Limited Public Knowledge of Obesity and Endometrial Cancer Risk

What Women Know

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OBJECTIVE: To estimate if women in the general population are aware of the relationship between obesity and cancer risk, and to identify groups who may benefit from educational programs.

METHODS: A self-administered survey was distributed to women in the Houston community. The questions were taken from a bank of validated questions published by the Center for Disease Control, Behavioral Risk Factor Surveillance System, and the Harvard Forums on Health Survey. Demographic information and participant knowledge of obesity-related cancer risk was collected. Logistic regression and Cochran-Armitage tests for trend were use to assess the association between predictor variables and knowledge.

RESULTS: One thousand five hundred forty-five women completed the survey; 28% were normal weight (body mass index [BMI] less than 25 kg/m²), 24% were overweight (BMI 25–30 kg/m²), and 45% were obese (BMI at least 30 kg/m²). Fifty-eight percent (95% confidence interval 56–61%) were not aware that obesity increased risk for endometrial cancer. There was no difference in knowledge of endometrial cancer risk associated with any of the demographic characteristics studied. Black women were the most likely to respond that they did not know about the relationship between obesity and cancer.

There was no association between personal weight and knowledge of obesity-associated risk.

CONCLUSION: There is limited knowledge of the relationship between obesity and cancer risk, particularly among black women. Patient education regarding these risks may increase awareness of the relationship between obesity and endometrial cancer among women.
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The prevalence of overweight and obese Americans has continued to rise over the last 3 decades. In 2003 to 2004, 66% of adults in the United States were either overweight or obese (body mass index [BMI] 25 kg/m² or higher), an increase from only 47% in 1960.[1] This increase in the prevalence of obesity has been shown to be particularly important in women and in minority groups. Black and Hispanic women have been shown to have the highest weight accumulation when compared with either white women or men.[2] In addition, black women are projected to have the highest increase in obesity based on current growth rates.[3]

It is well known that obesity increases risk for multiple medical problems, including type 2 diabetes mellitus, hypertension, coronary heart disease, hypercholesterolemia, and respiratory complications, including obstructive sleep apnea, and osteoarthritis.[4] Recently, several studies have shown that obesity also increases risk for certain types of cancer. Women who are obese have been shown to have significantly higher rates of endometrial, breast, and colon cancer when compared with nonobese women.[5,6] Endometrial cancer has the highest association with obesity, with a relative risk (RR) of 4.0 in women with a BMI 32 kg/m² or higher and 6.0 in women with a BMI 35 kg/m² or higher when compared with women with a BMI less than 23

kg/m^2.[7] In addition, increased body weight has been shown to increase mortality due to multiple cancers including endometrial, colon, and breast cancer, with the highest RR for death associated with endometrial cancer (RR 6.25, 95% confidence interval [CI] 3.75–10.42).[8,9]

While a majority of Americans recognize obesity as a major health problem, only about 50% are aware that obesity increases risk of cancer.[10] Because obesity is a modifiable and preventable disease, it is important to assess public knowledge about the health risks associated with obesity and identify particular groups who lack this knowledge. The purpose of our study was to estimate if women in the general population, and, in particular, women who are overweight or obese, are aware of the relationship between excess weight and cancer risk and to estimate if there are demographic groups who may benefit most from public education programs.

METHODS

After institutional review board approval was obtained from both M. D. Anderson Cancer Center and The University of Texas Houston Health Science Center, 1,545 women over the age of 18 were asked to complete a self-administered questionnaire. The questionnaire consisted of 38 questions that were taken from a bank of previously validated questions provided by the Center for Disease Control and Prevention (CDC), Behavioral Risk Factor Surveillance System, and the Harvard Forums on Health survey.[10,11]

Demographic factors including age, race/ethnicity, level of education, annual household income, and insurance coverage were collected. Knowledge of the relationship between excess weight and cancer risk were assessed (see the Box). To assess knowledge, participants were asked if being obese affected the risk

Survey Questions

Date of birth (month/day/year)	_____/_____/_____
Today's date (month/day/year)	_____/_____/_____
Which best describes your ethnic background?	____White
	____Black
	____Hispanic
	____Asian
	____Other _____
What is the highest grade or year of school that you have completed?	____8th grade or less
	____High school or general education diploma
	____Vocational school
	____College
	____Graduate/Professional school
What is your annual household income from all sources?	____Less than $20,000
	____$20,000 to less than $35,000
	____$35,000 to less than $50,000
	____$50,000 to less than $75,000
	____$75,000 or more
	____Not sure
Do you have any kind of health care coverage, including health insurance or prepaid plans such as HMOs, or government plans such as Medicare?	____Yes
	____No
	____I don't know
How tall are you?	____feet____inches
How much do you weigh without shoes?	_____pounds
Do you consider yourself to be overweight, average weight, or underweight?	____Overweight
	____Average weight
	____Underweight
	____I don't know

The following questions are about obesity and cancer risk. Adults are considered obese if they weigh just 30 or 40 pounds or more above their ideal weight. Being obese may increase people's risk of developing certain types of cancer and not others. As far as you know, does being obese affect the risk of developing the following types of cancer?

Type of Cancer	Increases a Lot	Increases a Little	Does Not Increase	I Don't Know
Breast cancer	1	3	5	DN
Colon cancer	1	3	5	DN
Cancer of the uterus (womb)	1	3	5	DN

of developing certain types of cancer including endometrial cancer, colon cancer, or breast cancer. Possible responses included "increases a lot," "increases a little," "does not increase," or "I don't know." Participants who responded that there was any increase in risk associated with obesity were considered as having the knowledge that obesity increases risk for cancer. Knowledge of obesity and endometrial cancer risk was then compared to knowledge of obesity and risk for colon and breast cancer.

The target population for the survey included all women over 18 years of age. Women from a variety of socioeconomic backgrounds were included. Women attending local community health fairs and local festivals, as well as local organizations including churches were invited to participate. The survey was also made available to women in the waiting rooms of general health clinics, gynecology clinics, and obesity clinics in different areas of Houston, Texas. The survey was made available for completion in both English and Spanish, and online through the M. D. Anderson Cancer Center website. The survey was anonymous and voluntary. All women were approached, regardless of weight, and were given the option to not participate. At the completion of the survey, participants were provided with an educational pamphlet addressing the risk of endometrial cancer associated with excess weight.

Self-reported height and weight were used to calculate the participants' body mass index (weight in kilograms divided by height in meters squared [kg/m^2]). Participants were then categorized into three weight groups based on BMI as defined by the National Institutes of Health: normal weight (BMI less than 25 kg/m^2), overweight (BMI 25–30 kg/m^2), and obese (BMI 30 kg/m^2 or higher).[8] In addition, the participants were categorized by other demographic characteristics including age, race/ethnicity, level of education, annual household income, and insurance coverage.

The association between knowledge of increase in cancer risk and demographic factors were analyzed using Spearman rank correlation. The answers "increases a lot" and "increases a little" were combined into one category "know" which indicated a definitive knowledge about increased cancer risk or lack thereof. Cochran-Armitage tests for trend were used to test the association between ordinal and categorical variables.[12] Fisher exact tests were used to test the association between categorical variables. Spearman rank correlation analyses were used to test the association between ordinal variables.

For multivariable analyses, logistic regression models were used to evaluate the association between dependent and independent variables. All variables from the univariable analyses that were found to be significant at $P<.05$ were included in the multivariable models. Proportional odds logistic regression was used to model the three ordered categories of knowledge of cancer risk.[13] Model fitting was performed using forward and backward selection procedures. No adjustments were made for multiple comparisons.

RESULTS

Between July 2005 and May 2005, a total of 1,545 women completed the survey. Of these, weight group was not available for 54 participants because either their height or weight was not reported. A total of 437 (28%) of the women were of normal weight, 365 (24%) were overweight, and 689 (45%) were obese. The demographic characteristics for the entire study group broken down by weight group are shown in Table 1. There was a significant association between age and weight group ($P<.001$). With regard to race, 772 (50%) described themselves as white, 411 (27%) as black, 232 (15%) as Hispanic, 95 (6%) as Asian, and 23 (1.5%) as other. The black and Hispanic groups had the highest percentage of obese and overweight participants. Among the black and Hispanic participants, 80% and 70% respectively, were overweight or obese, while only 65% of white women and 48% of Asian women were overweight or obese.

A majority of participants had a college education (709, 46%) or a professional or graduate degree (380, 25%). Four hundred forty-seven participants (29%) had the equivalent of a high school education or less. In regard to estimated household income, 481 (31%) made more than $75,000 per year, 314 (20%) made $50,000–75,000 per year, 314 (20%) made $35,000–50,000 per year, and the remainder (359, 23%) reported a household income of less than $35,000 per year. Ninety-one percent of participants (1,408) reported having current health insurance coverage.

When asked about the association between obesity and endometrial cancer, only 645 participants (42%) knew that obesity increased the risk for endometrial cancer; 58% (95% CI 56–61%) did not. Twenty-two percent responded "increased a lot" and 20% responded "increased a little." One hundred thirty-seven women (9%) responded incorrectly by stating there was "no increase in risk" for endometrial cancer associated with obesity, and the remaining 49% responded "did not know."

When asked about the association between obesity and colon cancer risk, 819 (53%) knew that

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Table 1. Demographic Characteristics by Weight Group

Characteristic	Normal Weight (n=437)	Overweight (n=365)	Obese (n=689)	Missing (n=54)	Total (n=1,545)
Age (y, mean)	39.5	45.2	44.0		$P<.001$
Race					$P<.001$
White	254 (33)	178 (23)	321 (42)	19 (2)	772
Black	65 (16)	98 (24)	229 (56)	19 (4)	411
Hispanic	56 (24)	50 (22)	112 (48)	14 (6)	232
Asian	50 (53)	33 (35)	12 (13)	0	95
Other	9 (39)	4 (17)	9 (39)	1	23
Unknown	3	2	6	1	12
Education					$P<.001$
8th grade or less	2 (12)	6 (38)	6 (38)	2 (12)	16
High school/general education diploma	65 (20)	98 (31)	173 (54)	17 (5)	319
Vocational school	20 (18)	19 (17)	67 (60)	5 (4)	112
College	196 (28)	182 (26)	310 (44)	21 (3)	709
Advanced degree	153 (40)	92 (24)	128 (34)	7 (2)	380
Unknown	1 (11)	2 (22)	3 (33)	2 (22)	9
Income					$P<.001$
Less than $20,000	25 (20)	33 (26)	60 (48)	7 (6)	125
$20,000–35,000	56 (24)	49 (21)	117 (50)	12 (5)	234
$35,000–50,000	70 (24)	64 (22)	150 (51)	1 (0)	295
$50,000–75,000	83 (26)	69 (22)	151 (48)	11 (4)	314
More than $75,000	169 (35)	123 (26)	181 (38)	8 (2)	481
Unknown	34 (35)	27 (28)	30 (31)	5 (5)	96
Insurance					$P=0.58$
Yes	397 (28)	331 (24)	635 (45)	45 (3)	1,408
No	35 (29)	30 (25)	46 (38)	9 (7)	120
Unknown	5 (29)	4 (24)	8 (47)	0	17

Data are presented as n (%).

obesity increased the risk for colon cancer, 33% responded "increased a lot," and 20% responded "increased a little." Only seventy-two participants (5%) responded incorrectly by stating there was "no increase in risk" for colon cancer associated with obesity; however 654 participants (42%) indicated that they "did not know" obesity increased risk for colon cancer.

Finally, when asked about the association between obesity and breast cancer risk, 834 participants (54%) were aware that obesity increases the risk for breast cancer, 30% responded "increased a lot," and 24% responded "increased a little." Only 116 participants (7.5%) responded incorrectly by stating there was "no increase in risk" for breast cancer associated with obesity and 595 (39%) participants "did not know" obesity increased risk for breast cancer.

Knowledge of risk associated with obesity for endometrial cancer, colon cancer, and breast cancer was then compared among participants by weight group (Table 2). There was no evidence of an association between knowledge of risk and weight group for endometrial cancer ($P=.23$), colon cancer ($P=.25$), or breast cancer ($P=.13$). In addition, there was no evidence of an association between the participant's

weight and her knowledge of endometrial cancer risk ($P=.27$) or breast cancer risk ($P=.18$). There was marginal evidence of an association between the participants weight and knowledge of colon cancer risk ($P=.045$), but this should be interpreted with caution given the number of statistical comparisons being performed.

Knowledge of cancer risk associated with obesity was then compared among different demographic groups, including age, racial/ethnic group, level of education, household income, and access to insurance. There was no association between age and knowledge of risk for endometrial cancer ($P=.65$), colon cancer ($P=.57$), or breast cancer ($P=.08$). There was no evidence of an association between racial/ethnic group and knowledge of increased risk associated with obesity for endometrial ($P=.70$), colon ($P=.062$), or breast cancer ($P=.17$). There was, however, an association between racial/ethnic group and lack of knowledge of cancer risk for all of the evaluated cancers ($P<.01$ for all cancers). For each cancer, black women were the most likely to answer that they did not know about the increased risk for cancer associated with obesity. Asian women, on the other

Table 2. Knowledge of Increase in Cancer Risk Among Women of Different Weight Groups

	Normal Weight (n=437)	Overweight (n=365)	Obese (n=689)	Missing (n=54)
Endometrial cancer risk				*P*=.23
Increases a lot	92 (21)	73 (20)	162 (24)	12 (22)
Increases a little	101 (23)	77 (21)	119 (17)	9 (17)
Does not increase	44 (10)	24 (7)	68 (10)	1 (2)
Do not know	200 (46)	191 (48)	340 (50)	32 (59)
Colon cancer risk				*P*=.25
Increases a lot	147 (34)	114 (31)	232 (34)	12 (22)
Increases a little	103 (24)	72 (20)	123 (18)	16 (30)
Does not increase	21 (5)	16 (4)	34 (5)	1 (2)
Do not know	166 (38)	163 (45)	300 (44)	25 (46)
Breast cancer risk				*P*=.13
Increases a lot	131 (30)	106 (29)	217 (31)	11 (20)
Increases a little	113 (26)	84 (23)	158 (23)	14 (26)
Does not increase	42 (10)	24 (7)	49 (7)	1 (2)
Do not know	151 (34)	151 (42)	265 (38)	28 (52)

Data are presented as n (%).

hand, were the least likely to answer that they did not know.

There was no evidence of an association between level of education and knowledge of risk for endometrial cancer (P=.71). Educated women, however, were more likely to indicate that the risk of developing either colon ($P<.01$) or breast ($P<.01$) cancer was higher with increasing weight. Women who reported a higher household income were more likely to know that there is an increase in risk for colon cancer ($P<.001$) and breast cancer (P=.003) associated with obesity. This association was not found regarding knowledge of endometrial cancer risk. In addition, women with health insurance coverage were more likely to know about the association between obesity and colon cancer (P=.006) and breast cancer ($P<.001$) but not endometrial cancer (P = .87). For all cancers, women without insurance were more likely to answer that they did not know about the cancer risk associated with obesity.

Multivariable models were then used to assess the relative contribution of weight, age, race/ethnicity, level of education, household income, and insurance on the knowledge of colon and breast cancer risk associated with obesity (Table 3). Because there were no variables that were significantly associated with knowledge of endometrial cancer risk in the univariable analysis, a multivariable analysis for this cancer was not performed. For knowledge of colon cancer risk, income was the most significant predictor of knowledge of cancer risk and remained the only independent predictor of knowledge in the multivariable analysis, that is, women with a higher reported income were more likely to report an association between weight and colon cancer risk.

For breast cancer, level of education and insurance were independently predictive of indicated knowledge of breast cancer risk, that is, women with higher education and those with health insurance were more likely to indicate that there was an increase in breast cancer risk associated with obesity.

DISCUSSION

Nearly two thirds of adults in the United States and an increasing percentage of the population worldwide are overweight or obese as defined by the World Health Organization (BMI 25 kg/m^2 or higher).[8] Obesity has long been recognized as a risk factor for a number of medical conditions including diabetes, high blood pressure, heart disease, and hypercholesterolemia.[8,14] While the relationship between obesity and cancer has received less attention, overweight and obese women have been shown to have an increased risk of cancer. For breast and endometrial cancer, this risk is thought to be due to a higher level of circulating estrogens when compared with non-obese women.[8] In addition, evidence suggests that adiposity may also increase the morbidity and mortality associated with a variety of human cancers including colorectal, breast, and endometrial cancer. Because obesity is a modifiable and preventable disease, it is important to assess public knowledge about the health risks associated with obesity and identify particular groups who may have limited knowledge about these risks.

A national poll conducted by the Harvard University's Interfaculty Program for Health System's Improvement in 2003 helped establish that the American public views obesity as a serious health concern

Table 3. Multivariable Models for Demographic Factors and Knowledge of Colon and Breast Cancer

Characteristic	Estimate	95% Confidence Interval	P
Colon cancer			
Race			<.001
White	–	–	
Black	0.561	0.436–0.724	
Hispanic	0.850	0.618–1.168	
Asian	1.490	0.878–2.531	
Other	0.440	0.185–1.049	
Education			<.001
8th grade or less	0.325	0.108–0.983	
High school/general education diploma	0.508	0.384–0.671	
College	–	–	
Advanced degree	1.52	10149–2.009	
Vocational school	0.931	0.610–1.420	
Breast cancer			
Race			.002
White	–	–	
Black	0.575	0.437–0.756	
Hispanic	0.809	0.576–1.137	
Asian	1.681	0.916–3.085	
Other	0.470	0.192–1.154	
Education			<.001
8th grade or less	0.364	0.105–1.262	
High school/general education diploma	0.611	0.453–0.823	
College	–	–	
Advanced degree	1.788	1.310–2.441	
Vocational school	1.134	0.721–1.784	
Income			.02
Less than $20,000	0.782	0.490–1.250	
$20,000–35,000	0.822	0.571–1.183	
$35,000–50,000	–	–	
$50,000–75,000	1.284	0.907–1.818	
More than $75,000	1.346	0.965–1.877	

An en dash (–) indicates reference category.

in the United States.[10] Seventy-nine percent of participants considered obesity on par with smoking as a major health problem. Only cancer (95%), heart disease (92%), and human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) (87%) were named more frequently as major health problems. In addition, 86% of Americans recognized that obesity increased risk of heart disease and high blood pressure. Seventy-eight percent knew obesity increased the risk of diabetes. Only 52% of Americans, however, were aware that obesity increases risk of cancer; 30% responded a lot and 22% responded a little.

Several years later, we report a similar level of knowledge among the participants in this study. While a majority of the study participants had at least a high school education, only 42% of participants were aware of the association between obesity and endometrial cancer, 53% were aware of the association with colon cancer, and 54% were aware of the association with breast cancer. Regarding endometrial cancer, there was no association between demographic characteristics and the likelihood of a participants' knowledge of cancer risk. Overall, there was a general lack of knowledge, providing an opportunity for public education.

While the knowledge of obesity-related colon and breast cancer risk was also limited, women with a higher household income were more likely to be aware of the association between colon cancer and obesity. Similarly, women with a higher education and health insurance were more likely to be aware of the association between obesity and breast cancer risk. These demographic characteristics are commonly used to estimate socioeconomic status, which helps characterize particular groups within a population. People with higher socioeconomic status may have more access to health education. While these findings are interesting, it is unclear what the practical implications are. It is possible that education regarding colon and breast cancer is more widespread due to the fact that these cancers are more common in the US population, with 112,340 new colon cancers and 180,510 new breast cancers estimated in 2007.[15]

Ackermann et al[16] evaluated awareness of personal risk factors for endometrial cancer among women in Germany. Ninety-six percent of participants felt they would benefit from more information regarding risk factors for endometrial cancer. Although obesity was not the primary focus, only 36% of participants thought "obesity and diabetes" increased risk for endometrial cancer.[16]

This study provides continued evidence of the gap in knowledge within the general population regarding the health risks, and in particular the cancer risks, associated with obesity. In 2001 the U.S. Department of Health and Human Services and the Surgeon General made a call to action to prevent and decrease overweight and obesity, in an effort to fight the growing issue of obesity in the United States. The prevention of childhood obesity was made a priority, and efforts were made to target lower socioeconomic and minority population groups who were thought to be at highest risk.[17–19]

Previous studies have reported that black and Hispanic women have the highest risk for the development of obesity.[3] In this study population, there was also a disproportionate weight distribution among racial and ethnic groups. Although it is not clear if this

accurately reflects the general population, a higher percentage of overweight and obese participants were black and Hispanic compared with white and Asian participants (80% and 70% compared with 64% and 47%). In addition, the black participants were the most likely to indicate that they did not know about the increased risk for cancer associated with obesity. These finding suggest that black and/or Hispanic women, who may be at higher risk for endometrial cancer due to the increase prevalence of obesity, could be potential target groups for educational programs.

In addition to identifying a target population for education, it is also important to determine who is responsible for educating the public on risks associated with obesity. A recent study in France evaluated the knowledge, attitudes, and practices of primary care physicians managing patients who were obese and overweight. Most practitioners recognized that obesity played a significant role in the health management of their patients. Seventy-nine percent of medical doctors agreed that managing weight was part of their role as a primary physician. However, a majority of practitioners (58%) did not feel that they were effectively counseling their patients regarding the risks associated with obesity, or adequately providing assistance with weight management.[20] This highlights the need for further education regarding the risks and management of obesity for providers as well as patients.

The American College of Obstetrics and Gynecology recently released a committee opinion regarding the role of the obstetrician–gynecologist in the assessment and management of obesity.[21] With endometrial cancer being the most common gynecologic malignancy, and obese women being 5 times more likely to develop endometrial cancer than nonobese women, obesity was identified as an important health issue to address.[22] Improved health through weight loss and increase in physical activity were the identified goals. Counseling to support improvements in diet and physical activity were considered first-line intervention and should be initiated by the obstetrician–gynecologist. Referral to dieticians and weight specialists for further evaluation and management should be considered if the resources of the physician are insufficient. In addition, all physicians should consider reviewing the signs and symptoms of endometrial cancer, including intermenstrual and post-menopausal bleeding, as these can be critical in the early detection of endometrial cancer.

While this study has highlighted the lack of knowledge of the relationship between obesity and cancer risk among women, there were limitations. The information was self-reported, including weight and height. There was no systematic recruitment system in place; therefore information on the number or the demographics of women who chose not to participate is not available. In addition, the participants represented in this study may not accurately reflect the general population in the United States. There were a higher percentage of black (26%) participants when compared with the U.S. population (12%). There were a lower percentage of whites (50%) and Hispanics (15%) when compared with the U.S. population (75% and 15%). Ninety-eight percent of the participants had at least a high school education compared with only 84% of U.S. residents who have at least a high school education. While this study group may reflect a selection bias toward a population that is more likely to seek medical care, the lack of knowledge of obesity-associated cancer risk was still prevalent.

While our study findings are compelling, this is only the first step for improving public education regarding this important issue. Once educational interventions are developed, it will be important to evaluate their effectiveness on both awareness of obesity-related cancer risk and how obese women in the population will respond to this information. Will knowledge of this increase in cancer risk among obese women change their behavior?

Obesity affects a significant proportion of the American population and can increase the risk of developing multiple cancers including endometrial, colon, and breast cancer. Black and Hispanic women may be at higher risk for cancer due to a higher prevalence of obesity in these groups. Based on our findings, there is a significant lack of awareness of the relationship between obesity and cancer risk and, particularly, endometrial cancer risk. Although an effective intervention still needs to be developed, obstetrician–gynecologists should start by educating their patients about the risk of cancer associated with obesity.

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