RESEARCH ARTICLE

Moderating Effects of Media Exposure on Associations between Socioeconomic Position and Cancer Worry

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Abstract

Reducing fear of cancer is significant in developing cancer screening interventions, but the levels of fear may vary depending on the degrees of media exposure as well as individuals' socioeconomic positions (SEP). However, few studies have examined how the SEP influences the fear of cancer under the moderating process of general and specific forms of media exposure. We investigated the moderating effect of media exposure on the relationship between SEP and the level of fear of cancer by assuming that cancer knowledge is a covariate between those two. In particular, this study examined how exposure to both general and specific media changes the series of processes from SEP to fear of cancer. We conducted path analyses with three types of media - television, radio and the Internet- using data from a health communication survey of 613 adults in Massachusetts in the United States. We found that SEP influences cancer knowledge directly and fear of cancer indirectly, as moderated by the level of media exposure. Health-specific exposure, however, had a more consistent effect than general media exposure in lowering the fear of cancer by increasing knowledge about cancer. A higher level of health-specific exposure and greater amount of cancer knowledge lessened the fear of cancer. In addition, the more people were exposed to health information on television and the Internet, the lower the level of fear of cancer as a result. These findings indicate a relationship between SEP and fear of cancer, as moderated by the level and type of media exposure. Furthermore, the findings suggest that for early detection or cancer prevention strategies, health communication approaches through mass media need to be considered.

Keywords: Cancer - worry - health communication - media exposure - knowledge - communication inequalities

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Introduction

The media play an important role in disseminating health information (Viswanath, Flynt-Wallington, and Blake, 2009). The messages conveyed via the media can impact health behavior change (Wakefield, Loken, and Hornik, 2010) as well as generate emotional arousal (Lemal and Van den Bulck, 2009). Research has generally shown that exposure to disease-related information on the media is likely to induce greater risk perception and emotions (Lemal and Van den Bulck, 2010). Evidence has demonstrated that risk perception and emotions such as fear or worry may influence protection motivations and health actions including sun protection (Cameron, 2008) and vaccination (Brewer et al., 2007) for example.

Considerable differences exist among the public in knowledge levels, values, and perceived risk concerning particular health issues (Wilcox and Stefanick, 1999; Viswanath, 2005; Andersson and Lundborg, 2007; McQueen et al., 2008; Al-Sharbatti et al., 2013; Saleh et al., 2014). Specifically, health knowledge among minority groups remains low (Schroy III et al., 2008). This might be attributed to communication inequalities, social and individual differences in access to and ability to take advantage of information (Viswanath, 2006). Socio-demographic factors such as education, income, gender and age may affect the extent to which an individual has access to health information.

Substantial evidence has shown that socioeconomic position (*SEP*) is related to information exposure, access to resources and susceptibility that may affect health. It is also well documented that access to, the use of, and exposure to general and content-specific media is strongly associated with *SEP* (Viswanath, 2006). That is, *SEP* influences the extent to which certain groups enjoy access to and use of certain media, their degree of attention to health topics and information processing, and the capacity to act on the information (Galarce et al., 2011). This phenomenon of communication inequalities, driven by *SEP*, could potentially lead to differential emotional arousals among different *SEP* groups, which can in turn affect health decision making. Due to better access and possibility of

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greater exposure to health information, the affluent and educated may have higher health-related knowledge and self-efficacy compared with their lower *SEP* counterparts (Vernon et al., 1993; Montgomery et al., 2003; Katapodi et al., 2004; Viswanath et al., 2006; Ackerson and Viswanath, 2010). Though some research suggests that differences in perceived risk can be partly explained by varying levels of exposure to media (Scheufele, 1999; Reese et al., 2001), very few studies, however, have examined the role of different types of media exposure, i.e., general or health-specific content, in explaining risk perception and cancer-related emotions. In addition, while the importance of *SEP* in health message exposure, health cognitions and behaviors has been well-documented, its impact on affect (worry or fear) media remains unclear.

SEP is important in understanding health disparities as it is evident that there are socioeconomic differences in health outcomes and health conditions, including cancer (Williams et al., 2012; Jung, 2014). Examining the mechanisms by which *SEP* and media exposure explain emotional reaction such as worry to diseases can identify effective means for future health education and addressing protective motivation associated with emotion.

We examined the mechanisms by which socioeconomic position and media exposure, may influence *cancer worry*. In particular, we focused on how the relationship between *SEP* and *cancer worry* is moderated by general and specific forms of media exposure according to three types of media. Also, we consider *cancer knowledge* in this conditional process due to the fact that *cancer knowledge* co-varies with worry as well as certain social determinants (Wilcox and Stefanick, 1999; Gu et al., 2013). Thus, the following two research questions guided our analyses: 1) Does media exposure moderate the conditional associations between socioeconomic position, *cancer knowledge*, and *cancer worry*? 2) How are general and health-specific forms of media exposure differentially associated with *cancer worry*? To address these questions, we applied the structural influence model as a conceptual framework for this study. It has been designed to explain how social determinants through health communication behaviors influence the varied health-related outcomes (Ramanadhan and Viswanath, 2006; Viswanath, 2006). Based on path models, we identified the effect of media exposure on *cancer worry* among different social groups and to gain insights needed for formulating cancer prevention strategies to mitigate communication inequalities.

Materials and Methods

Study sample

The data for this study came from a survey of perceived risk during a major infectious disease outbreak among residents of Massachusetts, United States. A sample of 786 subjects, representative of all adults in Massachusetts, was taken from a national panel maintained by the survey research company Knowledge Networks. Of these, 642 individuals responded to a survey administered over the Internet between October 18 and November 9, 2006 for a response rate of 81.7%. The panel recruitment methodology utilized dual sampling approaches of both list-assisted random digit dial sample as well as addressed-based sample thus ensuring those with cell-phone only households are covered in the final sample. Households without computers and the Internet access were provided one. The survey was fielded online where respondents were invited to participate in the survey.

Study model

We modeled hypothetical paths to determine the influence of *SEP* on *cancer worry*. In addition, as a moderating factor between *SEP* and *cancer worry*, general and health-specific forms of media exposure was included with a covariate of *cancer knowledge* (Figure 1).

Measures

The survey items used in this study were from the 2003 Health Information National Trends Survey (HINTS) by the National Cancer Institute (http://hints.cancer.gov/). Topics related to *cancer worry*, *cancer knowledge*, media exposure and demographics were targeted.

Dependent variable

Cancer worry was assessed by a single-item question, "Do you ever worry about getting cancer?" The responses were collapsed into the following categories: never (1), a little (2), some (3), and a lot (4). This simple question has been used to assess worry in other cancer studies (Hay, Coups, and Ford, 2006; Schnur et al., 2006; McQueen et al., 2008).

Independent variables

Socioeconomic Position (*SEP*): *SEP* was measured by education and household income. For education, the respondents were asked to report their highest level of education completed: less than high school; high school or associate degree; college, bachelor's degree or higher. For household income, the respondents were asked about their total household income before taxes: less than $20,000; $20,000-$39,999; $40,000-$59,999; $60,000-$99,999; $100,000 or more. In order to group socioeconomic position related variables in factors with minimal overlap, those two items were subjected to a principal component analysis with a promax oblique rotation (single component with eigenvalue <1), which generated one *SEP* construct (Cronbach's alpha=0.69).

General Media Exposure: General media exposure was assessed with two questions: 1) On a typical weekday, about how many hours do you spend on watching television, listening to the radio, and using the Internet for personal reasons, respectively. 2) During a typical weekend, including both Saturday and Sunday, about how many hours do you spend watching television, listening to the radio, and using the Internet for personal reasons, respectively. We combined these questions and calculated the average exposure times of each medium per day (Cronbach's alpha=0.74).

Health-Specific Media Exposure: Three questions measured health-specific forms of media exposure. Exposure to health information in the past three months was assessed by asking if participants have read, watched,

or listened to health reports on local television news, on a local radio program, or on the Internet, respectively. The results were collapsed into the following categories: not at all, less than once a week, more than once a week (Cronbach's alpha=0.65).

Covariate

We considered *cancer knowledge* as a covariate in the model in accordance with the literature (Wilcox and Stefanick, 1999; Gu et al., 2013). Cancer knowledge in this study was assessed by the following questions (Cronbach's alpha=0.79): Indicate whether each of the following increases a person's chance of getting cancer or decreases a person's chance of getting cancer: exposure to asbestos, exposure to lead in gasoline and paint, air pollution, water pollution, pesticide spraying, pesticides in food, drinking alcohol, smoking, eating a diet that is high in fiber, eating a diet that is low in fat, exercising 3-4 days per week, getting screened/getting tested for cancer, having an annual check-up at the doctor, exposure to second-hand smoke, exposure to radon, and family history of disease/illness. We calculated each individual's score of these sixteen questions and converted them into a percentage, which were coded as the high group (the rate of answering correctly exceeds 80%) and the low group (below 80%), in accordance with the bimodal distribution of the respondents' correct answers.

Statistical analyses

We conducted path analyses to determine the influence of *SEP* on *cancer worry* and how this association is moderated by general and specific forms of media exposure as well as *cancer knowledge*. Two exogenous variables, *SEP* and general media exposure, and the three endogenous variables of health-specific forms of media exposure, *cancer knowledge*, and *cancer worry* were included in the path model of this study. The two exogenous variables are modeled as being correlated and as having both direct and indirect (through health-specific forms of media exposure and *cancer knowledge*) effects on worry. In most real models, the endogenous variables are also affected by factors outside the model (including measurement error). The effects of such extraneous variables are depicted by "e," or the error terms, in the model. The sampling weight of the survey was reflected in the path model. All missing values were replaced by using the regression mean imputation method. Statistical analyses were performed using AMOS version 18.0 (IBM SPSS Institute, Chicago, IL).

Human subjects

This project was approved by the institutional review boards at the Dana-Farber Cancer Institute, Boston, USA.

Results

Sample characteristics

Of the 642 respondents, 45% were men and 55% were women (Table 1). About 40% were between 45 and 59 years of age, and 29% were over 60. Regarding educational background, 47% got a bachelor's degree or higher. Regarding household income, 32% of the respondents had an average household income in the range of $60,000 to $99,999. Regarding *cancer knowledge*, 57% of respondents had a high-level of knowledge about cancer. However, 23% of the respondents had some to a

Table 1. General Characteristics of the Sample (n=642)

	%	n
Gender		
Men	45	289
Women	55	353
Age (years)		
18-29	6.2	40
30-44	24.6	158
45-59	40.2	258
60+	29	186
Education		
Less than high school	4	26
High school	18.1	116
College	31.2	200
Bachelor's degree or higher	46.7	300
Missing	0	0
Household Income		
Less than $20,000	11.7	75
$20,000-$39,999	18.5	119
$40,000-$59,999	16.2	104
$60,000-$99,999	32.4	208
$100,000 or more	21.2	136
Missing	0	0
Cancer Knowledge*		
High (over 80%)	57.3	368
Low (below 80%)	42.7	274
Missing	0	0
Cancer Worry		
A lot	8.3	149
Some	14.5	260
Little	18.9	340
Never	57.7	1038
Missing	0.6	11
General Media Exposure (TV)		
2 hour or less (per day)	18.1	116
2 to 3 hours	40.8	262
4 to 5 hours	22	141
6 hours or more	17.8	114
Missing	1.2	8
General Media Exposure (Radio)		
2 hour or less (per day)	59.3	381
2 to 3 hours	22.4	144
4 to 5 hours	6.1	39
6 hours or more	7.6	49
Missing	4.5	29
General Media Exposure (Internet)		
2 hour or less (per day)	50.2	322
2 to 3 hours	31.5	202
4 to 5 hours	7.6	49
6 hours or more	6.7	43
Missing	4	626
Health-Specific Media Exposure (TV)		
Not at all (per month)	22.4	144
Once a week	40.3	259
Often	35.5	228
Missing	1.7	11
Health-Specific Media Exposure (Radio)		
Not at all (per month)	72.6	466
Once a week	19.8	127
Often	6.7	43
Missing	0.9	6
Health-Specific Media Exposure (Internet)		
Not at all (per month)	41.9	269
Once a week	40.5	260
Often	17.3	111
Missing	0.3	640

*Based on the percentage of correct answers

lot of worry of getting cancer.

About 41% of the respondents watched television on average of two to three hours a day, and 22% of the respondents spent two to three hours listening to the radio. About 32% of the respondents used the Internet for two to three hours per day. With regard to the exposure to health-specific information in the past three months, 40% of the respondents reported watching health reports on the local news once a week. However, a majority of the respondents (73%) answered that they had not listened to a health report on a radio program. About 58% of the respondents read health information on the Internet at least once a week (Table 1).

Fit statistics of the study model

According to the results of the goodness of fit statistics for the study model in Figure 1, all assumptions were checked. The p-values of the chi-square were greater than 0.05, which means that the study model was appropriate because the sample covariance matrix was not significantly different from the estimated covariance matrix. Root Mean-Squared Residual, which is the mean absolute value of the covariance residuals, was less than .05, which is generally considered adequate (Table 2).

Path diagram of the study model as types of mass media

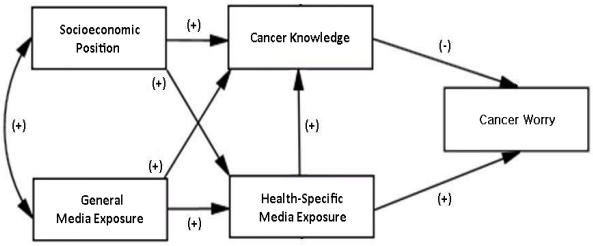

Figure 1. A Conceptual Model of this Study

According to the final diagram in Figure 2, empirical path models generally corresponded with the conceptual model of this study as well as previous studies. The common ground of all three models by media types was as follows. First, *SEP* influenced *cancer worry* under a series of moderating processes. Two conditional paths, *cancer knowledge* (P2→P8) and *health-specific media exposure* (P5→P6→P8), showed statistically significant effects on the relationship between *SEP* and *cancer worry*. Second, the model revealed two paths to reduce *cancer worry*. *High level of cancer knowledge* was directly associated with *low level of cancer worry* (P8). High *health-specific media exposure* by means of television or the Internet was indirectly associated with a *low level of cancer worry* (P6→P8). Third, *health-specific media exposure* was more significant than general media exposure in the path between *SEP* and *cancer worry* (P5→P6). The effect of *health-specific media exposure* was subjected to another conditional process of *cancer knowledge*.

When examined by the medium of exposure, the more health-specific information one was exposed to on television, the more *cancer knowledge* one acquired

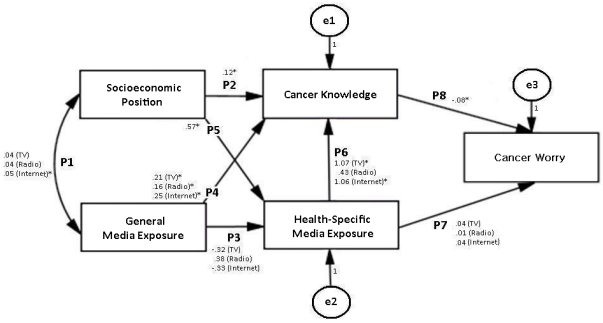

Figure 2. Path Models of Moderating Effect of Health Information between Socioeconomic Status and Cancer Worry

Table 2. Goodness of Fit Statistics of the Hypothetical Model

Indices	Acceptable value	Fitness indices of hypothetical model		
		TV	Radio	Internet
p-value of X^2 (Chi-square statistic)	0.05 or more	0.739	0.842	0.679
Root Mean-squared Residual (RMR)	0.05 or less	0.008	0.006	0.008
Adjusted Goodness of Fit Index (AGFI)	0.90 or more	0.997	0.998	0.996
Normed Fit Index (NFI)	0.90 or more	0.996	0.997	0.994

Table 3. Direct, Indirect, and Total Effect of Path Model (n=642)

	Direct Effect			Indirect Effect			Total Effect		
	TV	Radio	Internet	TV	Radio	Internet	TV	Radio	Internet
Health-Specific Media Exposure									
Socioeconomic position	0.57	0.57	0.57	-	-	-	0.57	0.57	0.57
General media exposure	-0.32	0.38	-0.33	-	-	-	-0.32	0.38	-0.33
Cancer Knowledge									
Socioeconomic position	0.12	0.12	0.12	0.57	0.57	0.57	0.69	0.69	0.69
General media exposure	0.21	0.16	0.25	-0.32	0.38	-0.33	-0.11	0.54	-0.08
Health-specific media exposure	1.07	0.43	1.06	-	-	-	1.07	0.43	1.06
Cancer worry									
Cancer knowledge	-0.08	-0.08	-0.08	-	-	-	-0.08	-0.08	-0.08
Health-specific media exposure	0.04	0.01	0.04	-0.19	-0.04	-0.19	-0.15	-0.03	-0.15
Socioeconomic position (only indirectly)	-	-	-	-0.05	-0.05	-0.06	-0.05	-0.05	-0.06
General media exposure (only indirectly)	-	-	-	0	-0.04	-0.01	0	-0.04	-0.01

(B=1.07, p<0.05) and the lower the levels of *cancer worry* (B=-0.08). Radio, however, had no significant path. On the other hand, the fact that the more health-specific information one was exposed to, the more *cancer knowledge* one acquired also held true for the Internet (B=1.06). In addition, when one had higher *SEP*, he or she was more likely to search on the Internet (B=0.05).

When effect sizes among the paths were examined, *cancer worry* was directly affected by *cancer knowledge* in all three types of media, i.e., television, radio, and the Internet (B=-0.08). However, if we consider the indirect effect, *health-specific media exposure* was more influential on *cancer worry* than *cancer knowledge*. Its effect size was -.15 in total for both television and the Internet. *SEP* exhibited a direct positive relationship with *cancer knowledge* (B=0.12) and was also moderated by *health-specific media exposure* (B=0.57). The total effect of *SEP* on *cancer worry* was -.05. On the contrary, for television and the Internet, general exposure to general media was associated with less health-specific media exposure, but it was not statistically significant (Table 3). Eventually, in comparison with the effect size of *SEP*, the moderating effect of *health-specific media exposure* was prominent, which was strongly associated with *cancer knowledge*. In other words, *cancer worry* was affected by the direct effect of *cancer knowledge* and the indirect effect of *SEP* and health-specific media exposure. Therefore, as *SEP* and *cancer knowledge* decreased, *cancer worry* increased, and this was moderated by health-specific media exposure.

Discussion

The goal of this study was to examine differences in *cancer worry* as a function of socioeconomic position under the moderating process of media exposure (i.e., different types of media and degrees of exposure). Essentially, we investigated how the relationship between *SEP* and *cancer worry* is moderated by general and specific forms of media exposure on three types of mass media. This article sets a theoretical framework for the hypothesized group of relationships by assuming that an excessive and inappropriate disease worry may arouse the avoidance of preventive behavior as well as social misinterpretation. Overall, the results showed that the *cancer worry* differs depending on individual levels of *SEP* under a series of conditional processes. *SEP* influenced *cancer knowledge* directly (B=0.12) and worry indirectly (B=-0.08), as moderated by the levels of media exposure. Specifically, health-specific exposure had a more consistent effect than did general media exposure in lowering *cancer worry* by increasing knowledge about cancer. A higher level of health-specific exposure (B=-0.15) and greater amount of *cancer knowledge* (B=-0.08) lessened worry in the cases of television viewers and Internet users. Therefore, cancer education through the media may attenuate knowledge gaps to reduce *cancer worry*.

As expected, the level of *cancer knowledge* was higher in those who reported greater exposure to health-specific information, and *cancer worry* was lower in those with a high level of *cancer knowledge*. At the same time, the negative relationship between knowledge and worry was indirectly associated with *SEP*. Accordingly, a higher level of health-specific exposure (B=-0.15) and greater amount of *cancer knowledge* (B=-0.08) lessened *cancer worry* in the cases of television viewers and Internet users. In other words, media exposure may have influenced individuals' emotional responses, i.e., *cancer worry*, through a series of indirect associations. Although the path between *SEP* and general media exposure, television and radio, was not significant, the low-*SEP* group was more likely to have *cancer worry* with insufficient *cancer knowledge* than the high-*SEP* group. However, among low-*SEP* groups, those who were frequently exposed to health information were less likely to have *cancer worry*. These findings show that it might be possible to reduce *cancer worry* among low-*SEP* groups by increasing their exposure to health information, as their *cancer knowledge* can increase by means of television and the Internet.

Taken together, this set of findings reveals that there may be important communication inequalities among social groups with respect to cancer and its associated cognitions. Many indicators of *SEP* are also related to the use of and exposure to media and information channels, which in turn are related to health knowledge (Viswanath, 2005; 2006; Viswanath et al., 2006; Viswanath et al., 2007). Consistent with the findings of these previous studies, the present findings revealed that media exposure could affect the interplay between *SEP*, *cancer knowledge*, and *cancer worry* (Ackerson and Viswanath, 2010; Witte and Allen, 2000). *SEP* may influence the level of worry through its direct positive relationship with *cancer knowledge* level, whereas media exposure may indirectly increase *cancer knowledge* level through moderating a process of health-related information exposure.

This study also reveals specific differences according to media types. For Internet users and television viewers, higher *SEP* is positively associated with health-specific forms of media exposure, and so they had a high possibility of increasing their *cancer knowledge* level. This result may be related to the consistency and reliability of health information. People in higher *SEP* are more educated and have more convenient access to health information which makes them more able to acquire *cancer knowledge*. Since there is a limit as to how much information people can pay attention to, it is important that mass media provide them with verified and coherent information. Without clear information about the risk of contracting different diseases, it may be difficult for individuals to seek information, assess its importance, and obtain knowledge regarding their own health (Ackerson and Viswanath, 2010; Galarce et al., 2011). Although the mass media is one of the key channels for the general public to obtain health-related information (Schwitzer et al., 2005; Viswanath et al., 2006), only a few health issues come under the media spotlight and not always in proportion to their influence over public health (Frost, Frank, and Maibach, 1997; Pribble et al., 2006). In addition, the media sometimes provide conflicting information to the public, thereby making it hard for them to judge which information is beneficial for their health (Hornik, 2002). Nevertheless, mass media plays a critical role in shaping the public's risk perception, including emotional reactions,

and in encouraging them to make health actions (Menashe and Siegel, 1998; Rodgers and Thorson, 2001; Dudo et al., 2007; Kim and Willis, 2007). This study provides evidence that general and specific forms of media exposure, in turn, may improve people's access to health messages and develop necessary knowledge. This finding is in line with the results of previous studies that information seekers are more likely to have high risk perception and knowledge in the case of chronic disease (Kellens, Zaalberg, De Maeyer, 2012; Katapodi et al., 2004; Vernon et al., 1993).

Several limitations should be noted. As with any cross-sectional analyses, this study is open to limitations regarding reverse causation. While it is possible that a certain socio-demographic group who are at risk of developing cancer may be more likely to pay attention to health news, there was no statistical difference between perceived cancer threat and their socio-demographic attributes except for *cancer knowledge* (Katapodi et al., 2004; Schnur et al., 2006). Therefore, it is more reasonable that the degrees of media exposure bring about the difference of *cancer worry*, and not the other way around. So, our findings offer a foundation for future research focused on strengthening the causal inference. The use of an one-item assessment of *cancer worry* might not be ideal but it has been shown to be an acceptable measure of worry in other previous studies (Schnur et al., 2006).

The relationship between media exposure and *cancer knowledge* is consistent with the fact that there is differential access and exposure to information services, such as the television and the Internet, among different social groups (Viswanath, 2006; Jung, 2013). The advantages from the increased availability of information may apply to the high-*SEP* group compared to the low-*SEP* group, a phenomenon characterized as a knowledge gap (Viswanath and Finnegan, 2002). This study, however, shows positive relationships driven by health information exposure which moderate between general media use and *cancer knowledge*. It can be interpreted that the public's level of *cancer knowledge* is assumed to increase if we delve further into the given health information and try to understand it more specifically. Thus, *cancer knowledge* acquisition through the media can be an intervention channel for reducing *cancer worry*. At the same time, the media should reliably report the health risk of cancer so that individuals can use this information to accurately assess their own health needs.

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