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Relationship of parent–child sun protection among those at risk for and surviving with melanoma: Implications for family-based cancer prevention

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Abstract

Preventing melanoma, the most serious form of skin cancer, is an important cancer control priority. This is especially true among children living in families previously affected by the disease because the risks for melanoma typically begin early in life. These risks accrue into adulthood but may be mitigated by parental intervention. Melanoma prevention behaviors that could be associated between adults and their children include use of sunscreen, protective clothing, seeking shade, or limiting sun exposure. This study sought to investigate how parent perceptions and behaviors influence sun protection and avoidance behaviors in their children, among relatives of melanoma survivors. In this cross-sectional study, parents ($N = 313$), all relatives of people diagnosed with melanoma, were surveyed about their melanoma risk-reduction behaviors and efforts to protect their children from sun exposure. Linear multiple regressions examined associations among parental behaviors, beliefs, and their reports of risk reduction for their children. Parents who practiced high sun protection themselves (i.e., wearing protective clothing, avoiding the sun, using sunscreen) were significantly more likely to report their child also wore protective clothing ($B = 0.04$, $p < .004$). Findings suggest that parents' use of risk-reducing behavioral measures extended to protective measures among their children. These findings have implications for the clinical care of melanoma survivors' families, including the design of targeted interventions that alter parental beliefs and behaviors surrounding both their own and their children's cancer prevention strategies.

Keywords

Melanoma prevention, Skin cancer risk, Primary care, Sun protection, Sun avoidance, Health communication

Implications

Practice: Interventions focusing on parent or family sun protection and avoidance behaviors may affect sun protection and avoidance behaviors in their children.

Policy: Resources should be directed toward the implementation and dissemination of interventions to improve parent sun protection and avoidance behaviors in families.

Research: Future research should explore whether child age affects the relationship between parent sun protection and avoidance behaviors and that of their children, and seek to develop and evaluate communication tools that improve child melanoma prevention behaviors.

INTRODUCTION

Melanoma is a serious disease, accounting for the vast majority of skin cancer deaths, with an estimated 90,000 new cases diagnosed in 2018 [1]. Nearly all cases of melanoma are caused by ultraviolet (UV) radiation, exposure, and therefore are preventable. Proper preventive and screening behaviors, including the use of sun-protective clothing and sunscreen with SPF 15 or higher, decrease melanoma morbidity and mortality. Inadequate sun protection or indoor tanning, however, puts people at higher risk of developing melanoma. This is particularly true of fair-skinned individuals and individuals who have a family history of melanoma [2]. The 2018 U.S. Preventative Services Task Force recommends sun protection counseling by primary care providers for children, adolescents, and parents of young children at risk to sunburn [3]. Counseling includes discussion about risk reduction behaviors such as sun protection and avoidance. These behaviors include encouraging the use of adequate sun-protective clothing when exposed to sunlight, such as broad-brimmed hats, using a broad-spectrum (UVA/UVB) sunscreen with SPF 15 or higher every day, and seeking shade when outdoors and limiting outdoor activities, especially between the hours of 10 am and 4 pm when UV rays are at their strongest. Counseling also covers limiting use of artificial sources of UV light, such as indoor tanning and encouraging young people to avoid such practices, given the association between youth tanning and poor sun protection [4, 5].

Parents probably have a strong influence on their child's cancer prevention habits, including sun

protection and avoidance behaviors [6]. They are well positioned as agents for socialization with respect to their child's development, influencing their child's immediate sun protection and avoidance behaviors and supporting early melanoma prevention [7]. This influence may lay the foundation for their child's sun protection and avoidance habits later in life, but more importantly, parents can reduce their child's sun exposure early [8, 9]. Parents can encourage children to wear sunscreen and protective clothing when they are young—two of the most frequently cited melanoma prevention behaviors—decreasing childhood sunburns and reducing the child's lifetime risk of melanoma [10–13].

To date, several studies have explored parental use of sun protection for their children, and the relationship between parents own sun protective behaviors and their children's sun protection and avoidance behavior [14–19]. Parent perceptions surrounding melanoma risk and prevention may also affect their child's risk reduction behaviors. Current research indicates that risk perception and beliefs about self-efficacy are predictive of health behaviors and can be leveraged to modify attitudes and facilitate health behavior change [20, 21]. Perception of risk and beliefs about self-efficacy may be influenced by family cohesion and support [22]. In other words, not only do parents' perceptions and beliefs affect their own health behaviors, but these factors may also influence their child's melanoma prevention behaviors given the important role parents play in shaping their child's cancer prevention habits [6, 20].

More research is needed to identify parent perceptions and melanoma prevention behaviors that shape their children's sun protection and avoidance behaviors. This is particularly true among relatives of melanoma survivors, in an effort to influence sun protection practices of those at higher risk for melanoma [2]. Leventhal's Common Sense Model of Health Behavior is well suited to address this area of need, describing how thoughts and beliefs about health and disease risk influence behavior [23]. This model emphasizes that the way people cope with information about their health, or in this case melanoma risk, affects the enactment of health behaviors for themselves and perhaps their children, incorporating the importance of the individual's emotional reaction to a health risk.

The present study investigated how parent perceptions and behaviors influence sun protection and avoidance behaviors in their children, among relatives of melanoma survivors. Parent perceptions included parental self-efficacy and self-confidence with melanoma screening habits and sunscreen use, perceptions about tanning, and family support. Parent sun protective behaviors included parent sun avoidance behaviors, use of adequate sun-protective clothing while outside between the hours of 10 am and 4 pm, and parent tanning behaviors. We surveyed parents about their own and their children's sun protection behaviors, hypothesizing that parents who practice adequate sun protection and avoidance, and believe that they can effectively perform these tasks, will have children who also exhibit adequate melanoma prevention behaviors.

METHODS

Original study and recruitment

Our present study analysis only included relatives of melanoma survivors, who were also a parent of a child 18 years and younger, from the Suntalk study. The Suntalk study is a randomized controlled trial of a web-based communication and support intervention funded by the National Cancer Institute (NCI) [24]. Study data included baseline parent data. Participants in the original Suntalk study were recruited through melanoma survivors from population-based cancer registries in the Pacific Northwest, including (i) the Northwest Cancer Genetics Network, a regional site of the Cancer Genetics Network, and (ii) the Surveillance, Epidemiology, and End Results (SEER) registry (Cancer Surveillance System) at the Fred Hutchinson Cancer Research Center [24]. Survivors provided contact information for first-degree relatives (FDRs) and other family members. Families with at least one melanoma survivor were recruited by telephone and invited to participate in a telephone survey at baseline. Participants included in the original Suntalk study were a combination of (i) the survivor of melanoma (case), (ii) an FDR of the case, and (iii) a relative who was a parent of a child 18 years and younger (parent).

Telephone survey

One relative was contacted for each melanoma survivor in the original Suntalk study. Participants were contacted via telephone to determine eligibility. Eligible individuals were asked to complete the baseline survey over the phone. The survey included questions about participants' skin self-examination behaviors, personal sun protection behaviors, sun protection behaviors practiced on their children, and provider skin screenings. Parents were asked to respond to a series of questions about one of their children. If the person had more than one child who was 18 years or younger, they were asked to randomly select one of their eligible children when responding to the questions about their child's sun avoidance and protection.

Measures

Present study outcomes

Dependent variables included parental reports of sunscreen use among children and use of protective clothing among children [25, 26]. For the child sun

protective behavior scale, parents were asked about their child's sunscreen and protective clothing use. Parents were asked if their child had worn sunscreen on eight different parts of their body (face, neck, shoulders, upper arms, lower arms, torso, legs, and feet) the prior day between the hours of 10 am to 4 pm. In scaling these data, participants received 1 for every yes and 2 for every no. We calculated a child sunscreen use scale by averaging responses; lower scores corresponded with greater sunscreen use and possible scores ranged from 1 to 2.

Parents were also asked about their child's use of protective clothing the prior day between the hours of 10 am and 4 pm. Protective clothing included head coverings and clothing that covers a child's upper body, lower body, and feet. Responses were dichotomized into high or low, where high protection for each body part was defined as clothing that covered the majority of the body part and included the use of (i) any type of hat or cap; (ii) a short-sleeved shirt with a collar or hood or any type of long-sleeved shirt with or without a collar or hood; (iii) long pants or jeans; and (iv) shoes or sandals with socks. Participants received a 1 for every report of low protective clothing for scaling purposes and a 2 for every report of high use of protective clothing, where higher scores indicate greater use of protective clothing among children and possible scores ranged from 1 to 2.

Parental sun protection and avoidance behaviors

For the parent sun protection scale, parents were asked about six sun protection behaviors in the previous 7 days including wearing a long-sleeved shirt or blouse, wearing long pants or skirts, wearing sunscreen SPF 15+, wearing something on the head, using sunglasses, or seeking available shade when outside. Responses were dichotomized based on previous work, as "high" or "low" [27, 28]. Individuals who indicated that they practiced recommended sun protection and avoidance behaviors *often* or *always* were coded as high (=1), and those who reported lower frequency were coded as low (=0). Scores across all domains were summed, resulting in an aggregate scale ranging from 0 to 8. Higher scores indicated that there was greater sun protection exercised among parents [29].

Parent tanning behaviors and perceptions

The tanning behavior scale was created by averaging responses to questions about parent tanning behaviors over the past 12 months [25, 26]. These questions asked parents to reflect on their use of tanning lamps or UV lamps in tanning salons, use of a spray tan from a tanning salon, or use of a spray or rub-on tanning product at home. Participants responded with a yes or a no and received a 1 for yes and a 2 for no. Scores were averaged, resulting in a scale with possible scores ranging from 1 to 2. Higher scores indicated decreased use of indoor tanning products and devices [30, 31]. We also evaluated beliefs about tanning and tanned skin, with the tanning family attitudes scale. This scale averaged participants' responses to questions about whether people in their family generally believe that tanned skin is healthy skin and that using tanning lamps is a good way to get tan. Responses were provided on a scale from 1 = *strongly agree* to 4 = *strongly disagree* [32]. Higher scores indicated disagreement that tanned skin was healthy skin and that artificial means of tanning were a good way to get tan, whereas lower scores indicated agreement with these beliefs and practices.

Other associated variables

We assessed participants' relationship with their family by using the emotional/informational support subscale from the Medical Outcomes Study Social Support Survey instrument [33]. This instrument measured family emotional and informational support by averaging responses to nine questions about family emotional and informational support variables. Participants were asked if they felt like they had someone in their family they could count on to listen to them, who could provide good advice about a crisis, who would take them to the doctor or help with daily chores when they are sick. Other questions prompted participants to reflect on if they had someone in their family that they could have fun with or that helped them feel wanted. Responses were provided on a scale from 1 = *none of the time* to 5 = *all of the time* and averaged to create a scale with possible scores ranging from 1 to 5, for which higher scores indicated higher levels of general emotional and informational support.

Finally, participant self-efficacy was assessed with four items asking participants to report how confident they were that they could examine and protect their own skin, adapted from Friedman et al., Oliveria et al., and Jackson and Aiken [34–36]. Responses were provided on a scale from 1 = *not at all* to 5 = *extremely* and averaged to create a scale with possible scores ranging from 1 to 5, where higher scores indicated higher level of confidence in their ability to check their own skin correctly and to detect changes in their skin. Similarly, participants responded to seven items asking them how certain they are that they could use sunscreen on a regular basis on every part of their body, and make it a part of their daily routine, including using sunscreen while doing outdoor activities, even if they were not planning on being outside very long [36]. Responses were provided on a scale from 1 = *not certain at all* to 5 = *very certain* and averaged to create a scale ranging from 1 to 5, where higher scores indicated increased certainty in their ability to use sunscreen appropriately in different scenarios and make sunscreen application a part of their daily routine.

Analysis

We calculated descriptive and summary statistics for participant's demographic characteristics and reported skin protection behaviors, worry, risk perception, and screening behaviors. We used linear regressions to evaluate associations between outcome variables, including sunscreen use among children and use of protective clothing among children, and independent variables of interest, including parental sun protection and avoidance behaviors, and parent perceptions and thoughts surrounding cancer and tanning. Regression models excluded age of child, as child age was underreported by participants. Analyses were conducted using SPSS version 24 (IBM Corp., Armonk, NY).

RESULTS

Participant demographic characteristics

Study participants included relatives of individuals with a history of melanoma, who had a child of 18 years or younger (n = 313). Table 1 describes participant characteristics, including demographics, if the participant had more than one child, and the age of the child they selected to respond in reference to. The majority of participants were white (96%) and just under 4% identified with more than one race. The average age of participants was just under 41 years of age (range = 21–61 years), more than half (66%) were female, the majority (91%) were married or partnered, over half (62%) had an income of $70,000 or higher, and over half (67%) had completed a college degree or higher. More than half of the participants (62%) had two or more children, and the remaining participants had one child. Participants also reported the age of the selected child. Almost one quarter of respondents (22%) indicated their child was 6 or under, 22% reported their child was between the age of 7 and 12, and 17% responded that their child was 13 years of age or older. The remaining participants (39%) did not report their child's age. Most participants had an FDR who had melanoma (73%). The majority (89%) did not live in the same city as the melanoma case.

Parent melanoma preventative behaviors and perceptions

Tables 2 and 3 present the parent behaviors and perceptions relative to preventing melanoma. Nearly half (48.5%) of parents reported they wore a long-sleeved shirt or blouse in the past 7 days, 70.0% wore long pants or a long skirt, and 14.0% wore something on their head (such as any type of hat, cap, or scarf; Table 2). Only 4.4% wore a hat with a wide brim (at least 2.5 inches wide around), and 47.3% wore sunglasses. About a third (33.2%) of participants wore sunscreen with SPF 15 or higher, 24.0% stayed in the available shade when outside, and 20.7% avoided going outside during the hours when the sun was strongest. For the tanning behaviors scale, more than a third (37.7%) of parents used one or more of the following in the last 12 months: tanning lamps or UV lamps, spray-on tan at a salon, or spray-on or rub-on tanning product at home (M = 1.84; SD = 0.23; Table 3). Responses to the family support scale indicated that more than a third of participants (33.9%) said they had received informational and emotional support from their family "all of the time," nearly half (46.3%) said they had support from their family "most of the time," 17.6% said they had support from their family "some of the time," and 1.9% of respondents reported support from their family members a "little bit of the time" (M = 4.48; SD = 0.62; Table 3).

On the self-efficacy scale, only 5.4% of respondents indicated that they felt very certain they could use sunscreen correctly and regularly, 20.1% were not certain at all, and the remaining 74.4% were somewhat certain they could comply with appropriate sunscreen use (M = 3.03; SD = 1.14). On the self-efficacy scales, participants reported how confident they felt to carry out skin cancer screening and protect themselves from the sun correctly. Very few (3.2%) said they were "not at all confident," 27.2% were a "little bit confident," almost half (49.8%) were "moderately confident," 17.3% were "quite confident," and only 2.6% were "extremely confident" (M = 3.25; SD = 0.76; Table 3).

Participants also reported (see Table 3) on family attitudes and perceptions around tanning, with 77.0% of participants expressing disagreement about tan skin being a sign of healthy skin, or, similarly, that using tanning lamps is a good way to get a tan (M = 3.16; SD = 0.67). Most participants (87.5%) reported family cohesion at least some of the time, and the remaining respondents said their family felt cohesive "once in a while" based on the criteria provided (M = 3.24; SD = 0.27). Most (93.9%) of respondents did not report any cancer worry at all, or rarely did, whereas the remaining 6.1% explained that they sometimes experienced worry about cancer (M = 1.25; SD = 0.31).

Child sun protection and avoidance behaviors

Most parents indicated that their child used some form of protective clothing, shown in Table 4, but relatively few reported that their child had high protective clothing across all domains. A total of 16.6% reported high protective clothing use for children, on average across all types of clothing, with the remaining 83.4% reporting low protective clothing use (M = 1.51; SD = 0.32). Almost a quarter of participants (24.9%) said their child wore something on their head when outside, and only 7.6% of the total study population reported use of a head covering that provided high sun protection. About half (54.6%) of participants reported that their child had clothing that provided high sun protection on their upper body, defined as short sleeves with

Table 1 | Parent demographic characteristics

Variable	*N*	%
Age of adult		
Average age (*SD*)	40.7 (7.5)	—
[Range]	[21–61]	—
Gender		
Female	206	65.8
Male	107	34.2
Participant familial relationship to melanoma case		
First-degree relative	227	72.5
Second-degree relative	50	16.0
Third-degree relative	36	11.5
Participant geographic closeness to melanoma case		
Lives in the same city as case	36	11.5
Does not live in the same city as case	277	88.5
Education level		
≤High school degree	17	5.4
Some college	88	28.1
≥College degree	208	66.5
Race		
White	299	95.5
Nonwhite/unknown	14	4.5
Marital status		
Never married	6	1.9
Married/partnered	286	91.4
Divorced/separated	19	6.1
Windowed	2	0.6
Income		
≤50 k	60	19.2
51–70 k	52	16.6
≥70 k	194	62.0
Refused/did not know	7	2.2
Number of children under the age of 18		
Has one child	117	37.4
Has two or more children	195	62.3
Refused	1	0.3
Age of reported child		
≤6 years old	69	22.0
7–12 years old	69	22.0
≥13 years old	54	17.3
Refused/did not report	121	38.7

a collar or hood or a long-sleeved shirt. Only 3.6% reported that their child worse something providing high sun protection on their lower body, defined as long pants or another item of clothing that went at least below their knees, and 72.2% of participants reported that their children wore shoes or sandals with socks when outside during peak sun exposure hours (10 am–4 pm) the previous day (Table 4).

The majority of parents (86.9%) reported low child sunscreen use, with only 13.7% using high sunscreen protection on average (M = 1.93; SD = 0.23). Specifically, 11.5% applied sunscreen to their child's face, 11.1% to their neck, 4.8% to their shoulders, 7.0% to their upper arms and 9.3% to their lower arms, 4.1% to their torso, 7.0% to their legs, and 4.4% indicated that their child used sunscreen on their feet (Table 4).

Associations between child and parent melanoma prevention behaviors

Table 5 summarizes the outcomes from the multiple linear regressions examining high protective clothing use while children were outside, based on parental melanoma prevention behaviors and perceptions. Parents who practiced high sun protection themselves, by wearing protective clothing, avoiding the sun, and using sunscreen, were more likely to report that their

Table 2 | Parent sun protection and avoidance behaviors

Sun exposure: In the past 7 days how often did you...	Never *n* (%)	Sometimes *n* (%)	Half the time *n* (%)	Often *n* (%)	Always *n* (%)	High *n* (%)
Wear a long-sleeved shirt or blouse	60 (19.2)	47 (15.0)	53 (16.9)	48 (15.3)	104 (33.2)	152 (48.5)
Wear long pants or a long skirt	30 (9.6)	33 (10.5)	30 (9.6)	49 (15.7)	170 (54.3)	219 (70.0)
Wear sunscreen SPF 15+	158 (50.5)	36 (11.5)	11 (3.5)	31 (9.9)	76 (24.3)	107 (33.2)
Wear something on your head	173 (55.3)	80 (25.6)	15 (4.8)	23 (7.3)	21 (6.7)	44 (14.0)
Wear a hat with a brim (at least 2.5 in wide all the way around)	267 (85.3)	26 (8.3)	5 (1.6)	9 (2.9)	5 (1.6)	14 (4.5)
Wear sunglasses	72 (23.0)	65 (20.8)	27 (8.6)	58 (18.5)	90 (28.8)	148 (47.3)
Stay in available shade	112 (35.8)	95 (30.4)	30 (9.6)	54 (17.3)	21 (6.7)	75 (24.0)
Avoid outdoors when the sun is strongest	169 (54.0)	64 (20.4)	14 (4.5)	43 (13.7)	22 (7.0)	65 (20.7)

Table 3 | Parent melanoma prevention behaviors and perceptions

Parent behavior/perception	*n* (%)
Aggregate scores for parental sun protection behaviors in the past 7 days...	
High sun protection in 5+ domains	29 (9.3)
High sun protection in 4 domains	49 (15.7)
High sun protection in 3 domains	81 (25.9)
High sun protection in 2 domains	95 (30.4)
High sun protection in 1 domain	41 (13.1)
High sun protection in 0 domains	18 (5.8)
Family emotional support scale	
Feels support from family all of the time	106 (33.9)
Feels support from family most of the time	145 (46.3)
Feels support from family some of the time	55 (17.6)
Feels support from family a little bit of the time	6 (1.9)
Tanning behavior scale	
Did not engage in indoor tanning in the past 12 months	195 (62.3)
Did engage in indoor tanning in the past 12 months	118 (37.7)
Certainty over ability to use sunscreen appropriately	
Very certain	17 (5.4)
Somewhat certain	233 (74.4)
Not certain at all	63 (20.1)
Confidence over ability to examine and protect their own skin	
Extremely confident	8 (2.6)
Quite confident	54 (17.3)
Moderately confident	156 (49.8)
A little bit confident	85 (27.2)
Not at all confident	10 (3.2)
Tanning family attitudes scale	
Agree: Strongly agree or agree with tanning behaviors	72 (23.0)
Disagree: Slightly disagree or strongly disagree with tanning behaviors	241 (77.0)

child used high protective clothing when outside (B = 0.04, p = .002). Tanning family attitude was not associated with the use of protective clothing among children. The relationship between participants who strongly disagreed that tanned skin was healthy skin and that tanning lamps were a good way to get a tan and use of protective clothing for their children was suggestive of an association (B = 0.05, p = .082). Family emotional support, tanning behavior, self-efficacy, and self-confidence were not associated with child use of protective clothing. Family cohesion and cancer worry were excluded from the final model because they did not significantly contribute to the main outcome.

DISCUSSION

Study participants were all relatives of people who had been diagnosed with melanoma. This

Table 4 | Parents who reported high child sun protection behaviors

Child sun protection behavior	*n* (%)
Sun exposure: In the past 7 days did your child...	
Wear a long-sleeved shirt or blouse	171 (54.6)
Wear long pants or a long skirt	30 (9.6)
Wear shoes (high defined as closed shoes or sandals with socks)	226 (72.2)
Wear a hat (high defined as a hat with a brim 2.5 in+)	24 (7.6)
Did your child wear sunscreen SPF 15+ on their...	
Face	36 (11.5)
Neck	30 (11.1)
Shoulders	13 (4.8)
Upper arms	19 (7.0)
Lower arms	25 (9.3)
Torso	11 (4.1)
Legs	19 (7.0)
Feet	12 (4.4)

Table 5 | The relationship between use of protective clothing reported for the child and parent melanoma prevention behaviors and perceptions

	Estimate	Lower CI	Upper CI	*p* value	Estimate	Lower CI	Upper CI	*p* value
	Model 1				Model 2			
Family support	0.02	−0.04	0.08	0.444	0.02	−0.03	0.08	.415
Tanning behavior	0.08	−0.08	0.24	0.317	0.05	−0.11	0.21	.577
High sun protection over the last 7 days (among parents)[a]	0.04	0.02	0.07	0.002*	0.04	0.01	0.07	.004*
Self-efficacy certainty scale					<−0.00	−0.04	0.03	.769
Self-efficacy confidence scale					−0.01	−0.06	0.04	.583
Tanning family attitudes scale					0.05	<−0.00	0.10	.082

CI confidence interval.
[a]Variable has total score of 8 possible, with higher scores indicating better sun protection.
*A statistically significant value, $p < .05$.

increased risk makes this population an important target for melanoma prevention and risk reduction interventions, particularly among children for whom sunburns contribute to lifetime risk of melanoma [10–13]. Findings from this study indicated that child use of protective clothing mirrors specific parent sun protective and avoidance behaviors. Parents who practiced sun protective and avoidance behaviors themselves by wearing protective clothing, avoiding the sun between the hours of 10 am and 4 pm, and applying sunscreen were more likely to report that their children used adequate protective clothing. Parental perceptions, about tan skin being healthy skin and parental belief that tanning lamps are a good way to tan, were not associated with child sun-protective clothing use. Parental sun protective and avoidance behaviors, or risk perception, were not associated with whether children used sunscreen or how much time they spent outside. No parent demographic variables, including geographic and relationship closeness to the case relative (i.e., the relative with melanoma), were associated with child sun protection use.

The association between parent sun protective and avoidance behaviors, and their child's use of protective clothing supports our hypothesis and aligns with prior studies finding an association between specific parental melanoma prevention behaviors and prevention behaviors practiced on children [13, 19]. The relationship between parent melanoma prevention behaviors, and that of their children, also supports the importance of invoking the "family," when planning risk reduction interventions for children in melanoma families [24]. Prior research indicates that the family is a critical source for support and information about disease prevention and is one of the most important variables in developing and modifying health risk behaviors, such as sun exposure [24].

The parent–child dyad might be particularly important when factoring in anticipated regret [37]. Anticipated regret, in the context of child sun protective and avoidance behaviors, refers to the belief that a parent will feel regret if they fail to encourage melanoma risk prevention behaviors in their children [37]. Leventhal's Common Sense

Model of Health Behavior suggests that the parent's emotional reaction to an anticipated health risk may influence the individual's mental representations and their action plan [23]. If a parent considers the regret they will feel in the future for not making their child wear adequate sun-protective clothing, the emotional response prompted may make them more likely to enforce melanoma prevention behaviors for their children. Future research could focus on anticipated regret as a possible mechanism for explaining the association between parent and child sun-protective behaviors.

The relationship between parental sun protective and avoidance behaviors and those of their children could inform the design of clinical interventions among survivors' families, including targeted family behavior interventions. For example, when talking to families about melanoma risk and prevention strategies, health care providers could target parents, with relatives who have been diagnosed with melanoma, and speak to them about appropriate sun protection and avoidance behaviors for them and their children. This might occur through transmission of risk perceptions, relevance to their family, or some other mechanism, all variables that may influence emotional response and help facilitate change. All of these could form the basis of an intervention, as well as future research. Future research could further assess how behavioral interventions targeting key parent sun protective and avoidance behaviors affect the sun protection and avoidance behaviors of their children.

Several parent attitudes and perceptions were not related to child sun protective and avoidance behaviors, including family cohesion and cancer worry. These psychosocial variables were excluded from the final regression model. It is possible that cancer worry was not related as the result of insufficient variance due to sampling because all participants had a family history of melanoma. Family cohesion, or the quality of interactions an individual has with their family, may be irrelevant to the child–parent dyad simply because it is separate from relationships with the extended family. In other words, an individual's relationship with their siblings or extended family has little impact on their relationship with their young child.

The present study had several limitations that limit the generalizability of the findings. First, child age was underreported and thus could not be included in analyses. Child age has been identified as related to sun protection in prior studies [17, 19]. Future studies may want to examine the impact of child age on the relationship between parental sun protective and avoidance behaviors and children's behaviors. Other limitations include the single geographic focus of this study (Pacific Northwest). Region-specific recruitment may limit generalizability due to differences in UV exposure between the Pacific Northwest and other locations. Participants from the Pacific Northwest may also practice different melanoma prevention behaviors when compared with other parts of the USA, in part due to these differences in UV exposure. In addition to these limitations, this study may also be subjected to recall bias, as the result of asking parents to self-report the sun protection and avoidance behaviors of their children. Child selection may also have invited bias because parents were asked to randomly select a child to respond to the questionnaire on behalf of. Finally, because these are the results from a cross-sectional study, the translational aspect of this project is limited. Future research will test this in a longitudinal setting.

In summary, we found that parent use of sun-protective clothing seems to affect child's use of sun-protective clothing, but other parent sun protective and avoidance behaviors or parent perceptions about melanoma prevention do not appear to affect child's use of sun-protective clothing or other child sun protective or avoidance behaviors. Based on our findings, future interventions, targeting relatives of people diagnosed with melanoma, should focus on talking to parents about how their own sun protective and avoidance behaviors affect their child's use of protective clothing and melanoma risk. More research is warranted to help translate these findings into clinical practice, enhancing melanoma prevention practices in children, and to learn more about how child age may influence the relationship between parent sun protection and avoidance behaviors and that of their children.

Compliance with Ethical Standards

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