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Correlates and Geographic Patterns of Knowledge That Physical Activity Decreases Cancer Risk

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Abstract

While many lifestyle-related cancer risk factors including tobacco use, poor diet, and sun exposure are well recognized by the general public, the role of physical activity in decreasing cancer risk is less recognized. Studies have demonstrated gender-, race/ethnicity-, and age-based disparities in cancer risk factor knowledge; however, beliefs and geographic factors that may be related to knowledge are under-examined. In this study, we analyzed data from the 2008 Health Information National Trends Survey to determine correlates of knowledge of the relationship between physical activity and reduced cancer risk in the adult US population. We generated geographic information system maps to examine the geographic distribution of this knowledge. Results revealed that there is confusion among US adults about the relationship between physical activity and cancer risk: Respondents who believed that cancer is not preventable had significantly lower odds of knowing that physical activity reduces cancer risk ($p < .001$) whereas respondents who believed that cancer is caused by one's behavior had almost two times the odds of knowing that physical activity reduces cancer risk ($p < .001$). Those who were aware of current physical activity guidelines were also significantly more likely to know that physical activity reduces cancer risk ($p < .01$). Observed geographic variability in knowledge was consistent with geographic trends in obesity and physical inactivity. Correlates of cancer risk factor knowledge point to opportunities for targeted interventions.

Keywords

Cancer risk perceptions; Cancer knowledge; Physical activity

Introduction

Over half of cancer mortality in the United States can be attributed to lifestyle behaviors including tobacco use, poor diet and lack of physical activity, alcohol overuse, excess exposure to ultraviolet radiation, and sexually transmitted viral exposures (Colditz et al., 1996; Doll & Peto, 1981; Willett et al., 1996). A growing body of research indicates the benefits of physical activity in cancer prevention and control over and above the other well-known health benefits of exercise (Kushi et al., 2012; Winzer et al., 2011). Despite the noted benefits of regular exercise, almost one-quarter of US adults report not being physically active in the past month (Centers for Disease Control and Prevention [CDC], 2012). Furthermore, in certain areas of the country, such as the South and Southeast, rates of physical inactivity reach almost 30 % (CDC, 2012).

Modification of risk behaviors is fundamental to reducing the cancer risk burden at the individual and population levels; thus, substantial public health and cancer control efforts have focused on educating the general public about evidence-based modifiable cancer risks (Ellis et al., 2005; Hiatt & Rimer, 1999). Research examining public awareness of modifiable cancer risk factors suggests that efforts to educate the public about cancer risk factors have been moderately successful. Generally high levels of awareness of associations between cancer and certain risk factors, such as tobacco use, poor diet, human papillomavirus infection, and exposure to ultraviolet radiation, have been reported (Finney Rutten et al., 2008; Hawkins et al., 2010; Keeney et al., 2009). However, awareness of cancer risk factors for which scientific evidence has more recently emerged, such as lack of physical activity, appears to be much lower (Hawkins et al., 2010).

Previous research has explored knowledge of the link between physical activity and cancer risk with a specific focus on racial/ethnic disparities in this knowledge (Oh et al., 2010). Key findings from this prior research revealed lower awareness of the association between physical activity and reduced cancer risk among non-Hispanic blacks, particularly those with lower levels of education, compared with non-Hispanic whites (Oh et al., 2010).

The primary aim of the current study was to expand prior efforts to explore the ways in which knowledge of physical activity recommendations and cancer risk perceptions are associated with knowledge of the link between physical activity and reduced cancer risk, after controlling for sociodemographic characteristics. Specifically, our analysis investigated the following three research questions: (1) Is knowledge of physical activity recommendations independently associated with knowledge about the link between physical activity and cancer risk? (2) Are beliefs about the controllability of cancer independently associated with knowledge about the link between physical activity and cancer risk? (3) Are there geographic differences in knowledge about the link between physical activity and cancer risk?

Methods

Data Collection

Data for the 2008 Health Information National Trends Survey (HINTS) were collected using a mixed-mode, dual-frame survey design ($N = 7,674$) including a list-assisted random digit dial frame ($n = 4,092$ adults) and a US Postal Service mail frame ($n = 3,582$). The household response rate for this component was 40 % and the within-household response rate was 77.4 %. Prior research examining mode effects for items with potential for respondent bias in HINTS 2008 indicated that there were no significant differences in responses to our primary outcome variable by mode (Peytchev et al., 2010). Additional details on the study design, methods, and operations of HINTS have been published elsewhere (Cantor et al., 2009).

Measures

Knowledge of Association Between Physical Activity and Cancer Risk—The following question was asked to assess respondents' knowledge of the link between physical activity and cancer risk: "As far as you know, does physical activity or exercise increase the chances of getting some types of cancer, decrease the chances of getting some types of cancer, or does it not make much difference?" Responses to this item were coded as correct ("decrease the chances of getting some types of cancer") or incorrect ("increase the chances of getting some types of cancer," it does "not make much difference," and "don't know").

Sociodemographic Characteristics—The following sociodemographic variables were assessed and included in our analyses: age, gender, education, and race/ethnicity. Age was categorized into the following groups: 18–34, 35–49, 50–64, 65–74, and 75 and older. Level of education was categorized as follows: less than high school, high school diploma or G.E.D., some college or technical school, and college degree. Race/ethnicity was categorized as follows: non-Hispanic white, Hispanic, non-Hispanic black, and non-Hispanic Asian.

Knowledge About the CDC's Recommendations for Physical Activity—The following two questions were asked to assess respondents' knowledge of the CDC's physical activity recommendations: (1) "How many days a week of physical activity or exercise are recommended for the average adult to stay healthy?" (2) "On those days, how long should the average adult be physically active to stay healthy?" Responses to these items were open-ended, allowing respondents to indicate the recommended number of days per week and number of minutes or hours per day of physical activity. Our categories for accurate knowledge of physical activity recommendations were based on current physical activity guidelines developed by the American College of Sports Medicine, which recommend a minimum of 30 min of moderate-intensity exercise on 5 days per week for adults. We recoded these HINTS items employing a strategy described in a prior publication of HINTS data (Bennett et al., 2009). Accuracy of knowledge was defined according to the 1995 CDC recommendation for moderate-intensity physical activity (Pate et al., 1995), with the modifications for intensity and duration of physical activity introduced by the American College of Sports Medicine and the American Heart Association (Haskell et al., 2007). For duration of physical activity, responses of 30 min or greater were coded as accurate and

responses less than 30 min were coded as inaccurate. For frequency of physical activity, responses of 5–7 days per week were coded as accurate and all responses less than 5 days were coded as inaccurate. Accurate knowledge of the moderate-intensity of physical activity recommendation was thus defined according to accurate knowledge for both duration (at least 30 min) and frequency (5–7 days per week).

Perceptions of Cancer Causes and Controllability—Respondents were asked to indicate the extent to which they agreed with several beliefs about cancer causes and controllability: “Cancer is most often caused by a person’s behavior or lifestyle”; “it seems like everything causes cancer”; “there’s not much you can do to lower your chances of getting cancer”; and “there are so many different recommendations about preventing cancer, it’s hard to know which ones to follow.” Response options for these questions were “strongly agree,” “somewhat agree,” “somewhat disagree,” “strongly disagree,” and “don’t know.” For the purposes of this analysis, “don’t know” responses were treated as missing and the strongly/somewhat responses were combined for each item, resulting in four unique dichotomous variables indicating agreement or disagreement with each statement. These items had low correlations (–0.01 to 0.26).

Data Analysis

To account for the complex survey design of HINTS, we conducted a weighted analysis using the survey module in STATA version 10.0 in order to calculate accurate population parameter estimates and confidence intervals for the US adult population.

Multivariable logistic regression analysis was used to examine current knowledge of the association of physical activity with reduced cancer risk in the adult US population and the associated behavioral factors, while controlling for key sociodemographic characteristics.

A geographic information system (GIS) isopleth map was generated to explore regional geographic trends in knowledge of the association between physical activity and reduced cancer risk (Kaw & Kalu, 2011); state-level estimates are not available due to instability related to small sample sizes (Finney Rutten et al., 2008). A weighted head-banging algorithm was applied to reduce the impact of random variability and outlying values that are often present in raw data. The Spline interpolation method estimates values using a mathematical function that minimizes overall surface curvature. This interpolation method was selected to ensure stability and precision of calculations with the large sample size.

Results

Sample Characteristics and Univariate Distributions

Of the weighted sample, about half was female (51.3 %), and 70.7 % were non-Hispanic white (Table 1). Sixty percent were less than 49 years of age. One-quarter (24.7 %) did not complete high school, while 13.9 % had a college degree or higher.

More than half of the weighted sample (59.8 %) correctly answered that exercise decreases the risk of some cancers, while just 37.6 % knew that current recommendations suggest individuals perform moderate physical activity for at least 30 min per day on at least 5 days

per week. There was substantial variation in beliefs about cancer controllability: About half agreed or strongly agreed with the statements “cancer is most often caused by a person’s behavior or lifestyle” (50.2 %) and “it seems like almost everything causes cancer” (54.9 %). Just over one-quarter (28.1 %) believed that “there’s not much a person can do to lower their chances of cancer.” Three-quarters (75.4 %) reported that “there are so many recommendations about preventing cancer, it’s hard to know which ones to follow.”

Correlates of Knowledge about Physical Activity and Cancer Risk (Research Questions 1 and 2)

After adjusting for sociodemographic factors, respondents who knew the current physical activity recommendations had 25 % higher odds of knowing that physical activity decreases cancer risk, compared with those who did not know the current physical activity recommendations ($p < .01$; Table 2).

Certain cancer controllability beliefs were independently associated with knowledge of the link between physical activity and cancer risk (Table 2). After adjusting for sociodemographic factors, respondents who believed that cancer is not preventable had less than half the odds of knowing that physical activity decreases cancer risk, compared with those who did not believe that cancer is unpreventable ($p < .001$). In addition, respondents who believed that cancer is caused by one’s behavior had nearly twice the odds of knowing that physical activity decreases cancer risk, compared with those who did not believe that cancer is caused by one’s behavior ($p < .001$). Beliefs about cancer controllability captured by responses to the statements “it seems like almost everything causes cancer” and “there are so many recommendations about how to prevent cancer, it’s hard to know which ones to follow” were not significantly associated with knowledge of the link between physical activity and cancer risk.

Geographic Patterns of Knowledge (Research Question 3)

Geographic variability in knowledge of the association between cancer risk and physical activity was observed (Fig. 1). The highest proportion of the population with correct knowledge of this association was located in the Pacific Northwest and Western regions of the United States, with a decreasing trend in this proportion evidenced into the Midwest and Eastern regions. Additional pockets of the highest proportion were located in the coastal Mid-Atlantic regions, expanding from the Washington Metropolitan Area up to Massachusetts. The lowest proportion of the population with correct knowledge of this association was observed in the Southern United States, particularly the Southeast region.

Discussion

In this study, we analyzed national cancer communication surveillance data to identify correlates of cancer risk factor knowledge as it relates to physical activity and illustrated geographic trends in this knowledge with GIS mapping. We found that individuals who are aware of current physical activity recommendations have higher odds of knowing that physical activity decreases cancer risk than those who are not aware to know. Two dimensions of cancer controllability were associated with knowledge of the link between

physical activity and decreased cancer risk: Individuals who believed cancer is not preventable had lower odds of having this knowledge whereas individuals who recognize the link between behavior and cancer had higher odds of acknowledging the relationship between physical activity and decreased cancer risk. Importantly, perceptions of cancer controllability emerged as independent correlates after controlling for the race/ethnicity-, age-, and education-based disparities in this knowledge previously identified by Oh et al. (2010). These results suggest that outreach and education efforts aimed at improving cancer risk knowledge should encompass broad messages about cancer controllability through lifestyle choices.

The observed geographic variability in knowledge of the link between cancer risk and physical activity is consistent with geographic trends in obesity and physical inactivity derived from the CDC's 2010 Behavioral Risk Factor Surveillance System (CDC, 2012). Geographic areas with the highest proportion of the population with correct knowledge of the link between cancer risk and physical activity, such as the Pacific Northwest, the West, and the Mid-Atlantic coast, tend to exhibit higher levels of physical activity and lower levels of obesity. Additionally, geographic areas with the lowest proportion of the population with correct knowledge of the link between physical activity and cancer risk, such as the South, tend to exhibit lower levels of physical activity and higher levels of obesity. While it is not possible to derive causal associations between these factors from the observed overlap in geographic trends, it is interesting to note such parallels, particularly in light of prior research (Oh et al., 2010) pointing to the persistence of the association between perceptions of cancer controllability and knowledge of the association between physical activity and cancer risk, after controlling for key sociodemographic variables.

Limitations

While our findings are important, they must be placed into context, recognizing certain limitations, including the cross-sectional design of HINTS. This study provided a unique visualization of cancer risk factor knowledge, demonstrating that there is a widespread need for improved education, but it did not examine why that knowledge is lacking for so many individuals. It may be that there has been relatively little public information (i.e., in mass media) about the link between physical activity and cancer risk, or that there has been confusing information about this link.

Finally, it is important to acknowledge that the primary outcome in this study, knowledge, is not the same as actual behavior, and we measured a single dimension of cancer risk knowledge using a single question. However, several health behavior theories and behavior change models propose that an important predictor of whether individuals will adopt a prescribed behavior is the extent to which they believe the behavior will lead to a desired outcome (Becker, 1974; Fishbein & Ajzen, 2010; Prochaska & DiClemente, 1983). In fact, research has shown positive associations between awareness of cancer risk factors and related prevention recommendations and adherence to such recommendations (Hammond et al., 2004; Harnack et al., 1997; Hay et al., 2003). In the case of physical activity, knowledge of its role in cancer risk reduction may be a more powerful motivator to engage in physical activity than the multiple other health conditions and diseases (e.g., obesity, diabetes, heart

disease) (Cancer Research UK, 2011) with which physical activity is also associated. This is, however, an empirical question. Further research is needed to assess associations between understanding the reduction in cancer risk associated with physical activity and behavior change.

Implications

Our findings can inform message development related to daily exercise guidelines and recommendations, exercise as a way to reduce cancer risk, and increased self-efficacy in preventing cancer. Research by Niederdeppe and Levy (2007) has indicated that individuals who thought cancer was not preventable were significantly less likely to exercise on a weekly basis, highlighting the need to educate, motivate, and engage individuals in changing their personal cancer risk. Bennett et al. (2009) reported that only one-third of US adults are knowledgeable of national physical activity guidelines, and such knowledge was notably lower among men, unemployed individuals, US born individuals, and those not currently meeting physical activity recommendations. Given our finding that awareness of physical activity guidelines was positively associated with knowledge of physical activity and decreased cancer risk, creative and broad-reaching strategies are needed to promote physical activity recommendations among the general public and specific population groups.

Another potential direction for message development is the observed relationship between knowledge about physical activity and cancer risk and fatalistic beliefs about cancer causes. We speculated above that cancer may be perceived as a particularly strong motivator for behavior change. While there are economic, structural, community, and environmental factors that influence individuals' ability to engage in physical activity (Kushi et al., 2012), physical activity is within many people's control; knowing that it can decrease the risk of cancer may provide a powerful antidote to feelings of powerlessness many feel with regards to cancer prevention. Research to further explore these interesting possibilities is warranted. Using findings from the present analysis to inform message development may be helpful in addressing the ambiguity in cancer prevention recommendations as perceived by the general public (Han et al., 2009).

The strategies suggested to improve population knowledge of cancer risk factors have public health implications beyond individual-level behavior change. In this vein, education is a single and perhaps first step toward behavior change. To truly enable change, research within communities to understand multi-level barriers to engaging in physical activity is needed. For example, campaigns that improve population knowledge may work by shifting norms about physical activity (Hornik, 2002). Raising public awareness and improving knowledge about cancer risk factors may increase support for public policies designed to influence relevant risk behaviors (Blake et al., 2009). For example, Niederdeppe et al. (2012) identified several beliefs that were both malleable and associated with policies to increase the price of high-fat and high-sugar foods.

Tracking population knowledge of the association between physical activity and cancer risk reduction can inform cancer control efforts and population health communication (Hawkins et al., 2007). Identifying characteristics of populations who remain unaware of the

demonstrated cancer risk reductions associated with regular physical activity can guide health communication efforts and promote greater efficiency in targeting behavioral interventions to specific populations (Oh et al., 2010). Future research may consider examining the moderating effects of fatalism and race/ethnicity and other sociodemographic factors on cancer risk factor knowledge and prevention behaviors. Further research may also consider differences within smaller geographic areas. Such research may shed light on the extent to which race/ethnicity or other sociodemographic characteristics that also cluster by neighborhood may influence knowledge of cancer causes and risk. Finally, research combining communication campaign exposures—especially within smaller geographic areas—with knowledge outcomes can be useful for evaluating the successes and failures of campaigns to reach particular audiences.

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Fig. 1.
GIS map showing US geographic distribution of accurate knowledge of the relationship between physical activity and cancer risk

Table 1

Sample characteristics (weighted)

Characteristic	Percentage
Sociodemographic characteristics	
Female (<i>n</i> = 7,665)	51.4
Race/ethnicity (<i>n</i> = 6,956)	
White, non-Hispanic	70.7
Black, non-Hispanic	11.7
Hispanic	13.1
Asian, non-Hispanic	4.6
Age (<i>n</i> = 7,594)	
18–34	30.8
35–49	29.6
50–64	23.1
65–74	8.4
75+	8.1
Education (<i>n</i> = 7,674)	
Less than high school	24.7
High school diploma or G.E.D.	34.8
Some college or technical school	26.6
College degree	13.9
Correct knowledge about outcome (exercise decreases risk of cancer) (<i>n</i> = 7,075)	59.8
Correctly identified exercise frequency and duration recommendations (<i>n</i> = 6,130)	37.6
Beliefs about cancer controllability (% agree or strongly agree with)	
“Cancer is most often caused by a person’s behavior or lifestyle.” (<i>n</i> = 7,270)	50.2
“It seems like almost everything causes cancer.” (<i>n</i> = 7,235)	54.9
“There’s not much a person can do to lower their chances of getting cancer.” (<i>n</i> = 7,262)	28.1
“There are so many recommendations about preventing cancer, it’s hard to know which ones to follow.” (<i>n</i> = 7,250)	75.4

Table 2

Correlates of accurate knowledge about physical activity and cancer risk (weighted)

Characteristic	Accurate knowledge of association between physical activity and reduced cancer risk (0 = No, 1 = Yes)	
	<i>N</i> = 5,631 OR (95 % CI)	<i>N</i> = 6,542 OR (95 % CI)
Gender (ref: male)	1.00	1.00
Female	1.00 (0.74, 1.33)	1.13 (0.96, 1.32)
Race/ethnicity (ref: White, non-Hispanic)	1.00	1.00
Hispanic	0.99 (0.74, 1.33)	1.08 (0.79, 1.48)
Black, non-Hispanic	0.60^{***} (0.44, 0.83)	0.61^{***} (0.48, 0.77)
Asian, non-Hispanic	0.69 [†] (0.45, 1.07)	0.75 (0.48, 1.18)
Age (ref: 18–34)	1.00	1.00
35–49	0.88 (0.65, 1.18)	0.90 (0.70, 1.16)
50–64	0.96 (0.74, 1.24)	0.94 (0.76, 1.17)
65–74	0.72[*] (0.54, 0.95)	0.76[*] (0.59, 0.96)
75+	0.55^{***} (0.41, 0.76)	0.65^{**} (0.48, 0.87)
Education (ref: college degree)	1.00	1.00
Some college	0.70^{***} (0.56, 0.86)	0.72^{***} (0.60, 0.87)
High school graduate	0.47^{***} (0.39, 0.58)	0.49^{***} (0.31, 0.56)
Less than high school	0.38^{***} (0.28, 0.58)	0.42^{***} (0.35, 0.52)
Knowledge of physical activity recommendations (≥ 30 min/day and ≥ 5 days/week = 1; <30 min/day and/or <5 days/week = 0)	1.25^{**} (1.05, 1.50)	
Beliefs about cancer controllability (agree/strongly agree = 1; disagree/strongly disagree = 0)		
“Cancer is most often caused by a person’s behavior or lifestyle”		1.91^{***} (1.64, 2.23)
“It seems like almost everything causes cancer”		0.97 (0.82, 1.16)
“There’s not much a person can do to lower their chances of getting cancer”		0.42^{***} (0.35, 0.52)
“There are so many recommendations about preventing cancer, it’s hard to know which ones to follow”		0.91 (0.77, 1.06)

Bold text indicates statistically significant values

[†]
p < .10;^{*}
p < .05;^{**}
p < .01;^{***}
p < .001