J Canc Educ (2017) 32:827–835
DOI 10.1007/s13187-016-1060-z

Improving Cancer Risk Awareness Including Obesity as a Risk Factor for Cancer in a Small U.S. Community

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Published online: 11 June 2016

Abstract Obesity is a risk for certain types of cancer; however, awareness of obesity as a risk factor for cancer is low. This study evaluated increases in cancer risk awareness, including obesity as a risk factor for cancer, from a quasi-experimental intervention that provided educational materials and community reinforcement for healthy living. The study uses data on participant's awareness of cancer risk factors along with sociodemographic variables collected from in-person surveys ($N = 863$) at baseline (June 2011) and post intervention (June 2012). The average awareness that overweight and obesity are risk factors for cancer was low (35 %) compared to chewing tobacco (92 %), using tanning bed (73 %), and sunburn (97 %) at baseline. The intervention significantly increased participants' awareness that overweight and obesity are risk factors for cancer. Based on regression analysis, the unadjusted intervention effect on cancer risk awareness was significant: 0.392 ± 0.165 (p value = 0.020) for matched participants and 0.282 ± 0.125 (p value = 0.024) for community participants. The adjusted intervention effect was significant in the matched participants (0.528 ± 0.189, p value = 0.006). Education, income, gender, and age had a significant impact on cancer risk awareness for the community participants. The results show that community intervention that incorporates community reinforcement can have the desired effect regardless of differences at participant level. Such interventions could be used to prevent cancer risk in communities that are at high risk.

Keywords Obesity · Community · Reinforcements · Cancer risk awareness

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Background

Cancer is one among the top five leading causes of preventable deaths in the USA [1]. According to the American Institute for Cancer Research, "apart from not smoking, being at healthy weight is the single most important thing Americans can do to protect themselves from cancer." Though obesity is not linked to increased risk of all types of cancer, obese individuals have an increased risk of developing and dying from many common cancers [2, 3]. Obesity is also linked to higher risk of cancer recurrence [4]. The latest statistics on awareness of obesity as a risk for cancer is at 50 % (2015), which is very low compared to cancer risk awareness from other risk factors, 94 % for tobacco and 84 % for sunburn [5]. Obesity as a risk factor for cancer has also very recently been highlighted in relation to childhood obesity [6].

Previous research in this area supports poor knowledge of obesity as a risk factor for cancer and highlights a need for efforts to improve knowledge and awareness of obesity as a cancer risk, specifically across minority populations. Communities with high percentages of minorities are generally medically underserved and have high rates of disease incidence [7, 8]. Residents of poorer counties were found to have higher death rates from cancer, and African American, American Indian/Alaskan Native, and Asian Pacific Islander were found to have lower 5-year survival rates than non-Hispanic Whites [9]. Poor knowledge of obesity as a risk factor for breast cancer was found across groups from subpopulations of African-, Caribbean-, and European-American women [10]. A study in Mexico found high knowledge about obesity and its health risk with the exception of cancer [11]. Furthermore, obesity is common for minorities with low socio-economic status [12, 13]. As such, programs and interventions that increase knowledge and awareness of obesity as a cancer risk factor in addition to risk for cancer from sunburn and tobacco are needed especially in communities with higher minority and low socio-economic status residents.

In the past, cancer knowledge program and intervention studies have not always included overweight and obesity as cancer risk factor. Such as a study relating to colon and bowel cancer, which are among the cancers with well-known risk associated with obesity, did not include obesity as a cancer risk factor [14]. However, there are studies that have reported intervention effectiveness in changing school children's belief about cancer. It was found with young adults (high school) that assessment of carcinogenic risk factors does not have direct influence on intentions to behave proactively against cancer but could have an indirect influence on their beliefs about the controllability of cancer [15]. Similarly, participatory intervention has found intended effect among school children. Cancer education through participatory intervention improved student's knowledge of cancer and healthy living concepts at the fourth grade level [16, 17]. Thus, participatory programs that include assessment of cancer risk factors along with increasing knowledge and awareness could be potential to enhance beliefs about preventing cancer also among adults in a community approach.

An intervention in public-private partnership of Texas Tech University with local supermarket in a small rural U.S. community was implemented to improve cancer risk awareness including obesity and overweight as risk factors for cancer. The intervention provided educational materials to prevent risk for cancer by selecting foods that are healthy and not calorie dense in addition to avoiding cancer risk from smoking and sunburn. Educational materials and one-on-one counseling were provided during sessions organized in the community. Information on healthy living were also provided in a participating local supermarket; this provided reinforcement to the information received in in-person sessions. The objective of this study is to evaluate the intervention effect when including obesity and overweight as risk factors for cancer on cancer risk awareness. This study adds to the literature on participatory interventions to improve cancer knowledge among adults at a community level. In addition, the analysis strategy of this study allows studying the effect of intervention on the community in general, and specifically to participants who received in-person intervention with community reinforcements.

Methods

Study Design

The study design is a quasi-experimental design with a control and an intervention community. The intervention site met the established and ongoing relationship criteria for implementing community-based intervention program [18]. The control site was selected based on its similarity with the intervention site. The criteria that were used to assess similarity were population size. According to 2010 US Census Bureau data, the population of the control site was about 7932 (34 % estimated to be Hispanic or Latino, poverty rate 13 %), and that of the intervention site was about 7165 (60 % estimated to be Hispanic or Latino, poverty rate of 20 %) [19]. Participants from both the control and intervention site received educational materials and one-on-one counseling on healthy living and maintaining healthy weight during in-person sessions organized in the community. However, community reinforcements were provided only to the intervention community.

The in-person sessions were organized in collaboration with community members. The settings for the sessions were in community locations including churches, community centers, and schools. During the session, each participant was given their unique project identification number after receiving written informed consent. Then, the participant completed pencil and paper survey. The one-on-one

counseling was provided at the end of the session. As such, the survey was not influenced by the counseling session. The educational materials provided during these sessions were developed by the American Cancer Society or by cancer and nutrition PhD specialists. Trainers for the one-on-one counseling sessions were trained by these specialists for message consistency and delivery. Trainers were observed by the specialists in providing the information and corrected as needed. The community reinforcements were provided in a participating local supermarket in the form of healthy eating placards and ceiling danglers. All materials that were used during the sessions were approved by the Texas Tech University's Human Research Protection Program. A total of four sessions were organized in the communities: two (baseline, post intervention) in the control site and two (baseline, post intervention) in the intervention site.

Study Participants and Data Collection

Study participants were volunteers recruited through flyers and pamphlets distributed in public areas and printed in local newspapers [20]. Participants were also invited to participate in the study through mail invitation sent out to addresses selected at random from a local telephone book. The participants participated in sessions that included anthropometric measurements of height, weight, waist circumference, and blood pressure by trained research staff; display and handing out of educational materials on healthy food habit and healthy living; and data collection through self-reported questionnaire. The questionnaires were pretested in an intercept survey in a supermarket serving low-income Hispanic population in a neighboring city. The questionnaires were also tested, and necessary changes were made to make it understandable at a low literacy level. The questionnaire consisted of a two part health assessment survey: (1) Nutrition and Health Practices Survey, focused on the participant's health practices, attitudes, and perceptions of cancer and cancer risk factors and individual dining practices, and (2) AIM-HI Fitness Inventory, was created by the American Academy of Family Physicians [21] and focused on the participants' level of interest in changing food behaviors, their physical activity levels, and their dietary intake. The demographic questions in the survey were drafted from the BRFSS 2010 Survey [22]. The questionnaires and education materials were made available in English and Spanish (a Spanish translator was also available to assist with data collection from participants whose first language was Spanish). Participants received a $20 gift card for the local supermarket to compensate for time and travel expenses. Participants had to be at least 18 years old and had to self-identify as living in the intervention or the control community to be eligible for data collection.

Data

The data for this study comes from the cancer risk awareness questions on five cancer risk factors: overweight and obesity, tanning beds, sunburn, chewing tobacco/using snuff, and smoking tobacco. The cancer risk awareness questions were as follows: Do you believe use of tanning beds can cause cancer? Do you believe getting sunburned can cause cancer? Do you believe being overweight can cause cancer? Do you believe chewing tobacco/using snuff can cause cancer? Do you believe smoking tobacco can cause cancer? For each question, participants were instructed to select one answer among yes, no, and do not know. The "no" and "don't know" responses were combined during analysis to create a dichotomous measure of cancer risk awareness. The demographic variables used in this study were language (English or Spanish), marital status (married, divorced, widowed, separated, never married), education (elementary, high school graduate, small college or technical school, graduate college), income (less than $20,000, $20,000 to $35,000, $35,000 to $50,000, $50,000 to $75,000, and >$75,000), age, gender (male, female), race (White, Hispanic), cancer survival status (participant is a cancer survivor or participant is not a cancer survivor), weight status (overweight, obese, or normal), and interest in reducing cancer risk (very interested, somewhat interested, or not interested).

Measure

A measure of cancer risk awareness, the cancer knowledge score, was developed to quantify cancer risk awareness and find the intervention effect on cancer risk awareness. The cancer knowledge score is the sum of affirmative responses to the questions on the five cancer risk awareness indicators (overweight or obese, tanning bed, sunburn, chewing tobacco/using snuff, and smoking tobacco). As such, the cancer knowledge score ranged from 0 to 5, 0 if awareness of none of the cancer risk indicators were answered as "yes", and 5 if awareness of all of the cancer risk indicators were answered as "yes." The method used to find cancer knowledge score is similar to several other studies that have used cancer knowledge score (computed as sum of correctly answered items) to analyze knowledge and screening behavior and intervention effect [14, 23]. Cancer knowledge score has also been used in oral cancer studies [24]. However, overweight and obesity as a cancer risk awareness indicators have not always been included in formulating the cancer knowledge score. This omission could be because the cancer studied is not considered to be related to obesity [23]. However, obesity has not been included as a risk factor for cancer even in studies relating to colon and bowel cancer which are among the cancers with well-known risk associated with obesity [14]. As such, the measure developed for this study builds upon methods from previous

studies to develop a cancer knowledge score and includes awareness of obesity as a risk factor for cancer to measure the intervention effect of an intervention that provided educational materials to improve cancer risk awareness and reinforcements at the community level to eat healthy and maintain a normal weight.

Statistical Analysis

Difference in difference regression analysis was used to find the intervention effect of providing education materials, one-on-one counseling on healthy living for cancer prevention, and providing information in the community. In this, the cancer knowledge score was regressed on an interaction dummy (of post intervention period and intervention site), and separate dummies for post intervention period and intervention site. The interaction dummy is an interaction of post intervention period and intervention site. The coefficient of the interaction dummy gives the intervention effect of the community reinforcements on the cancer knowledge score in a quasi-experimental design [25]. The controls for post intervention period and intervention site will allow isolation of intervention effect in the difference in difference method by taking into account potential sources of error [26]. In addition, a regression analysis method of evaluating simple intervention effect [21, 22] was used for matched participants. In this method, the change in cancer knowledge score from baseline to post intervention is computed at the matched participant level and regressed on a dummy for intervention site and baseline cancer knowledge score. The intervention dummy coefficient gives the intervention effect, and the baseline cancer knowledge score controls for differences in inherent cancer knowledge score among the participants. This method was used to study the intervention effect from information provided through educational materials, one-on-one counseling, and community reinforcements. Adjusted intervention effect was found for the matched and community participants to adjust for confounding from sociodemographic characters, weight status, cancer survivor status, and interest in reducing cancer risk. The adjusted intervention effect allows to isolate the intervention effect from differences at the participant level. The analysis was completed using SAS (2008), V 9.2, SAS Institute Inc.

Results

Sociodemographic Characteristics

A total of 756 participants attended the sessions: 424 (225 in the baseline and 199 in the post intervention) in the intervention community and 332 (157 in the baseline and 175 in the post intervention) in the control community. In addition to the total ($N = 756$) independent program participants, there were participants who attended both the baseline and post intervention survey. These participants form the matched group and are analyzed separately. There were 39 and 68 participants from the control and intervention community in the matched group. The community participants and matched participants total to 863 participants. The sociodemographic characteristics of the participants are shown in Table 1. The majority in both the control and intervention site and in the total and matched participants were married (on average 66 %), were very or somewhat interested in finding ways to reduce cancer risk (on average 97 %), and English was their primary language (on average 88 %). Females were over represented (on average 68 %). The respondents were diverse with regards to education, age, and weight status. Majority of the control group participants were White, and the majority of intervention group participants were Hispanic.

Cancer Knowledge Score

The cancer knowledge score in this study is the measure for cancer risk awareness. The average baseline cancer knowledge score and the score at post intervention is shown in Table 2 (for the matched participants in top panel and the community participants in bottom panel). The last column in the table shows the percentage change in the cancer knowledge score. The score increased by 13 % among the matched participants and by 6 % among the community participants in the intervention community. The score decreased by 1 % among both the matched and community participants in the control community. The lowest cancer knowledge score was at baseline (3.853 ± 0.935) among the matched participants in the intervention community. The highest cancer knowledge score was at post intervention (4.368 ± 0.731) also among the matched participants in the intervention community. As such, the highest increase in cancer knowledge score was among the matched participants in the intervention community.

Intervention Effect on Cancer Knowledge Score

The intervention effects from the unadjusted model and the intervention and confounding effects from the adjusted model are shown in Table 3 (for the matched participants in the top panel and for the community participants in the bottom panel). The confounders used to find the adjusted intervention effect were as follows: sociodemographic characters (language, marital status, education, income, age, gender, and race), weight status, cancer survivor status, and interest in reducing cancer risk. The analysis shows a significant intervention effect on cancer knowledge score. The unadjusted intervention effect are 0.391 (± 0.166, p value = 0.020) for the matched participants and 0.282 (± 0.125, p value = 0.024) for the community participants. The baseline cancer knowledge score was significantly

Table 1 Sociodemographic characteristics (percentages) of the participants

		Community participants		Matched participants	
		Control ($N = 332$)	Intervention ($N = 424$)	Control ($N = 39$)	Intervention ($N = 68$)
Marital status	Married	69	65	69	59
	Divorced	9	10	21	4
	Widowed	6	7	5	16
	Separated	3	5	0	9
	Never married	13	12	5	12
Education	Elementary or some high school	18	25	13	32
	High school graduate	35	36	28	40
	Some college or technical school	27	21	23	13
	College graduate	20	17	36	15
Income	Less than $19,999	23	40	26	68
	$20,000 to $34,999	29	25	28	13
	$35,000 to $49,999	14	13	13	1
	$50,000 to $74,999	16	13	18	12
	Equal or over $75,000	17	9	15	6
Age	18 to 30	17	16	13	16
	31 to 40	20	17	13	7
	41 to 50	20	16	21	15
	51 to 65	23	27	26	21
	66+	19	22	28	41
Interest in finding ways to reduce cancer	Very or somewhat interested	100	97	97	93
	Not interested	0	3	3	7
Gender	Male	37	33	31	29
	Female	63	67	69	71
Race	White	62	43	90	49
	Hispanic	38	56	10	51
Cancer survivor	Yes	14	7	26	18
	No	86	93	74	82
Weight status	Normal	26	18	26	15
	Overweight	33	31	28	38
	Obese	41	51	46	47
Language	Spanish	16	16	0	15
	English	84	84	100	85

Table 2 Percentage change in cancer knowledge score from baseline to post intervention in the communities

	Baseline	Post intervention	Percentage change in cancer knowledge score
	Matched participants		
Intervention ($x \pm SD$)	3.853 ± 0.935 (68)	4.368 ± 0.731 (68)	+13.36 %
Control ($x \pm SD$)	4.230 ± 0.872 (39)	4.179 ± 1.233 (39)	−1.21 %
	Community participants		
Intervention ($x \pm SD$)	4.022 ± 0.118 (225)	4.261 ± 0.124 (199)	+5.94 %
Control ($x \pm SD$)	4.306 ± 0.109 (157)	4.263 ± 0.129 (175)	−0.99 %

Table 3 Unadjusted and adjusted intervention effect on cancer knowledge score

Variable	Effect	Std. error	*P* value	Effect	Std. error	*P* value
Matched participants	Unadjusted effect			Adjusted effect		
Intercept	1.903	0.389	<0.0001***	1.704	1.110	0.128
Baseline cancer knowledge score	−0.462	0.087	<0.0001***	−0.465	0.091	<0.0001***
Intervention site	0.391	0.166	0.020*	0.528	0.189	0.006**
English language				0.171	0.297	0.566
Marital status				−0.127	0.068	0.064
Education				0.103	0.099	0.300
Income				−0.023	0.081	0.773
Age				0.006	0.005	0.255
Female				0.115	0.180	0.526
White				−0.045	0.217	0.838
Is a cancer survivor				−0.047	0.227	0.837
Overweight or obese weight status				−0.063	0.168	0.708
Interested in ways to reduce cancer				−0.309	0.835	0.712
Community participants	Unadjusted effect			Adjusted effect		
Intercept	4.306	0.068	<0.0001***	3.675	0.348	<0.0001***
Post intervention period	−0.043	0.093	0.646	0.001**	0.095	0.992
Intervention site	−0.284	0.088	0.001**	−0.110	0.091	0.226
Intervention period * site	0.282	0.125	0.024*	0.149	0.125	0.233
English language				−0.068	0.098	0.488
Marital status				−0.021	0.024	0.376
Education				0.095	0.035	0.006**
Income				0.073	0.027	0.006**
Age				−0.004	0.002	0.036*
Female				0.188	0.063	0.003**
White				0.087	0.077	0.258
Is a cancer survivor				−0.086	0.105	0.414
Overweight or obese weight status				−0.089	0.061	0.140
Interested in ways to reduce cancer				0.477	0.222	0.032*

P values are from Chi square and McNemar's test for community and matched participants respectively [25, 26].

* = $P < .05$

** = $P < .01$

*** = $P < .001$

lower (by 0.462 points, p value = <0.001) for the matched participants. The score was also significantly lower in the intervention site (by 0.284 points, p value = 0.001) compared to that in the control for the community participants.

When the model was adjusted for several confounders, the adjusted intervention effect on cancer knowledge score for the matched participants was significant (0.528 ± 0.189, p value = 0.006). None of the confounders had significant effect on cancer knowledge score for the matched participants. Hence, the intervention had significant effect on cancer risk awareness regardless of individual differences within the matched participants. The intervention effect on the matched participants is the effect from information provided through educational materials, one-on-one counseling, and community reinforcement.

For the community participants, adjusted intervention effect on the cancer knowledge score was not significant. However, confounding from education (0.095, p value = 0.006), income (0.073, p value = 0.006), age (−0.004, p value = 0.036), female (0.188, p value = 0.003), and interest in reducing cancer risk (0.477, p value = 0.032) were significant. The results show that cancer knowledge score was higher as the level of education and income increased. The score was also higher for participants who were interested in ways to reduce cancer. The score was lower for older participants.

The intervention effect on the community participants is the effect solely from healthy eating community reinforcements.

Cancer Risk Awareness Indicators

The cancer risk awareness indicators at baseline compared with post intervention indicators are shown in Table 4. This results show a breakdown for changes in cancer knowledge score for each participant group. There was a very high level of knowledge during the baseline that the use of tanning beds, sunburn, and chewing tobacco were potential risk factor for cancer. There was less knowledge, initially, that overweight/obesity is a risk factor for cancer across all the groups. Community participants' knowledge about overweight and obesity as a risk factor for cancer increased by 13 % (p value = 0.002) in the intervention community. However, there was also an 8 % (p value = 0.038) increase in the control community. As such, the net increase in knowledge about overweight and obesity as a risk factor for cancer was 5 %. This increase was very high for the matched participant, 19 % (p value = 0.003) in the intervention group; the change was insignificant in the control group. Awareness of tanning bed use as a risk factor for cancer increased significantly in both the matched and community participants in the intervention group. Awareness of tanning bed use as a risk factor for cancer decreased significantly in the community participants, and there was no change in the matched participants in the control group. There was also an increased awareness that sunburn and chewing tobacco as risk factors for cancer in the intervention community for both the matched and community participants.

Discussion

This study analyzed the intervention effect of providing educational materials, with community reinforcement, to prevent risk for cancer by selecting foods that are healthy and not calorie dense in addition to avoiding cancer risk from use of tanning beds, sunburn, and chewing tobacco. A separate analysis of the community participants and matched participants shows important findings. First, the unadjusted intervention effect was significant for both the matched and community participants. However, the adjusted intervention effect was significant for the matched participants and not significant for the community participants. For the community participants, there was confounding from education, income, gender, age, and interest in reducing cancer risk. This result shows that an intervention that provides information in the community is affected by participant-level differences. These findings seem meaningful as participant-level differences determine use and access to community, supermarket, and also media in this case. The significant adjusted intervention effect on the matched participant suggests that an intervention that provides

Table 4 Comparison of cancer risk awareness indicators

	Intervention			Control		
Matched participants						
	Baseline ($N = 68$) (%)	Post ($N = 608$) (%)	P value	Baseline ($N = 39$) (%)	Post ($N = 39$) (%)	P value
Overweight/obesity	32	51	0.003**	49	56	0.366
Tanning beds	66	90	0.000***	87	87	1
Sunburn	91	99	0.059	95	92	0.564
Chewing tobacco	97	97	1	92	90	0.560
Community participants						
	Baseline ($N = 225$) (%)	Post ($N = 199$) (%)	P value	Baseline ($N = 157$) (%)	Post ($N = 175$) (%)	P value
Overweight/obesity	38	51	0.002**	45	53	0.038*
Tanning beds	80	88	0.004**	93	86	0.009**
Sunburn	92	93	0.077	96	94	0.075
Chewing tobacco	96	98	0.043*	97	97	0.147

P values are from chi-square and McNemar's test for community and matched participants, respectively [25, 26]

*$P < 0.05$

**$P < 0.01$

***$P < 0.001$

community reinforcement in addition to providing educational materials is effective and has no significant confounding from participant-level differences.

This study also showed that there is lower knowledge of obesity as a risk factor for cancer among other risk factors. The post intervention awareness on obesity as a risk factor was 51 % in the intervention community which appears to be low despite of it being a significant increase from baseline level of awareness. Hence, this research on increasing cancer risk awareness through community-based approach with primary focus on obesity as a risk factor for cancer is timely in cancer risk prevention. Similar result was found in other community-level studies; as for example, a survey of 1545 women in the Houston community found low (58 %) awareness that obesity increased risk of endometrial cancer [27]. Another telephone survey of 1433 adults, aged 18+ years, found that obese respondents in particular did not rate being overweight as a very important risk factor for cancer [28]. The results also show that the intervention group had a much lower baseline knowledge of overweight and obesity as a cancer risk factor (32 and 38 % in the matched and community participants) compared to the control group (49 and 45 % in the matched and community participants). At post intervention, the knowledge that overweight and obesity are risk factors for cancer are comparable across the intervention and control group participants. As such, the intervention was effective in increasing awareness that overweight and obesity are risk factors for cancer in a community with lower baseline level of college education and higher Hispanic population to the levels observed in more well-educated communities with higher White population. Increased awareness on cancer risk and knowledge about the risk factors could lead to increased cancer screening, the rate of which is impacted by knowledge [29]. Moreover, knowledge and awareness are key elements in the process of behavioral change towards healthy living [30].

A major approach of this study was its focus on controlling the local media and the overall community context. Since the intervention was conducted in a small community, it allowed for relatively inexpensive and easier control of the media and the overall community context. Similar programs developed and tested in the past [31–33] in general have been conducted in larger urban areas. As such, this finding will add to the existent literature in implementing intervention in communities that are small and rural. Moreover, studies that tested addition of a community involvement component to a coordinated school health program on outcome found significantly greater changes in program effect with community involvement [34]. The current research was based in a community-based approach and shows the value of public community-based approach. In addition, while the focus of the project was on cancer risk awareness from obesity, other health-related issues (e.g., screening) could also be targeted with a similar approach. Moreover, weight status had no significant effect on intervention effectiveness suggesting potential replication of this type of intervention regardless of community weight status.

The imbalance in sociodemographic characteristics of the control and intervention community poses a limitation, and the results show confounding from sociodemographic variables in the adjusted intervention effect for the community participants. A more balanced control group in future studies would be needed to study the intervention effect at the community level. However, the confounding from sociodemographic variables in the matched intervention effect was not significant despite imbalance in the sociodemographic characters between the control and intervention groups. This suggests that an intervention that incorporates in-person sessions with community reinforcement can absorb the effect of sociodemographic effect on cancer risk awareness. A larger study with bigger sample size in the matched group is warranted to validate this finding. In addition, majority of the study participants were interested in ways to reduce cancer; as such, future studies should validate the findings among communities that are relatively less interested. However, the low level of awareness on obesity as a risk factor in a community with such high interest in finding ways to reduce cancer reflects on the need to emphasize on interventions that promote awareness on obesity as a risk for cancer.

Conclusions

This study shows that efforts are needed to increase population awareness of obesity as a risk factor for cancer. The results of the study also show that a community-based approach that incorporates a low-cost community reinforcement in addition to providing educational materials and one-on-one counseling can be one way to increase cancer risk awareness of overweight and obesity as risk factors for cancer. The results are particularly important in cancer prevention because of the potential to promote cancer risk awareness using an approach that could be inexpensively copied. In addition, the study shows effectiveness of a community approach including obesity as a risk factor for cancer. The results also show potential for application in promoting other public health outcomes.

Acknowledgement The authors would like to acknowledge the Cancer Prevention Research Institute of Texas for providing the funding support for this study.

Compliance with Ethical Standards

Competing Interests The authors declare that they have no competing interests.

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