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Perceptions of Cancer Risk: Differences by Weight Status

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Introduction

Cancer is the second leading cause of death in the United States (US) [1]. The National Cancer Institute (NCI), the Centers for Disease Control, and the National Center for Health Statistics predicted a total of 1,638,910 new cancer cases and 577,190 cancer deaths in 2014 [2]. The most commonly diagnosed cancers among men are prostate, lung, and colorectal; the most fatal types of cancer in men are lung, prostate, colorectal, and liver. The most commonly diagnosed cancers among women are breast, lung, and colorectal; the most fatal types of cancer in women are lung, breast, and colorectal [3]. The most commonly known and discussed risk factor for cancer is a positive family history; 89% of Americans believe that inherited predisposition or cancer genes have a significant effect in developing cancer [4]. First, second, or third degree familial history of specific cancers increases individual risk of cancer at both the same and other locations [5]. This link has been proven in colorectal, breast, ovarian, and uterine cancer for women and prostate cancer for men [5,6,7,8,9]. However, the majority of cancer patients (more than 85% of women with breast cancer) do not have a family member with the disease suggesting that other, lifestyle-related risk factors that are modifiable are at play [10,11].

Obesity, defined as having a body mass index (BMI) ≥30 kg/m^2, is a major public health problem. In 2013, 35% of adults in the US were obese with an additional 34% considered overweight (BMI between 25–29.9 kg/m^2) and at risk of becoming obese [11,12]. Each year in the US, 400,000 deaths and $117 billion in health care and related costs are attributed to obesity [12,13]. Obesity has been identified as a major, modifiable risk factor for cancer and has been associated with cancer development at several organ sites for both men and women [4]. The link between food, nutrition, physical activity and cancer risk was initially explored in a comprehensive review published by the World Cancer Research Fund (WCRF) in 2005

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and 2007 [14]. A meta-analysis by Renehan et al. extended the WCRF findings to confirm, among men, strong relationships exist between excess BMI (based on 5 kg/m2 increase) and esophageal adenocarcinoma, thyroid cancer, kidney cancer, and colon cancer [15]. Among women, results also confirmed strong relationships between endometrial cancer, gallbladder cancer, kidney cancer, and esophageal cancer, similar to the 2007 WCRF report [15]. Obesity has been shown to increase the risk of cancer as well as cancer mortality rates by 10% per 5 kg/m^2 weight increase [15]. The association between obesity and cancer is so significant that national cancer prevention and cancer survivorship guidelines have recommended an active lifestyle and maintaining a healthy body weight (BMI between 20–25 kg/m^2) for the prevention of cancer and optimal health as a cancer survivor [16, 17]. Engaging in healthy behaviors, including consuming a healthy diet, getting adequate physical activity, and participating in annual cancer screenings, can play a significant role in improving health outcomes and quality of life.

Awareness of one's risk of developing cancer is an essential first step in taking action to change behaviors to lower the risk of developing cancer. Previous research has shown that there is a significant association between family history of cancer and cancer risk perceptions [18]. The 2015 American Institute for Cancer Research (AICR) Cancer Risk Awareness Survey Report documented that 89% of respondents cited family history (or cancer genes) as a risk factor for cancer [4]. Women with a personal and family history of cancer were more likely than individuals without any cancer history to worry about getting cancer or believe that they will get cancer in the future, and disagree that cancer is caused by behavioral or lifestyle factors [19]. This link has been studied primarily in women regarding breast cancer. Women with a family history of breast cancer report having greater perceived breast cancer risk compared to women without breast cancer family history, which may be attributable to the increased attention to, and availability of, the breast cancer susceptibility genetic test [18, 20, 21, 22]. Yet, other prominent and modifiable risk factors for cancer may not alter cancer risk perceptions. Despite obesity being identified as a significant risk factor for cancer development and recurrence, awareness of obesity as a risk factor for cancer is suboptimal and those who are obese often do not have heightened perception of risk [12, 23, 24]. In fact, the AICR report documented that only little more than half of respondents (52%) correctly identified obesity as a risk factor for cancer [4]. However, the study only assessed average risk of getting cancer as opposed to one's personal risk based off of his or her personal characteristics and behaviors. The research evaluating weight status and personal cancer risk perceptions is extremely limited. This data is needed to develop effective, theory-driven interventions to promote a healthy lifestyle before and after a cancer diagnosis. To determine if absolute and relative risk perceptions of cancer vary in women by weight status, data from the NCI's Health Information National Trends Survey (HINTS 4, Cycle 1) were analyzed [25, 26].

Methods

This study analyzed data from the HINTS 4 (Cycle 1), a nationally representative survey that collected data on the American public's need for, access to, and use of health-related information and health-related behaviors, perceptions, and knowledge. HINTS 4 (Cycle 1) recruited American adults aged 18 and older, between October 2011 and February 2012,

using a self-administered mailed questionnaire. Additional details about the HINTS survey, sampling framework, and study purposes have been published previously [27,28]. The HINTS 4 (Cycle 1) sample consisted of 3,959 respondents and the final response rate was 36.7%. In this analysis, respondents that did not provide data on their age (n=68), absolute cancer risk perceptions (n=120), relative cancer risk perceptions (n=130), family history of cancer (n=322), and weight status (n=229) were excluded. Subjects with a BMI less than 18.5 kg/m^2 were excluded due to limited ability to make meaningful comparisons to the other groups in the models (n=69). We also excluded respondents with a positive personal history of cancer (n=563), as that would likely alter their risk perceptions. A total of 2,585 cases subjects were included in this analysis.

Variables

Main Independent Variable—Weight status was determined using the calculated BMI determined from self-reported height and weight measures. We were able to categorize subjects into three weight categories: healthy weight (BMI 18.5–24.9 kg/m^2), overweight (BMI 25.0–29.9 kg/m^2), and obese (BMI≥30 kg/m^2).

Outcome Variables—Absolute risk perception was measured using one question: How likely are you to get cancer in your lifetime? Relative risk perception was assessed using the question: Compared to other people your age, how likely are you to get cancer in your lifetime? Response options to both questions were a five point Likert scale, which ranged from very unlikely to very likely.

Patient Characteristics

Socio-demographics: Socio-demographic items included gender (male or female), age (18–39, 40–49, 50–59, 60–69, and 70+), race/ethnicity (Non-Hispanic White, Non-Hispanic Black and/or African American, Hispanic, and Other), educational attainment (less than high school, high school/equivalent, some college, 4-year college+) and income (<$20,000, $20,000–$49,999, $50,000–$99,999, >$100,000).

Medical History: Family history of cancer was assessed using one question: Have any of your family members ever had cancer? Two cancer history groups (positive and negative family history of cancer) were utilized to determine the association between family history and cancer beliefs.

Behavioral Risk Factors: Smoking status was determined using two questions: Have you smoked at least 100 cigarettes in your entire life and how often do you smoke cigarettes? Subjects were defined as a smoker if they answered “yes” to the first question and either “every day” or “some days” to the second question. Physical activity was assessed using two questions: 1. In a typical week how many days do you do any physical activity or exercise of at least moderate intensity, such as biking, walking, etc. and 2. How much time do you spend doing the activities from the previous question (minutes and hours). Adherence to the physical activity goal was defined, according to national physical activity recommendations, as participating in at least 150 minutes per week of moderate intensity exercise [16].

Statistical Analysis

All data were weighted to yield nationally representative estimates by using final sample weights and a set of jackknife replicate weights from the HINTS database. Means and standard deviations (SDs) or frequencies were used to summarize socio-demographics, weight, physical activity goal adherence, smoking status, and absolute and relative cancer risk perceptions. Percentages summarized the level of perceived risk (absolute and relative), among those who were a healthy weight versus overweight or obese. Proportional odds logistic regression assessed the association of BMI status with perceived risk (absolute and relative) of cancer. Additional logistic regression models examined family history as a predictor of absolute and relative risk perceptions for cancer. Backward stepwise selection identified control variables (i.e., race and age) that had statistically significant effects on the outcome variables (perceived absolute and relative risk of cancer). Statistical significance was assessed at an alpha of 0.05. The analysis was carried out in SAS® Version 9.3.

Results

Our study sample consisted of 2,585 participants who satisfied the study inclusion criteria. The mean reported age was 51.55 (±0.62) years and the mean BMI was 28.15 (±0.25) kg/m^2. The study demographics categorized by weight status are shown in Table 1. There were significantly more females included in this study than males. There were also significant gender differences between all three BMI categories, in particular between the healthy and overweight groups. The healthy weight respondents were significantly younger than the overweight respondents as well as the obese respondents. Non-Hispanic Black and Hispanic groups were significantly more overweight and obese compared to the Non-Hispanic White group. There were statistically significant differences in education levels across all three BMI categories, most notable between the healthy and obese groups. Compared to obese participants, healthy and overweight participants were more physically active.

Absolute and relative risk perceptions of developing cancer differed significantly between those with and without family history of cancer (Table 2). Participants with family history of cancer were significantly more likely to have increased absolute (OR=4.30) and relative (OR=3.82) risk perceptions of cancer and believe that they are more susceptible to cancer compared to individuals without a family history of cancer.

Absolute and relative risk perceptions of developing cancer by weight status are shown in Table 3. Absolute risk perception of cancer increased as weight increased yet was not statistically different between weight groups. Relative risk perceptions of cancer also trended upwards as weight increased and did vary by weight status with obese subjects significantly more likely to state that they were likely/very likely to get cancer in their lifetime compared to other people their age than healthy weight subjects (OR=1.51).

Absolute and relative risk perceptions are stratified by weight status and family history of cancer in Figure 1. For both absolute and relative risk perceptions, subjects with a family history of cancer were significantly more likely to have an increased risk perception across all three BMI groups ($p<.0001$). Within subjects that had no family history of cancer, there

were no significant differences in absolute or relative risk perception between BMI groups. Within subjects that had a reported family history of cancer, obese subjects were more likely to report an increased relative risk perception compared to healthy weight subjects (p=.0081). In a multivariate model adjusted for age, gender, race and education, this association remained significant (p=0.0310).

Discussion

Family history is a well-known risk factor for cancer; those who have a family history of cancer are more likely to perceive their own personal risk as higher compared to those without a family history of cancer [5, 12, 18, 19, 20, 21]. In our study, those with a family history of cancer were 4.24 times more likely to have an increased absolute risk perception and 3.78 times more likely to have an increased relative risk perception of getting cancer compared to those without a positive family history. Kowalkowski et al. found similar results in their analysis of the HINTS 2007 data; individuals with family history of cancer were 3.55 times more likely to worry about getting cancer and 8.81 times more likely to agree that they will develop cancer in the future [18].

Our HINTS data showed a trend in increasing cancer risk perceptions with increased BMI. However, we only demonstrated a significant difference in relative risk perception between healthy and obese participants (p=.0027). Obese subjects were 13% more likely to have an increased relative risk perception and stated that they were likely or very likely to get cancer in their lifetime compared to other people their age, compared to those of a healthy weight. This difference was also seen when the data was stratified by family history of cancer (p=.0081); among subjects with a positive family history, obese subjects were 14% more likely to have an increased relative risk perception of cancer and stated that they were likely or very likely to get cancer in their lifetime compared to other people their age, compared to healthy weight subjects. Educational interventions with an explanation of an individual's risk have been shown to reduce the gap between actual risk and perceived risk [29]. Improving accuracy of risk perception may lead to increased awareness of risk-reducing behaviors.

In our study, absolute risk perceptions of developing cancer did not differ based on weight status suggesting that those with a higher BMI did not understand the increased cancer risk associated with excess weight. This lack of increased awareness is consistent with an AICR report, which found that only 49% of female respondents and 56% of male respondents noted that obesity is a cancer risk factor [4]. When stratified by family history, there was still no significant difference in absolute risk perception between any of the weight categories. Prior research has shown that those with a cancer history are more likely to believe that cancer is caused by genetics alone and disagree with the idea that cancer is caused by a person's behaviors [16,30]. Therefore, it is especially important to educate overweight and obese patients with and without a positive family history of cancer about their increased risk of cancer and the lifestyle modifications required to reduce risk of cancer. Informing those with an elevated risk of cancer that their risk can be lowered by altering behaviors that effect their weight, including maintaining a healthy diet and an adequate level of physical activity, may be impactful [29,31].

Race, age, and smoking status were also found to be significant predictors of both absolute and relative cancer risk perceptions. These variables are known to influence both cancer risk and cancer risk perceptions [4,20,32]. When these potential confounders were included in a multivarite model, there was still a significant difference in relative risk perception between obese and healthy weight subjects. Surprisingly, there were no statistically significant differences based on educational attainment even though the HINTS data showed significant differences in weight status by education. While previous work has shown that those who are less educated perceived themselves as at lower risk of developing cancer this association was not seen in our study [30,31].

The HINTS survey is a nationally representative survey with a relatively large sample size. Very few participants were excluded from our study. During analysis, the jackknife procedure was utilized to ensure that the analyses were appropriately weighted. While there are many potential confounders to perceived cancer risk, we were able to analyze the effect of gender, age, race, income, and education. However, our study was limited by the questions asked in the HINTS 4 (Cycle 1) survey. While the survey obtained information on family history of cancer, the type of cancer was not recorded. The subject pool consisted of significantly more subjects with a family history of cancer than national norms (71% in our study versus <15% in other studies) indicating that future studies evaluating the association between weight status and cancer risk perceptions should explore the role of family history as a covariate further among subjects with a negative family history [6,11]. Additionally, cancer risk perception data was collected on one's risk of cancer in general so future studies should assess risk perceptions by types of cancer. The HINTS sample was largely Non-Hispanic White and highly educated (>high school). Research has shown that obesity rates are higher among Non-Hispanic Black and Hispanic populations as well as those with lower educational attainment. Further research is needed to better understand cancer risk perceptions among more diverse groups.

Conclusion

Obesity is a major, modifiable risk factor for a multitude of cancers among both men and women yet individuals are much less likely to identify obesity as a risk factor for cancer compared to family history of cancer. Public health education programs are needed to improve awareness of the impact of elevated weight on cancer risk. Health care providers should view the patient encounter as an opportunity to emphasize the role of weight management in cancer prevention, particularly among obese patients. Improved awareness may stimulate behavioral modification necessary to reduce cancer risk.

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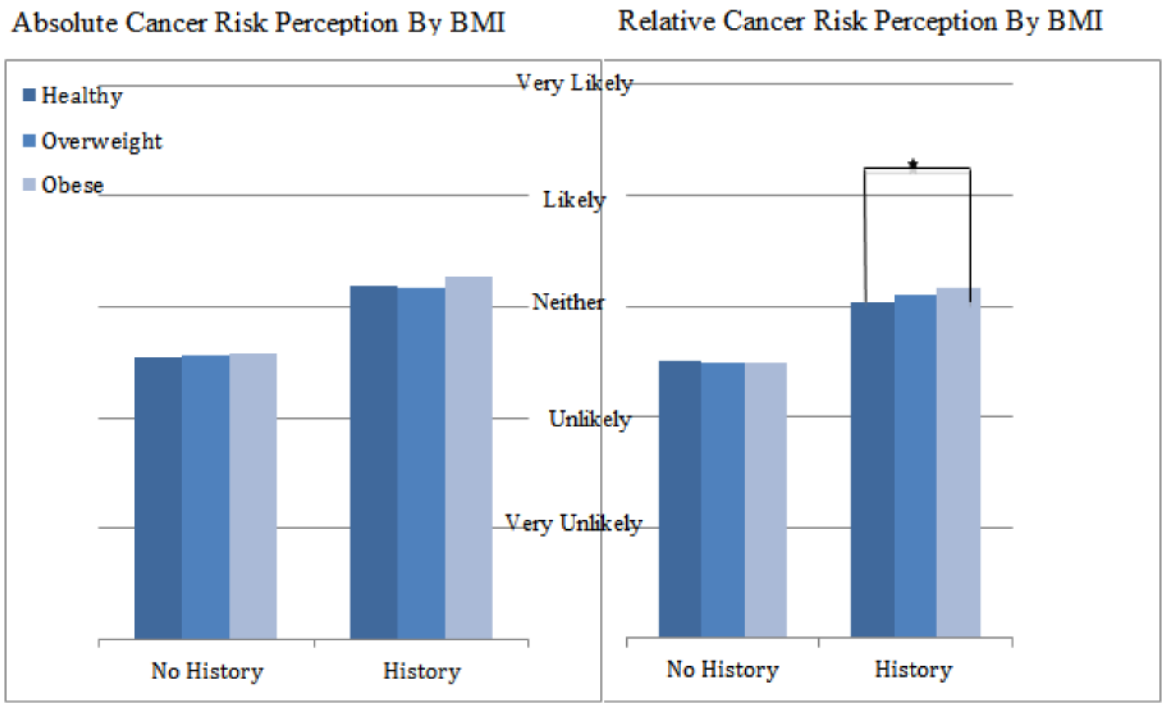

Figure 1.
Note: * = significant difference at p=.0081.

Table 1

Characteristics of Study Population: Overall and By Weight Status

	Overall	Healthy Weight		Overweight		Obese		Between healthy and overweight	Between healthy and obese	Between overweight and obese	Between healthy, overweight and obese
Variable Categories											
	n	**n**	**%**	**n**	**%**	**n**	**%**	**p value**	**p value**	**p value**	**p value**
Gender								.0044 *	.2050	.0896	.0168 *
Male	1051	287	27.31	454	43.20	310	29.50				
Female	1534	569	37.09	481	31.36	484	31.55				
Age								.0007 *	.0009 *	.9664	.0024 *
18–39	637	266	41.76	199	31.24	172	27.00				
40–49	511	166	32.49	185	36.20	160	31.31				
50–59	576	170	29.51	212	36.81	194	33.68				
60–69	499	124	24.85	210	42.08	165	33.07				
70+	336	121	36.01	121	36.01	94	27.98				
Race/Ethnicity								.0078 *	<.0001 *	.0640	<.0001 *
NH White	1591	565	35.51	571	35.89	455	28.60				
NH Black	382	71	18.59	126	32.98	185	48.43				
Hispanic	330	82	24.85	144	43.64	104	31.52				
Other	186	105	56.45	55	29.57	26	12.98				
Household Income								.5479	.3404	.1755	.1975
<$20,000	500	154	30.80	163	32.60	183	36.60				
$20,000–$49,999	732	213	29.10	264	36.07	255	34.84				
$50,000–$99,999	699	244	34.91	256	36.62	199	28.47				
>$ 100,000	450	180	40.00	167	37.11	103	22.89				
Education								.1243	.0001 *	.0835	.0021 *
<HS	231	63	27.27	84	36.36	84	36.36				

	Overall	Healthy Weight		Overweight		Obese		Between healthy and overweight	Between healthy and obese	Between overweight and obese	Between healthy, overweight and obese
Variable **Categories**											
	n	**n**	**%**	**n**	**%**	**n**	**%**	**p value**	**p value**	**p value**	**p value**
HS	472	127	26.91	162	34.32	183	38.77				
Post HS/Some College	780	218	27.95	309	39.62	253	32.44				
College Degree+	1087	436	40.11	363	33.39	261	24.01				
Physical Activity Goal Met								.6107	.0001 *	<.0001 *	<.0001 *
Yes	326	133	40.80	136	41.72	57	17.48				
No	2269	723	31.86	799	35.21	737	32.48				
Smoker								.3792	.9819	.3132	.4770
Yes	433	156	36.03	150	34.64	127	29.33				
No	2151	700	32.54	785	36.49	666	30.96				
Family History of Cancer								.9908	.0901	.0537	.1121
Yes	1837	587	31.95	650	35.38	600	32.66				
No	748	269	35.96	285	38.10	194	25.93				

Note: NH = Non-Hispanic, HS = High School,

* = significant difference at $p<0.05$.

Table 2

Absolute and Relative Risk Perceptions of Developing Cancer By Cancer History Status

	Overall		Family History of Cancer				
			None		Family		Difference between history groups
	N	%	N	%	N	%	p value
How likely are you to get cancer in your lifetime							
Very Unlikely	254	9.31	129	18.16	125	5.70	
Unlikely	380	13.51	193	25.48	187	8.65	
Neither	1104	43.58	306	41.96	798	44.24	<.0001 *
Likely	693	28.35	95	11.91	598	35.04	
Very Likely	130	5.24	15	2.48	115	6.36	
Compared to other people your age, how likely are you to get cancer in your lifetime							
Very Unlikely	250	9.02	126	18.44	124	5.19	
Unlikely	504	19.59	228	29.81	276	15.43	
Neither	1107	44.21	291	40.97	816	45.52	<.0001 *
Likely	589	22.11	79	8.72	510	27.56	
Very Likely	111	5.07	14	2.06	97	6.29	

Note:

* =significant difference at p<0.05.

Table 3

Absolute and Relative Risk Perceptions of Developing Cancer by Weight Status

	Healthy		Overweight		Obese		Between Healthy, Overweight and obese	Between healthy and overweight	Between healthy and obese	Between overweight and obese
	n	%	n	%	n	%	p value	p value	p value	p value
How likely are you to get cancer in your lifetime										
Very Unlikely	87	9.66	89	9.37	78	8.79				
Unlikely	132	13.72	142	13.56	106	13.20	.1089	.1262	.1633	.0706
Neither	384	47.50	412	45.01	308	37.01				
Likely	202	23.19	251	29.18	240	33.81				
Very Likely	47	5.94	31	2.88	52	7.20				
Compared to other people your age, how likely are you to get cancer in your lifetime										
Very Unlikely	87	10.14	88	8.76	75	7.94				
Unlikely	189	22.11	172	17.39	143	19.06	.0244*	.1046	.0027*	.1516
Neither	368	45.80	426	47.70	313	38.07				
Likely	167	15.21	210	22.29	212	30.50				
Very Likely	41	6.74	29	3.86	41	4.43				

Note:

* = significant difference at $p<0.05$.