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Journal of Behavioral Health

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Original Research

Knowledge about health effects of sun exposure, attitudes, and intention to screen for skin cancer: Findings from the Pennsylvania Cancer Education Network

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Received: May 30, 2012

Accepted: August 11, 2012

Published Online: September 14, 2012

DOI: 10.5455/jbh.20120811030211

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Key words: Skin cancer, education, behavioral health, pretest and posttest

Abstract

Skin cancer is reaching an epidemic and is the most common type of cancer in the United States with more than 1 million cases diagnosed annually. Using a pre-test and post-test study design, we compared participants' (n=800) knowledge (K), attitudes about skin cancer (A), and intention to screen (I) after their participating in a one-hour health education session that seeks to build trust, discuss health information, and encourage action. The results show that this educational session had a significant proximal impact on subjects' KAI status. Average knowledge scores on skin cancer prevention significantly increased, average attitude scores indicating that screening is embarrassing or painful, significantly decreased, and intention to screen scores significantly increased. Participants with higher education levels had higher favorable scores. In conclusion, the proximal results of the skin cancer education program suggest that an action-oriented participatory health education may play a pivotal role in improving skin cancer prevention.

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INTRODUCTION

Skin cancer is the most common type of cancer in the United States with more than 1 million cases diagnosed annually [1-4]. It is estimated that 1 in 5 Americans will develop some form of skin cancer in their lifetime. In 2005, the age-adjusted mortality rates for melanoma of the skin in Pennsylvania were slightly higher than the United States rates in males (4.7 vs. 4.0 per 100,000) and in females (2.0 vs. 1.8 per 100,000) [5]. The mortality rates for melanoma of the skin among males were more than twice the mortality rates among females in both Pennsylvania and United States [1,5]. In Pennsylvania, the age-adjusted incidence rate increased from 9.5 per 100,000 in 1995 to 17.9 per 100,000 in 2005 [5]. Although the recent increases in the number of patients with incident skin cancer can be partly attributed to better detection, there are significant differences in the disease screening rate and prevention by race/ethnicity [6-8]. Furthermore, subjects with

lower socioeconomic status tend to receive less effective health care service [9-11]. To address and improve major cancer preventions, including skin cancer, the State Department of Health has initiated the Pennsylvania Cancer Education Network (PCEN) since 2007 [12]. As part of the PCEN work, the present study reports the findings from a pilot study of skin cancer education. In the study, we hypothesized that an action-oriented participatory health education program will have significant impact on the improvement of knowledge of skin cancer prevention by promoting practices of limiting exposure to UV radiation, sunlight, and improving participants' attitudes and intentions to screen for skin cancer.

METHODS

Study design and setting

A pre-test and post-test study design was used to

examine the effect of a one-hour (an average 45-minute) health education program on changes in participants' knowledge, attitude, and intention to screen for skin cancer. This study was the pilot study for the Pennsylvania State Department of Health's PCEN. Residents of Pennsylvania aged 18 and older who were living in 67 counties of the State were invited to participate in a health education program offered at local community health care center, Faith-based organizations, Senior Centers, Social/Civic Clubs and Community Libraries across the State in July – August 2007.

Education Materials

PowerPoint presentations on knowledge of skin cancer's etiology, prevention, and control were developed by the Pennsylvania State Department of Health [5]. Attendees completed a pre-presentation questionnaire, and then completed a post-presentation questionnaire immediately following the health education session.

The structured questionnaire included five major components: (a) participants' demographic and social-economic status; (b) five questions on knowledge related to limiting exposure to UV radiation; (c) three questions concerning the attitude that whether screening was embarrassing or painful; and (d) two questions about intention to screen. A sum score for each of the three sections of knowledge, attitude, and intention to screen was calculated separately. Knowledge scores ranged between 0 and 5 with a higher value indicating better knowledge. Attitude scores ranged between 0 and 9 with a lower value indicating less worry about screening. The intent to screen scores ranged between 0 and 6 with a higher value indicating a stronger intention to screen for skin cancer (Appendix : Survey questionnaire).

The PCEN project was approved by the Institutional Review Board (IRB) of the Pennsylvania State Department of Health, and Drexel University.

Statistical analyses

We described the characteristics of the participants using Chi-squared tests for categorical variables and t-tests for continuous variables. To test the effects of the education program on participants' knowledge, attitude, and intention to obtain skin cancer screening, we used paired t-tests to examine the changes of knowledge, attitude, and intention scores between pre-tests to post-tests. To test whether there were any differences in these scores by race/ethnicity and educational levels, we repeated these analyses with stratification of these two variables, race/ethnicity and education.

To examine associations of educational levels in

relation to knowledge, attitude, and intention to screen scores we applied multiple linear regression analysis techniques with adjustment for potential confounders. In the analyses, scores of knowledge, attitude, and intention to screen for skin cancer, measured at post-tests, were the dependent variables, and education level (<high school, high school, and college+ were recorded as 0, 1, and 2, respectively) was the independent variable. To adjust covariates, four sets of regression models were performed: (a) age-adjusted model, (b) age and gender-adjusted model, (c) age, gender, race/ethnicity, and health insurance status adjusted model, (d) finally, to evaluate the effects of baseline scores of knowledge, attitude and intention to skin cancer screen on the changes these scores measured at post-test, we further adjusted their baseline scores. We focused on the association of education level with knowledge, attitude, and intention to screen because participants educational levels may play a critical role in cancer control. Also, it is a modifiable factor that has the potential to be improved on and may subsequently improve cancer screenings at population levels. In the final model, we applied condition index [$CI_i = (\lambda_{\max} / \lambda_i)^{1/2}$, where λ is the eigenvalue] to diagnose multicollinearity problem because of the interrelations of pre-test to post-test scores. If a CI equals to or greater than 30, it suggests multicollinearity is a problem, and then alternative approaches, such as mean deviation method, will be used to remedy multicollinearity problems [13].

All data analyses were conducted using SAS 9.1 version [14]. Two-tailed p-values below 0.05 were considered as statistically significant.

RESULTS

Characteristics of participants

A total of 800 participants aged 18 and older attended the health education sessions. Of them, 33% participants were under the age of 50, 18% were ages 50-64, and the remainder was ages 65 or older. Females had a higher participating rate than males (72% vs. 28%), and 84% were white, 11% black, and 5% other racial/ethnic groups, Table 1.

Changes in scores between pre-test and post-test

The average knowledge scores on limiting exposure to UV radiation significantly increased from pre-test to post-test (4.58 vs. 4.69, $p < 0.01$). Attitude scores indicating that screening is embarrassing or painful significantly decreased (2.79 vs. 2.60, $p < 0.001$), and intention to screen scores significantly increased (3.85 vs. 4.07, $p < 0.001$).

Table 1. Characteristics of participants at baseline survey (n=800)

	N*	%	p-value**
Age (years)			
<50	255	32.82	<.001
50-64	138	17.76	
≥65	384	49.42	
Gender			
Males	211	27.98	<.001
Females	543	72.02	
Race/Ethnicity			
White	652	83.59	<.001
Black	86	11.03	
Other	42	5.38	
Education level			
< High School	140	18.28	<.001
High School	347	45.30	
≥College	279	36.42	
Health Insurance			
Insured	672	87.05	<.001
No insured	100	12.95	

* Missing data are excluded. **: P-value for testing the distribution of proportions

Table 2. Knowledge, attitude and intention to screen for skin cancer scales measured at pre-test and post-test sessions by race/ethnicity and education status

	Pre-test		Post-test		Post-Pre-test	
	Mean	(SE)	Mean	(SE)	Diff.	p-value
Race/ethnicity						
Knowledge about skin cancer						
White (n=550)	4.612	(0.03)	4.692	(0.03)	0.081	.020
Black (n=70)	4.448	(0.10)	4.686	(0.09)	0.238	.038
Other(n=34)	4.294	(0.17)	4.765	(0.09)	0.471	.019
Attitude to screen for skin cancer						
White (n=491)	2.762	(0.07)	2.568	(0.07)	-0.193	.001
Black (n=68)	2.919	(0.17)	2.743	(0.18)	-0.176	.355
Other(n=31)	2.968	(0.25)	2.645	(0.24)	-0.323	.141
Intention to screen for skin cancer						
White (n=463)	3.877	(0.06)	4.073	(0.06)	0.197	<.001
Black (n=64)	3.797	(0.14)	4.125	(0.11)	0.328	.010
Other(n=29)	3.586	(0.25)	4.000	(0.26)	0.414	.123
Education level						
Knowledge about skin cancer						
<High School (n=101)	4.111	(0.10)	4.548	(0.09)	0.436	<.001
High School (n=290)	4.651	(0.04)	4.697	(0.04)	0.047	.345
≥College (n=252)	4.723	(0.04)	4.783	(0.04)	0.060	.181
Attitude to screen for skin cancer						
<High School (n=84)	3.619	(0.22)	3.345	(0.17)	-0.274	.128
High School (n=265)	2.917	(0.08)	2.672	(0.08)	-0.245	.003
≥College (n=234)	2.350	(0.09)	2.220	(0.09)	-0.130	.075
Intention to screen for skin cancer						
<High School (n=77)	3.455	(0.17)	3.455	(0.17)	0.000	.999
High School (n=245)	3.776	(0.07)	4.000	(0.07)	0.224	<.001
≥College (n=229)	4.066	(0.08)	4.323	(0.08)	0.258	<.001

*SE: Standard error of mean.

Table 2 shows that Whites had the highest knowledge score (4.61), lowest attitude to screen for skin cancer (2.76), and highest intention to screen for skin cancer (3.88) in pre-tests. Significant increases in knowledge scores were observed among all racial/ethnic groups. An increase in intention to screen scores was observed among both white and black participants from pre-test to post-test. Significant decreases in the attitude scores were observed among white participants only (a decreased value indicates less worry for screenings),

Participants with higher educational levels had higher knowledge scores at pre-test. There was a tendency for an increase in knowledge scores following the education sessions in all groups within different educational levels. This increase was statistically significant for those with the lowest education level (a 0.436 increase). Attitude scores decreased across all educational level groups from pre-test to post-test (indicating less worry about screening). A significant decrease was among the high school educational level group. Borderline significant results were found in those with college or higher educational levels. Increases in the intention to screen scores were observed those with high school, and those with college or higher educational levels following the attendance of the health education session, Table 2.

Multivariate Models

To examine the associations of educational levels with

knowledge, attitude, and intention to screen for skin cancer, we fitted multiple regression analysis models by using participants' post-test scores as the dependent variables, and educational level as the independent variable, with adjustment for participants' demographic variables. Table 3 shows that educational levels are significantly and positively associated with scores of knowledge about skin cancer prevention, and intention to screen for skin cancer, and negatively associated with attitude scores (indicating less worry about screening), (Models 1 to 3). These associations were independent of age, gender, race/ethnicity, and health insurance status (Model 3). A further adjustment by including baseline (i.e., pre-test) scores of knowledge, attitude, and intention to screen for cancer (Model 4) indicates that the associations between education levels and post-test scores of knowledge and attitude were greatly attenuated and became non-significant ($p>0.05$), except for the association between education levels and post-test score of intention to screen for cancer ($p<0.01$). Testing multicollinearity problem, condition indexes (CIs) are calculated and are 26.3 for education - knowledge model, followed by 22.6 for education - attitude model and 20.8 for the model between education and scores of intention to screen for cancer. All CIs are less than 30, as indicative of no multicollinearity problem.

Table 3. Multivariate analyses of education levels in relation to knowledge, attitude and intention to screen for skin cancer

Scores of									
Education levels	Knowledge			Attitude			Intention to screen		
	Beta	(SE)	p-value	Beta	(SE)	p-value	Beta	(SE)	p-value
Un-adjusted	0.124	(0.041)	.003	-0.527	(0.083)	<.001	0.388	(0.073)	<.001
Adjusted									
Model 1	0.098	(0.042)	.021	-0.543	(0.087)	<.001	0.406	(0.077)	<.001
Model 2	0.105	(0.043)	.016	-0.549	(0.088)	<.001	0.414	(0.078)	<.001
Model 3	0.090	(0.044)	.043	-0.517	(0.092)	<.001	0.369	(0.082)	<.001
Model 4	0.016	(0.043)	.708	-0.117	(0.077)	.128	0.189	(0.070)	.007

Beta: Regression coefficient; SE: standard error of beta.

Model 1: Adjusted for age (<50, 50-64, and >65).

Model 2: Adjusted for age and gender (male, female).

Model 3: Adjusted for age, gender, race (African Americans, White, Hispanic and other race/ethnic groups) and health insurance (yes, no).

Model 4: Adjusted for covariates in Model 3, and base line (i.e., pre-test) scores of knowledge, attitude and intention to screen for skin cancer.

DISCUSSION

In the study, by using the data from a statewide cancer education program, we demonstrated that an action-oriented participatory health education program had significant proximal effects on the improvement of knowledge and attitudes towards skin cancer control and prevention, and also increased the intentions to screen for skin cancer.

Skin cancer is largely preventable by limiting exposure to the primary source of UV radiation, sunlight. Studies have shown that excess exposure to UV radiation and sunlight is a major risk factor for the development of skin cancer [2,3,6,15]. Sunlamps and tanning beds are other sources. Other preventive measures include avoiding the sun between 10:00am and 4:00pm, wearing sun-protective clothing when exposed to the sun, etc [2,3,16]. The present study evaluated the knowledge for skin cancer prevention among a sample of subjects engaged statewide who participated in a skin cancer educational program. Whites had higher knowledge scores than Black and other racial/ethnic groups. Knowledge scores significantly increased following the education session in all racial/ethnic groups. The result adds new insights into the literature that a short-form health education session may significantly improve participants' knowledge on skin prevention.

Although a number of factors may contribute to the barriers of accepting to screen for cancer, we focused on 3 questions on subjects' attitude towards skin cancer screening, as these three questions provide an overall view of a subject's attitude. Whites had a lower attitude score (indicating less worry towards screening) than the other racial/ethnic groups at pre-test. This score was significantly reduced among whites following the attendance of the health education session. Although non-significant changes in attitude scores were observed among black and other ethnic groups, which may be partly contributed to the small sample size of these participants, there was a tendency of a decrease in the attitude score among all racial/ethnic groups.

The present study aimed to test whether an action-oriented health education program works at community education settings. Questions on subjects' intention to screen for skin cancer are one of the key components in the PCEN program. Two questions were designed to assess participants' intentions. White participants had a better intention to screen score than black and the other racial/ethnic groups. This one-hour education session had a significant impact on the improvement of intention to screen for skin cancer for both white and black racial/ethnic groups. Results from the study demonstrate that this short-form health education program may offer a successful model for inclusively

addressing the opportunity of skin cancer prevention at early stages.

In our multivariate analysis, the associations between participants' educational level and their post-test scores of knowledge and attitude on skin cancer prevention became non-significant after adjustment for pre-test scores. It suggests that baseline effects on observed results in a pre-test and post-test program should be taken into consideration when evaluating a education program. In the present study, the significant association between participants' educational levels and post-test scores of intention to screen for skin cancer suggests that this short-form education program has a greater proximal influence on participants' intention to screen, because this association remained significant even after adjustment for participants' pre-test scores of intention to screen for skin cancer.

Several limitations have to be kept in mind when interpreting the study. First, the study was designed using a pre-test and post-test method, that whether there is a natural change in the study outcomes (knowledge, attitude and intention scores) with time could not be tested. Second, the study sample sizes of minority participants are small. It may lead to decrease the statistical power to test for a significant effect by race/ethnicity groups. Third, the majority of participants were females. Further effort should be made to increase male participants, because incidence and mortality from skin cancer are significantly higher among males than it in females.

Strengths of the study include: the study was the first effort to evaluate whether a structured short-form health education program that builds trust, health information, and encourages action could have significant impact on skin cancer screening using a statewide sample of participants. Second, the present study provides evidence of an urgent need for health education programs among those with lower educational attainments. Last but not least, the present study was conducted statewide with multi-sites and involved a number of community health educators, which has a greater potential of improving cancer education and prevention programs at the state level. Findings of the study could be generalized to other prevention programs with an emphasis on health education at community-based population levels.

In conclusion, the proximal results of the PCEN skin cancer education program suggest that an action-oriented participatory health education program may play a pivotal role in improving cancer education and prevention at community settings, and subsequently preventing from the unwelcome epidemic of skin cancer.

Competing interests

None.

ACKNOWLEDGEMENTS

The PCEN program is funded by the Pennsylvania Department of Health through funding the Department receives from the Centers for Disease Control (CDC) and with state funding. Drexel University is funded by a grant from the Pennsylvania Department of Health. The authors' specific thanks go to Drs. Zekarias Berhane and Xiaohua Hu for their roles in statewide dataset management and support, and go to Drs. Zekarias Berhane and Zhen-qiang (Marshal) Ma for their valuable comments on statistical analysis.

The authors thank the PCEN community educators for their great contributions to the PCEN program. Our

great thanks also go to all participants. The present paper could not be completed without their invaluable contribution.

Investigators at Drexel University: Lisa Ulmer MSW, ScD (PI), and (a) Education group: Jamiliyah Gilliam, MS and Augusta Villanueva, PhD; (b) Epidemiology and Biostatistics group: Longjian Liu, MD, PhD, MSc and Zekarias Berhane, PhD; (c) Data Mining & Bioinformatics group: Xiaohua Hu, PhD, Xiaodan Zhang, PhD, Xiaohua Zhou, PhD, and Aek Palakorn, PhD.

Appendix:

Survey questionnaire used in the PCEN program



DEPARTMENT OF HEALTH
Michael G. Amodeo, Governor

Session ID # _____

Skin Cancer Education - Learning About You				
1. Gender ☐ Male ☐ Female	2. Age ☐ Under 50 ☐ 50-54 ☐ 55-59 ☐ 60-64 ☐ 65+	3. Race/Ethnicity ☐ White ☐ African American ☐ Hispanic or Latino ☐ Other	4. Highest grade of school completed ☐ Grades 11 or less ☐ Grade 12 or GED (High school graduate) ☐ College 1 year to 3 years (Some college) ☐ College 4 years or more (College graduate)	
5. How would you describe your health? ☐ Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Poor	6. Do you have any kind of health care coverage, including: health insurance, prepaid plans such as HMOs, or government plans such as Medicare? ☐ Yes ☐ No	7. What would you do if a health care provider told you to make lifestyle changes to improve your health? <i>Lifestyle changes may include eating healthier, exercising more, reducing stress, cutting down smoking, or cutting down alcohol.</i> ☐ I would not consider changing ☐ I would consider changing ☐ I would start to make a few changes ☐ I would change for awhile ☐ I would change permanently		
8. On a typical working week, how often do you work outdoors between 10 am and 4 pm?		_____ days/week		
9. When you go outside on a sunny summer day for more than one hour, how often do you use sunscreen or sunblock?		Never ☐	Sometimes ☐	Most times ☐
10. When you go outside on a sunny summer day for more than an hour, how often do you stay in the shade?		Never ☐	Sometimes ☐	Most times ☐
11. When you go outside on a sunny summer day for more than an hour, how often do you wear a wide-brimmed hat or any other hat that shades your face, ears, and neck from the sun?		Never ☐	Sometimes ☐	Most times ☐
12. When you go outside on a sunny summer day for more than an hour, how often do you wear long-sleeved shirts?		Never ☐	Sometimes ☐	Most times ☐
13. Have you used a sun lamp or tanning bed in the past 12 months?		Never ☐	Sometimes ☐	Most times ☐

14. If you have a history of sunburns early in life you are at higher risk for skin cancer	True ☐	False ☐	20. Compared to others my age, my chances of getting skin cancer are...	Much Less ☐	Less ☐	The Same ☐	More ☐	Much More ☐
15. Having constant exposure to the sun through work and play decreases your risk of skin cancer	True ☐	False ☐	21. Skin cancer is a serious disease	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
16. You should do a skin examination once a year and report changes to your provider	True ☐	False ☐	22. Screening can identify early stage skin cancer	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
17. You should ask your provider for a skin examination as part of your checkup	True ☐	False ☐	23. I am confident that I can get screened for skin cancer	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
18. A mole that varies in color is a symptom of skin cancer	True ☐	False ☐	24. I am worried that screening might be embarrassing or painful	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
19. A mole with one half different than the other half or irregular borders is a symptom of skin cancer	True ☐	False ☐	25. I intend to be screened for skin cancer	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
26. Have you ever had a skin examination? ☐ No ☐ Yes ⇒ How long has it been since you had a skin examination? ☐ Within the past year ☐ 1 year to less than 3 years ago ☐ 3 years to less than 5 years ago ☐ 5 or more years ago								
27. Has a doctor, nurse, or other health professional EVER told you that you had skin cancer? ☐ No ☐ Yes				STOP HERE - TIME FOR OUR PRESENTATION				

Post-Presentation - Please tell us what you learned about skin cancer								
28. If you have a history of sunburns early in life you are at higher risk for skin cancer	True ☐	False ☐	34. Compared to others my age, my chances of getting skin cancer are...	Much Less ☐	Less ☐	The Same ☐	More ☐	Much More ☐
29. Having constant exposure to the sun through work and play decreases your risk of skin cancer	True ☐	False ☐	35. Skin cancer is a serious disease	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
30. You should do a skin examination once a year and report changes to your provider	True ☐	False ☐	36. Screening can identify early stage skin cancer	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
31. You should ask your provider for a skin examination as part of your checkup	True ☐	False ☐	37. I am confident that I can get screened for skin cancer	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
32. A mole that varies in color is a symptom of skin cancer	True ☐	False ☐	38. I am worried that screening might be embarrassing or painful	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
33. A mole with one half different than the other half or irregular borders is a symptom of skin cancer	True ☐	False ☐	39. I intend to be screened for skin cancer	Strongly Agree ☐	Agree ☐	Not Sure ☐	Disagree ☐	Strongly Disagree ☐
Please give us feedback about the presentation and brochures								
40. Educator's knowledge about cancer	Excellent ☐	Good ☐	Fair ☐	Poor ☐	THANK YOU! Know The Facts...   Cancer www.PACancerEducationNetwork.com			
41. Educator's ability to encourage questions and discussion	Excellent ☐	Good ☐	Fair ☐	Poor ☐				
42. Cancer Brochures	Excellent ☐	Good ☐	Fair ☐	Poor ☐				

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