (0.87-1.28)	0.595	-	-	-	-
Brochures and Lectures	1.38 (0.97-1.95)	0.071	1.35 (0.95-1.93)	0.098	1.41 (0.94-2.09)	0.093	-	-

  

	Tobacco cessation		Health Screening		Exercise	
	Adjusted ORs (95% CI)	P-value	Adjusted ORs (95% CI)	P-value	Adjusted ORs (95% CI)	P-value
Sex (Male: reference Female)	2.13 (1.56-2.91)*	<0.001	0.82 (0.67-1.01)	0.056	1.64 (1.35-1.99)*	<0.001
Age	1.01 (0.99-1.02)	0.383	1.03 (1.02-1.04)*	<0.001	0.99 (0.98-0.99)*	0.001
Under Medical Treatment	1.08 (0.77-1.50)	0.669	1.18 (0.95-1.47)	0.144	0.64 (0.51-0.79)*	<0.001
Health Consciousness	1.47 (1.17-1.84)*	0.001	1.79 (1.54-2.08)*	<0.001	2.38 (2.05-2.77)*	<0.001
Internet	1.10 (0.79-1.53)	0.565	1.06 (0.85-1.31)	0.620	1.05 (0.86-1.29)	0.622
Books	1.07 (0.72-1.60)	0.729	1.00 (0.76-1.31)	0.984	1.08 (0.82-1.41)	0.587
Pharmacist	2.91 (1.67-5.07)*	<0.001	1.16 (0.74-1.82)	0.524	-	-
Friends and Family	1.45 (1.04-2.04)*	0.029	1.14 (0.91-1.44)	0.244	1.11 (0.89-1.38)	0.367
Newspapers	1.39 (1.00-1.93)*	0.048	0.90 (0.71-1.13)	0.372	1.08 (0.87-1.35)	0.475
Doctor	0.94 (0.62-1.43)	0.770	1.58 (1.21-2.08)*	0.001	-	-
Television	-	-	1.56 (1.26-1.93)*	<0.001	-	-
Brochures and Lectures	1.12 (0.67-1.87)	0.664	1.42 (0.99-2.03)	0.054	1.74 (1.22-2.46)*	0.002

\*:  $P < 0.05$ , -: excluded by variable filtration with univariable logistic regression

### (3) Association between online health information seeking behaviour and the changes in health behaviour

Table 3 shows the results of the multivariable logistic regression analyses for the association between seeking via online sources and the changes in health behaviour. Seeking via companies' websites was associated with improving dietary habits (OR: 1.37,  $p = 0.005$ ), using health products (OR: 2.76,  $p < 0.001$ ), and reducing alcohol consumption (OR: 1.61,  $p < 0.001$ ). Seeking via online mass media and blogs and Seeking via SNS were associated with improving dietary habits only (OR: 1.30,  $p = 0.027$ ). Seeking via advertisements was associated with using health products (OR: 1.37,  $p = 0.025$ ). Seeking via governmental and medical institutions' websites had a significantly positive association with improving dietary habits (OR: 1.30,  $p = 0.043$ ), whereas it had a significantly negative association with using health products (OR: 0.61,  $p = 0.002$ ).

Table 3. Association between online health information-seeking behaviour and the changes in health behaviour

	Improving sleep habits		Improving dietary habits		Using health products		Reducing alcohol consumption	
	Adjusted ORs (95% CI)	P-value	Adjusted ORs (95% CI)	P-value	Adjusted ORs (95% CI)	P-value	Adjusted ORs (95% CI)	P-value
Sex (Male: reference Female)	0.84 (0.67-1.04)	0.112	0.79 (0.63-0.99)*	0.042	0.94 (0.72-1.23)	0.655	1.84 (1.41-2.39)*	<0.001
Age	0.98 (0.97-0.99)*	<0.001	0.98 (0.97-0.99)*	<0.001	0.99 (0.98-1.00)	0.221	0.98 (0.97-0.99)*	0.002
Concurrent Medical Treatment	-	-	0.69 (0.54-0.89)*	0.004	1.25 (0.94-1.66)	0.122	-	-
Health Consciousness	1.82 (1.53-2.16)*	<0.001	2.51 (2.08-3.02)*	<0.001	1.64 (1.33-2.03)*	<0.001	1.38 (1.12-1.69)*	0.002
Companies	1.23 (0.99-1.51)	0.060	1.37 (1.10-1.71)*	0.005	2.76 (2.09-3.64)*	<0.001	1.61 (1.24-2.09)*	<0.001
Online mass media and Blogs	-	-	1.50 (1.20-1.88)*	<0.001	0.79 (0.60-1.03)	0.083	-	-
SNS	-	-	1.30 (1.03-1.64)*	0.027	-	-	-	-
Governmental and Medical institutions	1.20 (0.94-1.52)	0.142	1.30 (1.01-1.67)*	0.043	0.61 (0.45-0.83)*	0.002	1.19 (0.89-1.59)	0.250
Online advertisements	-	-	-	-	1.37 (1.04-1.80)*	0.025	-	-
Journal articles	-	-	1.16 (0.73-1.86)	0.532	-	-	1.52 (0.93-2.46)	0.092

\*:  $P < 0.05$ , -: excluded by variable filtration with univariable logistic regression

## 4. Discussion

This study has attempted to identify potential promoters with respect to changing health behaviour in Japan by analysing the associations between consumers' health information seeking behaviour via information sources and their changes in health behaviour. This study measured the outcome of behaviour change directly by asking self-reported changes in health behaviour in a year. In addition, this study addresses the limitations of earlier studies by examining the associations between online health information seeking behaviour and changes in health behaviour. This study has two important findings. The first is the difference between healthcare providers regarding their potential role in health promotion. The second is the association between companies as an online source of information and the changes in health behaviour.

The proportion of health information seeker via pharmacists and doctors was lower than that of the mass media or interpersonal sources. Seeking via pharmacists, however, was associated with reducing alcohol consumption, tobacco cessation, and using health products, whereas Seeking via doctors was associated with health screening only. Several studies have demonstrated associations between the seeking behaviour via pharmacists and purchasing health products<sup>27</sup> as well as the association between the seeking behaviour via healthcare providers and cancer screening.<sup>34</sup> The difference between doctors and pharmacists may be due to consumers' reliance on national health insurance. The cost of medical treatment is covered by national health insurance in Japan, although most health care promotion is excluded from coverage in reflection of its preventive purposes. No additional fee to gain and a lack of time to commit could be the reasons for doctors' reluctance to engage in preventive implementation.<sup>35</sup> For this reason, doctors may not have the opportunity to provide sufficient information to consumers. In contrast, pharmacists have many opportunities to promote consumers' health behaviour. Aside from their role dispensing prescribed medicine covered by the national health insurance, pharmacists are also responsible for the sale of OTCs. Most consumers in Japan continue to purchase health products through real-

world channels, despite the general steady growth in electronic commerce.<sup>36</sup> Thus, pharmacists do have sufficient opportunity to communicate directly with consumers when they sell OTCs and health products.<sup>37</sup> As has been found in this study, health information-seeking via pharmacists was uncommon among the respondents; thus, there is plenty of room for improvement of the consumers' lack of awareness and exposure to health promotion activities by pharmacists. Number of Health Support Pharmacies (HSP), pharmacies accredited by Ministry of Health, Labour and Welfare (MHLW) in promoting responsible self-medication with non-prescription medicines, and increasing awareness of public health, accounts for no more than three percent of the total number of the pharmacies in Japan.<sup>38-41</sup> Moreover, over 90 % of consumers in Japan did not know HSP, although half of them had the willingness to use it.<sup>42</sup> Greenhalgh et al. revealed five key factors on successful smoking cessation support in community pharmacy: pharmacist identity, pharmacist capability, pharmacist motivation, clinician confidence, and public trust.<sup>43</sup> Appropriate training and support for pharmacists are attributed to the improvement of pharmacists' confidence and effectiveness in providing public health services.<sup>43-45</sup> Pharmacists should pay more attention, confidence, and skill to the promotion of health behaviour to a wider range of consumers by using various learning opportunities such as a board-certified pharmacist system. In addition, stakeholders around HSP, including pharmacists, pharmacy owners, and policymakers, should demonstrate its role and usefulness in order to get consumer's trust, including improvement of awareness of HSP. Community pharmacies are considered to have advantages of delivering public health services in nationwide geographical accessibility and long-time operation over other primary healthcare facilities.<sup>41</sup> As effective primary care is promoted to contain health care expenditure in total, pharmacists should be able to meet the professional expectation by taking advantage of the opportunities they have for direct exchange at their pharmacies.

Seeking via the internet was the highest among the different information sources examined. Moreover, seeking via the internet was significantly associated with improving sleep habits, improving dietary habits, reducing alcohol consumption, and using health products. These findings suggest that the internet can play a major role in health behaviour promotion in Japan. In particular, seeking via companies was associated with improving dietary habits, reducing alcohol consumption, and using health products. In this survey, they were the most used online sources. Given their easy access to health care products or services, companies could provide more interesting information to consumers in health care. However, companies may also be noted for their extravagant advertisements. The Consumer Affairs Agency in Japan ordered 412 corporations to improve their internet advertisement in 2016.<sup>46</sup> A framework for appropriate advertisement and improving consumer literacy must be developed in order to promote better health behaviour.

This study is not without limitations. First, there is a possibility of selection bias regarding the socio-demographic status and the interest in health. This study was conducted using an online-based questionnaire on a website offering health-related information and was thus likely to attract more health-conscious participants to complete the survey. Moreover, participation in this study was dependent on the free will of the registrants. Therefore, the result cannot be simply applied to the general population in Japan. Second, this study is a cross-sectional survey; thus, it is not possible to establish causality between health information-seeking behaviour and changes in health behaviour without longitudinal observation. All of the variables in this study were based on self-reported information. Although we captured behaviour change outcomes by asking starting health behaviour in the preceding year, we did not validate the maintenance of health behaviours which the respondent reported. In addition, we take none of the content of health information seeking behaviour. Future research should seek to validate health promotion in relation to information sources.

Finally, this study has several implications. It has shown that health information seeking behaviour via pharmacists was associated with a change in health behaviours. This study also provides evidence that health information seeking behaviour via online sources is associated with a change in health behaviours. Pharmacists are expected to help consumers make informed choices about self-care and provide and interpret available information.<sup>29</sup> This study, however, did not explore either the magnitude of the health information-seeking behaviour or its contents. In our questionnaire, we also asked about healthcare providers and the internet as potential health promoters. Prior research has highlighted that the choice of information sources would be

influenced by the socio-economic status or educational backgrounds of the respondents<sup>47</sup>, which we have not explored in this study. Further studies are thus expected to take these factors into consideration.

## 5. Conclusions

This study showed that health information seeking behaviour was associated with various health behaviours. Although seeking via the internet is common, healthcare providers are also expected to play a role in health promotion. Further research is required to explore the role of information sources for health care promotion in Japan.

## Acknowledgements

This study is funded by 3H Holdings, Inc. The funder had no role in the analysis, or interpretation of the data, writing of the article, or the decision to submit the paper for publication. We are grateful to 3H Clinical Trial Inc. for providing technical support in conducting the questionnaire on the “Seikatsu-Kojo web”; Dr Keiko Satoh for providing statistical advice at an early stage of this paper; and Mr Masahiro Ohkura for providing helpful feedback on an early draft of this paper.

The date of submission Feb 28th, 2020

## List of abbreviations

non-communicable diseases: NCDs, social networking services: SNS, over-the-counter drugs: OTCs, Variance Inflation Factor: VIF, Odds Ratio: OR, 95% confidence interval: 95%CI, Health Support Pharmacy: HSP, Ministry of Health, Labour and Welfare: MHLW

## References

1. Katherine Leach-Kemon. *The Global Burden of Disease: Generating Evidence, Guiding Policy.*; 2013. <http://www.healthdata.org/policy-report/global-burden-disease-generating-evidence-guiding-policy>. Accessed August 21, 2019.
2. World Bank. *Live Long and Prosper: Aging in East Asia and Pacific.* The World Bank; 2016. doi:10.1596/978-1-4648-0469-4
3. World Health Organization. Noncommunicable diseases. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>. Published 2018. Accessed August 21, 2019.
4. Bettinghaus EP. Health promotion and the knowledge-attitude-behavior continuum. *Prev Med (Baltim)*. 1986; 15 (5): 475-491. doi: 10. 1016/0091-7435 (86) 90025-3
5. Schiavo R. *Health Communication From Theory to Practice.* San Francisco: Jossey-Bass; 2007. [http://iums.ac.ir/files/hshe-soh/files/health\\_communication\\_book1\(1\).pdf](http://iums.ac.ir/files/hshe-soh/files/health_communication_book1(1).pdf). Accessed August 21, 2019.
6. National Cancer Institute. *Making Health Communication Programs Work (Rev. Ed. )*; 2002. <https://www.cancer.gov/publications/health-communication/pink-book.pdf>. Accessed August 21, 2019.
7. Wakefield MA, Loken B, Hornik RC. Use of mass media campaigns to change health behaviour. *Lancet*. 2010; 376 (9748): 1261-1271. doi: 10. 1016/S0140-6736 (10) 60809-4
8. Heath GW, Parra DC, Sarmiento OL, et al. Evidence-based intervention in physical activity: lessons from around the world. *Lancet*. 2012; 380 (9838): 272-281. doi: 10. 1016/S0140-6736 (12) 60816-2
9. Bala MM, Strzeszynski L, Topor-Madry R. Mass media interventions for smoking cessation in adults. *Cochrane Database Syst Rev*. 2017; 2017 (11). doi: 10. 1002/14651858. CD004704. pub4
10. Calfas KJ, Long BJ, Sallis JF, Wooten WJ, Pratt M, Patrick K. A controlled trial of physician counseling to

- promote the adoption of physical activity. *Prev Med (Baltim)*. 1996; 25 (3): 225-233. doi: 10.1006/pmed.1996.0050
11. Tobari H, Arimoto T, Shimojo N, et al. Physician-pharmacist cooperation program for blood pressure control in patients with hypertension: A randomized-controlled trial. *Am J Hypertens*. 2010; 23 (10): 1144-1152. doi: 10.1038/ajh.2010.127
  12. Steed L, Sohanpal R, Todd A, et al. Community pharmacy interventions for health promotion: effects on professional practice and health outcomes. *Cochrane Database Syst Rev*. 2019; 2019 (12). doi: 10.1002/14651858.CD011207. pub2
  13. Miniwatts Marketing Group. World Internet Users Statistics and 2020 World Population Stats. <https://www.internetworldstats.com/stats.htm>. Published 2020. Accessed April 13, 2020.
  14. Evers KE. eHealth promotion: The use of the internet for health promotion. *Am J Heal Promot*. 2006; 20 (4): 1-7. doi: 10.4278/0890-1171-20.4.1
  15. Davies CA, Spence JC, Vandelanotte C, Caperchione CM, Mummery WK. Meta-analysis of internet-delivered interventions to increase physical activity levels. *Int J Behav Nutr Phys Act*. 2012; 9 (1): 52. doi: 10.1186/1479-5868-9-52
  16. Maher CA, Lewis LK, Ferrar K, Marshall S, De Bourdeaudhuij I, Vandelanotte C. Are Health Behavior Change Interventions That Use Online Social Networks Effective? A Systematic Review. *J Med Internet Res*. 2014; 16 (2): e40. doi: 10.2196/jmir.2952
  17. Laranjo L, Arguel A, Neves AL, et al. The influence of social networking sites on health behavior change: a systematic review and meta-analysis. *J Am Med Informatics Assoc*. 2014; 22 (1): 243-256. doi: 10.1136/amiajnl-2014-002841
  18. Lambert SD, Loiselle CG. Health information-seeking behavior. *Qual Health Res*. 2007; 17 (8): 1006-1019. doi: 10.1177/1049732307305199
  19. Zare-Farashbandi F, Lalazaryan A. A Review of models and theories of health information seeking behavior. *Int J Heal Syst Disaster Manag*. 2014; 2 (4): 193. doi: 10.4103/2347-9019.144371
  20. Kelly MP, Barker M. Why is changing health-related behaviour so difficult? *Public Health*. 2016; 136: 109-116. doi: 10.1016/j.puhe.2016.03.030
  21. Dutta-Bergman MJ. Health attitudes, health cognitions, and health behaviors among Internet health information seekers: Population-based survey. *J Med Internet Res*. 2004; 6 (2). doi: 10.2196/jmir.6.2.e15
  22. De Jesus M. The Impact of Mass Media Health Communication on Health Decision-Making and Medical Advice-Seeking Behavior of U.S. Hispanic Population. *Health Commun*. 2013; 28 (5): 525-529. <http://www.tandfonline.com/doi/abs/10.1080/10410236.2012.701584>. Accessed August 21, 2019.
  23. Lee YJ, Boden-Albala B, Jia H, Wilcox A, Bakken S. The Association Between Online Health Information-Seeking Behaviors and Health Behaviors Among Hispanics in New York City: A Community-Based Cross-Sectional Study. *J Med Internet Res*. 2015; 17 (11). doi: 10.2196/jmir.4368
  24. Viswanath K, Ackerson LK. Race, ethnicity, language, social class, and health communication inequalities: A nationally- representative cross-sectional study. *PLoS One*. 2011; 6 (1). doi: 10.1371/journal.pone.0014550
  25. Harada K, Shibata A, Lee E, Oka K, Nakamura Y. Sources of strength-training information and strength-training behavior among Japanese older adults. *Health Promot Int*. 2014; 31 (1): dau052. doi: 10.1093/heapro/dau052
  26. Takaizumi K, Harada K, Nakamura Y. Sources of health information related to eating behavior and physical activity among Japanese adults [in Japanese]. *J Japanese Soc Heal Educ Promot*. 2013; 21 (3): 197-205. [https://www.jstage.jst.go.jp/article/kenkokyoiku/21/3/21\\_197/\\_article/-char/en](https://www.jstage.jst.go.jp/article/kenkokyoiku/21/3/21_197/_article/-char/en). Accessed August 22, 2019.
  27. Hayashi M, Masuda S, Kimura H. Key information providers, channels, and characteristics of Japanese consumers' informed choices of over-the-counter medications. *Springerplus*. 2015; 4 (1): 1-11. doi: 10.1186/s40064-015-1549-7
  28. Ikeda N, Inoue M, Iso H, et al. Adult mortality attributable to preventable risk factors for non-communicable diseases and injuries in Japan: A comparative risk assessment. *PLoS Med*. 2012; 9 (1). doi: 10.1371/journal.

- pmed. 1001160
29. World Health Organization. *The Role of the Pharmacist in Self-Care and Self-Medication Contents.*; 1998. <http://apps.who.int/medicinedocs/pdf/whozip32e/whozip32e.pdf>. Accessed August 22, 2019.
  30. Ministry of Health Labour and Welfare. *Annual Health, Labour and Welfare Report For the Realization of a Society of Health and Longevity - First Year of Health and Prevention - [Summary].*; 2014. <https://www.mhlw.go.jp/english/wp/wp-hw8/dl/summary.pdf>. Accessed July 3, 2019.
  31. National Institute of Health and Nutrition. Health Japan 21 (the second term). <http://www.nibiohn.go.jp/eiken/kenkounippon21/en/>. Accessed August 22, 2019.
  32. Japanese Ministry of Internal Affairs and Communications. Current Population Estimates as of October 1, 2016. Statistics Bureau of Japan. <http://www.stat.go.jp/english/data/jinsui/2016np/index.htm>. Published 2016. Accessed November 6, 2019.
  33. Ministry of Health Labour and Welfare. Specific Health Checkups and Specific Health Guideline. 2008: 74.
  34. Redmond N, Baer HJ, Clark CR, Lipsitz S, Hicks LS. Sources of Health Information Related to Preventive Health Behaviors in a National Study. *Am J Prev Med.* 2010; 38 (6): 620-627. e2. doi: 10.1016/j.amepre.2010.03.001
  35. Sato Y, Sone H, Kobayashi M, et al. Current Situation of Exercise Therapy in Patients With Diabetes Mellitus in Japan (Report No. 1): Nationwide Survey to Physicians Using the Questionnaires [In Japanese]. *J Japan Diab Soc.* 2015; 58 (8): 568-575.
  36. Ministry of Economy Trade and Industry. *Results of FY2018 E-Commerce Market Survey [Details in Japanese].*; 2019. [https://www.meti.go.jp/english/press/2019/0516\\_003.html](https://www.meti.go.jp/english/press/2019/0516_003.html). Accessed August 9, 2019.
  37. Noshiro Y, Masuyama K. The Expected Role of Community Pharmacists and Pharmacy from the Survey about Patient Counseling Responce [In Japanese]. *50th Japan Pharm Assoc Conf.* 2017; P-1-029: 248. <http://www.nichiyaku-di.jp/congress/shosai.php>. Accessed April 22, 2020.
  38. Japan Pharmaceutical Association. *Annual Report of JPA.*; 2018. <https://www.nichiyaku.or.jp/>. Accessed April 20, 2020.
  39. Ministry of Health Labour and Welfare. Statistical handbook, Part 2 Health and Hygiene, Section 4 Pharmaceutical Affairs [In Japanese]. [https://www.mhlw.go.jp/toukei/youran/indexyk\\_2\\_4.html](https://www.mhlw.go.jp/toukei/youran/indexyk_2_4.html). Published 2018. Accessed April 20, 2020.
  40. Ministry of Health Labour and Welfare. *The Number of Health Support Pharmacies [In Japanese].*; 2019.
  41. Sato N, Fujita K, Kushida K, Chen TF. Exploring the factors influencing the quality of “Health Support Pharmacy” services in Japan: Perspectives of community pharmacists. *Res Soc Adm Pharm.* 2020. doi: 10.1016/j.sapharm.2020.02.012
  42. Japan Pharmaceutical Association. *The Survey on Attitude toward Health Support and Pharmacist [In Japanese].*; 2018.
  43. Greenhalgh T, Macfarlane F, Steed L, Walton R. What works for whom in pharmacist-led smoking cessation support: Realist review. *BMC Med.* 2016; 14 (1). doi: 10.1186/s12916-016-0749-5
  44. Eades CE, Ferguson JS, O’Carroll RE. Public health in community pharmacy: A systematic review of pharmacist and consumer views. *BMC Public Health.* 2011; 11 (1): 1-13. doi: 10.1186/1471-2458-11-582
  45. Carson-Chahhoud K V, Livingstone-Banks J, Sharrad KJ, et al. Community pharmacy personnel interventions for smoking cessation. *Cochrane Database Syst Rev.* October 2019. doi: 10.1002/14651858.cd003698.pub3
  46. Consumer Affairs Agency. Archives: Internet Monitoring Tasks [In Japanese]. [https://www.caa.go.jp/policies/policy/representation/extravagant\\_advertisement/past/](https://www.caa.go.jp/policies/policy/representation/extravagant_advertisement/past/). Accessed August 22, 2019.
  47. Ishikawa Y, Nishiuchi H, Hayashi H, Viswanath K. Socioeconomic Status and Health Communication Inequalities in Japan: A Nationwide Cross-Sectional Survey. *PLoS One.* 2012; 7 (7). doi: 10.1371/journal.pone.0040664