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Factors Associated with Sun Protection Behaviors Among Childhood Cancer Survivors

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Abstract

Background: Childhood cancer survivors are at increased risk of developing skin cancer. Engaging in sun protective behaviors may ameliorate that risk, but prior work shows that survivors engage in suboptimal levels of sun protective behaviors. Guided by the Health Belief Model, this study evaluated factors associated with sun protective behavior among childhood cancer survivors.

Procedure: This is a secondary analysis of a survey study of 94 adult survivors of childhood cancer recruited from a long-term follow-up clinic. Participants reported their sun protection habits, skin type/sensitivity, barriers to sun protection, and perceived severity and susceptibility of getting skin cancer. Descriptive statistics were used to describe the prevalence of sun protection behaviors and hierarchical linear regression was used to evaluate predictors of sun protection behavior following the Health Belief Model.

Results: On average, childhood cancer survivors engaged in moderate levels of sun protective behaviors ($M = 2.53$; $SD = 0.59$). Hierarchical linear regression indicated that fair skin type ($p = .02$) and higher perceived susceptibility relative to non-cancer survivors ($p = .02$) were associated with increased sun protection behaviors. Perceived barriers to sun protection were marginally significant ($p = .09$), while other constructs from the Health Belief Model did not contribute significantly to the model.

Conclusion: Although childhood cancer survivors are at increased risk of developing skin cancer, they engage in suboptimal levels of sun protection behaviors. Findings suggest that interventions to educate survivors about their unique risk of skin cancer and effective prevention behaviors are needed.

Keywords

childhood cancer survivors; sun protection; melanoma; health belief model

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Background

Childhood cancer survivors (CCS) are at greater risk for developing secondary malignancies (e.g., skin cancer) later in life due to individual factors, the disease itself, and treatment effects.[1–3] Certain factors, such as radiation and sun exposure at a young age, increases survivors' risk of being diagnosed with skin cancer later in life.[1, 3, 4] Researchers found that CCS who were treated with radiation are 2.5 times more likely to develop melanoma compared to the general population.[5]

Exposure to the sun is the most important and avoidable cause of skin cancer.[6, 7] Avoiding direct contact with ultraviolet rays can reduce chances of getting sunburns, which increases risk of developing skin cancer.[7, 8] One study found that in the general population, avoiding the sun (e.g. staying in the shade) and wearing long sleeves was associated with fewer sunburns.[9] Behaviors like limiting exposure to the sun during mid-day hours, wearing protective clothing (e.g., long pants) and applying sunscreen of SPF 15 or higher are shown to reduce the risk of developing skin cancer.[10, 11] Given CCS increased risk of developing skin cancer, it is essential for survivors to engage in protective sun behaviors including wearing sunscreen, wearing protective clothing, and avoiding the sun.[12]

Sun protection as a health behavior is not a well-studied area of research compared to other protective health behaviors in CCS.[11] Organizations, such as the Children's Oncology Group, recommend that CCS adhere to sun protection behaviors and be screened for skin cancer annually, yet little information is known about CCS engagement in such behaviors.[2, 11] Research suggests that despite their increased risk of aversive health outcomes, CCS engage in risky health behaviors, such as sun exposure, at rates similar to or slightly below the general population.[13] Further, survivors do not engage in behaviors that promote health and well-being at recommended levels.[14]

The Health Belief Model (HBM) is one framework that has been used to explain why a person will act to prevent, screen for, or control illness conditions, including engagement in health promotion behaviors such as sun protection.[15] Key concepts of the HBM include a person's perceived susceptibility to the illness, severity or seriousness, benefits of changed behavior, barriers or negative consequences of engaging in a health behavior, and self-efficacy.[15]

Although the HBM has been used in study of sun protection behaviors engagement among children of melanoma survivors,[16] it has not yet applied to the general CCS population. The goal of the research is to evaluate factors associated with sun protection behaviors using the HBM as a guiding framework. The goal of this research is to inform intervention development to enhance sun protection behaviors and reduce risk of melanoma among CCS.

Methods

CCS enrolled in the long-term follow-up (LTFU) care program at Rutgers Cancer Institute of New Jersey were asked to complete a survey inquiring about demographic information and skin cancer surveillance behaviors. Primary analyses focusing on skin cancer surveillance behaviors were previously published.[2]

Procedure

Study recruitment packets were mailed to all eligible CCS on the LTFU clinic's newsletter mailing list between December 2013 and February 2014. Packets included a study invitation letter and instructions for completing the survey either online or with an enclosed paper survey. Approximately 1 month after the initial mailing, non-responders received reminders (i.e., postcards, telephone calls, follow-up recruitment package). Participants received a $25 gift card for completing the survey. All study procedures were approved by the University's Institutional Review Board and participants provided informed consent prior to completing the survey.

Participants

Eligible participants were 18 years of age or older, diagnosed with cancer before the age of 20, had no severe cognitive deficits, and English speaking. Recruitment and enrollment are detailed in Stapleton et al.[2] Briefly, 94 participants completed the survey (61% enrollment rate; 94 of the 155 contacted eligible participants had completed the survey). Participants were 56% male and on average 24.6 years of age (SD = 4.45, range = 18 – 41) at the time of study. Most participants identified as Non-Hispanic White (70%); the remaining identified as Hispanic/Latino (14%), Asian (7%), Black/African American (6%), Hispanic Black/African American (1%), and Native Hawaiian/Pacific Islander (1%). In terms of demographics, there were no significant differences in age, race, or ethnicity between participants and nonparticipants[2] which was comparable to the Childhood Cancer Survivor Study (CCSS).[17]

Measures

The survey consisted of 78 items (informed by HBM) which were aimed at assessing the prevalence and correlates of skin cancer prevention and surveillance behaviors among CCS. According to the HBM, CCS will be more likely to engage in sun protection behaviors if they are aware of their susceptibility to skin cancer (including their absolute overall susceptibility as well as their relative susceptibility as cancer survivors compared to healthy peers), understand the severity of developing skin cancer (including both absolute perceived severity as well as their perceived severity relative to other cancers given their history of cancer), believe sun protection behaviors are effective (perceived benefits), and can overcome factors that may prevent them from limiting exposure to the sun (perceived barriers). The predictors of the action or inaction regarding a health behavior include both modifying factors (i.e., gender) and personal beliefs regarding sun protection.[18] Among young adults, other studies have suggested that women are more likely to engage in certain sun protection behaviors, such as limiting sun exposure and wearing sunscreen, compared to men.[12] The survey contained multiple choice, Likert-type, yes/no, and free response questions and took approximately 45 minutes to complete.

The first section of the survey consisted of questions on background information, which included demographics (e.g., age, sex, socioeconomic status), objective skin cancer risk factors (e.g., skin color and sensitivity), and medical risk factors (e.g., history of radiation).

A variation of the Fitzpatrick Skin Phototype Classification (FSPC), a well-established self-report measure was used to assess skin type or sensitivity to sun.[19] FSPC was measured based on responses to the question, “How would your skin react if after several months of not being in the sun, you stayed outdoors in the midday summer sun for 1 hour without sunscreen?”. Responses were measured based on a 6-point categorical scale ranging from “burn easily and do not get darker” to “not burn and not get darker” and dichotomized as “burn easily,” which was coded as 1 (e.g., “burn easily and not get darker/get a little darker”), or “not burn,” which was coded as 0 (e.g., “not burn and get darker/not get darker,” “burn minimally and get a lot darker,” and “burn moderately and get somewhat darker”). FSPC have often been modifications in empirical studies and in clinical, public information and ‘cosmetic’ contexts[19] and the current variation was used to reflect skin reaction to sun after a prolong stay indoors.

The Sun Habits survey consist of seven protective behaviors when outside on a warm sunny day (wearing a shirt with sleeves, wearing long pants, wearing sunglasses, staying in the shade, using sunscreen, limiting time in the sun during midday, and wearing a hat). Participants report their use of each behavior on a 5-point ordinal scale ranging from 1 = never to 5 = always.[20] The survey is scored as a composite average index score, which reflects overall engagement in sun protection behaviors.[21] Although considered an index, as not all behaviors would be expected to go together, it demonstrated reasonable internal consistency (Cronbach’s alpha=0.62). The sun protective behaviors index score was the primary outcome in this study.

Barriers to sun protection (i.e., cost, hassle, apply, inconvenience, comfort, and interference; Cronbach’s alpha=0.71) were measured on a 5-point ordinal scale ranging from 1 = strongly disagree to 5 = strongly agree. The measure yields an overall average sun protection barriers score, with higher scores indicating more barriers.

Absolute overall perceived severity assessed based on response to the question, “How severe do you think the health consequences of skin cancer are?” rated on a 5-point scale from 0 = not at all severe to 5 = very severe. Relative perceived severity was assessed based on the response to the question, “Compared to other types of cancer, how severe do you think the health consequences of skin cancer are?” rated on a 5-point scale from 0 = much less severe than other cancers to 5 = much more severe than other cancers.

One’s absolute overall perceived susceptibility of getting skin cancer was assessed based on the response to the question, “How would you rate your chances of getting skin cancer in your lifetime?” using a 5-point response scale from 1 = not at all likely to 5 = very likely. One’s susceptibility relative to healthy peers (without a history of cancer) was assessed based on the response to the question “Compared to other people of your gender, age and skin color, who have not had childhood cancer, how would you rate your chances of getting skin cancer in your lifetime” using a 5-point scale from 1 = much lower than people without a history of skin cancer to 5 = much higher than other people without a history of skin cancer.

Data Analysis

Data analyses were conducted in SPSS v.24. Three participants with missing data were excluded; a total of 91 participants were included in analyses. A sample size of 91 should yield a power of 0.8 in testing hypotheses for an effect size of 0.3 for a 9 predictor linear regression model. Frequencies of engaging in each sun protective behavior and the overall index score are reported as percentages and mean scores. A hierarchical linear regression model was used to evaluate each predictor variable from the HBM framework with the overall sun protection behavior index as the outcome. Age, gender, history of radiation therapy (Yes or No), and skin type were included in Step 1; predictors from the HBM framework were included in Step 2. Significance was set at $p < .05$.

Results

Engagement in Sun Protection Behaviors

Results showed that on average, CCS engaged in moderate levels of sun protective behaviors ($M = 2.53$; $SD = 0.59$). In terms of individual behaviors, the most commonly endorsed behaviors were wearing sunglasses ($M = 3.43$), wearing sunscreen with SPF 15 or higher ($M = 3.24$), staying in the shade ($M = 2.79$), and limiting mid-day exposure ($M = 2.68$). The lowest endorsed behaviors were wearing protective clothing, including long pants ($M = 2.16$), a hat ($M = 1.88$), and long-sleeve shirts ($M = 1.48$). Furthermore, only sunglasses resulted in over 50% of responses as “Often” or “Always.” The percentages and mean scores for each behavior are reported in Table 1.

Association between HBM factors and Engagement in Sun Protection Behaviors

Results of the hierarchical linear regression indicated a significant overall final model, F (9, 81) = 4.05, $p < .001$, $R^2 = .31$. In Step 1, demographic (age, gender), medical risk factors (history of radiation), and objective skin risk (skin type) accounted for a total of 14% of the variance in the outcome of sun protection behaviors. Specifically, there were marginally significant relationships between history of radiation (p = .06) and skin type (p = .06) with sun protection behaviors. That is, a history of radiation increased the protective behaviors index score by .27 while high risk skin type increased the index score by .25. The addition of the HBM factors contributed significantly to the model, $R^2_{change} = .17$, $F_{change}(5,81) = 3.89$, $p < .01$. While history of radiation was no longer significant ($p = .19$), results indicated that skin type (B = 0.31, $p = .02$) and relative risk ($B = 0.18$ $p = .02$) contributed significantly to the model. That is, having a high risk skin type increased the protective behaviors index score by .31, and a 1-unit increase in relative risk was associated with an increase in the protective behaviors index score by .18. Perceived barriers to sun protection (B = −0.16, $p = .09$) were marginally significant, while the remaining variables did not contribute significantly to the model (see Table 2).

Discussion

Although CCS are at increased risk of developing skin cancer, this study shows that they engage in suboptimal levels of sun protection behaviors to ameliorate this risk ($M = 2.53$ out of 5). This work aligns with other research that suggests that survivors engage in risky health

behaviors and suboptimal protective behaviors at rates similar to the general population.[13, 22] There is little research regarding sun exposure, sun protection, and effective interventions for this population.[23]

Aligning with a previous study,[16] results from this study indicate the most common sun protection behaviors endorsed by CCS are wearing sunglasses and wearing SPF of 15 or higher. Consistent with findings from Krull and colleagues,[24] less than half of the population uses sunscreen. Protective clothing, such as long pants, hats, and long-sleeve shirts are less commonly worn. This is important because a previous study showed that wearing long sleeves was associated with lower sunburns.[16, 25] Thus, while wearing long-sleeves might reduce sunburns, it may also be difficult to implement in this group due to barriers such as hot weather, comfort, and clothing style preferences. Future studies should explore the feasibility and acceptability of protective clothing intervention among this group. These findings are also consistent with previous findings that suggest that wearing SPF is a commonly endorsed sun protection behavior by women in both CCS[26] and the general population.[12] Previous literature suggests differences in sun protection behaviors in men and women, yet this study did not find sex to predict engagement in sun protective behaviors.[27] Further, our results converge with previous findings that suggest that while CCS are at increased risk relative to the general population, they endorsed sun protection behaviors at levels comparable to people who did not have cancer.[27]

This study was among the first to evaluate the association of Health Belief Model constructs with engagement in sun protection behaviors by CCS. By identifying theory-driven factors, results suggest a framework for future interventions tailored to this group that target these constructs. Results indicated that being of fair/easily burned skin type and perceiving greater relative susceptibility compared to healthy peers predicted more engagement in protective behaviors. Though only marginally significant, having more barriers to engaging in sun protective behaviors was related to lower engagement. Together, these findings indicate that providers should continue to council young adult CCS about their relative risk for skin cancer. Providers can reinforce sun protection behaviors among those with fairer skin types who are more likely to be engaging in these behaviors. Results also suggest that those with non-fair skin types may not be aware or have received counseling about their increased risk. Wider campaigns or different messaging may be needed to educate all CCS about their risk and strategies to protect themselves.

One prior study found that a multi-behavior intervention targeting sun protection behaviors was effective in improving health behavior engagement for adolescents who survived childhood cancer.[4] More interventions are needed to target sun specifically to facilitate sun protection behaviors to reduce the risk of developing skin cancer later in life.[4] In fact, a recent review found that the multi-behavior intervention by Mays and colleagues was the only intervention targeting sun protection among adolescent survivors of cancer.[23] Thus, there is a critical need to develop and evaluate new interventions tailored towards educating CCS about the importance of sun protection and helping them overcome potential barriers to engagement.[14] Theory-driven interventions like SHARE[4, 28] produced improvements in short-term self-reported sun safety practices among adolescent survivors of childhood cancer. More work is needed to demonstrate sustained changes in sun protection practices

among CCS. A review conducted by Diao and Lee suggested that increased knowledge and awareness does not consequently translate into behavior change.[29] Thus, interventions need to go beyond raising awareness about sun protection, and implement strategies to change behavior.

The results of our study should be considered in the context of study limitations. The study was a cross-sectional survey from a single institution in the Northeastern US conducted approximately 8 years ago. Although several years old, the trend in sun protective behaviors remains relatively stable over the years.[30] There have not been major public health campaigns or other interventions to improve sun safety broadly such that we would anticipate major improvements since that time. Although including all childhood cancer diagnoses was a strength, the sample was not large enough to compare different diagnoses or specific treatment exposures. In addition, some of the measures used were not validated and thus a potential new area for future work. Finally, the study only examined factors identified in the HBM model; there are likely other influencing factors that were not included.

Despite these limitations, our analysis highlights critical gaps in sun protective behaviors endorsed by young adult survivors of childhood cancer that may exacerbate their risk for skin cancer. These results supported the utility of the Health Beliefs Model in predicting sun protective behaviors, but there was still a large amount of variance not accounted for by the model. Therefore, further research is needed to identify other modifiable health-related variables that are associated with sun protection practices. Future studies should also aim to identify CCS who are at risk (e.g., barriers due to cost, hassle, apply, inconvenience, comfort, and interference) and provide targeted interventions focusing on modifiable behaviors. It is also beneficial to provide interventions to parents as their risk-reducing behavioral measures extended to protective measures among their children.[31] As mentioned previously, providers' role in consulting young adult CCS about their relative risk (e.g., those with fairer skin types) for skin cancer is important and research should explore multilevel factors that reinforce sun protection behaviors among CCS and their providers.

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Data Availability Statement:

The data that support the findings of this study are available from the last author upon reasonable request.

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Table 1.

Frequency of Engaging Sun Protection Behaviors among CCS

Variable	Never %	Rarely %	Sometimes %	Often %	Always %	*M*	*SD*
Wear sunglasses	10.6	9.6	27.7	30.9	21.3	3.43	1.23
Use sunscreen SPF 15 or higher	7.4	14.9	39.4	21.3	16.0	3.24	1.13
Stay in shade/ use an umbrella	9.6	27.7	39.4	21.3	2.1	2.79	0.96
Limit mid-day exposure	11.7	30.9	39.4	13.8	4.3	2.68	1.00
Wear long pants	41.5	21.3	21.3	11.7	4.3	2.16	1.21
Wear a hat	48.9	23.4	19.1	7.4	1.1	1.88	1.04
Wear long sleeve shirt	64.9	23.4	8.5	1.1	1.1	1.48	0.79
Total sun protection behaviors						2.53	0.59

Table 2.

Regression Predicting Total Sun Protection Behaviors

Model	B*	SE	β	*p*	R^2	Δ R^2
Step 1					.14	
Gender	0.15	0.12	.12	.23		
Age in years	0.01	0.01	.09	.40		
History of radiation[a]	0.27	0.14	.21	.06		
Skin type[b]	0.25	0.13	.20	.06		
Step 2					.31	.17**
Gender	0.05	0.12	.04	.66		
Age in years	0.01	0.01	.10	.34		
History of radiation[a]	0.18	0.13	.14	.19		
Skin type[b]	0.31	0.13	.25	.02		
Barriers to Sun Behaviors	−0.16	0.09	−.20	.09		
Overall Susceptibility	−0.05	0.06	−.09	.46		
Relative Susceptibility	0.04	0.06	.07	.52		
Overall Risk	0.02	0.07	.04	.73		
Relative Risk	0.18	0.07	.29	.02		

Note. SE = Standard Error of B. Model 2 Adjusted R^2 = .23, F(9, 81) = 4.05, p < .01.

Step 1 included demographic and personal risk factors predicting the sun protection behavior index score; Step 2 included variables from the Health Belief Model.

[a]Coded as 0 = No, 1 = Yes

[b]Coded as 0 = Low risk, 1= High risk

*For every one unit change in the predictors, the sun protection behavior index score changes by the corresponding B.

**Step 1 demographic and personal risk factors accounted for a total of 14% of the variance in the outcome of sun protection behaviors while Step 2 Health Belief Model factors accounted for 31% of the variance in the outcome. The additional 17% variance indicated a significant model improvement at p < .01.