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## Parent and Child Perspectives on Perceived Barriers to Child Sun Protection and their Association with Sun Protection Strategies among Children of Melanoma Survivors

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### Abstract

**Background/Objectives:** Children with an elevated familial risk for melanoma inconsistently implement sun protection behaviors that could mitigate their melanoma risk. Little is known about perceived barriers to child sun protection among this at-risk group and their parents, and the extent to which perceived barriers are associated with child sun protection. The goal of this study was to examine, among children with a family history of melanoma, the frequency with which children and their parents reported barriers to child sun protection and the extent to which barriers were associated with reported use of sun protection among children.

**Methods:** Children with a family history of melanoma and their parents completed questionnaires assessing perceived barriers and reported child use of sun protection.

**Results:** Common barriers to child sun protection included being bothered by implementing the behavior or forgetting. A greater number of perceived barriers was associated with less frequent child use of sunscreen, long-sleeved shirts, long pants, and shade.

**Conclusions:** Children at elevated risk for melanoma due to a family history of the disease and their parents perceive multiple barriers to sun protection that are associated with children's use of

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these melanoma preventive behaviors. Sun protection interventions for this at-risk population could provide families with specific strategies to address common barriers to implementing child sun protection.

## Keywords

Skin cancer; prevention; family; health behavior; children

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## Introduction

Melanoma is the most lethal form of skin cancer and was diagnosed in over 87,000 people in the United States in 2017.<sup>1,2</sup> It is one of the most common cancers diagnosed in young adults ages 15–29 years.<sup>3</sup> Sun protection strategies such as use of sunscreen, protective clothing, and shade should be implemented early in life, because childhood UVR exposure and sunburn occurrence are key risk factors for melanoma later in life.<sup>4,5</sup>

As melanoma rates increase, including among young adults,<sup>6</sup> healthcare providers will continue to encounter children with an elevated risk for melanoma due to a family history. Children who have a parent with a history of melanoma have a 2-fold risk for developing the disease, making implementation of sun protection to decrease environmental contributors to melanoma particularly important. Despite public health campaigns, children with a family history of melanoma do not consistently employ recommended sun protection strategies, and they experience sunburns.<sup>7–10</sup> With the exception of sunscreen use ranging from 69–79% for at-risk children and 9–40% for children from the general population, frequency of sun protection use is similar between at-risk children and children from the general population (protective clothing: at risk=28–76%, general population=22.8%; shade-seeking: at-risk=23–33%, general population=22%).<sup>9–11</sup>

To inform interventions to improve use of sun protection among children with a familial risk for melanoma, a better understanding of barriers to sun protection among these at-risk children and their parents is needed. Existing research has shown that among melanoma survivors, higher scores on barriers were associated with lower child use of sun protection.<sup>8,9</sup> Qualitative studies have identified barriers to sun protection among at-risk children and parents that include discomfort associated with applying sunscreen and parental beliefs that sun protection is not necessary.<sup>12,13</sup> However, no studies to our knowledge have documented the frequency with which children with a familial risk for melanoma and their parents experience specific barriers to child sun protection, and the extent to which specific barriers are associated with child sun protection. The current study documents the frequency with which children with a parent with a history of melanoma and parents endorsed barriers to child sun protection, and explores associations between barriers and reported child sun protection.

## Methods

Parents were eligible if they were the primary caregiver for at least one child under age 18, and the child had a biological parent with melanoma or at least three relatives on the same side of the family with melanoma. Children were eligible if their parent participated, they

were 8–17 years old, and had at least one parent (alive or deceased) with melanoma. Recruitment occurred through: 1) Letters to melanoma patients at a cancer center and individuals in a study about familial melanoma risk. 2) Advertisements in clinics, a skin cancer screening, the cancer center’s social media, and melanoma advocacy groups. 3) Potential adult participants approached in clinic. Participants provided written informed consent. Questionnaires were completed in-person or via mail and participants received a gift card. All procedures were approved by the Institutional Review Board.

Participants completed a questionnaire including items on barriers to and frequency of child sun protection use. Parents reported on all their children under the age of 18 as a group. The assessment of barriers to child sun protection consisted of 22 items assessing child use of sunscreen (10 items), protective clothing (9 items), and shade or avoiding peak UVR exposure (3 items).<sup>14–18</sup> Items were written at a 5<sup>th</sup> grade reading level for adults and a 4<sup>th</sup> grade reading level for children. Responses were rated on a 5-point Likert scale from “very unlikely” to “very likely.” Reported frequency of use for each child sun protection strategy and child intentional outdoor tanning was assessed on a 5-point Likert scale from “never” to “always,” a modified form of the Sun Habits Survey.<sup>19</sup> Parents completed demographic characteristic items. Children reported on their age and sex, and the same sun protection barriers as their parents.

Descriptive statistics were calculated to summarize demographic characteristics, child sun protection behaviors, and endorsement of barriers to child sun protection (i.e., barriers endorsed as “likely” or “very likely”). To understand the association between number of barriers and child sun protection use, linear regressions were conducted with total number of barriers for each behavior as the independent variable and corresponding sun protection behaviors as the outcome. To investigate whether specific barriers to child sun protection were associated with sun protection above other barriers, multivariable linear regressions were conducted with all parent- or child-reported barriers for each sun protection behavior (absent/present) simultaneously included as independent variables with child sun protective behavior as the outcome. Separate exploratory models were conducted for parent- versus child-report of barriers and child sun protection. The barriers were entered as present versus absent based on their frequency of endorsement. Chi-square tests were used to explore differences in child-reported barriers endorsed by children of different ages (8–12 year olds versus 13–17 year olds). All analyses were conducted using SPSS version 24.

## Results

In total, 419 adults were screened for eligibility and 140 were eligible (most common ineligibility reason was not having minor children; 43%). Of the 140 eligible, 69 (49%) participated. In one family, both parents participated, resulting in an overall sample of 70 adults. To maintain independence, one parent from this family was randomly selected to be included in analyses. Sixty-nine parents and 63 children (mean age=11.7 years, SD=2.8) participated (see Table 1).

## Adoption of Melanoma Prevention and Risk Behaviors, and Sunburn Occurrence

Children's use of sunscreen was the most frequently endorsed sun protective behavior by both parents (75%) and children (47%). Long-sleeved shirts and wide-brimmed hats were reportedly used infrequently (5–23%) (Table 1). Only 15% of parents reported their children wore long pants or a long skirt, as opposed to 50% of children. Avoidance of UVR exposure during peak hours and shade-seeking ranged from 23% to 34%. Outdoor intentional tanning was infrequently endorsed (1–5%). Approximately half of parents (51%) and three-quarters of children (73%) reported that the child experienced one or more sunburns in the past 12 months.

## Frequency of Endorsement of Barriers

On average, parents endorsed 10.6 (SD=4.8) sun protection barriers and children endorsed 8.1 (SD=5.1) sun protection barriers (out of a possible total of 22 barriers) (Table 2). The most commonly endorsed barriers to sunscreen use for both parents and children, respectively, were: Forgetting to apply sunscreen (80%, 55%), bother of sunscreen (48%, 30%), and sunscreen getting in the way of children's leisure activities (25%, 23%). For protective clothing use, the top parent-endorsed barriers were getting in the way of children's leisure activities (80%), bother of protective clothing (77%), and protective clothing being uncomfortable (75%). Children's top barriers to protective clothing use were protective clothing being uncomfortable (53%), bothersome (44%), and forgetting to bring and wear protective clothing (41%). Forgetting was also the top barrier to shade-seeking and avoiding peak UVR exposure (68% parents, 46% children).

Endorsement of barriers by youths differed based on their age. Older children (13–17 years old) were more likely to endorse "being different from friends" as a barrier to wearing protective clothing ( $\chi^2(1)=8.0$ ,  $p=.005$ ), using sunscreen ( $\chi^2(1)=4.9$ ,  $p=.03$ ), and staying inside or in the shade during the day ( $\chi^2(1)=4.2$ ,  $p=.04$ ) compared to children ages 8–12. Additionally, concern about protective clothing "looking funny" was more likely to be a barrier endorsed by older children ( $\chi^2(1)=4.3$ ,  $p=.04$ ). There were no other significant differences in barriers to sun protection by child age.

## Barriers Associated with Child Sun Protection Behaviors

The first set of regressions (Table 3) revealed that a greater number of perceived sunscreen barriers among both parents and children was associated with lower reported child use of sunscreen, long-sleeved shirts and long pants. Child-reported protective clothing barriers were not significantly associated with child-reported use of protective clothing. Greater child- but not parent-reported barriers to shade use and avoidance of peak UVR exposure were associated with lower shade use. Neither parent- nor child-reported barriers were associated with avoidance of peak UVR exposure.

The second set of regressions showed parent-reported barriers were associated with parent-reported child use of sunscreen ( $F(10,58)=2.52$ ,  $p=.01$ ,  $R^2=0.30$ ) and parent-reported child shade-seeking ( $F(3,62)=3.20$ ,  $p=.03$ ,  $R^2=0.13$ ) were significant. Per parent report child sunscreen use was lower among parents that endorsed sunscreen being bothersome ( $b=-0.44$ ,  $SE(b)=0.25$ ,  $t(10)=-2.97$ ,  $p=.004$ ). There was a marginal association between

endorsement of parent-reported concerns about chemicals in sunscreen with lower sunscreen use ( $b=-0.24$ ,  $SE(b)=0.30$ ,  $t(10)=-1.97$ ,  $p=.05$ ). Reported child shade-seeking was lower among parents who endorsed their children wanted tan skin (a barrier endorsed at relatively low frequencies) ( $b=-0.27$ ,  $SE(b)=0.34$ ,  $t(3)=-2.23$ ,  $p=.03$ ). The overall model with child-reported shade-seeking was marginally significant ( $F(5,52)=2.08$ ,  $p=.08$ ,  $R^2=.17$ ), with shade-seeking less frequent in children who endorsed forgetting as a barrier ( $b=-0.32$ ,  $SE(b)=0.29$ ,  $t(5)=-2.46$ ,  $p=.02$ ). No other overall models with child-reported barriers and sun protection behaviors were statistically significant.

## Discussion

The findings highlight the importance of identifying and addressing key barriers to sun protection among children with a parent with a history of melanoma, several of which are consistent with barriers endorsed by children and their parents who are at population risk for skin cancer.<sup>20</sup> A frequently-endorsed barrier by both parents and children across protection behaviors was forgetting, a commonly endorsed barrier in other pediatric populations with chronic health conditions.<sup>21</sup> Inconvenience and discomfort associated with sunscreen and protective clothing were also common barriers. Older children were more likely to endorse barriers related to appearance (e.g., concern about being different from friends). Perceived barriers may contribute to this at-risk pediatric population's inconsistent use of recommended melanoma preventive behaviors thereby increasing risk for melanoma through excess UVR exposure and sunburn occurrence.<sup>4,9,22</sup>

The results demonstrate the value of obtaining parent and child perspectives on child sun protection use and related perceived barriers. Results from parents and children differed in terms of which barriers were associated with reported use of various forms of sun protection among children. Interventions to promote child sun protection may want to acknowledge the unique perspectives that parents and children may have on barriers to and frequency of use of child sun protection.

Over half of children in our sample had one or more sunburns in the past 12 months, highlighting the need for interventions to improve sun protection practices in this at-risk population. Prior studies of children with a parent with melanoma found that 28% had at least one sunburn in the past 6 months, and 43% had at least one sunburn in the last year.<sup>9,10</sup> Higher sunburn rates in our sample may be due to unique characteristics of the geographic area in which participants live, including the high elevation and ample opportunities for outdoor activities, that may lead to high UVR exposure.

There are several limitations of this study. Our sample drew from a single geographic location characterized by high rates of melanoma and residents who are predominantly White, although this is the racial group most impacted by melanoma.<sup>23</sup> The median income and education levels reported by parents were high. Participants provided self-reported information on sun protection. The results should be replicated in longitudinal studies that further develop the questionnaire (e.g., readability levels for children), include larger samples, sampling stratification of children within different age ranges, prospective

assessment of barriers and sun protection behaviors over time, and direct comparison of parent and child reported barriers within families.

## Conclusion

Children at elevated risk for melanoma due to family history endorse barriers to sun protection which could contribute to their inconsistent use of recommended melanoma preventive behaviors and sunburn occurrence. Clinicians should obtain information from both children and their parents on frequency of and perceived barriers to child sun protection. Interventions to increase consistent use of sun protection among children with a history of melanoma are greatly needed,<sup>24</sup> and could target common barriers to sun protection. Although rates of reported outdoor intentional tanning in this sample were low, the findings indicate that children's desire to have tan skin was associated with lower use of shade when outdoors. Interventions should address social norms related to tanning and provide education on tanning's relationship to melanoma risk and potential negative effects on one's appearance, such as wrinkles.<sup>25</sup>

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**Table 1**

Participant demographic characteristics, sun protection behaviors, and sunburn

<i>Parent reported (n=69)<sup>a</sup></i>		
Age	Mean (SD)	Range
	40 (6.8)	21–56
<b>Sex</b>	<i>n</i> (%)	
Male	14 (20)	
Female	55 (80)	
<b>Highest level of school completed</b>	<i>n</i> (%)	
High school graduate or GED	6 (9)	
Vocational or technical school	2 (3)	
Some college or vocational school	20 (29)	
Bachelor's Degree	25 (36)	
Master's Degree	11 (16)	
Doctoral Degree (PhD, MD, JD)	5 (7)	
<b>Marital status</b>	<i>n</i> (%)	
Married	61 (88)	
Divorced	4 (6)	
Widowed	2 (3)	
Never married	2 (3)	
<b>Household income</b>	Median	Range
	\$100,000+	\$9,999 – \$100,000+
<b>Personal melanoma history</b>	<i>n</i> (%)	
	65 <sup>b</sup> (94)	
<b>Relationship to child<sup>c</sup></b>	<i>n</i> (%)	
Mother	53 (77)	
Father	14 (20)	
Step-Parent	3 (4)	
Grandparent	1 (1)	
<b>Number of children &lt;18 years of age in the family</b>	Mean (SD)	Range
	2.3 (1.1)	0–7
<b>Child race</b>	<i>n</i> (%)	
White	66 (96)	
Black	1 (1)	
Biracial	2 (3)	
<b>Child health insurance status</b>	<i>n</i> (%)	
Yes	68 (99)	
No	1 (1)	
<i>Child reported (n=63)</i>		
Age	Mean (SD)	Range
	11.7 (2.8)	8–17



<i>Parent reported (n=69)<sup>a</sup></i>						
Age	Mean (SD)	Range				
<b>Sex</b>	<i>n</i> (%)					
Male	36 (57)					
Female	27 (43)					
<i>Children's Sun Protection and Risk Behaviors<sup>d</sup></i>						
	Often/always <i>n</i> (%)	Mean (SD)				
<b>Sunscreen (SPF of 30+)</b>						
Parent-report	52 (75)	4.0 (0.8)				
Child-report	29 (47)	3.3 (1.4)				
<b>Shirt with long sleeves</b>						
Parent-report	6 (9)	2.5 (0.9)				
Child-report	14 (23)	2.6 (1.2)				
<b>Long pants or long skirt</b>						
Parent-report	10 (15)	2.5 (0.9)				
Child-report	31 (50)	3.4 (1.3)				
<b>Wide-brimmed hat</b>						
Parent-report	16 (23)	2.7 (1.1)				
Child-report	3 (5)	1.8 (0.9)				
<b>Stay in shade or under umbrella</b>						
Parent-report	23 (33)	3.1 (0.8)				
Child-report	19 (30)	2.7 (1.1)				
<b>Avoid sun between 10am-4pm</b>						
Parent-report	16 (24)	2.9 (0.9)				
Child-report	14 (23)	2.5 (1.1)				
<b>Spend time in the sun to get tan</b>						
Parent-report	1 (1)	1.2 (0.6)				
Child-report	3 (5)	1.4 (0.8)				
<i>Child Sunburn Occurrence, n (%)</i>						
Number of sunburns in last 12 months	0	1	2	3	4	5+
Parent-report <sup>e</sup>	64 (47)	39 (29)	18 (13)	12 (8)	1 (1)	1 (1)
Child-report <sup>f</sup>	15 (24)	20 (32)	16 (25)	5 (8)	1 (2)	4 (6)

Note.

<sup>a</sup> *n* = 69 after excluding one parent from a family where both parents participated.

<sup>b</sup> 4 participants had a spouse with a history of melanoma, 2 of whom were deceased. Spouses who did not have a history of melanoma were eligible to participate.

<sup>c</sup> *n* = 71 because 2 participants marked both biological parent and step-parent. All participating adults were a primary caregiver for the children on whom they reported.

<sup>d</sup> Response options: 1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Always

<sup>e</sup> Parents reported the occurrence of 0–5+ sunburns among 135 children. Percentages were therefore calculated out of a total of 135.

<sup>f</sup>Percentages were calculated out of a total of 63 children who completed questionnaires. 2 of the 63 children did not complete this item.

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**Table 2**

## Barriers to child sun protection

<i>Barrier type<sup>a</sup></i>		<i>Sun Protection Behavior</i>		
		<i>Sunscreen</i>	<i>Protective clothing</i>	<i>Avoidance of peak UVR exposure</i>
		Likely/Very likely n (%)		
<b>Gets in the way of children's leisure activities</b>	Parent	17 (25)	55 (80)	–
	Child	14 (23)	24 (39)	–
	Children 8–12	8 (22)	11 (31)	–
	Children 13–17	6 (24)	13 (50)	–
<b>Bother</b>	Parent	33 (48)	53 (77)	–
	Child	18 (30)	27 (44)	–
	Children 8–12	8 (22)	16 (44)	–
	Children 13–17	10 (40)	11 (42)	–
<b>Cost</b>	Parent	2 (3)	14 (20)	–
	Child	2 (3)	13 (21)	–
	Children 8–12	2 (5)	7 (19)	–
	Children 13–17	0 (0)	6 (23)	–
<b>Uncomfortable/unpleasant</b>	Parent	14 (20)	51 (75)	–
	Child	11 (18)	33 (53)	–
	Children 8–12	4 (11)	18 (50)	–
	Children 13–17	7 (28)	15 (58)	–
<b>Looks funny/unattractive</b>	Parent	11 (16)	37 (54)	–
	Child	5 (8)	24 (38)	–
	Children 8–12	4 (11)	10 (28)	–
	Children 13–17	1 (4)	14 (54)	–
<b>Child wants tan skin</b>	Parent	8 (12)	7 (10)	6 (9)
	Child	5 (8)	10 (16)	8 (14)
	Children 8–12	4 (11)	5 (14)	6 (18)
	Children 13–17	1 (4)	5 (19)	2 (8)
<b>Forget</b>	Parent	55 (80)	30 (45)	45 (68)
	Child	33 (55)	25 (41)	27 (46)
	Children 8–12	19 (54)	14 (39)	17 (49)
	Children 13–17	14 (56)	11 (44)	10 (42)
<b>Being different from friends</b>	Parent	13 (19)	33 (49)	34 (49)
	Child	6 (10)	15 (24)	12 (20)
	Children 8–12	1 (3)	4 (11)	4 (11)
	Children 13–17	5 (20)	11 (42)	8 (33)
<b>Wanting to get enough vitamin D</b>	Parent	1 (1)	5 (8)	–
	Child	2 (3)	6 (10)	–
	Children 8–12	1 (3)	3 (8)	–
	Children 13–17	1 (4)	3 (12)	–
<b>Concern about harmful chemicals in sunscreen</b>	Parent	9 (13)	–	–
	Child	6 (10)	–	–
	Children 8–12	5 (14)	–	–
	Children 13–17	1 (4)	–	–
<i>Total number of barriers</i>		<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>
	Parent	2.4 (1.8)	4.1 (1.9)	1.2 (0.9)
	Child	2.8 (1.8)	2.8 (2.3)	0.8 (0.8)
	Children 8–12	1.5 (1.9)	2.4 (2.1)	0.8 (0.8)
	Children 13–17	1.8 (1.7)	3.4 (2.6)	0.8 (0.8)

Note. “–” indicates barrier was not assessed for that sun protection behavior.

<sup>a</sup>Response options: 1=Very unlikely, 2=Likely, 3=Neither likely nor unlikely 4=Likely, 5=Very likely

Regression models examining association between total number of perceived barriers and sun protective behaviors

**Table 3**

Outcome	Number of Barriers (IV)	R <sup>2</sup>	F	b	SE(b)	B	t	P
Sunscreen	Parent	0.08	5.49	<b>-0.28</b>	0.06	-0.13	-2.34	0.02
	Child	0.08	1.54	<b>-0.26</b>	0.10	-0.21	-2.06	0.04
Long-sleeved shirt	Parent	0.08	5.79	<b>-0.28</b>	0.05	-0.13	-2.41	0.02
	Child	0.22	0.98	<b>-0.20</b>	0.07	-0.10	-1.49	0.14
Long pants or skirt	Parent	0.10	7.28	<b>-0.32</b>	0.06	-0.15	-2.70	<0.01
	Child	0.05	1.07	<b>0.02</b>	0.07	0.01	0.16	0.87
Hat	Parent	0.02	1.11	-0.13	0.07	-0.07	-1.05	0.30
	Child	0.08	1.61	-0.24	0.05	-0.09	-1.79	0.08
Shade	Parent	0.04	2.64	-0.20	0.11	-0.17	-1.63	0.11
	Child	0.15	3.21	<b>-0.36</b>	0.18	-0.51	-2.85	<0.01
Avoid sun between 10am-4 pm	Parent	0.04	2.41	-0.19	0.12	-0.19	-1.55	0.13
	Child	0.02	0.33	<-0.01	0.19	<-0.01	-0.01	0.99

Note. IV=Independent variable, P=parent-report, C=child-report. Bolded beta's are significant at the  $p<.05$  level. Results did not change when analyses were run with the parent that was randomly selected to be excluded from analyses for the family in which both parents participated. All child-reported models were adjusted for child age and sex