

# Can Education, Internet Use or Social Support Improve Health Literacy?:

A Pilot Study of a Cross-sectional Population Survey in Japan

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## Abstract

The revolution in information technologies has allowed people instant and equal access to health information. However, social support and socioeconomic status (SES), which all affect health literacy in the Internet era, has not been well documented in Japan. Therefore, the aim of this study is to evaluate whether education, Internet use, and social support affects health literacy among different age groups. This study is a secondary analysis using data gathered from 2,752 people aged 20 and over who participated in a cross-sectional population survey conducted in Japan in 2007. Three aspects of health literacy (finding, understanding, and evaluating) were assessed in terms of perceived self-efficacy. The results of a multivariate analysis of covariance indicated that although Internet use was correlated with high self-efficacy in finding health information, having informational social support was more strongly associated with self-efficacy in evaluating health information for all age groups. Education was statistically unrelated to self-efficacy with regard to all three abilities of health literacy among young adults. As such, Internet use, and informational social support appear to play a role in improving total health literacy for all age groups. Further studies are necessary in order to learn more about the effect of education on health literacy in the Internet era.

**Keywords:** socioeconomic status, Internet, social support, health literacy, Japan

## 1. Introduction

The revolution in information technologies has allowed people instant and equal access to health information. Nowadays, millions of people are using the Internet to get health information, and thousands of websites offer health information. According to Internet World Stats data on June 30, 2016 (Internet World Stats 2016), 49.2 percent of the global population used the Internet, and more than 90 percent of people in Japan use the Internet (Internet World Stats, Asia Internet States, Japan 2016). Another study reported that 72 percent of Internet users in 2014 in the U.S. (87 percent of adults) said that they had looked online for health information during the previous year (Pew Research Center 2014).

In addition, several recent studies report that people who use the Internet feel more empowered in obtaining health information and managing their health (Kivits 2004; Broom 2005; Nettleton, Burrows and O'Malley 2005; Hong 2006; Rains 2008). World Health Organization (1986) as-

serts that improving people's access to health information and their capacity to use it effectively—known as health literacy—is critical to empowerment. The meaning of health literacy itself continues to expand, and currently includes information-seeking, decision-making, problem-solving, critical thinking, and communication, along with a multitude of social, personal, and cognitive skills that are imperative to function in the health system (Van den Broucke 2014). There are several definitions of health literacy, but Sorensen et al. (2012) provided a useful redefinition, reviewing 17 definitions of health literacy and 12 conceptual models. They asserted that health literacy entails people's knowledge, motivation, and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention, and health promotion to maintain or improve their quality of life. Thus, managing health information is key to health literacy, and Internet use has recently acquired a more important role in people seeking health information to empower themselves.

However, persons with lower socioeconomic status (SES), such as lower levels of education and income and less skilled occupations, appear to face greater barriers to obtaining health information than those with higher SES, even in the Internet era (Hesse et al. 2005; Bass et al. 2006; Viswanath et al. 2006; Clayman, Manganello, Viswanath, Hesse and Arora 2010; Ishikawa, Nishiuichi, Hayashi and Viswanath 2012). One of the reasons for this is the “digital divide” between rich and poor people. According to the 2012 Pew Report (Zickuhr and Smith 2012), rich and more highly educated people are more likely than others to have good access to digital resources. Another reason for the digital divide is that a large amount of numerical health data is presented in the Internet. People with poor numeracy skills were associated with lower self-efficacy in managing their health and worse health information seeking experiences (Chen and Feeley 2014). Furthermore, people should assess the quality of health information available on the Internet, because it is not always reliable (Nathan et al. 2012).

Given these circumstances, several studies have reported on the important role that social support and personal social networks play in the dissemination of health information on the Internet (Kim, Kreps and Shin 2015). Not only elderly people (Bennett, Cameron, Whitehead and Porter 2009; Chaudhuri, Le, White, Thompson and Demiris 2013; Medlock et al. 2015), but also young people (Horgan and Sweeney 2010) prefer to use a living source with whom they are able to actively discuss their health, as opposed to a nonliving source such as the Internet. These findings may indicate that living sources are important to all people in managing health information using the Internet. However, the relationships between health literacy, social support, Internet use, and SES in the Internet era have not been well documented in Japan.

The purpose of this research is therefore to evaluate health literacy, Internet use, social support, and education. The following specific research questions were examined:

- (1) What are the differences between young adults and older adults with regard to factors relating to health literacy?
- (2) How do education, Internet use, and social support affect health literacy?

## **2. Methods**

### **2.1 Data collection**

This study is a secondary analysis of the data reported in “Research on Appropriate Delivery of Cancer Information and Support from the Viewpoint of Cancer Patients, their Family Members, and General Public,” supported by the Third-Term Comprehensive Control Research for Cancer of the Ministry of Health, Labour, and Welfare in Japan. The author received anonymous data from the principal researcher with her permission. According to the research report, the data gathered came from an anonymous, self-administered questionnaire survey distributed to 9,213 residents aged 20 and over from four districts in two prefectures in Japan in 2007. A random sampling method was used in distributing the mail survey to 5,000 people in two of the districts; in the other two districts, 4,213 people were selected in collaboration with the city health promotion divisions. In one of the districts, questionnaires were distributed and collected by mail, while in the other they were distributed and collected by 19 chairmen of local neighborhood associations. In total, 4,501 questionnaires were returned. In this study, a total of 2,752 questionnaires were used because 1,749 were excluded due to incomplete answers (the valid response rate was 30.0 percent).

### **2.2 Measurements**

**Health literacy:** In the original study, obtaining, understanding, and appraising health information, which were three of the four abilities of health literacy identified by Sorensen et al. (2012), were examined using perceived self-efficacy. According to Bandura (1997), perceived self-efficacy concerns people’s beliefs in their capabilities to produce given attainments, and plays a key role in human functioning because it affects behavior not only directly, but also by its impact on other determinants such as goals and aspirations, outcome expectations, affective proclivities, and perceptions of impediments and opportunities in the social environment. Bandura (2006) also asserted that the scale of perceived self-efficacy must be tailored to the particular domain of functioning—that is, the object of interest. Thus, assessing these three abilities of health literacy using perceived self-efficacy may be useful in estimating individuals’ perceptions their ability to manage health information. The three abilities used to measure health literacy were represented as: (1) ‘I can find appropriate health information when I need to’; (2) ‘I can understand the health information I need’; and (3) ‘I can evaluate the quality of the health information I obtained.’ Participants responded to these items on a 5-point Likert scale, wherein 1 = ‘strongly disagree’ and 5 = ‘strongly agree.’

**Health information from Internet sources:** Using the Internet to seek health information was represented as the following question: ‘Do you usually use the Internet to find health information?’ This was assessed as a dichotomous question (one requiring a yes/no answer).

**Health information from living sources:** This study used information support, which is a form of social support. Schaefer, Coyne, and Lazarus (1981) defined information support as communication that provides useful or needed information. Therefore, the question used was: ‘Do you have people who provide the health information you need or give you useful advice?’ This was assessed as a dichotomous question.

Socioeconomic status (SES): Respondents' educational levels were assessed and divided into three categories: attainment of junior high-school graduation; attainment of high-school graduation; and attainment of post-high-school education (junior college, vocational training school, university, and graduate school). Employment status was also assessed as a dichotomous question (unemployed/employed). Having problems paying medical bills was assessed on a three-level scale (no, several times, and always) and was used as the economic factor in this study. Because of universal health insurance and an expensive health insurance system, actual payments for care at medical institutions are quite low in Japan.

Health status: Because several studies have reported that health status is associated with health literacy (Omachi, Sarkar, Yelin, Blanc and Katz 2013), two factors were used in this study. One is having been diagnosed with a chronic disease, which was assessed as a dichotomous question (yes/no); the other is one's self-rated health status, which was assessed on a 5-point Likert scale, ranging from 1 = poor to 5 = excellent.

Demographic data: Age, gender, and marital status were also used in this study.

### **2.3 Data analysis**

Based on Internet use, respondents were divided into three categories: people aged 20–39, who have used the Internet since they were young; those aged 40–59, who had to learn to use the Internet when they reached young adulthood; and those aged 60 or over, who had to learn to use the Internet when they reached middle adulthood. Multivariate analyses of covariance (ANCOVA) were conducted to examine differences in perceived self-efficacy regarding the three abilities of seeking health information among the three age groups. Control variables used in the analysis included: age (in years), gender, marital status, and health status (existence of chronic illness and self-rated health). Bonferroni's multiple comparisons tests were performed after ANCOVA. Pearson product-moment correlation coefficients, t-tests, and analyses of variance were used as univariate analyses. All statistical analyses were performed using the SPSS program version 17.0. All p-values lower than 0.05 were considered statistically significant.

## **3. Results**

Table 1 displays all of the participant characteristics and variables used in this study. Data used in this analysis included 550 participants aged 20–39 years, 1,156 aged 40–59, and 1,046 aged 60 or over. Of all participants, 44.7 percent were men and 74.1 percent were married. Overall, approximately 30 percent of participants usually used the Internet to find health information; this percentage was lower in the higher age groups (58.7 percent, 36.2 percent, and 10.3 percent for the 20–39, 40–59, and 60 or over age groups, respectively). Almost all (90.3 percent) of the participants reported that they had informational health support; this percentage was almost the same across all age groups. There were differences in educational attainment among the different age groups (the levels of post-high-school education were 59.3 percent, 41.3 percent, and 22.5 percent for the 20–39, 40–59, and 60 or over age groups, respectively). Of all participants, 20.5 percent reported that they always had problems paying their medical bills; this percentage was consistent

across all age groups.

**Table 1. Characteristics of participants**

	total	20-39 ages	40-59 ages	n(%)
	N=2752	n=550	n=1156	over 60 ages n=1046
Gender				
Male	1230(44.7)	235(42.7)	513(44.4)	482(46.1)
Female	1522(55.3)	315(57.3)	643(55.6)	564(53.9)
Marital status				
Single	713(25.9)	246(44.7)	205(17.7)	262(25.0)
Married	2039(74.1)	304(55.3)	951(82.3)	784(75.0)
Educational attainment				
Junior high-school graduation	385(14.0)	16(2.9)	86(7.4)	283(27.1)
High school graduation	1329(48.3)	208(37.8)	593(51.3)	528(50.5)
Post-high-school education	1038(37.7)	326(59.3)	477(41.3)	235(22.5)
Employment				
Unemployed	1673(60.8)	139(25.3)	218(18.9)	722(69.0)
Employed	1079(39.2)	411(74.7)	938(81.1)	324(31.0)
Problems paying medical bills				
No	1477(53.7)	298(54.2)	626(54.2)	553(52.9)
Several times	710(25.8)	128(23.3)	292(25.3)	290(27.7)
Always	565(20.5)	124(22.5)	238(20.6)	203(19.4)
Chronic disease				
No	1291(46.9)	476(86.5)	662(57.3)	323(30.9)
Yes	1461(53.1)	74(13.5)	494(42.7)	723(69.1)
Self-rated health				
(1=very poor – 5=very good)	3.30 <sup>a</sup> (0.92 <sup>b</sup> )	3.53 <sup>a</sup> (0.89 <sup>b</sup> )	3.30 <sup>a</sup> (0.87 <sup>b</sup> )	3.19 <sup>a</sup> (0.97 <sup>b</sup> )
Using the Internet to seek health information				
No	849(30.9)	227(41.3)	738(63.8)	938(89.7)
Yes	1903(69.1)	323(58.7)	418(36.2)	108(10.3)
Informational support				
No	267(9.7)	40(7.3)	97(8.4)	130(12.4)
Yes	2485(90.3)	510(92.7)	1059(91.6)	916(87.6)

a: mean, b: SD

The results of the Pearson product-moment correlation coefficient for the three self-efficacies regarding seeking health information revealed that there were statistically significant relationships between the three variables (finding and understanding health information was .55; understanding and evaluating health information was .33; and finding and evaluating health information was .46). The data presented in Tables 2, 3, and 4 indicated that there were no clear differences between the results of univariate and multivariate analysis of the factors relating to the three abilities of self-efficacy regarding seeking health information for the three age groups, except for the results for participants aged 20–39.

Table 2 shows the results for participants aged 20–39. These results indicated that educational attainment, Internet use, and having informational support were associated with perceived self-efficacy regarding finding and understanding health information in univariate analyses. However, the results of the multivariate analyses showed that educational attainment and having informational support were not associated with finding and understanding health information. Internet use was significantly associated only with self-efficacy regarding finding health information, while having informational support and always having problems paying medical bills were significantly associated with higher self-efficacy in evaluating health information.

**Table 2. Variables associated with perceived self-efficacy regarding the three abilities in seeking health information among people aged 20–39.**

	Finding				Understanding				Evaluating						
	Mean (SD)	Univariate analysis	Multivariate analysis <sup>a</sup>		Mean (SD)	Univariate analysis	Multivariate analysis <sup>a</sup>		Mean (SD)	Univariate analysis	Multivariate analysis <sup>a</sup>				
		p	F value	p		p	F value	p		p	F value	p			
<b>Educational attainment</b>															
Junior high-school	2.88 (1.15)	6.434 <sup>b</sup>	.002 <sup>d</sup>	1.517	.220	3.00 (1.15)	4.379 <sup>b</sup>	.013 <sup>d</sup>	1.463	.232	3.13 (0.96)	1.069 <sup>b</sup>	.344	.223	.800
High school	3.25 (0.89)					3.34 (0.92)					3.23 (1.04)				
Post-high-school	3.45 (0.78)					3.51 (0.84)					3.35 (1.05)				
<b>Employment</b>															
Unemployed	3.37 (0.85)	.257 <sup>c</sup>	.797	.059	.808	3.43 (0.93)	.039 <sup>c</sup>	.969	.361	.548	3.31 (1.08)	.194 <sup>c</sup>	.847	.003	.954
Employed	3.35 (0.84)					3.43 (0.87)					3.29 (1.03)				
<b>Problems paying medical bills</b>															
No	3.36 (0.83)	.062 <sup>b</sup>	.940	.048	.953	3.41 (0.88)	1.149 <sup>b</sup>	.318	.972	.379	3.20 (1.10)	4.803 <sup>b</sup>	.009 <sup>e</sup>	5.514	.004 <sup>e</sup>
Several times	3.34 (0.84)					3.38 (0.85)					3.28 (0.98)				
Always	3.37 (0.88)					3.53 (0.94)					3.54 (0.92)				
<b>Using the Internet to seek health information</b>															
No	3.11 (0.88)	-5.962 <sup>c</sup>	<.001	27.158	<.001	3.34 (0.92)	-1.996 <sup>c</sup>	.046	1.647	.200	3.29 (1.02)	-.072 <sup>c</sup>	.943	.408	.523
Yes	3.53 (0.77)					3.49 (0.86)					3.30 (1.06)				
<b>Informational support</b>															
No	3.00 (0.96)	-2.807 <sup>c</sup>	.005	3.404	.066	3.15 (0.89)	-2.071 <sup>c</sup>	.039	1.226	.269	2.48 (1.09)	-5.290 <sup>c</sup>	<.001	22.801	<.001
Yes	3.39 (0.83)					3.45 (0.88)					3.36 (1.01)				

Dependent variables: finding (I can find appropriate health information when I need to); understanding (I can understand the health information I need); and evaluating (I can evaluate the quality of the health information I obtained). These were rated on a 5-point Likert scale, from 1 = strongly disagree to 5 = strongly agree, adjusting for age, gender, marital status, chronic disease, and self-rated health.

a: The result of the multivariate analyses of covariance

b: F value

c: t value

d: Bonferroni's multiple comparisons test: Post-high-school education > high-school graduation and junior high-school graduation; high-school graduation > junior high-school graduation

e: Bonferroni's multiple comparisons test: no < always

Table 3 shows the results for participants aged 40–59. Among this group, Internet use and having informational support were associated with all three abilities of health literacy. Better education was also associated with greater confidence in self-efficacy regarding all three abilities of seeking health information.

**Table 3. Variables associated with perceived self-efficacy regarding the three abilities in seeking health information among people aged 40–59.**

	Finding				Understanding				Evaluating						
	Mean (SD)	Univariate analysis	Multivariate analysis <sup>a</sup>		Mean (SD)	Univariate analysis	Multivariate analysis <sup>a</sup>		Mean (SD)	Univariate analysis	Multivariate analysis <sup>a</sup>				
		p	Fvalue	p		p	Fvalue	p		p	Fvalue	p			
<b>Educational attainment</b>															
Junior high-school	2.87 (0.94)	19.518 <sup>b</sup>	<.001 <sup>d</sup>	5.153	.006 <sup>d</sup>	3.17 (0.92)	21.421 <sup>b</sup>	<.001 <sup>e</sup>	10.118	<.001 <sup>e</sup>	2.94 (1.10)	8.473 <sup>b</sup>	<.001 <sup>d</sup>	3.166	.043 <sup>d</sup>
High school	3.24 (0.87)					3.46 (0.86)					3.17 (1.01)				
Post-high-school	3.46 (0.88)					3.72 (0.80)					3.36 (1.04)				
<b>Employment</b>															
Unemployed	3.20 (0.93)	-1.925 <sup>c</sup>	.055	1.168	.280	3.57 (0.83)	.560 <sup>c</sup>	.575	.896	.344	3.23 (1.10)	-.02 <sup>c</sup>	.980	.011	.916
Employed	3.33 (0.88)					3.54 (0.86)					3.23 (1.02)				
<b>Problems paying medical bills</b>															
No	3.33 (0.90)	.896 <sup>b</sup>	.940	.048	.953	3.41 (0.88)	1.149 <sup>b</sup>	.318	.972	.379	3.20 (1.10)	4.803 <sup>b</sup>	.009 <sup>e</sup>	5.514	.004 <sup>e</sup>
Several times	3.25 (0.92)					3.38 (0.85)					3.28 (0.98)				
Always	3.29 (0.84)					3.53 (0.94)					3.54 (0.92)				
<b>Using the Internet to seek health information</b>															
No	3.13 (0.92)	-9.695 <sup>c</sup>	<.001	55.530	<.001	3.41 (0.88)	-7.326 <sup>c</sup>	<.001	32.045	<.001	3.16 (1.04)	-3.296 <sup>c</sup>	.001	3.535	.060
Yes	3.61 (0.74)					3.78 (0.76)					3.36 (1.00)				
<b>Informational support</b>															
No	2.89 (0.92)	-4.835 <sup>c</sup>	<.001	9.569	.002	3.18 (0.90)	-4.469 <sup>c</sup>	<.001	6.976	.008	2.31 (0.99)	-9.520 <sup>c</sup>	<.001	59.310	<.001
Yes	3.34 (0.88)					3.58 (0.84)					3.32 (1.00)				

Dependent variables: finding (I can find appropriate health information when I need to); understanding (I can understand the health information I need); and evaluating (I can evaluate the quality of the health information I obtained). These were rated on a 5-point Likert scale, from 1 = strongly disagree to 5 = strongly agree, adjusting for age, gender, marital status, chronic disease, and self-rated health.

a: The result of the multivariate analyses of covariance

b: t value

c: F value

d: Bonferroni's multiple comparisons test: Post-high-school education > high-school graduation and junior high-school graduation; high school graduation > junior high-school graduation

e: Bonferroni's multiple comparisons test: Post-high-school education > high school graduation and junior high-school graduation

Table 4 shows the results for participants aged over 60. Similar to the results of participants aged 40–59, Internet use, having informational support, and education were associated with higher self-efficacy in finding and understanding health information. On the other hand, having informational social support rather than higher educational attainment was significantly associated only with a higher self-efficacy in evaluating health.

**Table 4. Variables associated with perceived self-efficacy regarding the three abilities in seeking health information among people aged over 60.**

	Finding				Understanding				Evaluating						
	Mean (SD)	Univariate analysis		Multivariate analysis <sup>a</sup>		Mean (SD)	Univariate analysis		Multivariate analysis <sup>a</sup>		Mean (SD)	Univariate analysis		Multivariate analysis <sup>a</sup>	
		p	Fvalue	p		p	Fvalue	p		p	Fvalue	p	Fvalue	p	
<b>Educational attainment</b>															
Junior high-school	3.19 (0.98)	9.113 <sup>b</sup>	<.001 <sup>d</sup>	4.872	.008 <sup>d</sup>	3.53 (0.96)	9.603 <sup>b</sup>	<.001 <sup>d</sup>	6.129	.002 <sup>d</sup>	3.28 (1.10)	.488 <sup>b</sup>	.614	.509	.601
High school	3.32 (0.89)					3.62 (0.80)					3.26 (1.09)				
Post-high-school	3.54 (0.88)					3.85 (0.80)					3.34 (0.98)				
<b>Employment</b>															
Unemployed	3.36 (0.93)	1.362 <sup>c</sup>	.173	1.468	.226	3.70 (0.84)	2.883 <sup>c</sup>	.004	5.842	.016	3.32 (1.08)	1.711 <sup>c</sup>	.087	.567	.452
Employed	3.27 (0.91)					3.53 (0.88)					3.20 (1.05)				
<b>Problems paying medical bills</b>															
No	3.38 (0.90)	1.703 <sup>b</sup>	.183	1.337	.263	3.67 (0.87)	.944 <sup>b</sup>	.389	.528	.590	3.33 (1.06)	1.165 <sup>b</sup>	.312	.609	.544
Several times	3.29 (0.96)					3.65 (0.83)					3.26 (1.12)				
Always	3.26 (0.94)					3.58 (0.85)					3.20 (1.03)				
<b>Using the Internet to seek health information</b>															
No	3.30 (0.93)	-4.494 <sup>c</sup>	<.001	12.575	<.001	3.62 (0.87)	-4.437 <sup>c</sup>	<.001	12.026	.001	3.27 (1.07)	-7.716 <sup>c</sup>	.474	1.069	.301
Yes	3.66 (0.78)					3.93 (0.67)					3.35 (1.05)				
<b>Informational support</b>															
No	3.02 (1.04)	-4.118 <sup>c</sup>	<.001	12.038	.001	3.37 (0.95)	-3.993 <sup>c</sup>	<.001	11.052	.001	2.48 (1.17)	-9.550 <sup>c</sup>	<.001	81.615	<.001
Yes	3.38 (0.90)					3.69 (0.83)					3.40 (1.01)				

Dependent variables: finding (I can find appropriate health information when I need to); understanding (I can understand the health information I need); and evaluating (I can evaluate the quality of the health information I obtained). These were rated on a 5-point Likert scale, from 1 = strongly disagree to 5 = strongly agree, adjusting for age, gender, marital status, chronic disease, and self-rated health.

a: The result of the multivariate analyses of covariance

b: F value

c: t value

d: Bonferroni's multiple comparisons test: Post-high-school education > high school graduation and junior high-school graduation; high-school graduation > junior high-school graduation

## 4. Discussion

This study examined the effects of a variety of factors on self-efficacy in seeking health information among different age groups. The results indicated that having informational social support was a more valuable tool than higher educational attainment in evaluating health information among all age groups. The most common problem with gathering health information on the Internet is that not all such information is reliable. For instance, a 2009 study conducted in the United Kingdom showed that only 4 of 10 websites provided correct information regarding pediatric issues (Scullard, Peacock and Davies 2010). Another study reported that coverage of key information on English- and Spanish-language websites is poor and inconsistent, although the accuracy of the information provided is generally good (Berland et al. 2001). Therefore, to gather health information effectively, such sources need to be evaluated. Several studies showed that an individual's social network has a positive effect on health literacy. For example, Lee et al. reported that positive



support in one's social networks buffer and alleviate the adverse health consequences of low health literacy (Lee, Boden-Albala, Quarles, Wilcox and Bakken 2012). Because only informational social support was associated with self-efficacy in evaluating health information among younger adults as well as older adults, individuals should rely more on living sources when they evaluate such information. Informational social support is essentially communication, which is a reciprocal process between two or more people rather than a one-way process (Riley 2011), and involves trust in one's informants. Interpersonal trust, norms of reciprocity, and mutual aid were features of social capital, which impacts the health and well-being of communities and individuals (Coleman, 1988; Kawachi, Kennedy and Glass 1999). Therefore, scholars need to focus on the mechanism of trust in health information and social capital as well as the effects of information technology on improving health literacy.

In addition, having informational social support was also associated with self-efficacy in finding and understanding health information in respondents aged 40 and over. According to a study conducted in France in 2010, young adults trust online information and consider the Internet a valid source of health advice (Beck et al. 2014). On the other hand, Kobayashi, Wardle, and von Wagner (2015) indicated that not only Internet use but also social engagement may help maintain health literacy, especially for elderly people. Older adults place a greater amount of trust in people with whom they are able to actively discuss their health, rather than the Internet (Chaudhuri et al. 2013). Therefore, it can be said that people aged 40 and over who do not believe blindly in information on the Internet also rely on information from living sources when they look for and understand health information.

Moreover, Internet use was associated with finding health information among all age groups, and with understanding health information among those aged 40–59 and 60 or over. Usually, people use the Internet to quickly find answers to health-related queries, and they typically do not employ any means of fact-checking or source verification (Eysenbach and Kohler 2002). Therefore, it is assumed that Internet use was strongly related to finding and understanding information, but not with evaluating it.

Additionally, education was also related to finding and understanding health information among those aged 40–59 and over 60. Educational attainment is a strong predictor of health literacy (Howard, Sentell and Gazmararian 2006; Berkman, Sheridan, Donahue, Halpern and Crotty 2011; van der Heide et al. 2013). However, when it comes to facing difficult problems beyond one's abilities, such as evaluating health information, people may rely on social support and social networks rather than their own abilities, which was expressed as educational attainment in this study. Therefore, education may be related to self-efficacy in finding and understanding health information but not to evaluating it.

In addition, one remarkable finding of this study is the effect of educational attainment in the 20–39 age group. The results of the univariate analyses show that there were correlations between lower education levels and lower self-confidence in finding and understanding health information. When educational levels were subjected to multivariate analysis, however, the association between finding and understanding health information was attenuated among participants aged 20–39, but

remained stable among participants aged 40–59 and over 60. One reason for this may be that equal access to health information via the Internet may reduce the effect of education on self-efficacy in finding health information. The gap in educational attainment may have been replaced by a gap in Internet access, or it may be that traditional ways of assessing educational attainment are no longer effective measurements of SES among young people in Japan. Considering that upper secondary education has become popularized, the level of an individual's educational attainment rather than his or her total years of schooling may be more useful predictors of SES. Further study will be needed to confirm these effects on SES in Japan.

### Implications and limitations

This study indicates that not only equal access to health information but also informational social support may reduce the effect of education attainment on health literacy. Because it was a population survey, this result was expected to provide useful suggestions on researching health information, and the data might be useful for later comparisons in the era of more advanced and sophisticated information technologies.

However, this study has several limitations—it is a cross-sectional study, it used secondary analysis, the response rate was low, and the target population resided in rural areas, which should be taken into consideration when interpreting its results. Moreover, the data used in this study was collected in 2007, and rates of Internet use have changed because of the increasing prevalence of smartphones, which give people easier access to the Internet. According to Statista (2016), for 2016, the number of smartphone users is forecast to reach 2.08 billion, and just over 36 percent of the world's population is projected to use a smartphone by 2018. Additionally, social networking sites, Internet-based services that allow people to share information and communicate interactively, may change the effects of living resources on seeking health information. Further studies are necessary in order to know more about the relationship between SES, information technology, social networks, and health literacy.

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