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Interpersonal Diffusion of Health Information: Health Information Mavenism among People Age 65 and over in Japan

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ABSTRACT

Health information mavens are those who provide and share health information with others via interpersonal communication. We investigated the characteristics of health information mavens among Japanese elderly and whether those who share health information with others via interpersonal communication behave more healthily or report better health status compared to their peers. Data come from a cross-sectional analysis of 27,414 participants in the Japanese Gerontological Evaluation Study (JAGES) (mean age = 74 years). Mavenism is associated with being female, younger age, higher educational status, and perceived financial condition, as well as larger social networks, higher social support, and media exposure. A higher mavenism score was associated with healthier dietary, and exercise behaviors, but not associated with smoking or alcohol consumption. Mavens were more likely to have a disease and/or report disease symptoms. Health information mavens have the potential to facilitate word-of-mouth communication among older adults, who tend to be more disadvantaged in terms of health information access compared to younger populations.

Introduction

Communication inequality among older population in the rapidly aging society

Older populations are disadvantaged in terms of their access, use, attention to and processing of health information, as well as their capacity for changing behavior based on acquired health information (Abratt, Nel, & Nezer, 1995; Viswanath, 2006). Also, older adults are less confident in seeking health information compared to younger adults (Ishikawa, Nishiuchi, Hayashi, & Viswanath, 2012). Communication inequalities are defined as the differences within and between socioeconomic groups in terms of capacity for information generation, dissemination and use by communities, and information access, processing and decision-making by individuals (Viswanath, 2006), are an important determinant of health inequalities (Viswanath, 2006; Viswanath, Ramanadhan, & Kontos, 2007). Nonetheless, health communication behaviors among older adults tend to be under-studied (Chaudhuri, Le, Thomson, & Demiris, 2013).

Previous literature has shown the impact of interpersonal communication in this population (Cabinet Office, Government of Japan, 2014; Duggan, 2006; Southwell & Yzer, 2007). Interpersonal communication is important in terms of not only facilitating information but also as a mediator and moderator of campaign effects (Southwell &

Yzer, 2007); however, little is known about the dissemination of health information in the elderly. With the rise of aging populations, identifying the most effective communication strategy among older populations is critical.

Older population in Japan: Left behind from health information access

Japan currently has one of the fastest rates of population aging in the world. By 2030, it is estimated that one-third of the Japanese population will be over the age of 65 years (Cabinet Office, Government of Japan, 2012; Ministry of Internal Affairs and Communication, 2013). In the context of population aging, an important challenge in public health is how to promote access to health information in this vulnerable population.

Although the Internet is an expanding source of information, older people are likely to have barriers to use these technologies due to physical, psychological and economic reasons (Ihm & Hsieh, 2015; Smith, 2014). In Japan, older people are less likely to receive health information through this medium – relying instead on television and newspapers (Ishikawa et al., 2012). Beyond mass media, older Japanese adults express more trust in health information obtained through interpersonal channels, such as through interactions with health-care providers, friends, and family members

(Ishikawa et al., 2012). Studies have demonstrated the importance and impact of interpersonal communication for health information seeking (Ackerson & Viswanath, 2009; Chaudhuri et al., 2013). In fact, in Japan, the number of single-person and elderly-couple households has been increasing and has contributed to social isolation among the elderly (Cabinet Office, Government of Japan, 2014). This situation may create difficulties for the elderly in accessing necessary information via interpersonal interaction (Cabinet Office, Government of Japan, 2014).

Theoretical framework: Combining marketing approach (The idea of market mavenism) and communication inequality (Structural influence model)

This paper applies the concept of “market maven” to the public health domain to identify characteristics of high health information mavenism in a large sample of community-dwelling seniors. Mavens are defined as people who provide and share information with others via interpersonal communication based on their own knowledge, beliefs, and experiences (Abratt et al., 1995; Feick & Price, 1987; Kontos, Emmons, Puleo, & Viswanath, 2011). Market mavenism is used in the fields of marketing and advertising to identify how people share information on products and/or services with others. Interpersonal communication channels and casual word-of-mouth communication are one of the most important strategies to reach consumers (Ackerson & Viswanath, 2009; Kontos et al., 2011; Viswanath, 2008). Marketers have successfully created new norms about their products and/or services through mavens (Arndt, 1967; Bayns, 1985; Kontos et al., 2011). Market mavens share similar characteristics with early adopters (in diffusion theory) or opinion leaders (Kontos et al., 2011; Rogers, 2010; Valente & Pumpuang, 2007). However, they are different in the sense that mavens are not required to have specific knowledge, and they share more general information (Feick & Price, 1987; Kontos et al., 2011). In public health, although the importance of interpersonal communication and information sharing has been recognized (Ackerson & Viswanath, 2009), few studies have been conducted to investigate health information mavens, especially in an older population. Access to health information is unequal across different population groups (Southwell, 2013).

We also used the Structural Influence Model (SIM) (Viswanath et al., 2007) for theoretical guidance. SIM describes the relationship between social determinants, communication inequalities including health information and media access, and health outcomes, emphasizing that differences among upstream factors are connected to communication inequalities, which in turn produce health inequalities (Viswanath et al., 2007). According to SIM, in addition to demographic characteristics, socioeconomic status (SES) affects health information access including media access, use, and processing information, mediated and/or moderated by age, gender, and resources. Eventually, these factors impact health outcomes including knowledge, beliefs and behaviors.

Identification of health information market maven profile among older population

In this paper, using the mavenism concept with SIM, we are particularly interested in the effect of people’s background including social determinants on health and health information exposure and seeking. Although previous literature shows the impact of communication inequalities on health in Japan (Ishikawa et al., 2012), the specific impacts among the elderly are unknown. We hypothesized that there are health information mavens among older adults, and there is association among social determinants and other demographic characteristics, health communication-related factors, and health outcomes between health information mavens.

Two research questions guided our analyses. First, what are the characteristics and predictors of health information mavens among older Japanese adults? We specifically investigated the relationship between health information mavenism and SES, gender, health information exposure and four types of social relationship variables (social network, social support, social capital and social participation) (Ackerson & Viswanath, 2009; Kontos et al., 2011; Viswanath, 2006, 2008). Our second research question is, to what extent is health information maven status associated with their health-related behavior and health status? A previous U.S. study hinted that health mavens may not be necessarily equipped with expert knowledge of health, e.g. mavens are more likely to have an accurate belief on diet, however, there were no differences of belief on physical activity and smoking between mavens and non-mavens (Kontos et al., 2011).

Methods

Data source and study population

The data for this paper come from the Japanese Gerontological Evaluation Study (JAGES). JAGES is an ongoing prospective cohort established in 2010 to investigate the social determinants of healthy aging in a national sample of community-dwelling seniors aged 65 years or older. Since 2003, a mail-based survey has been conducted every three years. For this study, we drew from the latest wave in 2013, when health communication-related questions were included for the first time; thus, our data are cross-sectional. Thirty-one municipalities agreed to cooperate with the study.

Data collection

From October to December 2013 a self-administered questionnaire was mailed to the study participants. The questionnaire was mailed to 193,694 participants living in 31 municipalities and achieved a response rate of 71.1%. Those municipalities, which agreed to cooperate, participated in this study. Geographically, the survey has national coverage; however, it is not nationally representative. The questionnaire was sent to all or randomly sampled participants who are living independently in these communities, and not recipients of public long-term care insurance, depending on the size of municipalities. The questionnaire was composed of two parts: core questions and modules. There were five types of

modules in total. Participants were randomly assigned to one out of the five modules. As a result, 38,756 people received the health communication module, and 27,414 people responded (response rate: 70.7%).

Study variables

Health information mavenism

The health information mavenism index was obtained by summing responses to five questions about providing or sharing health information with others: 1) I like introducing new health topics to my friends and family; 2) I like helping people by providing them with information about health; 3) People ask me for information about health; 4) If someone asked where to get the best information about a particular health topic, I could tell him or her where to go; 5) My friends think of me as a good source of information when it comes to new information about health. The response options were: 1. Agree, 2. Somewhat agree, 3. Somewhat disagree, 4. Disagree. Scores from each item were added, and the total score (range: 4–20) was considered a health information maven score. These items were adapted from previous research (Kontos et al., 2011). Considering the target population of the present study (elderly population aged 65 or older), we used a 4-point Likert scale for the purpose of reducing respondent burden, instead of the previously developed 7-point scale (Kontos et al., 2011). The health information mavenism index measures demonstrated high internal consistency (Cronbach's alpha = 0.910).

Health information exposure

Health information exposure was summed across seven items asking respondents how frequently they were exposed to health information from various sources (e.g., news about health on TV or talked to family members or friends about health) (range of index was 7–28). Responses ranged from “twice a week or more” to “not at all” on a 4-point scale. These questions were adapted from previous research and modified to the Japanese context (Annenberg School for Communication, 2013; Ishikawa et al., 2012).

Social relationships

Social relationship variables were measured using questions inquiring about people's social network, social support, social capital, and social participation. These four concepts were measured separately. Social network was measured by asking for the frequency of seeing friends and the number of friends with whom respondent met during the last month. Perceived social support was measured by summing up social support related questions that include both instrumental and emotional social supports (score range 0–14, higher score indicating higher perceived social support). Social capital was measured by three items inquiring about trust in neighbors, perceptions of helpfulness of neighbors, and attachment to the neighborhood. Social participation was measured by the sum of the frequency of participation in 14 different social activities.

Health-related behavior and health status

The following nine health behaviors and outcomes were assessed: 1) smoking (non-smoker, current smoker, or former smoker), 2) alcohol consumption (no alcohol intake, current alcohol intake, or past alcohol intake), 3) diet (frequency of fruit and vegetable intake over the past month), 4) vigorous exercise (frequency), 5) moderate exercise (frequency), 6) mild exercise (frequency), 7) history of health check-ups (the latest checkups), 8) subjective health status (poor to excellent), and 9) having current health conditions including both physical and psychological symptoms such as high blood pressure, cancer, and depression (yes or no).

Covariates

We assessed sociodemographic variables and covariates including age, sex, household income in the past year, perceived financial condition, and years of education. The phrasing of the above survey items is included in [Appendix A](#).

Data analysis

Our outcome, health information mavenism index, was analyzed as a continuous variable. First, we examined the descriptive characteristics of health mavens – e.g., health information exposure, social interaction and demographic variables ([Table 3](#)). We next constructed logistic or multinomial regression models to assess the association between health information mavenism and health status/health behaviors, controlling for age, gender, education, household income, perceived financial condition, social relationship variables (social network, social support, social capital and social participation) and health information exposure (each media). For missing data, we used complete case analysis with listwise deletion. We excluded individuals with one or more missing values for any of the variables used in the analysis. All analyses were performed using STATA 13.0 SE.

Results

Descriptive analyses ([Tables 1 and 2](#))

[Table 1](#) summarizes the demographic characteristics of the study sample and the distribution of the key variables. Approximately 54% of the JAGES sample was female. The age range was from 65 to 106 years, and the mean age was 74. The median annual household income for the sample was 2.5 million to less than 3 million yen (approximately 24,500 to 29,350 USD annually, at 1USD equals 102.20 yen). This matches the Japanese annual mean income of the household in which the head of household is age 65 or older (2.97 million yen) (Ministry of Health, 2015). Thus, the JAGES samples are close to the national average. Sixteen percent of the sample did not report their income. Nearly 40% of the sample had 6–9 years of education (elementary and junior high school education), more than half of the people had more than 10–12 years of education (more than high school) and one fifth had 13 years or more education (some college and/or professional school). The mean score of the health information exposure index was 19 (range 7–28, SD = 4.53). Health information exposure varied across types of media. In terms of mass media, except for magazine or articles featuring

Table 1. Demographic, socioeconomic status, social relationship, and media exposure: JAGES 2013 Survey (n = 27414).

		Mean	SD
Age	n = 24108	74	6.27
		n	%
Sex			
	Male	12,188	46.47
	Female	14,098	53.63
Household income (yen, last 12 months, before tax)			
	<500,000	615	2.34
	500,000 < 1,000,000	1,435	5.46
	1,000,000 < 1,500,000	1,692	6.44
	1,500,000 < 2,000,000	2,388	9.08
	2,000,000 < 2,500,000	2,709	10.31
	2,500,000 < 3,000,000	2,762	10.51
	3,000,000 < 4,000,000	3,516	13.38
	4,000,000 < 5,000,000	2,197	8.36
	5,000,000 < 6,000,000	1,284	4.88
	6,000,000 < 7,000,000	853	3.25
	7,000,000 < 8,000,000	680	2.59
	8,000,000 < 9,000,000	417	1.59
	9,000,000 < 10,000,000	471	1.79
	10,000,000 < 12,000,000	428	1.63
	≥12,000,000	538	2.05
	Missing	4301	16.36
Perceived financial condition			
	Very difficult	2,015	7.67
	Difficult	8,889	33.82
	Comfortable	12,424	47.26
	Very comfortable	2,286	8.7
	Missing	671	2.55
Education			
	<6 years	453	1.72
	6–9 years	10,438	39.71
	10–12 years	9,446	35.94
	>13 years	5,299	20.16
	Others	168	0.64
	Missing	482	1.83
Social network			
Frequency of meeting friends			
	Rarely	10,522	7.98
	A few times a year	23,130	17.53
	One to three times a month	27,873	21.13
	Once a week	16,306	12.36
	Two or three times a week	25,130	19.05
	Four or more a week	21,484	16.29
	Missing	7,475	5.67
The number of friends you met over the past month			
	0	10,543	7.99
	1–2 people	22,373	16.96
	3–5 people	31,251	23.69
	6–9 people	17,247	13.07
	More than 10 people	42,993	32.59
	Missing	7,513	5.7
Social Capital			
Trust in neighborhood			
	Not at all	248	0.94
	Slightly	885	3.37
	Neutral	6,823	25.96
	Moderately	14,590	55.5
	Very	3,100	11.79
	Missing	640	2.43
Helpful neighborhood			
	Not at all	484	1.84
	Slightly	1,940	7.38
	Neutral	9,465	36.01
	Moderately	11,853	45.09
	Very	1,594	6.06
	Missing	950	3.61
Attachment to neighborhood			
	Not at all	263	1.00
	Slightly	1,137	4.33
	Neutral	3,900	14.84
	Moderately	13,763	52.36
	Very	6,600	25.11
	Missing	623	2.37
Health Information Exposure (past one month)			
	News program on TV		
	Not at all	1,858	7.07
	Less than once a week	4,930	18.76

(Continued)

Table 1. (Continued).

	Mean	SD
About once a week	8,117	31.11
Twice a week or more	10,042	38.20
Missing	1,279	4.87
Informational TV program featuring about health, doctors or hospitals		
Not at all	3,516	13.38
Less than once a week	6,598	25.10
About once a week	7,981	30.36
Twice a week or more	6,604	25.12
Missing	1,587	6.04
Article about health in a newspaper or magazine		
Not at all	4,254	16.18
Less than once a week	6,164	23.45
About once a week	6,705	25.51
Twice a week or more	7,725	29.39
Missing	1,438	5.47
Magazine or newsletter with a special column on health or medical care		
Not at all	10,969	41.73
Less than once a week	7,598	28.91
About once a week	3,917	14.90
Twice a week or more	2,138	8.13
Missing	1,664	6.33
Family members and friends		
Not at all	4,071	15.49
Less than once a week	9,052	34.44
About once a week	6,151	23.40
Twice a week or more	5,520	21.00
Missing	1,492	5.68
Internet		
Not at all	20,451	77.80
Less than once a week	2,120	8.07
About once a week	960	3.65
Twice a week or more	634	2.41
Missing	2,121	8.07
Government-issued announcement or newsletter		
Not at all	7,612	28.96
Less than once a week	11,869	45.15
About once a week	3,521	13.39
Twice a week or more	1,230	4.68
Missing	2,054	7.81
Perceived Social Support (range: 0–16)		
	n	Mean
Score	26286	3.63
Social participation (range: 14–84)		SD
	Obs	Mean
Score	20096	50.02
Health Information Exposure Index (range: 7–28)		SD
Score	22785	19
Health Information Mavenism Index (range: 5–20)		SD
Score	23267	14.8

health and medicine, more than half of people were exposed to health information through TV and/or newspaper at least once a week. Nearly 80% of people responded that they never obtained health information via the Internet. More than 44.4% obtained health information at least about once a week through interpersonal communication such as conversations with family and friends. The mean of the health information mavenism score was 14.8 (range 5–20, SD = 3.68).

Table 2 shows the distribution of the health behaviors and health status of the study population. Although nearly 80% of people reported their health status as good or excellent, nearly 80% also reported disease and/or symptoms including either currently receiving treatment and/or experiencing after-effects. In terms of health behaviors, more than 70% of people indicated that they were non-smokers and nearly 60% of people did not drink alcohol. Nearly 80% of people have fruit and vegetables at least once a day. Although 60% of people indicated that they rarely do vigorous exercise,

approximately 50% of people stated that they do mild exercise four or more times a week. More than 50% of people received a health check within the past year.

Characteristics and determinants of health information mavens (Table 3)

Table 3 shows the sociodemographic and health characteristics of health mavens.

Adjusted models with overall health information exposure

Women (0.24, CI = 0.13–0.34), younger age (–0.01, CI = –0.02–0.00), higher educated, having a larger social network, better perceived financial position (0.10, CI = 0.02–0.17) were associated with higher mavenism. Those who had higher overall health information exposure had higher health information mavenism scores (0.33, CI = 0.32–0.34). Having

Table 2. Health-related behavior and health status: JAGES 2013 Survey (n = 27414).

	n	%
Health related behavior		
Smoking status	19,275	73.33
Non-smoker		
Current smoker	2,599	9.89
Former smoker	3,999	15.21
Missing	413	1.57
Alcohol consumption		
No alcohol intake	15,683	59.66
Current alcohol intake	8,890	33.82
Past alcohol intake	1,350	5.14
Missing	363	1.38
Diet (fruits and vegetable intake)		
None	48	0.18
Less than once a week	159	0.6
Once a week	268	1.02
Two or three times a week	1,919	7.3
Four to six times a week	3,180	12.1
Once a day	9,452	35.96
Twice a day	10,873	41.36
Missing	387	1.47
Exercise		
Vigorous	15,889	60.45
Rarely	1,470	5.59
A few times a year	904	3.44
One to three times a month	1,175	4.47
Two or three times a week	1,817	6.91
Four or more times a week	1,296	4.93
Missing	3,735	14.21
Moderate	5,847	22.24
Rarely	1,488	5.66
A few times a year	2,240	8.52
One to three times a month	2,247	8.55
Two or three times a week	4,823	18.35
Four or more times a week	7,192	27.36
Missing	2,449	9.32
Mild	3,659	13.92
Rarely	740	2.82
A few times a year	1,301	4.95
One to three times a month	1,784	6.79
Two or three times a week	5,154	19.61
Four or more times a week	11,230	47.72
Missing	2,418	9.2
History of health check-ups		
Never had one	4,803	18.27
More than 4 years ago	2,727	10.37
Within 2 to 3 years	3,060	11.64
Within 1 year	14,860	56.53
Missing	836	3.18
Health Subjective		
Health		
Poor	679	2.58
Fair	4,079	15.52
Good	17,756	67.55
Excellent	2,955	11.24
Missing	817	3.11
Health Status		
Having diseases and/or symptoms (currently receiving treatment or experiencing after-effects)	20,781	79.06
No disease	3,831	14.57
Missing	1,674	6.37

higher perceived social support and social participation were each associated with having higher mavenism score (0.16, CI = 0.13–0.19). Among social capital variables, having a higher attachment to the neighborhood (0.12, CI = 0.04–0.19) as well as higher perceptions of helpful neighbors (0.20, CI = 0.12–0.28) were associated with higher mavenism scores.

Adjusted models with each health information exposure

We conducted additional analyses to predict mavenism with individual health information sources. Most of the findings

are similar to the adjusted model with overall health information exposure. Health information exposure from each source was significantly associated with health information mavenism.

The relationship between health information mavens and health-related behavior & health (Table 4)

Table 4 shows the associations between health information mavenism and each health behavior and outcome. Having a higher mavenism score was associated with healthier behaviors such as dietary behavior (0.006, CI = 0.0006–0.01), exercise at any level, and having a more recent health check (0.001, CI = –0.002–0.004), controlling for confounders. In terms of smoking and alcohol consumption, although unadjusted analyses indicated statistically significant lower relative risk of these behaviors, the associations were not significant after controlling for confounders. In terms of health status, having a higher health information mavenism score was significantly associated with having any physical and/or mental disease and/or symptoms (1.03, CI = 1.02–1.05). There was no association between health information mavenism and subjective health status.

Discussion

Who are health mavens?: Demographic and socioeconomic characteristics of mavens

As we expected, some demographic characteristics, for example, female sex, younger age, higher SES, social interaction and media exposure were influential factors for determining health information mavenism. Women generally tend to be more socially engaged than men in general (Bell, 1991; Kawachi & Berkman, 2001). Thus, women may be more likely to share information compared to men. Our finding is consistent with prior work showing that women more actively engaged with others providing health information (Bell, 1991; Kawachi & Berkman, 2001). In terms of age, younger-old individuals among this elderly population are more likely to be health information mavens. A previous study found that being older was related to health information mavens (Kontos et al., 2011).

Considering the fact that the previous study includes all old people without sub-dividing them and their study population includes much younger age groups, this result is reasonable. In Japan, older people's social withdrawal and social isolation have been serious issues, especially among men (Cabinet Office, Government of Japan, 2014). The tendency to be house-bound is more prevalent among men (Cabinet Office, Government of Japan, 2014). Thus, it is likely that older males have fewer opportunities to interact with other people. In terms of SES, higher SES individuals (i.e., higher education and perceived financial condition) are more likely to be mavens. SIM and other existing research demonstrate that SES affects health as it affects social relationship (social support, social networks, and social capital), health information usage (media exposure, access and use), and information seeking and processing (Viswanath et al., 2007). Our finding is consistent with these models. Previous research shows that

Table 3. Multivariable linear regression of association between demographic, socioeconomic, social relationship, and health information exposure-related variables, and health information mavenism.

Independent variable	Unadjusted model			Adjusted model with overall health information exposure			Adjusted model with each health information exposure		
	Coefficient	CI	P	Coefficient	CI	P	Coefficient	CI	P
Education									
< 6 years		1 (ref)			1 (ref)			1 (ref)	
6-9 years	0.91	0.53-1.30	0.0001***	0.38	-0.06-0.81	0.08	0.51	0.08-0.94	0.02*
10-12 years	1.41	1.02-1.79	0.0001***	0.58	0.14-1.01	0.01**	0.69	0.26-1.12	0.002**
13 years or more	1.94	1.55-2.34	0.0001***	0.91	0.47-1.35	0.0001***	0.96	0.52-1.40	0.0001***
Other (unknown)	1.95	1.25-2.64	0.0001***	1.27	0.50-2.04	0.001	1.37	0.60-2.13	0.0001***
Income									
Objective income	0.08	0.06-0.09	0.0001***	0.0003	-0.02-0.02	0.967	-0.004	-0.02-0.01	0.629
perceived financial position	0.58	0.51-0.64	0.0001***	0.10	0.02-0.17	0.013*	0.10	0.02-0.17	0.015*
Age	-0.01	-0.02-0.00	0.06	-0.01	-0.02-0.00	0.02*	-0.001	-0.02-0.0002	0.043*
Sex									
reference: male	0.71	0.62-0.80	0.0001***	0.24	0.13-0.34	0.0001***	0.29	0.18-0.40	0.0001***
Social network									
Frequency of meeting friends	0.54	0.50-0.56	0.0001***	0.15	0.11-0.19	0.0001***	0.14	0.10-0.18	0.0001***
The number of meeting friends last month	0.64	0.60-0.67	0.0001***	0.15	0.10-0.20	0.0001***	0.13	0.09-0.18	0.0001***
Social Support									
Perceived social support (both emotional and instrumental)	0.41	0.38-0.43	0.0001***	0.16	0.13-0.19	0.0001***	0.15	0.12-0.18	0.0001***
Social capital									
Trust in neighborhood	0.63	0.57-0.70	0.0001***	-0.05	-0.14-0.05	0.327	-0.04	-0.13-0.05	0.353
Helpful neighborhood	0.69	0.63-0.75	0.0001***	0.20	0.12-0.28	0.0001***	0.19	0.11-0.28	0.0001***
Attachment to neighborhood	0.66	0.61-0.72	0.0001***	0.12	0.04-0.19	0.002**	0.19	0.11-0.28	0.0001***
Social participation	0.19	0.18-0.20	0.0001***	0.07	0.06-0.08	0.0001***	0.07	0.06-0.08	0.0001***
Health Information Exposure (HIE)									
Overall	0.39	0.37-0.40	0.0001***	0.33	0.32-0.34	0.0001***	NA		
TV (news)	1.15	1.11-1.21	0.0001***	NA			0.21	0.13-0.29	0.0001***
TV (informational programs)	1.19	0.114-1.23	0.0001***	NA			0.23	0.16-0.31	0.0001***
Newspaper or magazine for general population	1.14	1.10-1.18	0.0001***	NA			0.11	0.05-0.17	0.001**
Magazine or article featuring health and medicine	1.41	1.36-1.45	0.0001***	NA			0.50	0.43-0.56	0.0001***
Internet	1.32	1.24-1.39	0.0001***	NA			0.54	0.46-0.62	0.0001***
Community news letters	1.51	1.45-1.57	0.0001***	NA			0.28	0.20-0.36	0.0001***
Interpersonal communication	1.44	1.39-1.48	0.0001***	NA			0.62	0.56-0.68	0.0001***
Perceived social support (both emotional and instrumental)	0.41	0.38-0.43	0.0001***	0.16	0.13-0.19	0.0001***	0.15	0.12-0.18	0.0001***
Social capital									
Trust in neighborhood	0.63	0.57-0.70	0.0001***	-0.05	-0.14-0.05	0.327	-0.04	-0.13-0.05	0.353
Helpful neighborhood	0.69	0.63-0.75	0.0001***	0.20	0.12-0.28	0.0001***	0.19	0.11-0.28	0.0001***
Attachment to neighborhood	0.66	0.61-0.72	0.0001***	0.12	0.04-0.19	0.002**	0.19	0.11-0.28	0.0001***
Social participation	0.19	0.18-0.20	0.0001***	0.07	0.06-0.08	0.0001***	0.07	0.06-0.08	0.0001***
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Overall	0.39	0.37-0.40	0.0001***	0.33	0.32-0.34	0.0001***	NA		
TV (news)	1.15	1.11-1.21	0.0001***	NA			0.21	0.13-0.29	0.0001***
TV (informational programs)	1.19	0.114-1.23	0.0001***	NA			0.23	0.16-0.31	0.0001***
Newspaper or magazine for general population	1.14	1.10-1.18	0.0001***	NA			0.11	0.05-0.17	0.001**
Magazine or article featuring health and medicine	1.41	1.36-1.45	0.0001***	NA			0.50	0.43-0.56	0.0001***
Internet	1.32	1.24-1.39	0.0001***	NA			0.54	0.46-0.62	0.0001***
Community news letters	1.51	1.45-1.57	0.0001***	NA			0.28	0.20-0.36	0.0001***
Interpersonal communication	1.44	1.39-1.48	0.0001***	NA			0.62	0.56-0.68	0.0001***

Adjusted model with overall health information exposure = multivariable linear regression model adjusted for age, gender, education, household income, subjective economic status, social relationship variables (social network, social support, social capital, and social participation) and health information exposure (overall index). Adjusted model with each health information exposure = multivariable linear regression model adjusted for age, gender, education, household income, perceived financial condition, social relationship variables (social network, social support, social capital, and social participation), and health information exposure (individual sources).

*p < 0.05, **p < 0.01, ***p < 0.001.

Table 4. Polynomial, linear, and multivariable logistic regression of association between health information mavenism, and health-related behavior and health: JAGES 2013 Survey.

Polynomial Regression Outcome		Unadjusted model			Adjusted model		
		Relative Risk Ratio (RRR)	CI	P	Relative Risk Ratio (RRR)	CI	P
Smoking	Non-smoking	1 (reference)			1 (reference)		
	Current smoking	0.92	0.91-0.93	0.0001***	0.99	0.97-1.01	0.272
	Past smoking	0.95	0.94-0.96	0.0001***	0.99	0.98-1.01	0.427
Drinking	Non-drinking	1 (reference)			1 (reference)		
	Current drinking	0.99	0.98-0.99	0.0001***	1.00	0.98-1.01	0.612
	Past drinking	0.98	0.96-0.99	0.0001***	1.01	0.98-1.03	0.44
Linear Regression Outcome		Coefficient	CI	P	Coefficient	CI	P
Diet		0.04	0.03-0.04	0.0001***	0.006	0.0006-0.01	0.027*
Exercise	Vigorous	0.07	0.06-0.07	0.0001***	0.008	0.0002-0.015	0.044*
	Moderate	0.09	0.09-0.10	0.0001***	0.0236	0.014-0.033	0.0001***
	Mild	0.10	0.09-0.10	0.0001***	0.04	0.04-0.05	0.0001***
History of health check-ups		0.038	0.03-0.04	0.0001***	0.01	0.004-0.02	0.001**
Health							
Subjective health		0.01	0.01-0.02	0.0001***	0.001	-0.002-0.004	0.533
Multivariable Logistic Regression Outcome		OR	CI	P	OR	CI	P
Health status		1 (reference)			1 (reference)		
No disease							
Having disease/symptoms		1.02	1.00-1.02	0.001**	1.03	1.02-1.05	0.0001***

Adjusted model = adjusted polynomial, linear and multivariable logistic regression model adjusted for age, gender, education, household income, perceived financial condition, social relationship variable (social network, social support, social capital, and social participation), and health information exposure (overall index).

*p < 0.05, **p < 0.01, ***p < 0.001.

perception of inequality, including perceived income, affects social trust (Steijin & Laurence, 2011). People who are more comfortable with their financial situation may be able to trust people more, which may lead to sharing information.

Social relationships of mavens

Social relationships also affect health information mavenism, consistent with findings from previous studies (Kontos et al., 2011). The social interactions such as social network, social support, social participation, social capital, are related to important factors in interpersonal communication, including information seeking, uncertainty management, mediated social interaction, and stress reduction buffers (Ackerson & Viswanath, 2009; Viswanath, 2008). Higher social capital and higher civic engagement are related to better health message recall (Viswanath, Steele, & Finnegan, 2006). Perceived social support is known as an influential factor for people's interaction (Holt-Lunstad & Uchino, 2015). In a previous study about health information mavenism (Kontos et al., 2011), mavens with a larger social network have a higher mavenism score. Similarly, mavens in our study were more socially engaged, and reported larger social networks, more perceived social support, as well as more active social participation. In terms of social capital, having a helpful neighborhood and attachment to neighborhood were related to mavenism.

Health information exposure of mavens

Exposure to all types of health information exposure was associated with health information mavenism. This is also consistent

with the previous research that consumers of media, in general, were significantly associated with mavens (Kontos et al., 2011). Interpersonal communication, Internet, magazine or articles featuring health and medicine were strongly associated with mavenism. On the other hand, exposure to mass media including TV, newspaper or general-topic magazines was not strongly correlated with mavenism. This may be because of two reasons. First, in Japan, people generally have a very high consumption of mass media, especially TV and newspapers. For example, TV is one of the most popular media regardless of SES (Ishikawa et al., 2012). Especially among the elderly, on average, people aged over 70 years spend more than 5.0 hours per day watching TV (Nippon Hoso Kyokai, 2010). Also, four Japanese national newspapers rank in the top 10 of the paid-for daily newspapers in the world (World Association of Newspapers and News Publishers, 2014). This may lead to limited variance and have produced a small association between media exposure to TV and newspapers and health information mavenism. Second, TV, newspapers or magazines covering general topics can be considered as more passive media. Interpersonal communication, Internet, magazine or articles featuring health and medicine are either interactive and/or active media, as people may reach out to these resources with specific objectives. In terms of the interpretation of this finding, the portion of Internet users is very small in this population. This is consistent with other data in Japan that older people in Japan are not heavy Internet users (Ishikawa et al., 2012).

Are health mavens healthier?

Previous studies have shown that health information mavens do not necessarily hold accurate health beliefs (Kontos et al.,

2011). Contrary to our expectation, health information mavens generally maintain healthier behaviors in this Japanese sample except for smoking and alcohol consumption. This could be because the variance is limited as a majority of the sample is non-smokers and non-alcohol drinkers. However, this is still important because mavens could potentially influence the health behaviors of others with whom they interact (Kontos et al., 2011) and can shape and model both healthy and unhealthy behaviors. In fact, previous studies demonstrated that smoking and alcohol drinking can be categorized as social behaviors that tend to occur in group settings within in their social networks (Christakis & Fowler, 2008; Rosenquist, Murabito, Fowler, & Christakis, 2010). Further study is needed to investigate what kinds of behaviors and knowledge these mavens share. In terms of health status, mavens were more likely to report comorbid conditions and/or symptoms. This could be because developing a chronic condition motivated the individuals to seek more information about their health. Older Japanese are more likely to receive health information via health-care providers (Ishikawa et al., 2012), and we should consider health clinics and hospitals to be important channels for disseminating health information.

Practical implications

These findings suggest several practical applications in terms of targeting, venue of communication and pitfalls. First, for people who are likely to be a maven, it is important to convey messages considering the fact they may likely to share the information with others. For example, for women and younger group of older adults, information for not only themselves but also their families or partners may be helpful. For public health information dissemination and information campaigns, these groups could be potential targets who may be sharing information with others as compared to other demographic groups. Workshops and lectures done by public health experts for these mavens may be also helpful to use their characteristics (to share health information) with others.

Second, in terms of the venue of communication, considering the fact that these mavens are likely to have health issues, clinics and hospitals as well as other venues which can be a touch point of these people (e.g., health section of community newspaper, and newspapers) can be another way to reach out to them. Another study shows that Japanese citizens, in general, have higher trust of health-care professionals and community newspapers (Ishikawa et al., 2012). Combined with the previous study results, clinics and hospitals may contribute to effective communication without expensive costs.

Last but not least, it is also important to consider the pitfalls of mavens. There is a risk that mavens do not necessarily have appropriate behaviors and knowledge, which is consistent with previous research (Kontos et al., 2011). For example, in our study, mavens reported healthy dietary habit and exercise behavior, but not in terms of alcohol and smoking behaviors. Previous research showed that mavens do not have the correct health knowledge (Kontos et al., 2011). Mavens may potentially disseminate inappropriate knowledge

or model unfavorable behaviors. Thus, when we use the market maven approach, it is very important to make sure that the information is correct. Also, it may be helpful to create communication tools (such as website or brochures) so mavens can check their knowledge and avoid sharing unexpected messages.

Limitations

Although this is the first study to investigate the characteristics of health information mavens among older adults, there are several limitations. Only one previous study used the health information mavenism index, so this index has not been validated. Information about mavenism was obtained via self-reporting, i.e., by individuals perceiving themselves to be mavens. A social network analysis approach may help to validate our index by asking people to nominate others in their network who are the mavens and to assess if the nomination matches the health information mavenism index score. The individual receiving the most nominations from others would be an objective indicator of mavenism. Also, in this study, we measured health information mavenism by asking about sharing health information in general. Further study is needed to investigate specific health behaviors and information (i.e., smoking, alcohol consumption, and diet, etc.) that mavens share.

In conclusion, health information mavens have potentially important roles to facilitate health information among older adults who tend to have limited health information exposure as compared to younger populations. Our study demonstrated certain characteristics of health information mavens among older adults in Japan. These findings can potentially be used in health communication strategies targeting these groups. This is the first study to investigate the characteristics of health information mavens, and also their relationship with health behavior and health status in Japan. In an aging society, older populations can be disadvantaged because of their social isolation, cognitive status, and reduced access to information technologies. Our study has identified a potentially powerful source of interpersonal communication about health issues among older populations.

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Appendix A

Health Information Mavenism Index

The five questions were as follows: 1) I like introducing new health topics to my friends and family; 2) I like helping people by providing them with information about health; 3) People ask me for information about health; 4) If someone asked where to get the best information about a particular health topic, I could tell him or her where to go; 5) My friends think of me as a good source of information when it comes to new information about health. Considering the target population of the present study (geriatric population aged 65 or older), we used a 4-point Likert scale for the purpose of convenience, instead of the 7-point scale developed by Kontos et al. The response options were: 1. Agree, 2. Somewhat agree, 3. Somewhat disagree, 4. Disagree. Scores from each item were added, and the total score (range: 4–20) was considered a health information maven score.

Health information exposure:

Health information exposure in the last month was asked using seven items. Items were: 1. How often did you hear about health in a news program on TV? 2. How often did you see a program about health,

doctors or hospitals in an information program on TV?: 3. How often did you read an article about health in a newspaper or magazine for the general population?: 4. How often did you read a magazine or newsletter with a special column on health or medical care?: 5. How often did you talk with family members or friends about health?: 6. How often did you see information about health on the Internet?: 7. How often did you read an article about health in a government-issued announcement or newsletter? Response choices were: 1. Twice a week or more, 2. About once a week, 3. Less than once a week, 4. Not at all. Each item was analyzed separately. The type of media was chosen based on the Health Information National Trend Survey (HINTS) and previous work conducted in Japan (Ishikawa, 2012).

Social network

Two items were used to ask about friends. First, respondents were asked about the frequency of seeing friends. Response choices were: 1. More than four times a week, 2. Twice or three times a week, 3. Once a week, 4. One to three times a month, 5. Few times a year, 6. Never. Second, the number of friends with whom they met within the past month was ascertained by the question, "how many friends/acquaintances have you seen over the past month? Count the same person as one, no matter how many times you have seen him/her." Response choices were: 1. 0 (no one), 2. 1 to 2, 3. 3 to 5, 4. 6 to 9, 5. 10 or more. Each item was analyzed separately.

Social support

Perceived social support was measured by four items. The first question was "Do you have someone who listens to your concerns and complaints?" (receiving emotional support). The second question was "Do you listen to someone's concerns and complaints?" (providing emotional support). The third asked, "Do you have someone who looks after you when you are sick and confined to a bed for a few days?" (receiving instrumental support). And the fourth was "Do you look after someone when he/she is sick and confined to a bed for a few days?" (providing instrumental support). Response choices were as follows and respondents could circle all that apply: 1. Spouse, 2. Children living together, 3. Children or relatives living apart, 4. Brother/sister, relative, parents, grandchildren, 5. Neighbor, 6. Friend, 7. Other, 8. None. First, receiving and providing social support scores were added and analyzed as a group. Then, emotional and instrumental support scores were added and analyzed as a group.

Social capital

Social capital was asked with four items: 1) Do you think people living in your area can be trusted in general? 2) Do you think people living in your area try to help others in most situations? 3) How attached are you to the area you live? (with response choices on a 5-point Likert scale ranging from very, moderately, neutral, slightly, or not at all). These items were summed and analyzed as an index. 5) What kind of interactions do you have with people in your neighborhood? (Response choices were: 1. Mutual consultation, lending and borrowing daily commodities, cooperation in daily life, 2. Standing and chatting frequently, 3. No more than exchanging greetings, 4. None, not even greetings). The first item was analyzed separately to see whether trust was associated with health information mavenism. Then, these scores were added and used as an index.

Social participation

Social participation was defined as a person's involvement in formal and/or informal activities. It was measured with two items. Respondents reported club and group participation for social activities. Fourteen different types of social activities were listed (volunteer group, sports group or club, leisure activity group, senior citizen club, neighborhood association or residents' association, study or cultural group, nursing care prevention or health-building activities, activities to teach skills or pass on experiences to others, local events (e.g., festivals, Bon [summer] festival dance), activities to support older people requiring protection, activities to support older people requiring nursing care, activities to support parents raising children, local living arrangement improvement (beautification) activities, another group or organization (if possible, please give the name and type of activity)). For each activity, the frequency of participation was asked with the following choices: 1. More

than four times a week, 2. Twice to three times a week, 3. Once per week, 4. Once to three times a month, 5. A few times a year, 6. Never. Frequencies of participation for each activity were summed and used for analysis.

Smoking:

Smoking was measured by asking one item "Do you smoke cigarettes?" Response choices were: 1. Yes, 2. I used to smoke (but not now), 3. No. Responses were dichotomized into either current smoker or past smoker/non-smoker.

Diet:

Diet was measured by one item: "How often did you eat fruits and vegetables over the past month?" Response choices were 1–7: 1. Twice a day or more, 2. Once a day, 3. Four to six times per week, 4. Twice or three times per week, 5. Once a week, 6. Less than once a week, 7. None. Responses were dichotomized into either once a day or more or less than once a day.

Alcohol consumption:

Alcohol consumption was measured by asking one item: "Do you drink alcohol?" Response choices were: 1. Yes, 2. I used to drink (but not now), 3. No. Responses were dichotomized into either current drinker or past drinker/non-drinker.

Exercise:

There were three questions asked about the three levels of physical movement (vigorous, moderate, and mild) and their frequency in regular daily life. These physical movements did not include movement for work. Vigorous physical movement included running, swimming, bicycling, playing tennis, exercise at a gym, hiking, etc. Moderate physical movement included walking (at a brisk pace), dancing, gymnastics, playing golf, farming, gardening, car washing, etc. Light physical movement included stretching (calisthenics), bowling, walking to shops or the station, laundry, etc. These categories were made based on METS (metabolic equivalents) (Ainsworth et al., 2000; MHLW, 2013). Depending on METS (a unit of energy expenditure considering 1 METS as consumed energy for sitting quietly), exercise is categorized into three categories (vigorous: 6.0 > METS, moderate: 3.0–6.0 METS, light: <3.0 METS). Response choices were: 1. More than four times per week, 2. Twice or three times per week, 3. Once a week, 4. One to three times per month, 5. A few times a year, 6. Rarely. We investigated the relationship between mavenism score and each level of exercise separately.

Health check:

The health check history was asked by one item: "Have you ever had a check-up at a health center, your workplace, a medical institution, or another place?" Response choices were: 1. I had one within a year, 2. I had one within two to three years, 3. I had one more than four years ago, 4. I have never had one. We dichotomize the response as people who had had a health check within two to three years versus those who had had it more than four years ago or never at all.

Subjective health:

Subjective health was measured by asking for self-rated health (SRH): "How is your current health status?" The response choices were: 1. Excellent, 2. Good, 3. Fair, 4. Poor. Responses were dichotomized as either "Excellent/good" (score of 1) or "Fair/poor" (score of 0). Although there have been ongoing discussions about self-rated health as an assessment tool of health and whether it is "a valid measure of health status" (Jylha, 2009), or "people's perception of their health rather than a measure of true health" (Huisman and Deeg, 2010), this measurement has been used in previous work in JAGES. A previous JAGES study suggests that psychological aspects of SRH need to be considered (Nishi, 2012).

Current health status:

Current health status was measured by asking whether the respondent was currently receiving treatment for specific diseases or having after-effects of a disease (17 types of diseases were listed in addition to others) or not. At the end of the question, there was an item of no disease/symptom above. People who answered yes to this item were counted as having no disease/symptom.