



# Communication to Promote Healthier Behaviors – Understanding the Roles of Channels and Message Formats

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**Communication to promote healthier behaviors –  
Understanding the roles of channels and message formats**

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A Dissertation Submitted to the Faculty of  
The Harvard T.H. Chan School of Public Health  
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**Communication to promote healthier behaviors**

**–Understanding the roles of channels and message formats**

**ABSTRACT**

Communication has been used to change people's health knowledge, attitudes and behaviors, and it is critical for improving people's lives, especially those who are in a disadvantaged group. Many studies suggest that communication is a powerful tool when it is used effectively for these population groups. In this dissertation I explored the roles of channels and message formats among vulnerable populations. Paper 1 investigated interpersonal diffusion of health information, specifically health information mavenism among people over age 65 in Japan, identifying the characteristics of health information mavens and whether they behave more healthily or report better health status. The study found that health information mavens can be a potential channel to facilitate word-of-mouth communication among the elderly, who are considered as a disadvantaged group.

Paper 2 explored the impact of discrete emotions to Graphic Health Warnings (GHWs) on tobacco-related outcomes among smokers and non-smokers from lower socioeconomic status (SES) in the U.S. The paper researched the relationship between different discrete emotional reactions and smoking cessation-related cognitive outcomes. It demonstrated the importance of focusing on discrete emotional reactions and the intensity of the discrete emotional reactions that GHWs induce, beyond positive or negative valence, on tobacco-related outcomes.

Paper 3 examined segmentation, specifically focusing the effectiveness of matched GHWs by race, gender, and chronic disease conditions on cognitive outcomes among smokers in vulnerable populations. It assessed whether the GHWs matched with the image of particular groups, in terms of race, gender and chronic disease conditions, increases risk

perception and intention to quit smoking among the intended audience. Segmentation showed the increased effect for risk perception among female-targeted GHWs, however, the increased effect was not shown for other groups and outcomes. Further research is needed to investigate whether segmentation works for matched groups.

The findings not only make contribution to the literature by generating new evidence on the role of channels and formats, but also contribute to practice by offering practical implications for program and strategy development in health communications among vulnerable population.

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I would like to return all of their kindness by dedicating the remainder of my life to making a healthier society worldwide.

## **v. INTRODUCTION**

### **The power of communication**

Communication has tremendous potential to impact people's behavior in health. Private industry has successfully used marketing and communication to change consumer behaviors. In 2015, an estimated \$540 billion was spent on marketing communications, a 4.6% increase from the previous year globally.<sup>1</sup> For example, the tobacco industry spent approximately \$9.5 billion for marketing and promotion of its products in the United States.<sup>2-4</sup> This translates into more than \$30 million spent each day. The fast food industry spent nearly \$4.6 billion for advertising in 2012 across the U.S., which was an 8% increase from 2011.<sup>5</sup> These industries have successfully promoted their products and services, and impact the consumer's lifestyle, regardless of their background, such as race/ethnicity, gender, socioeconomic status (SES). The marketing and communication approaches used by the private sector have demonstrated the power of communication and its global impact on people's lifestyles and lives. Working in a global communication agency for over 10 years, public health can learn from private sector's successful approach to promote healthier behavior.

### **Communication in public health**

Within public health, the field of "Health Communication" did not start to be formed until the late 20<sup>th</sup> century. In 1989, *Health Communication*, the first academic journal exclusively focused on this topic, was published.<sup>6</sup> The National Cancer Institute established the Health Communication and Informatics Research Branch under the Division of Cancer Prevention and Control in 1999, in order to invest in the research of communication for cancer prevention and control.<sup>6</sup> A number of campaigns and programs have been conducted globally. Some documentation showed that some of health communication campaigns and programs successfully resulted in favorable outcomes. These included the TRUTH campaign® (anti-

tobacco campaign for youth) by Truth Initiative <sup>7</sup>, and the Tips From Smokers campaign (smoking cessation for smokers) by the Centers for Disease Control and Prevention (CDC), among others.<sup>8</sup> With the development of information and communications technologies (ICTs) such as telecommunication, satellite television, the Internet, and social media, the possibilities of communication have exponentially expanded.<sup>9</sup> Health communication came to play a critical role both in the prevention and treatment in many areas.<sup>9</sup>

### **Communication inequalities**

While opportunities for communications have substantially expanded, thanks to the revolution in ICTs, not all population groups have been able to take advantage of them, a phenomenon characterized as “Communication Inequalities.” Communication inequalities are “the differences among social groups in their ability to generate, disseminate, and use information at the macro level and to access, process, and act on information at the individual level”.<sup>10</sup> This explains many kinds of barriers in communication among certain groups of people. These include physical and financial barriers to accessing certain media and information, difficulties in understanding and processing the information gained, and taking action based on information. Eventually, these communication inequalities negatively contribute to health.<sup>10</sup> It is especially problematic because the communication inequalities tend to align with socioeconomic disparities in health.<sup>11</sup> In other words, lower SES groups are more likely to suffer from communication inequalities. As a result, the combination of communication and socio-economic inequalities burden their health.<sup>11</sup> Despite the huge potential of communication, it may create further barriers for disadvantaged groups.

### **Health communication for vulnerable population**

In my dissertation, I seek possibilities for communication in health by better understanding

the role of media channels and formats, especially among disadvantaged groups. Specifically, I focus on examining three approaches in marketing and advertising that have proven to be successful in affecting people's behavior - interpersonal communication, emotional reaction and segmentation. Although a number of studies have been conducted in health communication, surprisingly, the research on these topics among vulnerable populations is scarce.

In Paper 1, I investigate interpersonal diffusion of health information using the concept of health information mavenism among people aged over 65 in Japan. Elderly can be considered as a vulnerable population because of their social isolation, cognitive status, and limited access to information technologies. Health information mavens are those who provide and share health information with others via interpersonal communication. I identify the characteristics of health information mavens and whether those who share health information with others via interpersonal communication behave more healthily or report better health status compared to their peers.

In Paper 2, I examine the impact of emotional reactions to Graphic Health Warnings (GHWs) on tobacco-related outcomes among low socioeconomic status (SES) smokers and non-smokers in the Greater Boston area. Specifically, we analyze the effects of discrete emotional reactions to graphic health warnings (GHWs) on risk perceptions, intention to quit, and other cognitive outcomes among smokers and non-smokers.

In Paper 3, I assess the effect of audience segmentation to GHWs on cognitive outcomes among low SES smokers. Specifically, using the same data as paper 2, we aim to investigate whether GHWs with the image of particular groups in terms of race, gender and chronic

disease conditions work more effectively for risk perception and intention to quit smoking among the intended audience.

Throughout all three papers, my goal is to conduct research that considers the end point, that is, the practical implication of the findings in the field. Paper 1 will help enhance health communication strategies among the elderly, specifically understanding the use of interpersonal communication as a channel for public health strategies. Paper 2 will help design GHWs and smoking cessation advertisements to determine what kind of discrete emotions and their level should be addressed for smokers and non-smokers. Paper 3 helps determine whether the segmentation approach would be useful, considering both positive and negative impacts on outcomes as well as resources. The findings may contribute to understanding the roles of channels and message formats in successfully communicating with vulnerable population, and offer clues to best practices.

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**vi. Paper 1**

**Interpersonal diffusion of health information: Health information mavenism among people age over 65 in Japan**

## **ABSTRACT**

**Objectives.** 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.

**Methods.** Cross-sectional analysis of 27,414 participants in the Japanese Gerontological Evaluation Study (JAGES) (mean age = 74 years).

**Results.** Mavenism is associated with being women, younger age, higher education, better perceived financial position, larger social networks, higher social support, as well as media exposure. Higher mavenism score was associated with healthier dietary and exercise behaviors but not associated with smoking and alcohol consumption. Mavens were more likely to have a disease and/or disease symptoms.

**Conclusions.** Health information mavens have the potential to facilitate word-of-mouth communication among the elderly, who tend to be more disadvantaged in terms of health information access compared to younger populations.

## INTRODUCTION

Older populations are disadvantaged in terms of their access, use, attention to and processing of health information, as well as their capability of changing behavior based on acquired health information<sup>1</sup>. In the context of population aging, an important challenge in public health is how to promote access to health information in this vulnerable population. 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<sup>2,3</sup>.

Previous research has shown that Japanese elderly are less confident in seeking health information compared to younger adults<sup>4</sup>. Communication inequalities, defined as “the differences among social groups in their ability to generate, disseminate, and use information at the macro level and to access, process, and act on information at the individual level”<sup>1</sup> generated by demographic characteristics and socioeconomic status (SES) can adversely affect health, and thereby exacerbate health inequalities.<sup>1,5</sup> However, health communication behaviors among older adults has not been sufficiently documented.<sup>6</sup>

Although the Internet is an expanding source of information, older Japanese are less likely to receive health information through this medium.<sup>4</sup> Beyond mass media, health information obtained through interpersonal communication, such as through interactions with healthcare providers, friends, and family members, is considered trustworthy by the Japanese elderly.<sup>4</sup> Studies have demonstrated the importance of interpersonal communication for health information seeking.<sup>6,7</sup> However, the number of single-person and elderly-couple households has been increasing and has contributed to social isolation among the elderly.<sup>8</sup> This situation may create difficulties for the elderly in accessing necessary information via interpersonal

interaction.<sup>8</sup> As a result, both the digital divide and social isolation have adversely affected access to health information for the older population.

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.<sup>9,10,11</sup> Market mavenism is used in the fields of marketing and advertising to identify how people share information on products and/services with others. Interpersonal communication channels and casual word-of-mouth communication are one of the most important strategies to reach consumers.<sup>7,11,12</sup> By identifying people who play an important role in interpersonal communication, marketers have successfully created new norms about their products and/or services.<sup>11,13,14,</sup>

Market mavens share similar characteristics with early adopters (in diffusion theory), or opinion leaders.<sup>11, 15, 16</sup> However, they are different in the sense that mavens are not required to have specific knowledge, and they share more general information.<sup>10,11</sup>

In public health, although the importance of interpersonal communication has been recognized,<sup>7</sup> few studies have been conducted to investigate health information mavens.<sup>11</sup> Additionally, to date, no study has focused on health information mavens among the elderly.

We used the Structural Influence Model (SIM)<sup>5</sup> 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 lead to health inequalities.<sup>5</sup>

Two research questions guided our analyses. First, what are the characteristics and predictors of health information mavens among the Japanese elderly (RQ1)? 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).<sup>1, 7, 11, 12</sup> Although previous literature has shown the impact of communication inequalities on health in Japan,<sup>4</sup> the specific impact among the elderly is unknown. Our second research question is to what extent is health information maven status associated with their health-related behavior and health status (RQ2)?

## **METHODS**

### **Data Source and study population**

The data for this paper come from the Japanese Gerontological Evaluation Study (JAGES). JAGES is an on-going prospective cohort that aims to investigate social, psychosocial, and epidemiologic factors for health among people aged 65 and older who are community-dwelling and living independently in Japan. A mail survey was sent to the study participants between August 2010 and January 2012 across 31 municipalities. 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.

## **Data collection**

From October to December 2013 a self-administered questionnaire was mailed to the study participants. The questionnaire was sent to 193,694 participants living in 31 municipalities and achieved a response rate of 71.1%. The questionnaire was composed of two parts: core questions and modules. There were five types of modules in total. Participants were randomly assigned to 1 out of the 5 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 (e.g., I like introducing new health topics to my friends and family; see appendix for the wording of the questions). The response options were on a 4-point Likert scale from agree to disagree. These items were adapted from previous survey research by Kontos et al.<sup>11</sup> In order to assess the reliability of the index in this population, internal consistency reliability (Cronbach's alpha) was assessed. Health information mavenism index is highly reliable (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 considering the context<sup>417</sup>. The questions were reverse coded.

### *Social relationship variables*

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 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 more higher perceived social support). Social capital was measured by three items inquiring about trust in neighbors, perceptions of helpfulness of neighbors, and attachment to 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**

We used the health information mavenism index as a continuous variable. For RQ 1, we investigated the relationship between such characteristics as health information exposure, social interaction and demographic variables and health information mavenism using multiple linear regression (Table 3). For RQ 2, we ran a logistic or multinomial regression to assess the association between health information mavenism and health behaviors as well as health status, 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 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, and the median age 73. 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). The typical Japanese median income is 4.32 million yen (42,260 USD). 16% 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 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 social support score was 3.62, and the median was 3 (range 0-16).

The mean score of the health information exposure index was 19 (range 7-28, SD=4.53). Health information exposure largely varied depending on media. In terms of mass media, except for magazine or articles featuring 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 never obtained health information via 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% had 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% people shows that they do not drink alcohol. Nearly 80% 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 conducted health check within one year.

### **Characteristics and determinants of health information mavens (Table 3)**

Table 3 shows the associations between between Demographic, Socioeconomic, Social relationship, and Health information exposure related variables, and Health Information Mavenism.

#### *Adjusted models with overall health information exposure*

Women, younger age, higher educated, having a larger social network, better perceived financial position were associated with higher mavenism. Those who had higher overall health information exposure had higher health information mavenism scores. Having higher perceived social support and social participation were each associated with having higher mavenism score. Among social capital variables, having a higher attachment to the neighborhood as well as higher perceptions of helpful neighbors were associated with higher mavenism scores, however, having trust in the neighborhood was not significantly associated with mavenism.

#### *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, exercise at any level, and having a more recent health check, 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. This change could be due to confounders. In terms of health status, having a higher health information mavenism score is significantly associated with having any physical and/or mental disease and/or symptoms. There was no association between health information mavenism and subjective health status.

**Table 1.1.** 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	46.37
	Female	14,098	53.63
		26,286	
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
Subjective economic status			
	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			
		Number of people	%
	<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

**Table 1.1.** (Continued)

Marital status		
Married	18,338	69.76
Widowed	5,447	20.72
Divorced	936	3.56
Never married	616	2.34
Other	228	0.87
Missing	721	2.74
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

**Table 1.1. (Continued)**

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
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

**Table 1.1. (Continued)**

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)

	Obs	Mean	SD
Score	26286	3.63	1.81

Social participation (range: 14-84)

	Obs	Mean	SD
Score	20096	50.02	4.90

Health Information Exposure Index (range: 7-28)

	Obs	Mean	SD
Score	22785	19	4.53

Health Information Mavenism Index (range: 5-20)

	Obs	Mean	SD
Score	23267	14.8	3.68

**Table 1.2.** Health related behavior and health status: JAGES 2013 Survey (n=27414)

		n	%
Health related behavior			
Smoking	Non-smoking	19,275	73.33
	Smoking	2,599	9.89
	Past smoking	3,999	15.21
	Missing	413	1.57
Alcohol consumption			
	Non-drinking	15,683	59.66
	Drinking	8,890	33.82
	Past drinking	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	Rarely	15,889	60.45
	A few times a year	1,470	5.59
	On to three times a month	904	3.44
	Once a week	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	Rarely	5,847	22.24
	A few times a year	1,488	5.66
	On to three times a month	2,240	8.52
	Once a week	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			
Mild	Rarely	3,659	13.92
	A few times a year	740	2.82
	On to three times a month	1,301	4.95
	Once a week	1,784	6.79



**Table 1.2.** (Continued)

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
Health check		
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
Current Health		
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

**Table 1.3.** Multivariable Logistic Regression of Association Between Demographic, Socioeconomic, Social relationship, and Health information exposure related variables, and Health Information Mavenism: JAGES 2013 Survey

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	
<b>Education</b>										
< 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***	
<b>Income</b>										
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	
Subjective income	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	0.0002	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***
<b>Social network</b>										
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***	
<b>Social Support</b>										

**Table 1.3. (Continued)**

Social capital	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***
	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***
Social participation	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***
	Health Information Exposure (HIE)	0.19	0.18-0.20	0.0001***	0.07	0.06-0.08	0.0001***	0.07	0.06-0.08	0.0001***
Overall	TV (news)	0.39	0.37-0.40	0.0001***	0.33	0.32-0.34	0.0001***	NA		
	TV (informational programs)	1.15	1.11-1.21	0.0001***	NA			0.21	0.13-0.29	0.0001***
	Newspaper or magazine for general population	1.19	01.14-1.23	0.0001***	NA			0.23	0.16-0.31	0.0001***
	Magazine or article featuring health and medicine	1.14	1.10-1.18	0.0001***	NA			0.11	0.05-0.17	0.001**
	Internet	1.41	1.36-1.45	0.0001***	NA			0.50	0.43-0.56	0.0001***
		1.32	1.24-1.39	0.0001***	NA			0.54	0.46-0.62	0.0001***

**Table 1.3.** (Continued)

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***

Notes: Adjusted model with overall health information exposure =multivariable logistic 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 logistic 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<0.0001

**Table 1.4.** Polynomial and Multivariable Logistic Regression of Association Between Health Information Mavenism, and Health Related Behavior and Health: JAGES 2013 Survey

		Unadjusted model			Adjusted model		
Outcome		Relative risk	CI	P	Relative risk	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)					
	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
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***
Health check		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
Outcome		OR	CI	P	OR	CI	P
Current health							

**Table 1.4. (Continued)**

No disease	1 (reference)			1 (reference)		
Having disease/symptoms	1.02	1.00-1.02	0.001**	1.03	1.02-1.05	0.0001***

Notes: Adjusted model= Adjusted polynomial 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<0.0001

## DISCUSSION

### *Who are health mavens?*

As we expected, some demographic characteristics, for example, female sex, SES, social interaction and media exposure were influential factors for determining health information mavenism. Previous research showed that women generally tend to be more socially engaged than men in general.<sup>18 19</sup> 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.<sup>18 19</sup> In terms of age, we found that among this elderly group, relatively the younger-old are more likely to be health information mavens. A previous study found that being older was related to health information mavens.<sup>11</sup> Considering the fact that the previous study includes all old people without sub-dividing them, this result suggests that the relationship between age and mavenism is more complex. In Japan, older people's social withdrawal and social isolation have been serious issues, especially among men.<sup>8</sup> These older people tend to remain at home, and less likely to go out, and this tendency is more prevalent among men.<sup>8</sup> Thus, it is likely that older males have fewer opportunities to interact with other people.

In terms of SES, education matters. Our data suggest that higher educational background was associated with being mavens. The Structural Influence Model of Health Communication and other existing research demonstrates that educational background affects health as it affects social relationship (social support, social networks and social capital), health information usage (media exposure, access and use), information seeking and processing.<sup>5</sup> Thus, our finding is consistent with these models. Another finding about income shows that perceived financial condition is influential in that people have better perceived financial

condition are more likely to be health information mavens, however, actual household income is not. Previous research shows that perception of inequality, including perceived income, affects social trust.<sup>20</sup> People who are more comfortable with their financial situation may be able to trust people more, which may lead to sharing information. Further research is needed to see if the association between SES and mavens is valid in other populations.

Social relationship affects health information mavenism. This finding is consistent with findings from previous studies.<sup>11</sup> Existing literature suggests that 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.<sup>7,12</sup> Higher social capital and higher civic engagement are related to better health message recall.<sup>21</sup> Perceived social support is known as an influential factor for people's interaction.<sup>22</sup> In our study, mavens are characterized as socially engaging people who have a larger social network and more perceived social support, as well as more active social participation. In terms of social capital, our finding demonstrates that this characteristic is applicable to older population. In terms of social capital, having a helpful neighborhood and attachment to neighborhood were related to mavenism, but not having trust. This finding is reasonable. Although Japan is well-known for its high social capital<sup>23</sup>, there is research which shows that Japanese shows lower trust towards others in general, as compared to Americans.<sup>24-26</sup>

Health information exposure from various sources is an important factor for mavenism. Exposure to all types of health information exposure was associated with health information mavenism. Among health information exposure, the level of influence varies. Interpersonal communication, Internet, magazine or articles featuring health and medicine are highly



associated with mavens. People are more often exposed to mass media including TV, newspaper or magazine for general topics, however, the level of influence on health information mavens were small. This may be because of two reasons. First, in Japan, people generally have higher consumption of mass media especially about TV and newspaper. For example, TV is one of the most popular media regardless their SES.<sup>4</sup> Especially among elderly, on average, people aged over 70 years spend more than 5.0 hours per day watching TV.<sup>27</sup> Also, four Japanese national newspapers are in the top 10 of the paid-for daily newspapers in the world.<sup>28</sup> This may lead to limited variance and have produced the 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, we have to be aware that 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.<sup>4</sup>

### ***Are health mavens healthier?***

Previous studies have shown that health information mavens do not necessarily hold accurate health beliefs.<sup>11</sup> Contrary to our expectation, regarding the relationship between health information mavenism and health behavior, health information mavens generally maintain healthier behaviors, except for smoking and alcohol consumption. 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<sup>11</sup> 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.<sup>29,30</sup> Further study is needed to investigate what kind of behaviors and knowledge that these mavens share. In addition, the characteristics of behaviors that mavens are willing to share may relate to this result. For example, eating healthily and doing exercise can be categorized as health promoting behavior that may bring a positive change in their lives. Thus, as compared to encouraging behavior change to quit or stop a certain activity, mavens are more likely to share information with others more easily. Thus, they may be willing to gain further information on these topics, which help keep their behaviors healthy. On the other hand, smoking and drinking are the behaviors that require people to quit and/or reduce their current behaviors. Thus, as reactance theory indicates<sup>31</sup>, telling people to quit and/reduce something may be considered as controlling and threatening to their freedoms. As a result, these behaviors may be interpreted as unwelcome advice and lead to psychological reactance. Thus, in terms of sharing information, it is important to investigate further what kind of information that mavens share.

In terms of health status, those with higher mavenism were associated with reporting having disease and/or symptoms in the present study. This could be due to reverse causation, meaning having disease and/or symptoms may lead people to seek more information than healthy people. In communicating with people about health messages, thinking about teachable moments is important. In this way, health information dissemination should not be restricted to only healthy people. It should target people who have disease and/or symptoms and, who search specific information about their situation. Japanese elderly are more likely to receive health information via health care providers<sup>4</sup>, and we should consider health clinics and hospitals to be important channels for disseminating health information.

## **Limitation**

Although this is the first study to investigate the characteristics of health information mavens among older adults, there are several limitations. The data are cross-sectional, which means that we cannot exclude reverse causality in some of the associations observed (e.g. between health status and health mavenism). Information about both mavenism and health behaviors were self-reported. There is only one previous study that has used the health information mavenism index, and this index has not been validated. For example, a social network analysis approach may help validate by asking people to nominate others in their network who are the mavens, and 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 summary, this is the first study to investigate the characteristics of health information mavens, and also their relationship with health behavior and health status. 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**

### 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 four-point Likert scale for the purpose of convenience, instead of the seven-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, 2010).

### 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 five-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 mavens. Then, these scores were added and used as an index.

### Social participation

Social participation was defined as 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, 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 drink/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, 2008). Depending on METS (a unit of energy expenditure considering 1 METS as consumed energy for sitting quietly), exercise is categorized into three categories (vigorous:  $6.0 > \text{METS}$ , moderate:  $3.0\text{-}6.0 \text{ METS}$ , light:  $<3.0 \text{ METS}$ ). 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 on-going 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” (Deeg, 2009; Huisman, 2007), 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 question, there was an item of no disease/symptom above. People who answered yes to this item were counted as having no disease/symptom.

**vii. Paper 2**

**The impact of discrete emotions to Graphic Health Warnings (GHWs) on tobacco-related outcomes among low SES smokers and non-smokers**

**vii. Paper 2**

**The impact of discrete emotions to Graphic Health Warnings (GHWs) on tobacco-related outcomes among low SES smokers and non-smokers**

## **ABSTRACT**

### **Objective**

We examined the effects of discrete emotional reactions to graphic health warnings (GHWs) on risk perception, intention to quit, and other cognitive outcomes among smokers and non-smokers.

### **Methods**

We measured the intensity of ten discrete emotional reactions to each label and their impact on tobacco-related outcomes. We choose to analyze emotions (disgust for smokers; disgust, sad, fear and worry for non-smokers), which had variations in terms of intensity (low, middle and high). Data from a low SES sample were collected in the field. Multiple linear regression was used to examine the association between each emotional response and cognitive outcomes. All of the analyses controlled for age, gender, education, household income, race, English fluency, depression and anxiety symptoms.

### **Results**

Among smokers, “disgust” was the only GHWs category which elicited a strong emotional reaction. Overall, only the “disgust” labels were associated with cognitive outcomes; however, both middle and high-level scores on “disgust” GHWs were associated with increased risk perception and salience of quitting. High-level score on “disgust” inducing GHWs were associated with intention to quit smoking and intention to reduce the number of cigarettes smoked. Among non-smokers, viewing GHWs elicited emotions of “disgust”, “sad”, “fear”, and “worry”. All of the emotional reactions at both middle and high level scores were associated with increased risk perception. However, for outcomes such as

reinforcement of non-smoking, intention to information seeking, intention to talk to someone about quitting smoking and GHWs, the association between viewing GHWs that generated specific emotions and cognitive outcomes varied. It depended on the types of emotions as well as the intensity.

### **Conclusion**

GHWs induce different discrete emotional reactions (in terms of both types of emotions and their intensity), which are in turn associated with cognitive outcomes among smokers and non-smokers from lower SES and minority groups. In the design of GHWs, it is important to move beyond emotional valence to investigate the impact of discrete emotions on smoking-related cognition.



## **INTRODUCTION**

Smoking is the leading cause of death in the U.S.<sup>1,2</sup> Although the smoking rate among U.S. adults has fallen to the lowest percentage since the CDC started to track the numbers starting in 1965, there is still much room for improvement. The slow pace of decline in smoking rates in recent years is of critical importance.<sup>3</sup> In addition, disparities in smoking prevalence remain in terms of gender, socioeconomic status, and race/ethnicity.<sup>2</sup> It is well-documented that Graphic Health Warnings (GHWs) on cigarette boxes are one of the more effective ways to promote smoking cessation and help people quit.<sup>4</sup> One study showed that GHWs' messages are more influential than text-only labels,<sup>5,6</sup> with vivid images and increased salience among smokers,<sup>7</sup> especially when it evoked strong emotional reactions.<sup>7</sup> Also, GHWs were helpful for non-smokers as they increased exposure to messages about negative consequences of smoking. Documentation also showed that they were beneficial for non-smokers in terms of recall of the health messages, increase in risk perceptions and awareness, and prevention of smoking.<sup>7</sup> An especially strong effect on discouragement of smoking was found for vulnerable populations as a result of exposure to GHW.<sup>7</sup> In 2009, the United States Food and Drug Administration (FDA) mandated the use of Graphic Health Warnings (GHWs) on cigarette packs.<sup>8,9</sup> The FDA required larger graphic health warning images with text that describes the negative health consequences (except in one image) of smoking in 2012.<sup>8,9</sup> More recently, the FDA was required to revise the labels in March 2013 because of a lawsuit. This paper will examine how the exposure to these FDA-mandated initial GHWs engendered discrete emotions and the impact of these emotions on tobacco-related outcomes.

### **Emotional reactions and behavior change in smoking cessation**

The importance of emotions to communication related to health behaviors among both

smokers and non-smokers has been documented in a variety of areas, including tobacco control.<sup>10</sup> Previous research showed that emotionally graphic imagery helps to reduce brain responses to smoking cues.<sup>11</sup> Existing research demonstrated that GHWs evoking negative emotional reactions (such as pictures arousing fear) work to increase acceptance, processing, and engagement of smoking cessation messages and behavior among smokers.<sup>7</sup> Specifically, smokers who reported greater negative emotional reactions had increased success in recalling the messages, quitting smoking, making an attempt to quit, as well as reducing their smoking at follow-up.<sup>7,12-15</sup> It is documented that negative GHWs help with recall of health messages among non-smokers.<sup>7</sup> Often, these GHWs evoke fear, anger, or disgust. In addition, using factual or scientific information these GHWs enhanced emotional reactions, which eventually led to optimal outcomes.<sup>7</sup> On the other hand, the effectiveness of positive emotional reactions to GHWs has not been clear.<sup>7</sup> It has been documented that positive emotional reactions are related to positive effects, such as attracting smokers' attention, increasing comprehension, and adding credibility, and novelty.<sup>7,16</sup> However, for the most part gain-framed smoking cessation messages are reported to be less effective in terms of message recall,<sup>7,16</sup> and less likely to lead to cessation behavior, including reduction in the number of cigarettes smoked and greater likelihood to quit smoking.<sup>7,17</sup> Overall, a body of evidence has shown that negative emotional reactions can work more effectively than positive ones among both smokers and non-smokers. Furthermore, previous research on GHWs has focused mainly on emotional reactions categorized by either positive or negative valence; it is unknown whether and how specific emotional reactions differently affect these outcomes. Also, to our knowledge, there is no previous study that investigates the effect of discrete emotions on cognitive outcomes for smoking cessation among low SES and/or minority groups who still have high smoking prevalence.<sup>18</sup>

### **Beyond positive or negative valence - Appraisal Tendency Framework**

The role and effect of discrete emotions on message processing has been well documented in the field of psychology.<sup>19,20</sup> Appraisal Tendency Framework (ATF) explains the effect of specific emotions on consumer judgment and decision-making.<sup>21</sup> ATF has demonstrated that, regardless of positive or negative valence, different emotional reactions induce different cognitive and behavioral responses.<sup>21</sup> For example, although fear and anger are categorized as negative emotional reactions, each leads to differential effects on information accessibility, processing, and desired information seeking.<sup>20</sup> Fear predicts higher risk perceptions, which may lead to risk-averse behavior; however, anger produces optimistic risk estimates, which may result in lower risk perceptions and more risk-seeking behavior.<sup>22-24</sup> In addition, emotions in different valences can produce the same outcome. For example, both anger and happiness produce lower risk perceptions and increase risk-seeking choices.<sup>23,24</sup> However, ATF has not been fully utilized in a public health context.

Thus, beyond only positive or negative valences, more detailed investigation is needed to understand the relationship between discrete emotional reactions and cognitive outcomes in smoking cessation. Also, this has not been studied among low SES and/or minority groups. Furthermore, most interventions using ATF were conducted in a lab, not in a field setting. The purpose of this study is to examine the effect of emotional reactions to GHWs for cognitive outcomes. Specifically, we aimed to investigate 1) the relationship between discrete emotional reactions to GHWs and risk perception, salience of quitting, intention to quit smoking and intention to quit the number of cigarettes smoked among low SES and/or minority smokers; and 2) the relationship between emotional reactions to GHWs and risk perception, reinforcement of non-smoking, intention to seek information, intention to talk to someone about quitting smoking and the warning label on the cigarette pack among low SES

and/or minority non-smokers. The variable of intention to talk to someone was added to the analyses of non-smokers as other studies showed that non-smokers who talk about labels were associated with lower intention to smoke.<sup>25</sup>

## **METHODS**

### **Data**

The proposed study utilized data from Project CLEAR that aimed to investigate the effectiveness and resonance of GHWs on cigarette packs among smokers and non-smokers in vulnerable populations. The project was conducted from August 2012 to April 2014 in three Massachusetts cities: Boston, Worcester, and Lawrence. For recruitment, fliers were placed throughout local community centers. The inclusion criteria comprised people between the ages of 18 and 70 who spoke English or Spanish. We oversampled vulnerable populations including lower SES and/or minority groups such as African American, Hispanic, Latinos, immigrants, blue-collar workers, and Lesbian, Gay, Bisexual and Transgender (LGBT) individuals. We recruited both smokers and non-smokers in this study as GHWs aimed to reach out to both groups. The recruitment occurred between August 2013 and April 2014. A total of 1,200 people participated in this study (565 smokers and 635 non-smokers). Smoking status was self-identified at recruitment.

### **Survey Development**

A mixed method approach was used to develop the survey, including an extensive literature review, focus groups, and key informant interviews. The survey questions were drawn from validated measures in past surveys. Focus group interviews were conducted in order to develop the survey. For participants with low literacy, the study used electronic tablets with

the option to hear questions and answer choices using headphones, in addition to being shown questions and answer choices on the screen. Prior to actual implementation, cognitive testing was conducted to check both the survey instrument itself and the tablet delivery system.

## **Design**

A randomized experimental design was used. First, each participant answered a pre-test survey that included demographic information, baseline smoking-related cognitive and behavioral measures, and chronic disease status. Second, the participants were randomized to be exposed to one of the nine GHWs, which were developed and chosen by the FDA,<sup>26</sup> and then answered questions to assess their level of perceived effectiveness, emotional reaction, risk perception, intention to quit smoking, and further behavioral response. In the third step, participants were exposed to and reacted to the other 8 labels and answered questions. In March 2013, the FDA was required to revise the labels because of a lawsuit.<sup>27,28</sup>

## **Predictor variables**

### *Emotional reactions*

Ten kinds of emotional reactions were assessed for each GHW: scared (fear), worried (worry), guilty, hopeful, disgusted or grossed out (disgust), sad, angry, stressed-out, amused, motivated, or inspired. People were asked to mark an answer for questions in the table which listed 10 kinds of emotions. The question was “does the warning label make you feel (emotion)?”. Response choices were categorized with a 5-point Likert scale: 1. Not at all, 2. A little, 3. Some, 4. A lot and 5. Completely. For the analysis, we used the median score of each emotional reaction to classify them into three levels of intensity (low=1 up to 3, middle=3 up to 4, and high=4 to 5).

## **Dependent variables**

### *Risk perception and salience of quitting among smokers*

Risk perception and salience of quitting were assessed with two items directly after viewing the assigned GHW: “(the label) makes me think about the health risks of smoking (risk perception)” and “(the label) put thoughts in my mind about quitting smoking (salience of quitting)”. The response items were on a 5-point Likert scale: strongly disagree, disagree, neither disagree nor agree, agree, and strongly agree. The score was used as a continuous variable.

### *Intention to quit smoking and intention to reduce the number of cigarettes among smokers*

We evaluated intention to quit smoking and reduce the number of cigarettes with two separate items. First, intention to quit smoking was asked with a question that indicated the readiness to quit smoking. Second, the intention to reduce number of cigarettes smoked was also asked. These assessed the stage of change of smoking among participants based on the Transtheoretical model.<sup>29</sup> The items were “How likely is it that you will do each of the following in the next 30 days: 1) try to quit smoking, and 2) reduce the number of cigarettes you smoke.” This time period means that the respondent is in the preparation stage, based on the Transtheoretical model. The response items were on a 5-point Likert scale from “not at all likely, somewhat likely, moderately likely, very likely, and extremely likely.” The score was used as a continuous variable.

### *Risk perception and reinforcement of non-smoking among non-smokers*

Risk perception and reinforcement of non-smoking were assessed with two items directly after viewing the assigned GHW: “(the label) makes me think about the health risks of smoking (risk perception)” and “(the label) makes me glad I don’t smoke (reinforcement of

non-smoking)”. The response items were on a 5-point Likert scale: strongly disagree, disagree, neither disagree nor agree, agree, and strongly agree. The score was used as a continuous variable.

*Intention to seek information and intention to talk to someone about the warning label on the cigarette pack among non-smokers*

Information seeking was assessed by the item “Look for information about the health risks of cigarette smoking” in the next 30 days. Information sharing was measured “talk to someone (friend, family member, spouse) about the warning label on the cigarette pack” in the next 30 days. The response items were on a 5-point Likert scale from “not at all likely, somewhat likely, moderately likely, very likely, and extremely likely.” The score was used as a continuous variable.

**Smoking status**

Smokers were self-identified through screening questions including smoking history in the past 30 days and self-identification of smoking status (1. Regular smoker, 2. Occasional smoker, 3. Ex-smoker, 4. Someone who tried smoking, 5. Non-smoker). Participants who answered that they had taken at least one puff in the past 30 days were considered smokers, even if they identified themselves to be a non-smoker.<sup>30,31</sup> Although self-reporting was used to assess smoking status, its reliability and validity has been documented in a number of studies<sup>32,33</sup>, and self-reporting in smoking status identification is mostly consistent with bio-marker assessment.<sup>34</sup>

**Covariates**

Demographic and SES including age, gender, education, household income, race, English

fluency, depression and anxiety symptoms were also measured and controlled for in our analyses.

### **Statistical Analysis**

First, we assessed people's emotional reactions to each label. We focused on the median of emotional reactions to each label (the labels are shown in Appendix 1) and categorized the intensity of emotions into high, middle and low as we wanted to investigate the effect of discrete emotions on cognitive outcomes, depending on the intensity of the emotions (Appendix 2). Among smokers, the emotion "disgust" induced by GHWs showed variations in the intensity. Among non-smokers, "disgust", "sad", "fear" and "worry" GHWs elicited variations in terms of the intensity.

Second, we conducted descriptive analysis among sample populations (smokers and non-smokers, respectively). Then, we used a multiple linear regression to investigate the association between each emotional response and cognitive outcomes (smokers: risk perception, salience of quitting, intention to quit smoking and intention to reduce the number of cigarettes among smokers; non-smokers: risk perception, assurance of non-smoking, information seeking, information sharing about quitting smoking and GHWs among non-smokers). For missing data, we used complete case analysis using listwise deletion. All analyses were performed using STATA 13.0 SE.

## **RESULTS**

After categorizing emotional reactions among smokers, we found that only "disgust" GHWs elicited variations (all levels of intensity) in the emotional reactions (low=1 up to 3, middle=3



up to 4 and high=4 to 5) (Appendix 2). Among non-smokers, responses of disgust, sad, fear (scared) and worry GHWs elicited variations. Thus, we focused on one emotion (disgust) for smokers and these four emotions (disgust, sad, fear and worry) for non-smokers for further analyses, as we investigated the effect of discrete emotions by their intensity. Appendix 3 shows the distribution of the level of emotional reactions among both smokers and non-smokers.

In terms of Research Question 1 (the relationship between discrete emotional reactions to GHWs and risk perception, salience of quitting, intention to quit smoking and intention to reduce the number of cigarettes among smokers), Table 2 shows the association between GHWs that elicited “disgust” and cognitive outcomes. Overall, among smokers, viewing GHWs that elicited medium and high levels of “disgust” was associated with increased risk perception and salience of quitting smoking, compared with viewing GHWs that elicited low levels of “disgust”. In addition, viewing GHWs that elicited high levels of “disgust” was associated with increased intention to quit smoking and intention to reduce the number of cigarettes.

Regarding research question 2 (the relationship between emotional reactions to GHWs and risk perception, reinforcement of non-smoking, intention to seek information, intention to talk to someone about GHWs among non-smokers), viewing GHWs that elicited medium and high levels of all four emotions (disgust, sad, fear and worry) was associated with increased risk perceptions, compared with viewing GHWs that elicited low levels of these emotions (Table 3). However, for other cognitive outcomes, the effects varied depending on the types and the intensity of the emotional reactions. Viewing GHWs that elicited middle levels of “disgust”, and middle and high levels of “sad”, “fear” and “worry” were all associated with

increased reinforcement of non-smoking as compared to viewing GHWs that elicited low levels of these emotions. Only viewing high level “sad” GHWs was associated with increased intention to seek information. In terms of intention to talk to someone about the warning labels on the cigarette pack, GHWs that elicited both medium and high levels of “fear” and “worry”, high level of “sad” and middle level of “disgust” were associated with increased intention.

**Table 2.1.** Demographics, socioeconomic status, and health status among smokers and nonsmokers (n=1200)

		Smoker (565)		Non-smoker (635)	
Age (mean, range)		34.09 (18-68)		32.43 (18-70)	
		n	%	n	%
<b>Gender</b>					
	Male	302	53.45	283	44.57
	Female	254	44.96	344	54.17
	Transgender	4	0.71	4	0.63
	Other	3	0.53	4	0.63
	Missing	2	0.35	0	0
<b>Race</b>					
	White	173	30.62	180	28.35
	Black	159	28.14	206	32.44
	Non-White Hispanic	223	39.47	238	37.48
	Other	10	1.77	11	1.73
<b>Education</b>					
	Completed grade school or less	28	4.96	30	4.72
	Some high school	78	13.81	54	8.50
	Completed high school	167	29.56	170	26.77
	Completed GED	86	15.22	34	5.35
	Some college	145	25.66	200	31.50
	Completed associate's degree	18	3.19	39	6.14
	Completed college	22	3.89	70	11.02
	Graduate or professional school after college	13	2.30	31	4.88
	Don't know, or does not apply	6	1.06	6	0.94
	Missing	2	0.35	1	0.16

**Table 2.1.** (Continued)

Household income				
Under \$10,000	141	24.96	105	16.54
\$10,000-\$19,999	91	16.11	99	15.59
\$20,000-\$29,999	57	10.09	63	9.92
\$30,000-\$39,999	54	9.56	56	8.82
\$40,000-49,999	28	4.96	39	6.14
\$50,000-\$59,999	24	4.25	29	4.57
\$60,000-\$69,999	12	2.12	14	2.20
\$70,000-\$74,999	7	1.24	12	1.89
\$75,000 or above	20	3.54	31	8.03
Don't know	129	22.83	163	25.67
Missing	2	0.35	4	0.63
Currently have symptom/have been diagnosed				
Depression or anxiety				
Yes	235	41.59	150	23.62
No	314	55.58	467	73.54
Missing	16	2.83	18	2.83

**Table 2.2.** Emotional reactions and cognitive outcomes among smokers (n=565)

	Risk perception Makes me think about the health risks of smoking		Salience of quitting Put thoughts in my mind about quitting smoking		Intention to quit smoking Try to quit smoking		Intention to reduce # of cigarettes Reduce the number of cigarettes you smoke	
	Coefficient	CI	Coefficient	CI	Coefficient	CI	Coefficient	CI
Disgust (Reference: low)								
Middle	0.52***	0.24-0.80	0.29*	0.01-0.58	0.26	-0.08-0.60	0.27	-0.08-0.61
High	0.69***	0.37-1.02	0.54**	0.21-0.86	0.47*	0.07-0.87	0.47*	0.07-0.87

Adjusted for age, gender, education, household income, race, English fluency, depression and anxiety symptoms

\*=p<0.05, \*\*=p<0.01, \*\*\*=p<0.001

**Table 2.3.** Emotional reactions and cognitive outcomes among smokers (n=565)

	Risk perception Makes me think about the health risks of smoking		Reinforcement of non-smoking Makes me glad I don't smoke		Intention to seek information Look for information about the health risks of cigarette smoking		Intention to talk to someone about the warning label on the cigarette pack Talk to someone (friend, family member, spouse) about the warning label on the cigarette pack	
	Coefficient	CI	Coefficient	CI	Coefficient	CI	Coefficient	CI
Disgust (reference: low)								
Middle	0.34**	0.11-0.57	0.29**	0.09-0.50	0.14	-0.14-0.43	0.34*	0.04-0.63
High	0.25*	0.03-0.47	0.16	-0.04-0.36	-0.01	-0.28-0.26	0.26	-0.02-0.53
Sad (reference: low)								
Middle	0.53***	0.30-0.77	0.27*	0.06-0.48	0.17	-0.12-0.46	0.16	-0.14-0.46
High	0.56***	0.31-0.81	0.42***	0.19-0.64	0.46**	0.16-0.77	0.52**	0.20-0.84
Fear (reference: low)								
Middle	0.90***	0.58-1.23	0.46**	0.17-0.76	0.35	-0.05-0.75	0.68**	0.27-1.09
High	1.08***	0.71-1.44	0.71***	0.38-1.05	0.43	-0.03-0.88	0.74**	0.28-1.21
Worry (reference: low)								
Middle	0.84***	0.51-1.18	0.41**	0.10-0.72	0.33	-0.09-0.74	0.62**	0.19-1.05
High	1.01***	0.69-1.34	0.59***	0.29-0.89	0.40	-0.01-0.80	0.74***	0.33-1.16

\*Adjusted for age, gender, education, household income, race, English fluency, depression and anxiety symptoms

\*=p<0.05, \*\*=p<0.01, \*\*\*=p<0.001

**Table 2.4.** Emotional reactions and cognitive outcomes summary

	Smoker	Non-smoker
Risk perception	Disgust (high and middle)	Disgust (high and middle) Sad (high and middle) Fear (high and middle) Worry (high and middle)
Salience of quitting	Disgust (middle & high)	NA
Intention to quit smoking	Disgust (high)	NA
Intention to reduce the number of cigarettes	Disgust (high)	NA
Reinforcement of non-smoking	NA	Disgust (middle) Sad (high and middle) Fear (high and middle) Worry (high and middle)
Intention to seek information	NA	Sad (high)
Intention to talk to someone about the warning label on the cigarette pack	NA	Disgust (middle) Sad (high) Fear (middle and high) Worry (middle and high)

## **DISCUSSION**

In this study, we aimed to investigate the effect of different types and intensity of emotional reaction to GHWs on cognitive outcomes among smokers and non-smokers with low SES and/or minority backgrounds.

### **Discrete emotion and the intensity matter depending on target audience**

In terms of association with cognitive outcomes among smokers, overall, GHWs that elicited “disgust” were associated with increased risk perceptions, salience of quitting, intention to quit smoking and intention to reduce the number of cigarettes. It demonstrated that viewing a disgust label is important to positively affect different types of smoking-related cognitive outcomes for smokers. This finding is important for choosing the design of GHWs. Other research identified that the GHW’s pictorial images are particularly important in helping with cognitive processing and are equally effective among disadvantaged groups since it can reduce disparities because of the audience’s literacy and language levels, culture and prior health knowledge.<sup>35</sup>

Previously, studies documented that negative images are associated with positive

outcomes in smoking cessation. However, this study can add that, among negative valence, GHWs that elicited high level of “disgust” are promising among low SES smokers.

The effects of negative emotional reactions on cognitive outcomes among non-smokers varied. This aligned with our hypothesis based on ATF, which states that discrete emotions induce different types of cognitive responses. Furthermore, not only the type of emotions, but also the level of emotional reaction mattered in influencing cognitive outcomes. ATF does not explain all of the emotions that we tested, however, some of findings were aligned with the framework. For example, in our study high-level “sad” GHW helps non-smokers to take further action after GHW exposure (i.e. intention to seek information, intention to talk to someone about quitting smoking and to talk about the warning label on the cigarette pack, respectively). ATF explains that sadness induces the feeling of loss and increases blame.<sup>36,37</sup> Sadness helps people to take actions to change their environment by seeking rewards, as compared to other



emotions.<sup>36</sup> Thus, in the case of non-smokers, “taking action” may have resulted in steps to process the information.

These findings suggest two important implications. First, it is necessary to focus on discrete emotions beyond positive and negative valence discussions, as well as the intensity of the emotion. In this study, we only tested GHWs that elicited a strong negative emotional reaction (disgust) for smokers, and GHWs that elicited strong negative emotional reactions (disgust, sad, fear, and worry) among non-smokers. For further study, we should also investigate discrete emotional reactions in other negative and positive valences. Second, depending on the audience, the same design brings different emotional reactions, and these eventually affect cognitive outcomes differently.

These findings suggest practical implications for developing new GHW designs. In most current GHW designs, based on the previous studies, the focus is still either on using negative or positive appeal in the design. However, beyond positive or negative valence, it is necessary to test the effectiveness of GHWs that elicit different levels of discrete emotions and their intensity on the cognitive reactions, and design them

specifically. Also, for future development of anti-smoking communication, differences in emotional reaction to cognitive outcomes should be carefully considered depending on the audience and target behaviors (i.e., smoking cessation for smokers, or smoking prevention for non-smokers).

### **Practical implications for further study and implementation**

In 2013, although FDA obtained the authority to mandate that tobacco companies use GHWs on cigarette packs, it was required to redesign and revise the current GHWs due to an appeals court decision related to a lawsuit by the tobacco industry.<sup>27,28</sup> The ongoing challenge is that the FDA was required to redesign GHWs that do not evoke emotions, as the agency was criticized for “unabashed attempts to evoke emotion (and perhaps embarrassment) and browbeat consumers into quitting”.<sup>27</sup> As existing research clearly demonstrates, emotion plays an important role with GHW,<sup>7,38</sup> and it leads to cognitive and even behavioral outcomes in addition to affecting smoking prevalence.<sup>39</sup> As this study shows, discrete emotion and the level of intensity have a specific effect on the cognitive outcomes of specific target audiences. Thus, in order to increase the

effects of these cognitive outcomes, it is necessary to consider discrete emotions beyond positive or negative valence. There are still ways to create new GHWs in response to the court decision. For example, CDC's Tips From Former Smokers' campaign uses former smokers' actual voices to convey information. It provides an emotionally powerful yet fact-based message, and evaluation shows significant effectiveness of the campaign.<sup>40</sup> This campaign's approach can be used for GHWs as well.

### **Limitations**

The research has a few limitations. The results of this study may not be generalizable to other populations and regions. However, considering disparities between population groups in smoking prevalence<sup>1</sup>, our study population represents one of the most vulnerable populations. In addition, we conducted the study with a tablet; participants were allowed to view assigned GHWs once. This may differ from the natural settings where people can view GHWs on cigarette packages in terms of environment, level of exposure to GHWs (length and frequency), and being a teachable moment that they would receive messages when they are about to smoke. Also, the intention to quit

smoking was used as a behavioral outcome indicator; however, a gap has been reported between intention to quit and actual behavior of quitting smoking.<sup>41</sup>

## **Strengths**

This paper has several strengths and may contribute to understanding the complex relationships between emotional reactions to GHWs and cognitive outcomes among smokers and non-smokers with low SES and/or minority backgrounds. First, to our knowledge, there has been no prior research on GHWs that focuses on discrete emotional effects, beyond negative and positive valence among low SES and/or minority groups, which are one of the most disadvantaged groups in smoking. Most of the previous study did not include many respondents among these lower SES and/or minority groups. There is health disparity in smoking and it is required to address this issue.<sup>42</sup> These disadvantaged groups can benefit the most from GHWs as they may help reduce communication inequalities across sub-populations due to their ability to reach these groups and increase their likelihood of understanding and processing the health information.<sup>35, 43</sup> Second, this is an experiment, so the causal direction is more clear. In

summary, exploring the effects of emotional reaction to GHWs may help elucidate specific types of emotions needed to induce particular cognitive outcomes. These results may be useful in developing further effective GHWs and other advertisements for smoking cessation.

In conclusion, negative discrete emotions had different effects on the cognitive outcomes for smoking cessation and its preventive effects among smokers and non-smokers. Also, the intensity of emotional reactions affected the effectiveness of these cognitive outcomes. Further studies are needed to investigate the effects of other discrete emotions that are elicited by GHWs on smoking-related cognitive and behavioral outcomes beyond positive and negative valence for both smokers and non-smokers. These future findings would have meaningful and practical implications for communicating anti-smoking messages in the development of not only GHWs, but also other smoking cessation and/or prevention advertisements.

**APPENDIX**

**Appendix 1. FDA’s Graphic Health Warnings**



**Appendix 2. Emotional responses to each label (median, smoker and non-smokers).**

Emotional responses to each label (median, smokers).

	Amused	Angry	Disgust	Hope	Motivated	Guilt	Sad	Scare (Fear)	Stress	Worry
Hole	1	2	4	1	2.5	3	3	3	1.5	3
Baby	1	2	3	2.5	3	3	3	2	1.5	3
Lung	1	1	4	2	3	3	3	3	2	3
Teeth	1	2	4	2	2	3	3	3	2	3.5
Stroke	1	2	3	1	2	3	3	3	2	3
Toon	1	2	3	1.5	2	2	3	2	2	3

Dead	1	2	3	3	2	3	3	3	2	3
Cry	1	1	2	1	2	2	3	2	1	3
Quit	1	1	1	2	2	2	2	1	1	2

Emotional responses to each level (median, non-smokers)

	Amused	Angry	Disgust	Hope	Motivated	Guilt	Sad	Scare (Fear)	Stress	Worry
Hole	1	2	4	1	1	1	3	3	1	3
Baby	1	3	2	2	3	2	3	3	2	3
Lung	1	2	4	1	3	2	3.5	3.5	2	4
Teeth	1	2	4	2	1	1	4	3	2	4
Stroke	1	2	3	3	2	1	4	4	2	4
Toon	1	3	3	1	1.5	1.5	4	3	1.5	4
Dead	1	1	3	2	1	1	3	4	1	4
Cry	1	1	2	1	2	1	3	3	1	3
Quit	1	1	1	1	1	1	1	1	1	1

### Appendix 3. Distribution of each emotional response among smokers

Disgust

	GHW	Frequency	%
High (either 4 or 5)	Hole, Lung, Teeth	97	17.2
Middle (3 or 3.5)	Baby, Stroke, Toon, Dead	339	60.00
Low (either 2 or 1)	Cry, Quit	210	22.65
Missing	NA	1	0.18

### Appendix 4. Distribution of each emotional response among non-smokers

Disgust

	GHW	Frequency	%
High (either 4 or 5)	Hole, Lung, Teeth	209	32.91
Middle (3 or 3.5)	Stroke, Toon, Dead	193	30.39
Low (either 2 or 1)	Baby, Cry, Quit	233	36.69

Sad

	GHW	Frequency	%
High (either 4 or 5)	Teeth, Stroke, Toon	141	22.2
Middle (3 or 3.5)	Hole, Baby, Lung, Dead, Cry	289	45.51
Low (either 2 or 1)	Quit	205	32.20

Scared (fear)

	GHW	Frequency	%
High (either 4 or 5)	Stroke, Dead	57	8.98
Middle (3 or 3.5)	Hole, Baby, Lung, Teeth, Toon, Cry	517	81.42
Low (either 2 or 1)	Quit	61	9.61

Worry

	GHW	Frequency	%
High (either 4 or 5)	Lung, Teeth, Stroke, Toon, Dead	57	8.98
Middle (3 or 3.5)	Hole, Baby, Cry	236	37.17
Low (either 2 or 1)	Quit	342	53.86



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**viii. Paper 3**

**Does segmentation really work? Effectiveness of matched Graphic Health**

**Warnings (GHWs) by race, gender and chronic disease conditions on cognitive**

**outcomes among vulnerable populations**

## **ABSTRACT**

### **Objective**

Graphic Health Warnings (GHWs) on cigarette packages are considered one of the most powerful tools to convey smoking cessation messages to smokers and particularly to disadvantaged groups who suffer more from the burden of tobacco use compared to others. This paper examined the effect of audience segmentation by race, gender and chronic disease conditions to GHWs on cognitive outcomes among smokers. Segmentation is defined as matching on some relevant characteristic. Specifically, this is whether GHWs that portray specific groups in terms of gender, race, and chronic disease conditions are associated with differences in risk perception and intention to quit among smokers who match the portrayed group, versus those who do not match the portrayed group.

### **Methods**

We used data from Project CLEAR, which oversampled vulnerable populations including lower SES persons and racial, ethnic and sexual minorities in the Greater

Boston area (n=565). We fitted multiple linear regression models to predict each study outcome using relevance of the GHWs with images of particular sub-groups, participants' characteristics (race, gender and chronic disease conditions), and interaction terms between GHW relevance and each of these characteristics. All of the analyses were controlled for age, gender, education and household income.

## **Results**

There was a significant interaction between GHWs portraying women (versus men) and participants' gender such that women who viewed GHWs portraying females reported increased risk perception as compared to women who viewed GHWs portraying men. In terms of main effects, being Black or Hispanic was associated with increased risk perception and intention to quit smoking as compared to not being Black or Hispanic (being White or others). Regarding gender, being female was associated with increased intention to quit smoking. The relevance of GHWs to those with chronic disease condition was more effective for both risk perception and intention to quit smoking, however, there was no interaction for these outcomes.

## **Conclusion**

The findings suggest that segmentation of GHWs may have limited impact on risk perceptions and intention to quit smoking among adult smokers in this sample. In addition, the study did not find evidence that segmentation was associated with reactance among racial or ethnic minority participants.

## **INTRODUCTION**

### **Disparities in smoking among sub-populations**

In the United States, smoking rates reached a historic mark in 2015, recorded at their lowest levels since tracking began in 1965.<sup>1</sup> However, smoking still remains the leading cause of disease and death in the US. Moreover, the effects of smoking are suffered disproportionately by those who are underserved, generally those from lower socioeconomic status (SES), especially the poor and racial, ethnic and sexual minorities.<sup>2</sup> American Indian/Alaska natives and Native Hawaiians and Pacific Islanders have higher smoking rates than Whites and Hispanics.<sup>3</sup> Although smoking rates among African Americans are less than that of Whites, African American have lower rates of successful smoking cessation<sup>3,4</sup> While Hispanics have lower smoking rates than Whites, these rates vary across Hispanic/Latino sub-groups.<sup>3,5</sup> Smoking rates among men are higher (18.8%) than those for women (14.8%)<sup>6</sup>; however, female smokers are likely to have a higher risk of disease burden as compared to male smokers.<sup>7</sup> Smokers have higher rates of chronic disease conditions and experience longer hospitalization times, complications that increase mortality risk.<sup>7</sup> Disparities in

smoking have helped create a demand for developing programs to prioritize disadvantaged groups and redress these differences.<sup>8</sup> Health communication campaigns targeting specific audiences have been used as a legitimate approach to address the disparities.<sup>8</sup> Evidence has shown that disadvantaged groups tend to have less access, and lower ability to understand, process and take action on health information.<sup>9</sup> Furthermore, these communication inequalities are associated with smoking-related knowledge, belief and outcomes.<sup>10,28</sup> In order to convey health messages to disadvantaged groups, it is important to consider these disparities and inequalities in communication.

### **GHW's effectiveness for vulnerable population**

Graphic Health Warnings (GHWs) on cigarette packs are considered to be one of the most powerful ways to reduce disparities due to multiple reasons.<sup>11</sup> The effectiveness of GHWs for vulnerable populations has been well-documented in terms of both cognitive and behavioral intention outcomes such as risk perception, credibility and intention to quit smoking.<sup>10</sup> GHWs are considered an effective tool for communicating risk to smokers at the point of behavior; graphic rather than text-only warnings appear to

enhance the effects of messages across different groups.<sup>11,12</sup> Specifically, GHWs' pictorial image is helpful in enhancing cognitive processing and is equally effective among sub-populations since it can address differences due to the audience's literacy, language proficiency, culture and prior health knowledge.<sup>10</sup> However, it is unknown whether a GHW with the image representing a member or an image to typify a specific sub-group is particularly effective for the intended audience. For instance, are GHWs with certain images such as a person of color, a crying woman, and someone having a hole in their throat more or less likely to be effective on smokers of color, mothers or those with chronic disease conditions, respectively? To our knowledge, surprisingly, there are very few studies that assessed this targeted effect, which is the focus of our investigation – whether the GHW with a depiction of particular group works more or less effectively among members of that group. In particular, we investigated whether exposure to GHWs with a particular image can have increased effects on cognitive outcomes such as risk perception and intention to quit smoking for the audience depicted in the images, in terms of race, gender and chronic disease condition. To assess segmentation effect, it is important to find out whether targeted health warnings are



more or less effective than intended. We were specifically interested in examining if such a matching matters in lower SES groups given barriers they face in accessing, processing and using health and risk information.

### **Communication campaign development and segmentation**

In order to convey messages effectively, segmentation has been used in marketing and advertising. Segmentation is the process of categorizing diverse populations into sub-groups which have similar backgrounds, demographic and psychological characteristics, as well as experiences, among other differences.<sup>13</sup> By doing so, it is believed that audiences can find more relevance and salience in the messages, and it can increase the effectiveness of communication by leading people to pay more attention, process messages more deeply, and take action.<sup>13</sup> Segmentation is frequently employed in communication campaigns.<sup>13</sup>

### **Anti-smoking communication and segmentation**

The use of audience segmentation to develop targeted advertisements to promote

smoking has been used for a long time by the tobacco industry, resulting in enormous smoking-related harms.<sup>14</sup> There are some examples of segmentation and targeting subgroups in the literature in anti-smoking campaigns. However, few studies have discussed and documented the effects of segmentation and targeting for GHWs.<sup>15</sup>

Among those that exist related to anti-smoking campaigns in general, there have been mixed findings. Some studies show moderation effects among anti-smoking advertisements related to race<sup>15</sup>, being female and young.<sup>16</sup> However, other studies demonstrate no significant differences in campaign and/or health warning effectiveness by race/ethnicity, gender, age<sup>10 15-17</sup>, income and education<sup>10</sup>, except for one study showing that females and younger smokers may find relevance in the advertisement when it portrays females.<sup>16</sup> In addition, there is little evidence that segmentation and targeted approaches can address disparities.<sup>8,18</sup> Some studies even conclude that segmentation and targeted messages are not advisable when considering the additional cost for campaign development and potential negative effects due to segmentation, such as stigmatization.<sup>8</sup> Other studies criticized how a GHW creates reactance, eliciting counter-productive psychological responses since they elicit negative emotions (i.e. fear

and being scared), especially when people found personal relevance.<sup>19,20</sup> Such reactance could lead to unintended outcomes such as negative impact on attitudes and behavior, and even desire to smoke, or smoke more.<sup>19,20</sup> In terms of practice, segmentation requires additional resources such as time and people to develop different versions. Thus, when segmentation is used for anti-smoking messaging, an extra level of consideration is needed.

### **The aim of the study**

The purpose of this study was to examine segmentation effect. In this paper, segmentation is defined as matching on some relevant characteristic. Specifically, we aim to investigate whether GHWs with an image representing a member or an image typifying a specific sub-group are more or less effective for the intended audience. Specifically, this study aimed to investigate 1) whether GHWs which portrayed particular groups (race, gender, and chronic disease conditions) work more or less effectively for risk perception among the described audience (RQ1) and 2) whether GHWs which portrayed particular groups work more or less effectively for intention to

quit smoking among the intended audience (RQ2). For instance, we investigated whether GHWs that portrayed a female elicit higher risk perception/intention to quit among women as compared with men.

## **METHODS**

### **Data source and study population**

The data for this study come from Project CLEAR. In 2012, the United States FDA mandated the use of GHWs on all cigarette packaging to educate the general public about health risks and consequences of smoking. In order to study the impact of GHWs on both smokers and non-smokers, particularly among vulnerable populations, Project CLEAR aimed to assess the impact of GHWs among disadvantaged groups including: African Americans, Hispanics, low SES, chronic disease patients, lesbian, gay, bisexual and transgender (LGBT) individuals, and blue-collar workers. With the help of three Massachusetts-based community partners (Alliance for Community Health in Boston; Common Pathways in Worcester; and the Mayor's Health Task Force in Lawrence), this project was conducted between August 2012 and April 2014 in the Greater Boston

area, including Boston, Worcester, and Lawrence. Inclusion criteria for this study were people between the ages of 18 and 70, who speak English or Spanish. At the recruitment, we aimed to enroll 1200 participants (600 smokers and 600 non-smokers). Smoking status was self-identified at recruitment. For this study, we only analyzed data from smokers.

### **Survey development**

A mixed-methods approach was used to develop the survey, including an extensive literature review, focus groups, and key informant interviews. The survey questions were drawn from both validated measures used in past surveys as well as focus groups. For participants with low literacy, the study used electronic tablets with the option of hearing the questions and answer choices through headphones, in addition to being shown questions and answer choices on the screen. Prior to actually fielding the experiment, cognitive testing was conducted to check both the survey instrument itself and the tablet delivery system.

## **Design**

A randomized experimental design was used for this study. All participants were randomized to view one of nine GHW that were developed and chosen by the FDA. First, each participant answered a pre-test survey that included demographic information, baseline smoking-related cognitive and behavioral measures, and chronic disease status. Second, the participants were randomized to be exposed to one of the nine GHWs, then answered questions to assess their level of perceived effectiveness, emotional reactions, intention to quit smoking, and further cognitive and behavioral responses. In the third step, participants were exposed to and answered questions on their reactions and thoughts about the other 8 labels.

## **Study variables**

### **Independent variables:**

#### *Relevance of GHW*

Relevance of GHWs with race, gender, and chronic disease condition was determined based on the graphic design on the label. For example, the variable “relevance of race”

was determined to be relevant for Black and Hispanic populations when they were shown images of persons of color. Gender was found to be relevant for women when the pictorial images showed a woman. Chronic disease conditions were considered to be relevant if the pictorial images showed a disease condition (e.g., having a hole in a throat, lungs affected by smoking, etc.). The categorization of GHWs and relevance of race, gender and chronic disease status are shown in Appendices 1 and 2, respectively. Relevance of each GHW was categorized as binary (1 –yes and 0 –no).

### *Race*

Race and ethnicity were measured using two items. First, respondents were asked “Are you Hispanic, Latino/a, or Spanish origin? (Select One)”. The response choices were: 1) No, not of Hispanic, Latino/a, or Spanish origin, 2) Yes, Mexican, Mexican American, Chicano/a, 3) Yes, Puerto Rican, 4) Yes, Dominican, 5) Yes, Cuban, and 6) Yes, another Hispanic, Latino/a, or Spanish origin. Then, another question was asked followed by this sentence: “In the United States, Hispanic/Latino is not currently considered a race. It is considered an ethnicity. Even if you are Hispanic/Latino, please

answer the following question by selecting the race or races that best describe you. What is your race? Select one or more”. The response choices were: 1) American Indian or Alaska Native, 2) Asian, 3) Black or African American, 4) Native Hawaiian or Other Pacific Islander, 5) White and 6) I do not identify with any of the above. Then, we categorized respondents as non-Hispanic White when they choose 1) no, not of Hispanic, Latino/a, or Spanish origin for the first item and 5) White for the second item, and as Black when they choose 1) no, not of Hispanic, Latino/a, or Spanish origin for the first item and 3) Black. People who answered Hispanic or Latino origin for the first question and any categories were categorized as Hispanic. The rest were categorized as “Other”.

### *Gender*

Gender was asked by a question “What is your gender?”. The response choices were: 1) Male, 2) Female, 3) Transgender and 4) Other (please specify). For this study, respondents who answered either male or female were used for the analysis. A total of 7 people were omitted from the analysis.



### *Chronic disease condition/status*

Chronic disease condition/status was measured by one item, “Do you currently have or have been diagnosed with (the following diseases/symptoms)?” Five items were listed: cancer, depression or anxiety, trouble breathing, asthma or other lung disease (for example, emphysema or chronic bronchitis), heart disease including high blood pressure, effects of stroke, in addition to a space which indicated “other (specify)”. For this study, people who checked any one of the five listed diseases were categorized as having chronic disease condition/status.

### **Dependent variables:**

#### *Risk perception*

Risk perception was asked directly after viewing the assigned GHW. People were asked to respond to this statement: “(the label) makes me think about the health risks of smoking”. The response items were ranked on a 5-point Likert scale from “strongly disagree, disagree, neither disagree nor agree, agree, to strongly agree”.

### *Intention to quit smoking*

We measured intention to quit smoking via a question that indicated the readiness of quit smoking. Specifically, we asked “How likely is it that you will do each of the following in the next 30 days: try to quit smoking”. The responses indicated whether participants were seriously thinking about quitting smoking in the next 30 days. This time period means that the respondent is in the preparation stage, based on the Transtheoretical model.<sup>21</sup> The response items used a 5-point Likert scale to “not at all likely, somewhat likely, moderately likely, very likely, and extremely likely”. The score was used as a continuous variable.

### **Covariates:**

Age, gender, education and household income were used as covariates. When we assessed gender relevance and their outcomes, gender was not used as a covariate in order to avoid collinearity.

## **Statistical analysis**

We conducted descriptive analysis to assess the sample population (Table 1). To investigate the relationship between relevance of GHWs and cognitive outcomes, we used multiple regression analyses. For each analysis, an interaction term was included to assess the moderation effect due to the relevance of the GHW and each independent variable (race, gender and chronic disease conditions, respectively). For missing data, we used complete case analysis. We excluded individuals with at least one missing value for any of the variables used in the analysis (0.35% of the total participants). All analyses were performed using STATA 13.0 SE. For all analyses, we used two-sided p-value at 0.05 level.

## **RESULTS**

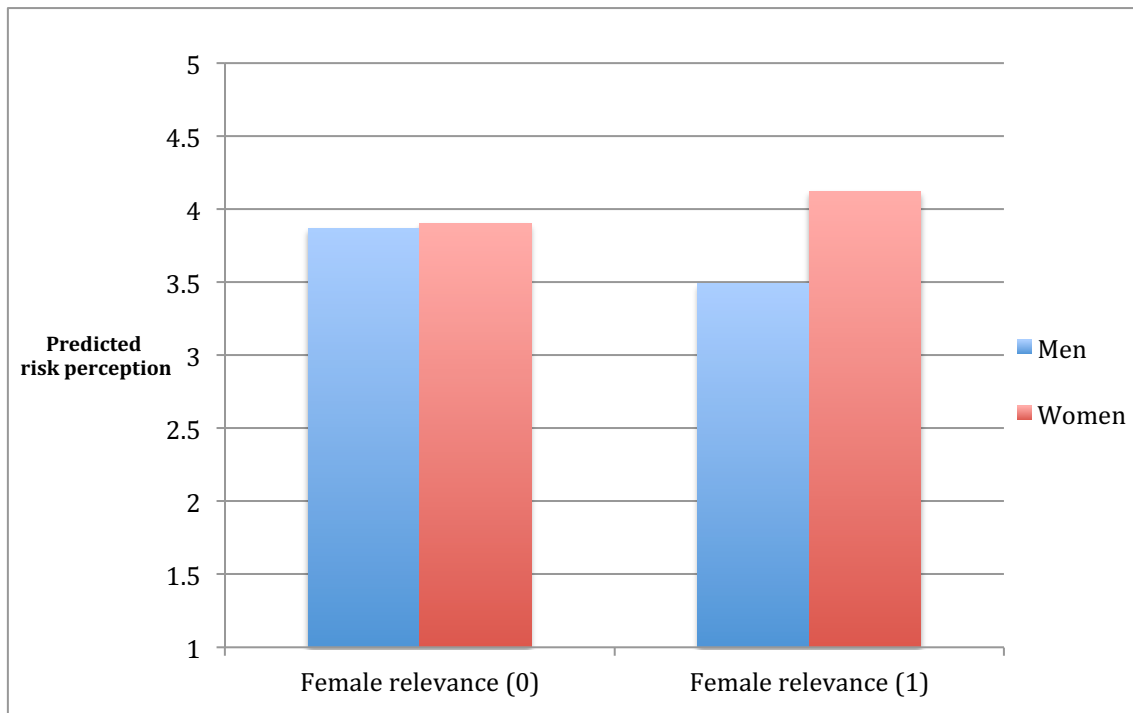
Table 1 shows the description of the sample population. In total, there were 565 smokers in the sample, aged 18 to 68. The average age was about 34 years old. The number of women was slightly less than men, but both accounted for approximately half of the population. Nearly 40% of the population was Hispanic, with Blacks and

Whites accounting for approximately 30% each. In terms of education, people who completed high school accounted for 30%, the highest among all of the categories. Nearly one in four of the respondents among smokers responded that their household income was under US\$10,000 in 2012.

The first research question is whether GHWs with the image of a particular group work more effectively for risk perception for the targeted audience, in terms of race, gender and chronic disease conditions. Results of the multiple linear regression result are shown in Table 2. The unadjusted model (the main effects model) shows the main effect (without interaction). The adjusted model (the interaction model) shows the interaction between the relevance of the GHW to the group and being in a certain group (being Black or Hispanic, being women, or having chronic disease conditions, respectively). In terms of race, the unadjusted model (the main effects model) shows that being Black or Hispanic is associated with increased risk perception as compared to being White or others. For the adjusted model (the interaction model), with the interaction between relevance of Black or Hispanic race in the GHW and being Black or Hispanic, no

interaction effect was found. In terms of gender, the main effects were not significant. However, the interaction term between the relevance of females in the GHW and being female was significantly associated with increased risk perception (Figure 1). That is, the GHWs showing female pictures were more effective for women in terms of their risk perception. In terms of chronic disease condition, in the unadjusted model (the main effects model), the relevance of the chronic disease condition in the GHW showed significant results for risk perception. However, no interaction was found.

**Figure 1.** Interaction between female relevance to the GHWs and gender (being female) for risk perception



\*Female relevance=0 means the exposure to GHW with male image

Female relevance=1 means the exposure to GHW with female image

The second research question was whether the GHWs with the image of a particular group works more effectively for intention to quit smoking among the intended audience, in terms of race, gender and chronic disease conditions. Table 3 shows the multiple linear regression result adjusting for covariates. In terms of race and gender, in both unadjusted model (without interaction) and adjusted model (with interaction), being Black or Hispanic and being a woman were significant for intention to quit smoking, respectively. In other words, being Black or Hispanic, and also being female was associated with increased intention to quit smoking. However, both interaction terms were not significant. With regard to chronic disease conditions, the relevance of chronic disease condition was significant in unadjusted model, but no interaction was found.

**Table 3.1.** Demographics, socioeconomic status, and health status among smokers  
(n=565)

		Smoker (565)	
		34.09 (18-68)	
		n	%
Age			
Gender			
	Male	302	53.45
	Female	254	44.96
	Transgender	4	0.71
	Other	3	0.53
	Missing	2	0.35
Race			
	White	173	30.62
	Black	159	28.14
	Hispanic	223	39.47
	Other	10	1.77
Education			
	Completed grade school or less	28	4.96
	Some high school	78	13.81
	Completed high school	167	29.56
	Completed GED	86	15.22
	Some college	145	25.66
	Completed associate's degree	18	3.19
	Completed college	22	3.89
	Graduate or professional school after college	13	2.30
	Don't know, or does not apply	6	1.06
	Missing	2	0.35
Household income in 2012			
	Under \$10,000	141	24.96
	\$10,000-\$19,999	91	16.11
	\$20,000-\$29,999	57	10.09
	\$30,000-\$39,999	54	9.56
	\$40,000-\$49,999	28	4.96
	\$50,000-\$59,999	24	4.25
	\$60,000-\$69,999	12	2.12
	\$70,000-\$74,999	7	1.24
	\$75,000 or above	20	3.54
	Don't know	129	22.83

**Table 3.1. (Continued)**

Missing	2	0.35
Currently have symptom/have been diagnosed		
Yes	301	46.73
No	262	53.27



**Table 3.2.** Risk perception in relation to relevance of the GHW by race, gender and chronic disease condition with interaction term among smokers (n=565)

Race					
Unadjusted model (main effects model)			Adjusted model (interaction model)		
Predictor variable	Coefficient	p-value	Predictor variable and interaction term	Coefficient	p-value
Relevance of Black or Hispanic	0.07	0.60	Relevance of Black or Hispanic	0.05	0.82
Black or Hispanic	0.34	0.02	Black or Hispanic	0.33	0.10
			Interaction (Relevance of Black and Hispanic * Black and Hispanic)	0.03	0.92
Gender					
Unadjusted model (main effects model)			Adjusted model (interaction model)		
Predictor variable	Coefficient	p-value	Predictor variable and interaction term	Coefficient	p-value
Relevance of female	-0.12	0.389	Relevance of female	-0.38	0.05
Female	0.21	0.121	Female	0.03	0.853
			Interaction (Relevance of female* female)	0.60	0.04
Chronic disease conditions					
Unadjusted model (main effects model)			Adjusted model (interaction model)		
Predictor variable	Coefficient	p-value	Predictor variable and interaction term	Coefficient	p-value

**Table 3.2.** (Continued)

Relevance of chronic disease condition	0.41	0.0001	Relevance of chronic disease condition	0.52	0.001
Chronic disease condition	0.55	0.618	Chronic disease condition	0.18	0.284
			Interaction (Relevance of chronic disease condition* chronic disease condition)	-0.21	0.328

\* Unadjusted model (main effects model) was to investigate the relevance of race, gender, and chronic disease conditions respectively without interaction. Adjusted model (interaction model) was to investigate these relevancies with interaction.

\*Adjusted for age, education and household income. When we assessed gender relevance and their outcomes, gender was not used as a covariate in order to avoid collinearity.

**Table 3.3.** Intention to quit smoking in relation to relevance of the GHW by race, gender and chronic disease condition with interaction term among smokers (n=565)

Race					
Unadjusted model (main effects model)			Adjusted model (interaction model)		
Predictor variable	Coefficient	p-value	Predictor variable and interaction term	Coefficient	p-value
Relevance of Black or Hispanic	-0.17	0.26	Relevance of Black or Hispanic	-0.19	0.45
Black or Hispanic	0.63	0.0001	Black or Hispanic	0.61	0.008
			Interaction (Relevance of Black or Hispanic * Black or Hispanic)	0.04	0.89

**Table 3.3.** (Continued)

Gender					
Unadjusted model (main effects model)			Adjusted model (interaction model)		
Predictor variable	Coefficient	p-value	Predictor variable and interaction term	Coefficient	p-value
Relevance of female	-0.28	0.10	Relevance of female	-0.11	0.609
Female	0.41	0.01	Female	0.53	0.006
			Interaction (Relevance of female* female)	-0.40	0.247
Chronic disease conditions					
Unadjusted model (main effects model)			Adjusted model (interaction model)		
Predictor variable	Coefficient	p-value	Predictor variable and interaction term	Coefficient	p-value
Relevance of chronic disease condition	0.32	0.014	Relevance of chronic disease condition	0.13	0.49
Chronic disease condition	0.13	0.327	Chronic disease condition	-0.09	0.67
			Interaction (Relevance of chronic disease condition* chronic disease condition)	0.36	0.17

\* Unadjusted model (main effects model) was to investigate the relevance of race, gender, and chronic disease conditions respectively without interaction. Adjusted model (interaction model) was to investigate these relevancies with interaction.

\*Adjusted for age, gender, education and household income. \*Adjusted for age, education and household income. When we assessed gender relevance and their outcomes, gender was not used as a covariate in order to avoid collinearity.

## **DISCUSSION**

### **Do GHWs work more effectively for the specific audience, as intended?**

#### *Race*

Although being Black or Hispanic was associated with increased risk perception and intention to quit smoking as compared to being White and “Other”, there is no segmentation effect. This is consistent with a previous study which showed that GHWs can be equally or more effective for disadvantaged groups.<sup>10, 28</sup> Also, the finding addresses concern from other studies about reactance due to the segmentation. That is, targeting a disadvantaged racial group does not cause reactance (counter-productive psychological effects).<sup>29</sup>

#### *Gender*

Being female was associated with increased intention to quit smoking. Although there is mixed evidence about the reaction to GHWs by gender, other research shows that a GHW works more effectively for women than men in terms of negative emotional reactions, cognitive reactions, beliefs about health risks, and negative emotional reactions.<sup>22</sup> In terms of segmentation, our study found that it partially worked. In other words, segmentation only worked for females when there was a female-targeted GHW for risk perception, but not for intention to quit smoking. Also, this segmentation effect was shown only among women, but not men. Although the evidence remains insufficient, our result is consistent with past study.<sup>16</sup> Since women tended to have greater personal relevance to the image with unborn babies and children as compared to men, female smokers may tend to create stronger emotional bonds with female-targeted advertisements.<sup>16</sup>

#### *Chronic disease condition*

For both risk perception and intention to quit smoking, relevance of chronic disease

condition-related GHWs worked more effectively than non-chronic disease GHWs. However, there was no segmentation effect. For smokers, warnings about disease condition may be a powerful way of communication in general, and it supports current evidence that smokers have greater awareness about images with smoking-related diseases.<sup>16</sup>

### **Is segmentation really necessary?**

When using GHWs and other smoking cessation advertisements, the necessity of segmentation should be carefully considered, especially when we target disadvantaged groups. Due to its successful implementation in marketing and communication, segmentation has been commonly used in public health. However, evidence on GHWs and anti-smoking advertisements is still insufficient.

Considering segmentation approach in smoking cessations, there are two points worth noting – the effectiveness as well as available resources. First, we may have to consider the effectiveness of segmentation and the possibility of its negative impacts. Our finding demonstrates that segmentation works partially for women for risk perception. At the same time, segmentation did not cause any unintended outcomes for the disadvantaged groups. These findings practically imply that there is a potential that segmentation approach is effective for certain sub-groups without causing harm; at the same time, segmentation may not be the best way to convey messages effectively to the intended audiences when warning against unfavorable behaviors. Regarding negative impacts due to segmentation, it is necessary to consider both the unintended outcomes of the behavior itself, as well as that segmentation may cause unnecessary stigma. Unlike consumer advertisements, which show modeling behaviors which reinforce good behavior, public health communication often shows unfavorable behaviors that should be modified. In that case, targeting a particular

audience could imply that the group has unfavorable behavior.<sup>8</sup> These impressions are likely to lead to unfavorable stigma towards the groups.<sup>8</sup> We tested whether segmentation works for the intended audiences (Black and Hispanic, female and people having chronic diseases as considered as a disability and disadvantages in health). These audiences, such as racial and ethnic minorities, women, and the disabled, are generally subject to discrimination and stigmatization.<sup>23,24</sup> Furthermore, as the Structural Influence Model (SIM) describes, these vulnerable groups tend to be exposed to communication inequalities.<sup>25</sup> Discrimination, stigmatization and communication inequalities are contributors to health inequality.<sup>23,25</sup> GHWs are expected to address these disparities, especially for disadvantaged groups. Thus, it is not necessary to create additional suffering for these groups as a result of segmentation, unless there is a solid favorable effect. Second, when making a decision about segmentation, research has argued that segmentation might increase unnecessary production costs.<sup>8</sup> Furthermore, by focusing on particular segments, we may lose opportunities to develop wider consensus, such as creating social norms as an entire community, rather than targeting a specific sub-group.<sup>8</sup> This could be the case especially with issues like smoking, where it may be better to keep social norms and community consensus for anti- or no- smoking. In that case, the better option could be to disseminate messages to a wider audience, but not a particular sub-group. For these reasons, when developing GHWs and smoking cessation advertisements, the necessity of segmentation should be considered deeply, and both positive and negative effects should be tested before implementation.

### **Limitation**

This is an experimental study. The study environment was different from natural settings in terms of seeing GHWs on the actual packages and the level of exposure to GHWs, as this study was conducted using a tablet and we assigned and showed a GHW to participants only

once. Thus the result may be different if smokers are exposed multiple times to GHWs in a real-world setting. We used intention to quit smoking as a behavioral outcome indicator. However, a gap has been documented between intention to quit smoking and actual behavior (quitting smoking).<sup>26</sup> The relevance of the GHWs was determined based on the pictorial images on GHWs. We only investigated smokers in this study. For further research, we would like to research non-smokers as well as assess other characteristics of segmentation via other demographic factors such as age and geographic locations, as well as lifestyle factors including cultural and psychological characteristics.

### **Strengths**

This paper may contribute to a better understanding of the adequacy of segmentation and targeted communication using GHWs due to several strengths. First, this is among the first GHW study using FDA's labels to investigate the relevance of advertisements and their effect on cognitive outcomes among vulnerable populations. There are existing studies about interaction effects due to sub-population characteristics, however these studies have mainly focused on the overall effects of GHW exposure without considering the issue of matching. Our study looked at GHWs matched with the population, so that it can more clearly demonstrate segmentation effect. This study focused on whether sub-group characteristics (race, gender, and chronic disease conditions) moderate the relationship between the relevance of GHWs (matched images) and cognitive outcomes, which enabled us to determine if the targeted GHW was more effective for the intended audiences. The results of the study have practical implications for reconsidering how to communicate with these groups about quitting smoking, and aiming to reduce disparities among sub-populations. Second, the population of this study represents the most disadvantaged groups for quitting smoking, and where urgent and effective intervention is most needed. Previous study has

documented that GHWs will be the most beneficial for these disadvantaged groups as GHWs may contribute to redressing communication inequalities due to differences in access, understanding and processing health information.<sup>10</sup> This study may help to deepen the understanding of a GHW's approach, especially among these lower-SES groups.

In conclusion, there is no significant segmentation advantage effect of GHWs on risk perception and intention to quit smoking among smokers in terms of race and chronic disease conditions, except for gender (being a woman) for risk perception. Further studies are needed to understand whether this result is applicable to non-smokers and also for other smoking-cessation related variables. Also, testing in a real-world setting such as giving people cigarette packs with GHWs, and considering repeated exposure may help. These findings will help public health experts make a decision whether segmentation and targeted communication is truly necessary when developing GHWs and other anti-smoking communications.


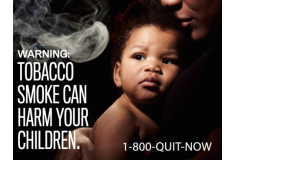


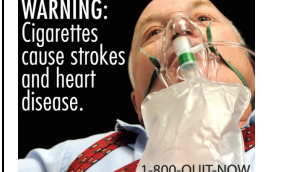
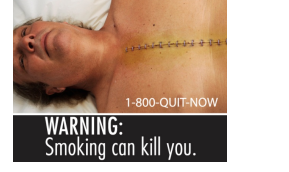



**APPENDIX**







Appendix 1: FDA’s Graphic Health Warnings

		
Hole	Baby	Lung
		
Teeth	Stroke	Toon
		
Dead	Cry	Quit



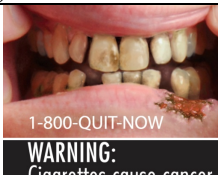






Appendix 2: Categorization of relevance of race, gender and chronic disease conditions  
Race (Black and Hispanic or White and Others)

Relevance of Black and Hispanic			
			
Hole	Baby	Toon	Cry
Relevance of non-Black and Hispanic			
			
Stroke	Dead	Quit	

Gender (female or male)

Relevance of female			
			
Baby	Cry		
Relevance of non-female (male)			
			
Hole	Stroke	Dead	Quit

Chronic disease conditions (having disease and disease symptoms or not)

Relevance of chronic disease conditions (yes)			
			
Hole	Lung	Teeth	Stroke
			
Dead			
Relevance of no chronic disease conditions (no)			
			
Baby	Toon	Cry	Quit

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## **ix. CONCLUSION**

This dissertation investigated effective communication in health by better understanding the role of media channels and message formats, specifically focusing on low SES groups, and using two different datasets (JAGES for Paper 1, and Project CLEAR for Papers 2 and 3).

In Paper 1, we found that health information mavens who share health information with others were associated with certain factors such as being women, and having higher education, better perceived financial position, larger social networks, higher social support, as well as media exposure. Also, these mavens were associated with healthier dietary and exercise behaviors but not associated with smoking and alcohol consumption. They were more likely to have a disease and/or disease symptoms. Health information mavens are the potential important media channels to facilitate interpersonal communication among the elderly who are more disadvantaged in terms of health information access as compared to younger populations. Thus, when designing health communications strategies for the elderly, it is important to take the perspective of word-of-mouth communication into consideration.

In Paper 2, we researched the impact of discrete emotions to GHWs on tobacco-related cognitive outcomes among low SES smokers and non-smokers. We found that GHWs induce different discrete emotional reactions (in terms of both type of emotion and its intensity), which are in turn associated with cognitive outcomes among smokers and non-smokers from lower SES and minority groups. As a media channel, GHWs are considered as a very powerful tool to promote smoking cessation for low SES groups. Thus, it is very important to design effective messages. This study expanded beyond current focus on message format –



either positive or negative valence of GHWs – to investigate the impact of discrete emotions and the specific level of intensity on smoking-related cognition.

In Paper 3, we studied segmentation effects by researching the effectiveness of matched GHWs by race, gender and chronic disease conditions on cognitive outcomes among low SES groups. Segmentation due to race, gender and chronic disease conditions among smokers did not demonstrate increased effects except for risk perception among female-targeted GHWs. In terms of negative effect due to segmentation, the matched GHWs did not cause unintended negative outcomes among the targeted population. Further study is still needed to investigate this with other outcomes and in different settings (i.e., natural environments and/or multiple exposures, etc.) though, this research demonstrated that the decision to use segmentation needs to be determined carefully, striking a balance between message effectiveness, potential unfavorable outcomes, and available resources in terms of cost and time.

All three papers aimed to produce meaningful practical implications in the field. There are two overall implications. First, in terms of message channels, throughout the three papers we found the potential of communications to address health inequalities among disadvantaged groups (the elderly and low SES groups). In health communications a one size fits all strategy does not work – instead, especially for vulnerable populations, it is important to investigate the characteristics of media channels and make sure that they are an effective tool to reach out to these populations. Word-of-mouth communications are a potentially powerful tool to convey messages to the elderly, who have disadvantages in access to information and new media channels such as Internet and smartphones. GHWs are already known to be a powerful channel to disseminate smoking cessation messages for lower SES groups, which are the

most disadvantaged groups in smoking disparities. These papers added that it could be more impactful when the message format is appropriately designed.

Second, examination of the appropriate message content and formats is critical to convey messages effectively and lead to behavior changes. For example, Paper 1 identified that health information mavens who are likely to share health information with others do not necessarily have healthy behaviors in terms of smoking and alcohol. When we develop a health communications strategy through interpersonal communication, it is important for us to know that these mavens may not conduct appropriate behavior (and do not have correct knowledge). Thus, when we design messages for the elderly, it is critical to make these messages as easy to understand and as accurate as possible. In terms of GHWs, we should focus on discrete emotions beyond either positive and negative valence discussions. In addition, segmentation should be considered based on not only the effectiveness but also the potential negative impact. Furthermore, in order to develop health messages, it is important to conduct formative research in advance, to make sure that messages are received as intended.

This dissertation offered strong evidence as well as practical implications in health communication to better understand the role of media channels and message formats among disadvantaged groups. As the Structural Influence Model describes, communication could be a potential factor in connecting disparities in health. On the other hand, communication is also a modifiable factor and a strong tool, which can be designed by policies and programs to reduce health inequalities. Disadvantaged groups have already experienced health and communication disparities. Thus, it is necessary not only to make health communications effective, but also to avoid creating further inequalities among these populations. Our



research demonstrated the further potential of communication among disadvantaged populations by choosing appropriate media channels and using appropriate message formats.

These days, globally, many public health policies and programs include health communication related activities. However, for public health researchers and practitioners, there is still room to make health communications more effective. These are due to the lack of evidence generation (evidence has not yet been generated), and/or the lack of evidence translation (evidence has not been translated well in practice). In order to maximize the power of communication in public health, collaborative work by researchers and practitioners is necessary. By bridging between research and practice, we hope that health communication will be fully utilized as a strong driver for behavior change, and contribute to reducing health inequalities among disadvantaged populations.