HHS Public Access

Author manuscript

Am J Prev Med. Author manuscript; available in PMC 2017 September 01.

Published in final edited form as:

Am J Prev Med. 2016 September ; 51(3): e77–e85. doi:10.1016/j.amepre.2016.02.032.

Correlates of Sun Protection and Sunburn in Children of Melanoma Survivors

Mary K. Tripp, PhD[1], **Susan K. Peterson, PhD**[1], **Alexander V. Prokhorov, MD, PhD**[1], **Sanjay S.Shete, PhD**[2], **Jeffrey E. Lee, MD**[3], **Jeffrey E. Gershenwald, MD**[4], and **Ellen R. Gritz, PhD**[1]

[1]Department of Behavioral Science, The University of Texas MD Anderson Cancer Center, Houston, Texas

[2]Department of Biostatistics, The University of Texas MD Anderson Cancer Center, Houston, Texas

[3]Department of Surgical Oncology, The University of Texas MD Anderson Cancer Center, Houston, Texas

[4]Departments of Surgical Oncology and Cancer Biology, The University of Texas MD Anderson Cancer Center, Houston, Texas

Abstract

Introduction—Sunburns during childhood increase melanoma risk. Children of melanoma survivors are at higher risk, but little is known about their sunburn and sun protection. One study showed that almost half of melanoma survivors' children experienced sunburn in the past year. This study evaluated sunburn and sun protection in melanoma survivors' children, and relevant survivor characteristics from Social Cognitive Theory and the Health Belief Model.

Methods—Melanoma survivors (N=340) were recruited from a comprehensive cancer center. Survivors completed a baseline questionnaire administered by telephone to report on the behavior of their children (N=340) as part of an RCT of a sun protection intervention. Data were collected in 2008 and analyzed in 2015.

Results—In the prior 6 months, 28% of children experienced sunburn. "Always" or "frequent" sun protection varied by behavior: sunscreen, 69%; lip balm, 15%; wide-brimmed hats, 9%; sleeved shirts, 28%; pants, 48%; sunglasses, 10%; shade, 33%; and limiting time outdoors, 45%. Survivors' sunburn and sun protection were positively associated with these outcomes in children. Correlates of sunburn also included older child age and higher risk perceptions. Correlates of sun protection behaviors included younger child age; stronger intentions, higher self-efficacy, and more positive outcome expectations about sun protection; and greater number of melanomas in survivors.

Address correspondence to: Mary K. Tripp, PhD, Department of Behavioral Science – Unit 1330, The University of Texas MD Anderson Cancer Center, P.O. Box 301439, Houston TX 77230-1439. mtripp@mdanderson.org.

No financial disclosures were reported by the authors of this paper.

Conclusions—Melanoma survivors may have a heightened awareness of the importance of their children's sun protection, but their children are not routinely protected. Correlates of children's sunburn and sun protection suggest subgroups of survivors to target with interventions to improve sun protection.

Introduction

Melanoma incidence has doubled over the past 30 years, with 73,870 new cases expected in 2015.[1] Sunburns during childhood increase risk.[2] Using sunscreen, wearing protective clothing, seeking shade, and limiting exposure to midday sun are recommended.[1,3] Between 55% and 72% of children are sunburned annually.[4–6] Some (25%–65%) children always or often use sunscreen[4,6]; fewer wear wide-brimmed hats (5%) or protective clothing (21%) or seek shade (26%).[6]

Melanoma survivors' children are at twofold or higher melanoma risk, depending on family history and susceptibility characteristics.[7–11] Little is known about their sunburn and sun protection. Of melanoma survivors from the California Cancer Registry, 43% reported their children were sunburned in the past year.[12] Most children were protected often or always by sunscreen (79%) or sleeved shirts (75%). Fewer wore hats (30%) or sunglasses (8%) or sought shade (23%).[12] Findings approximate earlier results.[13] Of children whose mothers were diagnosed with skin cancer (mostly basal cell carcinoma), 39% reported at least three sunburns during the past summer; 42% often or always used sunscreen.[14]

This study evaluated sunburn and sun protection in melanoma survivors' children by analyzing data drawn from the baseline assessment of an RCT of a sun protection intervention.[15] Although there were positive effects on children's sunscreen reapplication and wide-brimmed hat use, the intervention had limited effects on other outcomes.[15] This study is different from and builds upon the trial by examining the associations of survivors' characteristics with children's outcomes, to inform intervention refinement. It was expected that children would be more protected when survivors reported higher self-efficacy, more positive expectations, and stronger intentions regarding sun protection and higher-risk perceptions per Social Cognitive Theory[16] and the Health Belief Model.[17]

Methods

Sample and Procedures

Eligible survivors were identified from the tumor registry of The University of Texas MD Anderson Cancer Center, diagnosed between 1990 and 2008 with Stage 0 to Stage IIIB melanoma,[18] aged ≥18 years, fluent in English, and had at least one child aged ≤12 years. Up to ten calls were attempted to contact survivors. Of 1,171 survivors who completed screening, 372 were eligible (797 [99.7%] ineligible survivors did not have a child aged ≤12 years); 340 provided informed consent and completed the 2008 baseline telephone questionnaire to report on their children's behavior. Researchers randomly selected one child when a survivor had more than one child. The child did not answer any questions. Survivors resided in the U.S.; most (82%) resided in Texas. The study was approved by the MD Anderson IRB (ClinicalTrials.gov NCT00394134).

Measures

Children's and survivors' age, sex, race, ethnicity, and sun sensitivity, as well as survivors' education and marital status, were reported. The survivor sun sensitivity index asked about eye and hair color, skin's reaction to an initial dose of summer sun without protection (adapted from Fitzpatrick's scale[19]), and skin's sensitivity to sun exposure (i.e., from extremely sensitive to not sensitive at all). To minimize nonresponse, skin's reaction was omitted from the children's index because pilot work showed that some survivors could not answer this question, stating their children were not outside without sun protection. Scores could range from 1 to 4. Lower scores indicated higher sun sensitivity. Number of melanomas, time since diagnosis, stage, and number of survivors' first-degree relatives with melanoma were assessed.

Sunburn was defined as any reddening or discomfort of the skin that lasts longer than 12 hours after exposure to the sun. Survivors reported on their children's and their own number of sunburns experienced during the past 6 months.

Items assessed frequency of using sunscreen (six items); wearing a wide-brimmed hat (one item), clothing (two items), and sunglasses (one item); staying in the shade (one item); and limiting time outdoors between 10AM and 4PM (one item) (Table 2). The sunscreen measure omitted the seventh item, which was included in the original trial report,[15] to enhance comparison of findings with the literature. Responses ranged from *never* (1) to *always* (5); response options were not combined. Survivors reported on their children's and their own behavior. For multi-item measures, scores were averaged to create composite behavior scores. A composite sun protection score was the average of the composite sunscreen score, composite clothing score, wide-brimmed hat score, sunglasses score, shade score, and limiting time outdoors score.

Two items about sunscreen and one item each about shade, clothing, and limiting time outdoors assessed knowledge relevant to practicing sun protection (e.g., the interpretation of sunscreen's sun protection factor). Items were coded as correct/incorrect (missing/*don't know* responses were coded as incorrect). A summed knowledge score could range from 0 to 5. The measure omitted the sixth item about swimwear, which was included in the original trial report,[15] as it was outdated given the increased availability of protective swimwear.

Measures associated with Social Cognitive Theory included self-efficacy, outcome expectations, behavioral intention, and perceived availability/accessibility of materials. Item scores were averaged to create a scale score; Cronbach's alpha (α) estimated internal consistency reliability. Measures were based on previous research.[20,21] Self-efficacy measures assessed belief in the capability to protect children with sunscreen (three items, α=0.79), hats (one item), clothing (one item), shade (two items, α=0.76), and limiting children's time outdoors midday (three items, α=0.89). Responses ranged from *not confident at all* (1) to *extremely confident* (5).

Outcome expectation measures assessed expectations about the outcomes of protecting children with sunscreen (two items, α=0.37), hats (three items, α=0.73), clothing (three items, α=0.74), shade (three items, α=0.66), and limiting time outdoors (three items,

α=0.67). Expectations could relate to convenience, comfort, practicality, difficulty, or children's reactions. Responses ranged from *strongly disagree* (1) to *strongly agree* (5). Higher scores indicated more negative outcome expectations, analogous to barriers. Three items (α=0.74) assessed positive expectations of tanning outcomes (i.e., would make a person look healthier or more attractive, and would be relaxing). Responses ranged from *strongly disagree* (1) to *strongly agree* (5). Higher scores indicated more positive outcome expectations.

Measures assessed intentions during the next 3 months to protect with sunscreen (two items, α=0.77), a wide-brimmed hat (one item), clothing (one item), shade (one item) and limiting time outdoors (one item). Responses ranged from *strongly disagree* (1) to *strongly agree* (5). Perceived availability/accessibility measures asked (*yes/no*) about wide-brimmed hat, clothing, and shade materials availability and sunscreen, hat, and clothing accessibility.

Health Belief Model measures included perceived risk, worry, perceived benefits, and doctor/healthcare provider recommendations. Two items assessed perceptions of the child's risk of developing sunburn, or melanoma/skin cancer, in the future if they are not protected from sun exposure. Responses ranged from *very unlikely* (1) to *very likely* (4). Two items adapted from the literature[22] included: *How worried are you that your child may develop melanoma/skin cancer in the future, and how much does worry about your child developing skin cancer affect your mood?* Responses ranged from *not at all* (1) to *a lot* (4). Four items assessed beliefs about whether behaviors would reduce child's skin cancer risk. Responses ranged from *strongly disagree* (1) to *strongly agree* (5). Finally, measures asked whether survivors had received recommendations (*yes/no*) to use sunscreen or hats and clothing to protect children.

Statistical Analysis

Variables were described using raw means (baseline means reported in the trial[15] were adjusted for covariates in the mixed models of intervention effects), SDs, and proportions. Because sunburn prevalence was low, sunburn variables were treated as binary (i.e., zero or one or more sunburns). The association between each study variable (Table 1) and children's sunburn or sun protection was assessed by Pearson correlation, regression, one-way ANOVA, or chi-square test. Each sociocognitive characteristic was examined for its association with children's sunburn and sun protection (individual behavior and composite). A behavior-specific characteristic (e.g., sunscreen self-efficacy) was examined for association with that behavior (e.g., sunscreen) only. Survivors' sunburn and sun protection was examined for its association with the corresponding child outcome. Associated variables ($p<0.10$) were included in a multivariable model (logistic regression for sunburn and linear regression for sun protection outcomes) that adjusted for all other model variables. Reference categories were male (sex), Hispanic or Latino (ethnicity), white (race), not married (marital status), and high school or some college (education). Data were analyzed in 2015 using SPSS, version 22.

Results

Survivors were not highly confident that they could protect their children from sun exposure (Table 1). Slightly positive expectations were reported for sunscreen use. Survivors held mostly neutral opinions about the expected outcomes of other behaviors. Survivors reported slightly negative tanning expectations. Survivors had stronger intentions to protect their children with sunscreen or shade or by limiting time outdoors. Survivors thought it was likely that their children would develop sunburn or melanoma/skin cancer if they were not protected from sun exposure. Survivors were somewhat worried that their children would develop melanoma/skin cancer. This worry did not appear to affect their mood. Survivors strongly agreed about the perceived benefits of sun protection. Most believed sun protection materials were accessible. Most reported doctor recommendations to use sunscreen; only half reported hat and clothing recommendations.

The majority of children (n=245, 72%) did not experience any sunburns in the past 6 months. Twenty-eight percent of children experienced one (n=58, 17%), two (n=26, 8%), three (n=7, 2%), four (n=2, 0.6%), or six (n=2, 0.6%) sunburns. Mean sun protection scores ranged from 2.03 (SD=1.05) for wide-brimmed hats to 3.24 (SD=0.70) for shade (Table 2). Overall, survivors reported that children were “sometimes” protected. Most (69%) children always or frequently wore sunscreen. Half or fewer always or frequently had sunscreen cover all exposed skin, applied 30 minutes before going outdoors, or reapplied within 1 hour or after each hour outdoors (Table 2). Few (15%) children always or frequently used lip balm with a sun protection factor. Some children always or frequently wore shirts with sleeves to the elbow or longer (28%) or knee-length or longer pants (48%), stayed in the shade (33%), or had their midday hours outdoors limited (45%). Few children were routinely protected with wide-brimmed hats (9%) or sunglasses (10%).

The odds of children’s sunburn increased with children’s age (OR=1.34, 95% CI=1.20, 1.50) and survivors’ sunburn (OR=6.96, 95% CI=3.44, 14.08), perception about child’s sunburn risk (OR=1.65, 95% CI=1.02, 2.67), and belief that their worry about the child developing melanoma/skin cancer affects their mood (OR=1.82, 95% CI=1.22, 2.72) (Table 3). The odds of children’s sunburn decreased if survivors were female (OR=0.25, 95% CI=0.12, 0.53), perceived greater shade benefits (OR=0.69, 95% CI=0.52, 0.91), and had higher worry that their children may develop melanoma/skin cancer (OR=0.61, 95% CI=0.39, 0.95). Other sociocognitive factors, demographics, sun sensitivity, melanoma history, and knowledge were not associated.

Children’s sunscreen use was positively associated with child age, survivors’ number of melanomas, intentions to protect children, and survivors’ sunscreen use (Appendix Table 1A). Children’s wide-brimmed hat use increased with survivors’ intentions, self-efficacy, more positive outcome expectations for protecting the child with a hat, perceived availability of a wide-brimmed hat, and survivors’ wide-brimmed hat behavior. Children were more likely to wear wide-brimmed hats if they were younger, survivors were not Hispanic or Latino, and survivors held more negative expectations about tanning (Appendix Table 1B). Children’s protection by clothing increased if they were male, and if survivors had more positive expectations about protecting children with clothing and used protective clothing

more frequently themselves (Appendix Table 1C). Wearing sunglasses was positively associated with survivors' number of melanomas, time since diagnosis, and use of sunglasses (Appendix Table 1D). Children were more frequently protected by shade if they were younger or if their parents had higher levels of shade self-efficacy, more positive shade expectations, stronger shade intentions, and more frequently sought shade for themselves (Appendix Table 1E). Survivors more frequently limited their children's time outdoors if they had stronger intentions to do so, were more likely to limit their own time outdoors, and if their children were younger (Appendix Table 1F). Other sociocognitive characteristics, demographics, sun sensitivity, melanoma history, and knowledge were not associated with all or most outcomes.

Discussion

In this study, children's sunburn prevalence (28%) was lower than that reported in the general population for similar recall periods (55%–72%),[4–6] but remains concerning. Melanoma survivors' children are at higher risk, and risk increases with sunburns.[2] Sun protection was somewhat more frequent in this sample, compared with the general population, but still relatively infrequent, particularly wide-brimmed hats, protective clothing, and shade. All sun protection behaviors are recommended to be used in combination, to maximize protection.[1,23] Most children routinely used sunscreen. A subset was protected on all exposed skin or had sunscreen reapplied frequently.

Children were seven times more likely to have experienced sunburn if survivors experienced sunburn, accounting for sun sensitivity. Survivors who practiced sun protection for themselves were more likely to protect their children. These findings, consistent with community studies,[24–26] could inform research on mechanisms of survivor influences on child behavior. Results underscore the importance of designing interventions for melanoma survivors, to motivate their own sun protection and support their children's protection. This is critical because surveys show that few pediatricians note patients' skin cancer family history[27] or use it to prioritize sun protection counseling.[28] Children and parents are important intervention populations in "The Surgeon General's Call to Action to Prevent Skin Cancer."[3] The retail industry may serve as a strong ally, given its interest in growing sales of sun protection products.

Melanoma history was not associated with children's sunburn or most sun protection behaviors. Children of female survivors were less likely to experience sunburn, controlling for survivors' own sunburn experience. This finding may be attributed to the primary caregiver role that women often assume, but suggests a potential need for enhanced interventions for male survivors. Consistent with other studies, sunburn was more prevalent with increasing child age and sun protection was more frequent with decreasing child age[29,30] (except sunscreen use was more frequent with increasing age in this study).

Survivors were not highly confident they could protect children when faced with challenges. Survivors did not hold positive expectations or strong intentions about protecting their children. Further research would inform whether these characteristics are affected by survivors' melanoma experiences, fatalism, or negative expectations about their ability to

influence children's behavior as they age. Although Social Cognitive Theory characteristics were associated with children's sun protection, no characteristic remained significant in all models. Further scale development to expand content domains may enhance associations. Significant parent characteristics from Social Cognitive Theory and the Health Belief Model in this study were associated with children's sun protection in community studies.[20,31,32]

Risk perceptions and worry, which may be driven by survivors' melanoma experiences, were not associated with children's sun protection. Higher sunburn risk perceptions were associated with greater odds of children's sunburn. Given the cross-sectional design, it is unknown whether risk perception influenced sunburn, or survivors perceived their children to be at higher risk because they had experienced sunburn. Similarly, it cannot be determined whether worry that is strong enough to affect mood influenced survivors to inadequately protect their children, which resulted in sunburns, or whether a history of sunburns in children increased survivors' worry enough to affect mood. Prospective studies will enhance understanding of the relationship among risk perceptions, worry, and skin cancer risk behaviors in this population.

It is challenging to compare findings with the California Cancer Registry study, which reported on melanoma survivors, because sunburn recall periods differed (1 year vs 6 months in this study) and samples were notably different: The California study[12] reported more Hispanic and Latino survivors (16% vs 3.5% in this study), fewer college graduates (61% vs 79%), fewer survivors diagnosed with Stage 2 or higher disease (7% vs 15%), and a higher mean child age (9 vs 7 years). Both studies clearly showed that melanoma survivors' children receive significant sun exposure. Prevalence of sunscreen, sunglasses, and shade behavior in the California study was similar (within 10%) to reports in this study. Sleeved shirt protection was much lower in this study (75% vs 28%), possibly because most of this sample resided in the southern U.S., where year-round temperatures are higher. This study assessed additional protective behaviors (limiting time outdoors, using lip balm with a sun protection factor, wearing pants and wide-brimmed hats) and sociocognitive characteristics (behavior-specific self-efficacy, intentions and outcome expectations, tanning outcome expectations, and sunburn risk perceptions).

Limitations

The study design limits the ability to draw conclusions about causality. The sample was limited in regard to diversity of respondents' racial, ethnic, and educational characteristics, which may limit generalizability of findings to melanoma survivors identified from population-based cancer registries or community settings. The observed associations are reported as preliminary, given the few studies of sunburn and sun protection in children of melanoma survivors, and the examination of understudied sociocognitive characteristics in this population. Thus, analyses were not adjusted for multiple testing.[34] Future studies using independent data are warranted to establish the correlates reported in this study. The proportions of variance explained by regression models were typical of sun protection research, but suggest other characteristics not present in the models may be associated with behavior. Investigation of parent–child relationship characteristics may enhance the explanatory power of models.[35] Characteristics that have become relevant after these data

were collected, such as awareness of the indoor tanning tax of 2010[36] or indoor tanning laws,[37] also may be informative. Validated measures of parental sociocognitive characteristics specific to children's individual sun protection behaviors are lacking.[38] Measures were developed for this study based on previous validity and reliability research.[21] The lack of standardized measures in this study may limit interpretation of findings.

Conclusions

Melanoma survivors may have a heightened awareness of the importance of protecting their children from sun exposure, but they are not routinely doing so. Correlates of sunburn and sun protection suggest subpopulations for enhanced intervention, including children of melanoma survivors who are not protecting themselves, and theoretic variables that may be influenced by intervention to increase sun protection. Research is warranted to translate these findings into clinical practice to enhance skin cancer prevention practices in this group at higher risk.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This research was funded by a grant from the American Cancer Society (RSGPB04-010-01-CPPB to E.R. Gritz, PhD). The study sponsor did not have any role in study design; collection, analysis, and interpretation of data; writing the report; or the decision to submit the report for publication. Support provided, in part, by the generous philanthropic contributions to The University of Texas MD Anderson Cancer Center Melanoma Moon Shots Program, and by the Patient-Reported Outcomes, Survey, and Population Research (PROSPR) Shared Resource and the Biostatistics Resource Group through a Cancer Center Support Grant (CA16672, Principal Investigator: R. DePinho, MD Anderson Cancer Center) from the National Cancer Institute, NIH.

References

1. American Cancer Society. Cancer Facts & Figures 2015. Atlanta: American Cancer Society; 2015.
2. Dennis LK, Vanbeek MJ, Beane Freeman LE, et al. Sunburns and risk of cutaneous melanoma: does age matter? A comprehensive meta-analysis. Ann Epidemiol. 2008; 18(8):614–627. http://dx.doi.org/10.1016/j.annepidem.2008.04.006. [PubMed: 18652979]
3. U.S. DHHS. The Surgeon General's Call to Action to Prevent Skin Cancer. Washington, DC: U.S. DHHS, Office of the Surgeon General; 2014.
4. Dusza SW, Halpern AC, Satagopan JM, et al. Prospective study of sunburn and sun behavior patterns during adolescence. Pediatrics. 2012; 129(2):309–317. http://dx.doi.org/10.1542/peds.2011-0104. [PubMed: 22271688]
5. Davis KJ, Cokkinides VE, Weinstock MA, O'Connell MC, Wingo PA. Summer sunburn and sun exposure among U.S. youths ages 11 to 18: national prevalence and associated factors. Pediatrics. 2002; 110(1 Pt 1):27–35. http://dx.doi.org/10.1542/peds.110.1.27. [PubMed: 12093943]
6. Cokkinides V, Weinstock M, Glanz K, et al. Trends in sunburns, sun protection practices, and attitudes toward sun exposure protection and tanning among U.S. adolescents, 1998–2004. Pediatrics. 2006; 118(3):853–864. http://dx.doi.org/10.1542/peds.2005-3109. [PubMed: 16950974]
7. Gandini S, Sera F, Cattaruzza MS, et al. Meta-analysis of risk factors for cutaneous melanoma: III. Family history, actinic damage and phenotypic factors. Eur J Cancer. 2005; 41(14):2040–2059. http://dx.doi.org/10.1016/j.ejca.2005.03.034. [PubMed: 16125929]

8. Ford D, Bliss JM, Swerdlow AJ, et al. Risk of cutaneous melanoma associated with a family history of the disease. The International Melanoma Analysis Group (IMAGE). Int J Cancer. 1995; 62(4): 377–381. http://dx.doi.org/10.1002/ijc.2910620403. [PubMed: 7635561]
9. Cutler C, Foulkes WD, Brunet JS, et al. Cutaneous malignant melanoma in women is uncommonly associated with a family history of melanoma in first-degree relatives: a case-control study. Melanoma Res. 1996; 6(6):435–440. http://dx.doi.org/10.1097/00008390-199612000-00005. [PubMed: 9013481]
10. Olsen CM, Carroll HJ, Whiteman DC. Familial melanoma: a meta-analysis and estimates of attributable fraction. Cancer Epidemiol Biomarkers Prev. 2010; 19(1):65–73. http://dx.doi.org/10.1158/1055-9965.EPI-09-0928. [PubMed: 20056624]
11. Fallah M, Pukkala E, Sundquist K, et al. Familial melanoma by histology and age: joint data from five Nordic countries. Eur J Cancer. 2014; 50(6):1176–1183. http://dx.doi.org/10.1016/j.ejca.2013.12.023. [PubMed: 24461199]
12. Glenn BA, Lin T, Chang LC, et al. Sun protection practices and sun exposure among children with a parental history of melanoma. Cancer Epidemiol Biomarkers Prev. 2015; 24(1):169–177. http://dx.doi.org/10.1158/1055-9965.EPI-14-0650. [PubMed: 25587110]
13. Glenn BA, Bastani R, Chang LC, Khanna R, Chen K. Sun protection practices among children with a family history of melanoma: a pilot study. J Cancer Educ. 2012; 27(4):731–737. http://dx.doi.org/10.1007/s13187-012-0377-5. [PubMed: 22610837]
14. Geller AC, Brooks DR, Colditz GA, Koh HK, Frazier AL. Sun protection practices among offspring of women with personal or family history of skin cancer. Pediatrics. 2006; 117(4):e688–694. http://dx.doi.org/10.1542/peds.2005-1734. [PubMed: 16585282]
15. Gritz ER, Tripp MK, Peterson SK, et al. Randomized controlled trial of a sun protection intervention for children of melanoma survivors. Cancer Epidemiol Biomarkers Prev. 2013; 22(10):1813–1824. http://dx.doi.org/10.1158/1055-9965.EPI-13-0249. [PubMed: 24097199]
16. Bandura, A. Social foundations of thought and action: a social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall, Inc; 1986.
17. Becker, MH. The health belief model and personal health behavior. Thorofare, NJ: Slack; 1974.
18. Balch CM, Soong SJ, Atkins MB, et al. An evidence-based staging system for cutaneous melanoma. CA Cancer J Clin. 2004; 54(3):131–149. http://dx.doi.org/10.3322/canjclin.54.3.131. [PubMed: 15195788]
19. Fitzpatrick TB. The validity and practicality of sun-reactive skin types I through VI. Arch Dermatol. 1988; 124(6):869–871. http://dx.doi.org/10.1001/archderm.1988.01670060015008. [PubMed: 3377516]
20. Tripp MK, Carvajal SC, McCormick LK, et al. Validity and reliability of the Parental Sun Protection Scales. Health Educ Res. 2003; 18(1):58–73. http://dx.doi.org/10.1093/her/18.1.58. [PubMed: 12608684]
21. Tripp MK, Diamond PM, Vernon SW, et al. Measures of parents' self-efficacy and perceived barriers to children's sun protection: construct validity and reliability in melanoma survivors. Health Educ Res. 2013; 28(5):828–842. http://dx.doi.org/10.1093/her/cys114. [PubMed: 23204537]
22. Lerman C, Daly M, Masny A, Balshem A. Attitudes about genetic testing for breast-ovarian cancer susceptibility. J Clin Oncol. 1994; 12(4):843–850. [PubMed: 8151327]
23. Gimotty PA, Glanz K. Sunscreen and melanoma: what is the evidence? J Clin Oncol. 2011; 29(3): 249–250. http://dx.doi.org/10.1200/JCO.2010.31.7529. [PubMed: 21135278]
24. Buller DB, Callister MA, Reichert T. Skin cancer prevention by parents of young children: Health information sources, skin cancer knowledge, and sun-protection practices. Oncol Nurs Forum. 1995; 22(10):1559–1566. [PubMed: 8577624]
25. O'Riordan DL, Geller AC, Brooks DR, Zhang Z, Miller DR. Sunburn reduction through parental role modeling and sunscreen vigilance. J Pediatr. 2003; 142(1):67–72. http://dx.doi.org/10.1067/mpd.2003.mpd039. [PubMed: 12520258]
26. Glanz K, Lew RA, Song V, Cook VA. Factors associated with skin cancer prevention practices in a multiethnic population. Health Educ Behav. 1999; 26(3):344–359. http://dx.doi.org/10.1177/109019819902600305. [PubMed: 10349572]

27. Gritz ER, Tripp MK, de Moor CA, et al. Skin cancer prevention counseling and clinical practices of pediatricians. Pediatr Dermatol. 2003; 20(1):16–24. http://dx.doi.org/10.1046/j.1525-1470.2003.03004.x. [PubMed: 12558840]

28. Balk SJ, O'Connor KG, Saraiya M. Counseling parents and children on sun protection: a national survey of pediatricians. Pediatrics. 2004; 114(4):1056–1064. http://dx.doi.org/10.1542/peds.2004-1305. [PubMed: 15466105]

29. Hall HI, Jorgensen CM, McDavid K, Kraft JM, Breslow R. Protection from sun exposure in U.S. white children ages 6 months to 11 years. Public Health Rep. 2001; 116(4):353–361. http://dx.doi.org/10.1016/S0033-3549(04)50057-2. [PubMed: 12037264]

30. Hall HI, McDavid K, Jorgensen CM, Kraft JM. Factors associated with sunburn in white children aged 6 months to 11 years. Am J Prev Med. 2001; 20(1):9–14. http://dx.doi.org/10.1016/S0749-3797(00)00265-8. [PubMed: 11137768]

31. Lescano, CM., Rodrigue, JR. Skin cancer prevention behaviors among parents of young children; Child Health Care. 1997. p. 26107-114.http://dx.doi.org/10.1207/s15326888chc2602_4

32. Turner LR, Mermelstein RJ. Psychosocial characteristics associated with sun protection practices among parents of young children. J Behav Med. 2005; 28(1):77–90. http://dx.doi.org/10.1007/s10865-005-2565-9. [PubMed: 15887878]

33. Hay J, DiBonaventura M, Baser R, et al. Personal attributions for melanoma risk in melanoma-affected patients and family members. J Behav Med. 2011; 34(1):53–63. http://dx.doi.org/10.1007/s10865-010-9286-4. [PubMed: 20809355]

34. Schochet, PZ. Technical methods report: Guidelines for multiple testing in impact evaluations. Washington D: National Center for Educational Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education; 2008. NCEE No. 2008–4018

35. Turrisi R, Hillhouse J, Robinson J, Stapleton J, Adams M. Influence of parent and child characteristics on a parent-based intervention to reduce unsafe sun practices in children 9 to 12 years old. Arch Dermatol. 2006; 142(8):1009–1014. http://dx.doi.org/10.1001/archderm.142.8.1009. [PubMed: 16924050]

36. Jain N, Rademaker A, Robinson JK. Implementation of the federal excise tax on indoor tanning services in Illinois. Arch Dermatol. 2012; 148(1):122–124. http://dx.doi.org/10.1001/archderm.148.1.122. [PubMed: 22250250]

37. Gosis B, Sampson BP, Seidenberg AB, et al. Comprehensive evaluation of indoor tanning regulations: a 50-state analysis, 2012. J Invest Dermatol. 2014; 134(3):620–627. http://dx.doi.org/10.1038/jid.2013.357. [PubMed: 23974917]

38. Tripp MK, Vernon SW, Gritz ER, Diamond PM, Mullen PD. Children's skin cancer prevention: a systematic review of parents' psychosocial measures. Am J Prev Med. 2013; 44(3):265–273. http://dx.doi.org/10.1016/j.amepre.2012.10.027. [PubMed: 23415124]

Table 1

Descriptive Statistics of Study Variables, N=340 Melanoma Survivors and Their Children

Study variable	n (%)	Mean (SD)
Children's demographics and sun sensitivity		
Age, y (range, newborn-12)		7.3 (3.84)
Sex, female	167 (49.1)	
Ethnicity, not Hispanic or Latino	315 (93.2)	
Race, white	334 (99.1)	
Sun sensitivity		2.31 (0.68)
Survivors' demographics and sun sensitivity		
Age, y (range, 24–55)		40.5 (6.45)
Sex, female	210 (61.8)	
Ethnicity, not Hispanic or Latino	328 (96.5)	
Race, white	337 (99.7)	
Education, college graduate	266 (78.5)	
Marital status, married	311 (91.7)	
Sun sensitivity		2.23 (0.60)
Survivors' melanoma history		
Number of melanoma diagnoses		
1	289 (85.3)	
2	36 (10.6)	
3 or more	14 (4.1)	
Time since melanoma diagnosis, y		4.50 (3.64)
Stage of melanoma at diagnosis		
0	57 (16.8)	
I	232 (68.2)	
II	21 (6.2)	
III	30 (8.8)	
Number of survivor's first-degree relatives diagnosed with melanoma		
0	273 (81.3)	
1	51 (15.2)	
2	12 (3.6)	
Survivors' knowledge (5 items)[b]		2.71 (1.00)
Survivors' sociocognitive characteristics		
Self-efficacy to protect children from sun exposure		
Sunscreen		3.32 (0.96)
Hats		2.69 (1.18)
Clothing		2.56 (1.16)
Shade		2.95 (1.04)
Limiting time outdoors		3.48 (1.02)
Outcome expectations about children's sun protection		
Sunscreen		2.36 (0.94)

Study variable	n (%)	Mean (SD)
Hats		3.22 (1.08)
Clothing		3.45 (1.00)
Shade		3.16 (0.98)
Limiting time outdoors		2.63 (1.12)
Outcome expectations about tanning		2.31 (1.03)
Intentions to protect children from the sun during the next 3 months		
Sunscreen		3.77 (0.99)
Wide-brimmed hat		2.97 (1.21)
Clothing		3.08 (1.17)
Shade		3.77 (1.00)
Limiting time outdoors		3.64 (1.19)
Availability of sun protection materials (yes)		
Wide-brimmed hat	173 (52.1)	
Clothing	252 (77.5)	
Shade materials	241 (71.7)	
Accessibility of sun protection materials (yes)		
Sunscreen	321 (94.7)	
Hat	274 (82.5)	
Clothing	290 (87.1)	
Perceived risk		
Child developing sunburn		3.52 (0.79)
Child developing melanoma or another form of skin cancer		3.27 (0.67)
Worry		
How worried that child may develop melanoma/skin cancer in the future		3.16 (0.75)
How much does worry about child developing skin cancer affect mood		1.75 (0.88)
Perceived benefits in reducing children's risk of skin cancer		
Sunscreen		4.80 (0.58)
Hats/clothing		4.57 (0.71)
Shade		4.17 (1.12)
Limiting time outdoors		4.46 (0.83)
Doctor/health care provider recommendations (yes)		
Use sunscreen to protect child	260 (80.5)	
Use hats and clothing to protect child	146 (46.6)	

Note: Valid percentages are reported. Percentages may not total 100 due to rounding.

Table 2

Frequency of Sun Protection Behaviors in Children, N=340 Melanoma Survivors Reporting on One of Their Children

Sun protection behavior	Always n (%)	Frequently n (%)	Sometimes n (%)	Rarely n (%)	Never n (%)	Mean (SD)
Sunscreen						2.97 (0.72)
Wear sunscreen	73 (21.5)	163 (47.9)	76 (22.4)	14 (4.1)	14 (4.1)	
Put on 30 minutes before going outdoors	30 (8.8)	98 (28.8)	131 (38.5)	55 (16.2)	26 (7.6)	
Put on all body parts not covered by clothing	54 (15.9)	115 (33.8)	79 (23.2)	59 (17.4)	33 (9.7)	
Reapply within 1 hour after going outdoors	5 (1.5)	58 (17.1)	139 (40.9)	100 (29.4)	38 (11.2)	
Reapply after each hour outdoors	8 (2.4)	58 (17.2)	139 (41.1)	99 (29.3)	34 (10.1)	
Lip balm	8 (2.4)	41 (12.1)	84 (24.7)	86 (25.3)	121 (35.6)	
Wide-brimmed hat	9 (2.6)	23 (6.8)	70 (20.6)	104 (30.6)	134 (39.4)	2.03 (1.05)
Clothing						3.21 (0.71)
Shirt with sleeves to elbow or longer	16 (4.7)	79 (23.2)	159 (46.8)	75 (22.1)	11 (3.2)	
Knee-length or longer pants	20 (5.9)	143 (42.1)	134 (39.4)	33 (9.7)	10 (2.9)	
Sunglasses	5 (1.5)	28 (8.2)	103 (30.3)	115 (33.8)	89 (26.2)	2.25 (0.98)
Shade	10 (2.9)	102 (30.0)	188 (55.3)	39 (11.5)	1 (0.3)	3.24 (0.70)
Limiting time outdoors 10AM to 4PM	27 (8.0)	124 (36.6)	93 (27.4)	55 (16.2)	40 (11.8)	3.13 (1.14)
Sun protection composite						2.80 (0.48)

Note: Valid percentages are reported. Percentages may not total 100 due to rounding.

Table 3

Correlates of Children's Sunburn in Multivariable Analyses, N=340 Melanoma Survivors Reporting on One of Their Children

Independent variables	Sunburn		
	AOR	95% CI	*p*-value
Child			
Age	**1.34**	**1.20, 1.50**	**<0.001**
Sun sensitivity	0.61	0.37, 1.02	0.06
Survivor			
Sex (Reference category, male)	**0.25**	**0.12, 0.53**	**<0.001**
Self-efficacy			
Sunscreen	1.35	0.83, 2.18	0.22
Hat	0.74	0.50, 1.08	0.12
Shade	1.28	0.77, 2.13	0.34
Limiting time	0.66	0.39, 1.10	0.11
Outcome expectations			
Sunscreen	1.11	0.73, 1.69	0.62
Hat	0.92	0.59, 1.43	0.70
Clothing	1.17	0.79, 1.72	0.43
Shade	1.29	0.78, 2.12	0.32
Limiting time	0.93	0.60, 1.46	0.75
Intentions			
Hat	0.90	0.64, 1.28	0.56
Shade	1.32	0.88, 1.98	0.18
Limiting time	0.93	0.65, 1.34	0.71
Perceived benefits			
Shade	**0.69**	**0.52, 0.91**	**0.010**
Perceived risk			
Sunburn	**1.65**	**1.02, 2.67**	**0.04**
Worry			
Worry child may develop melanoma/skin cancer	**0.61**	**0.39, 0.95**	**0.03**
Worry about child developing melanoma/skin cancer affects survivor's mood	**1.82**	**1.22, 2.72**	**0.004**
Survivor sunburn	**6.96**	**3.44, 14.08**	**<0.001**

Note: An independent variable was included in the table if it was significantly associated ($p<0.10$) with sunburn in univariate analyses. AOR, 95% CI and *p*-value estimates are from the multivariable model, where boldface indicates statistical significance ($p<0.05$).