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# Sun protection and skin cancer screening after childhood cancer – a report from the Swiss Childhood Cancer Survivor Study (SCCSS)

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**Précis:** Sun protection is poor among childhood cancer survivors, particularly among younger generations. Only one in five treated with radiotherapy or HSCT meets current recommendations for skin cancer screening. This highlights the need to systematically integrate sun safety education and skin cancer screening into follow-up care.

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**Data availability statement:** We accessed the data that support the information of this manuscript via secured servers of the Institute of Social and Preventive Medicine at the University of Bern. Individual-level, fully anonymized, sensitive data can only be made available for researchers who fulfil the legal requirements. Requests for data from the Childhood Cancer Registry of Switzerland must be directed to this organization (<https://www.childhoodcancerregistry.ch>). Requests for data from the Swiss Childhood Cancer Survivor Study (SCCSS) should be communicated to the study lead, Claudia E. Kuehni ([claudia.kuehni@unibe.ch](mailto:claudia.kuehni@unibe.ch)).

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NOTE: This preprint reports new research that has not been certified by peer review and should not be used to guide clinical practice.

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## Abstract

**Background:** Childhood cancer survivors (CCS) face elevated skin cancer risk, especially after radiotherapy or hematopoietic stem cell transplantation (HSCT). We evaluated the prevalence and predictors of sun protection, sunburn, and physician skin examination (PSE) among CCS in Switzerland.

**Methods:** We surveyed CCS diagnosed <21 years and surviving  $\geq 5$  years after diagnosis about sun protection, sunburns during last summer, and PSE within the last year. We retrieved cancer-related data from the Swiss Childhood Cancer Registry and used multivariable logistic regression, stratified by age group, to identify predictors.

**Results:** We included 1,048 children (5-15 years), 572 adolescents (16-19 years), and 1,959 adults ( $\geq 20$  years). Regular sun protection was reported by 89% of children, 65% of adolescents, and 77% of adults, and sunburns by 23%, 49%, and 43%. PSE prevalence among those treated with radiotherapy was 21%, 18%, and 17%, and among HSCT recipients 36%, 28%, and 28%. Radiotherapy was unrelated to sun protection and PSE, but associated with fewer sunburns (OR=0.63-0.77). HSCT recipients were more likely to have attended a PSE (OR=2.06-3.75), but not radiotherapy recipients. Across age groups, survivors born more recently were less likely to protect from sun (OR range=0.94-0.97) and more likely to report sunburn (OR=1.04-1.14).

**Conclusion:** Survivors protect insufficiently from sun and only few who are particularly at risk for skin cancer due to their treatment history attend PSEs as recommended by the Children's Oncology Group. Healthcare practitioners should systematically integrate yearly PSE after radiotherapy or HSCT and encourage consistent sun protection, particularly among younger generations and adolescents.

## Introduction

Melanoma skin cancer incidence, the most serious skin cancer type, has increased significantly in Switzerland over the past 40 years: While 4,000 melanomas were registered in Switzerland between 1982 and 1986, this number quadrupled to 16,500 cases between 2017 and 2021.<sup>1</sup> This makes melanomas the fifth most common cancer type in Switzerland,<sup>2</sup> and Switzerland one of the leading melanoma incidence countries in Europe.<sup>3</sup> Genetic predisposition, especially a fair, sun-sensitive skin type, and environmental exposure, particularly ultraviolet radiation through sun exposure, are the main risk factors for developing skin cancer.<sup>4</sup> For CCS, certain cancer treatments, such as radiation, chemotherapy including alkylating agents or bleomycin, or hematopoietic stem cell transplantation (HSCT) increase the risk for developing basal and squamous cell carcinomas,<sup>5,6</sup> and melanomas.<sup>7</sup> CCS are twice as likely to develop melanomas compared to their peers without cancer history,<sup>8</sup> and have a 30-fold higher risk of developing basal cell carcinoma (BCC) already in young adulthood. The Children's Oncology Group (COG) recommends that survivors treated with radiation or HSCT have a physician skin examination (PSE) once a year and that all survivors protect from sun<sup>9</sup> to reduce skin cancer mortality.<sup>10-12</sup> Yet, we know little about sun protection and PSE after childhood cancer. Existing studies focus primarily on the US,<sup>13-17</sup> with different sun protection practices compared to Europe,<sup>18</sup> and on adult CCS.<sup>13-15,19,20</sup> Most findings originate from studies conducted 15 to 20 years ago.<sup>13,14,17,19</sup> We aim to describe sun protection, sunburns, and PSE in participants of the Swiss Childhood Cancer Survivor Study (SCCSS), a population-based study of pediatric, adolescent, and adult CCS with data collected 2007-2022. In particular, this study evaluates prevalence and predictors of sun protection, sunburn, and PSE, and assesses compliance with PSE as recommended by the COG.

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## Methods

### *Study design and study population*

The Swiss Childhood Cancer Survivor Study (SCCSS) is a population-based study nested in the Childhood Cancer Registry (ChCR). Detailed methods of the SCCSS are available elsewhere.<sup>21</sup> The ChCR includes all children and adolescents diagnosed with leukemias, lymphomas, central nervous system (CNS) tumors, malignant solid tumors, or Langerhans cell histiocytosis prior to age of 20 years in Switzerland since 1976.<sup>22</sup> In the SCCSS, we sent questionnaires to all CCS who had survived  $\geq 5$  years since their initial diagnosis. Questionnaires are available in German, French, and Italian. For this study, we included CCS who participated in the SCCSS between 2007 and 2022. For CCS aged 5-15 years, we asked their parents to fill in the questionnaire. Ethical approval was granted by the ethics committee of the canton of Bern, Switzerland (KEK-BE: 166/2014 and 2021-01462).

### *Sun protection, sunburn, and physician skin examination*

*Sun protection.* We asked all participants how consistently they (or their child, for parents) protect themselves from the sun (e.g., using sunscreen, seeking shade, or wearing protective clothing). Response options ranged from “Always” to “(Almost) never” (*Supplementary Table 1*). For risk factor analysis, we defined good sun protection as protecting always or mostly from sun, and poor sun protection as protecting rarely or never from sun.

*Sunburn:* We asked all participants whether they (or their child, for parents) had experienced one or more sunburns in the past summer (response options no/yes).

*Physician skin examination:* We asked all participants whether they had ever had their skin or moles examined by a physician within the last 12 months, more than 12 months ago, or never. We defined compliance with the COG guidelines as having had the skin examined

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within the last 12 months, and no compliance if they had never had a PSE or if it was more than 12 months ago.

### *Explanatory variables*

*Sociodemographic characteristics.* We assessed the following sociodemographic characteristics via questionnaires: Swiss language region, parental and participant nationality, and parental education. We categorized language region into German and French/Italian. For migration background and parental education, we applied the definitions of the Federal Statistics Office.<sup>23,24</sup> If both parents were born Swiss or if the participant and at least one parent were born Swiss, we defined this as no migration background.<sup>23</sup> For those with migration background, we applied the United Nations' geographic coding scheme to obtain some information on their cultural background.<sup>25</sup> For educational background, we considered the highest educational level achieved by either parent. We divided education into three categories: primary (compulsory schooling only), secondary (higher schooling or vocational training), or tertiary (upper vocational education or university or technical college).<sup>24</sup>

*Cancer-related characteristics.* We received the following cancer-related characteristics from the ChCR: sex, date of birth, age at diagnosis, and diagnosis according to the International Classification of Childhood Cancer, third edition (ICCC-3).<sup>26</sup> Treatment information included chemotherapy, radiotherapy, HSCT, and relapse (all no/yes).

*Skin type.* We used the Fitzpatrick scale to assess skin phototyping. This six-level system classifies skin type based on genetic predisposition, skin reaction to sun exposure, and tanning ability.<sup>27</sup>

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### Statistical analysis

We stratified analyses by age group: children (5-15 years), adolescents (16-19 years), and adults (>20 years). We included all participants in the analysis who responded to at least one of the questions in the questionnaire section about sun protection and PSE.<sup>9</sup> We calculated the number and proportion of CCS for each of the response options for sun protection, sunburn, and PSE. To assess compliance with COG recommendations, we further assessed number and proportion of CCS treated with radiotherapy or HSCT who attended a PSE within the last 12 months.<sup>9</sup> To investigate factors associated with sun protection, sunburn, and PSE, we applied multivariable logistic regression analysis. We decided *a priori* to include age at study, sex, migration background, language region, parental education, radiotherapy, and HSCT as exposures in all models, and also considered year of study and birth year to account for potential age–period–cohort effects. Because age, year of study, and birth year are perfectly collinear, we compared models including these predictors separately and in combination.<sup>28</sup> Model fit based on Akaike (AIC) and Bayesian (BIC) information criteria indicated that including all three was unnecessary. Models including birth year consistently showed the best fit when also considering all other exposures (*Supplementary Table 2*) and were thus used in final analyses, while we retained models with year of study for sensitivity analyses. As we had only asked a subsample of study participants on skin type, we performed additional sensitivity analyses including this variable. Given that several outcomes were common, we also conducted Poisson regression with robust error variances to estimate the relative risk (RR) and enable direct comparison between exposure groups.<sup>29</sup>

### Results

In total, of 5,940 eligible survivors, 5,427 were contacted. Of those, 3,768 (69%) filled in the questionnaire, and 3,579 (66%) responded to at least one question regarding sun exposure or

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PSE (1,048 pediatric, 572 adolescent, and 1,959 adult CCS, *Supplementary Figure 1*). Median age at study was 21 years (interquartile range [IQR] 15-27), median age at diagnosis 7 years (IQR 3-13), and median time since diagnosis 12 years (IQR 8-19). Leukemia was the most common cancer diagnosis (32%), followed by lymphomas (17%) and CNS tumors (16%). Overall, 77% had received chemotherapy, 31% radiotherapy, and 7% HSCT (*Table 1*).

### *Prevalence of sun protection, sunburn and PSE*

Overall, 79% of survivors reported good sun protection (*Supplementary Table 3*). Sun protection differed by age group (*Figure 1*): 88% of children, 65% of adolescents, and 77% of adults reported protecting always or mostly from sun. Nonetheless, 38% reported at least one sunburn the previous summer, with the highest prevalence among adolescents (49%). PSE compliance with the COG recommendation was low (*Figure 2, Supplementary Table 4*). Among survivors treated with radiotherapy, 17% had a PSE within the past 12 months compared with 15% of those without radiotherapy. Among HSCT survivors, 29% reported a recent PSE versus 15% without HSCT. These patterns were similar across age groups.

### *Factors associated with sun protection and sunburn*

*Table 2* shows results from logistic regression analyses, *Supplementary Table 5* results from Poisson regression. Across age groups, good sun protection was less likely among survivors with a migration background, whose parents had only primary education, and among survivors born more recently, indicating birth cohort effect. Independent of birth cohort, among children, higher age was associated with less sun protection (OR = 0.78, 95%CI 0.71-0.85). Male adolescent (OR = 0.37, 95%CI 0.24-0.56) and adult survivors (OR = 0.51,

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95%CI 0.40-0.65) were less likely to protect from sun than females. Radiotherapy and HSCT treatment were unrelated to sun protection.

Similar to sun protection, more recent birth cohorts were more likely to report sunburn.

Independent of birth cohort, among children, higher age was associated with higher sunburn odds (OR = 1.28, 95%CI 1.18-1.38). Survivors with migration background were less likely to report sunburn across children and adults. Sunburn was less likely among pediatric (OR = 0.67, 95%CI 0.43-1.01), adolescent (OR = 0.63, 95%CI 0.43-0.93), and adult (OR = 0.77, 95%CI 0.63-0.94) survivors treated with radiotherapy, and among adult HSCT recipients (OR = 0.62, 95%CI 0.39-0.95).

## *Factors associated with PSE*

HSCT pediatric (OR = 3.75, 95%CI 1.39-9.83), adolescent (OR = 2.06, 95%CI = 0.87-4.55), and adult (OR = 2.07, 95%CI 1.29-3.27) recipients were more likely to have had a PSE within the last 12 months. For radiotherapy, this only applied to pediatric survivors (OR = 2.62, 95% CI 0.94–6.86) (Table 2). Pediatric (OR = 2.21, 95%CI 0.99-4.95) and adult (OR=1.39, 95%CI 1.06-1.82) survivors in the French or Italian language region were more likely to have had a PSE, as were pediatric survivors whose parents had tertiary education. PSE was unrelated to birth year.

## *Sensitivity analyses*

Across all outcomes, sensitivity analyses yielded similar results. When including skin type, the direction of associations remained unchanged: darker skin type was linked to lower likelihood of sun protection and sunburn but was unrelated to PSE. Results were also stable when replacing birth year with year of study participation (Supplementary Tables 6-8).

## Discussion

Despite their elevated skin cancer risk, one in five childhood cancer survivors in our study reported insufficient sun protection, and one in three experienced a sunburn during the past year. Sun protection was poorer and sunburn more frequent among younger generations. Survivors who received radiotherapy or HSCT did not protect substantially better from the sun than those without these treatments. Only 18% of survivors treated with radiotherapy and 29% of those treated with HSCT reported a physician skin examination (PSE) within the past year, as recommended in the COG guidelines.

Compared with previous CCS studies, sun protection was relatively high in our study. In the North-American Childhood Cancer Survivor Study with predominantly adult survivors, 67% reported regular sunscreen use and 41% report wearing protective clothing.<sup>13</sup> In smaller survivor studies, only 23%-59% apply sun safety measures such as using sunscreen, wearing protective clothing, or seeking shade.<sup>15,20,30</sup> Differences may partly reflect measurement approaches: we assessed sun protection as a composite of behaviors (sunscreen use, shading, protective clothing), whereas other studies evaluated single behaviors.<sup>13,15,30</sup> In the general Swiss population, 54-80% of children<sup>31-33</sup> and 77% of young adults use sunscreen,<sup>34</sup> which is slightly lower or similar to our study. Sunburn was less common among pediatric survivors than among children in the general population (40–60%),<sup>31,32</sup> which may reflect better protection through parents after their child's cancer. Sunburn prevalence among adult survivors was comparable to adults in Germany (49%),<sup>35</sup> which may reflect decreased awareness compared to children due to longer time since treatment and less presence of their cancer history in everyday life (e.g., less follow-up examinations).<sup>36</sup> Sun protection was lowest and sunburn prevalence highest among adolescent survivors. This finding is consistent with previous evidence highlighting adolescence as a vulnerable stage for poor health behaviors.<sup>37</sup>

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Across age groups, survivors born more recently were less likely to use sun protection and more likely to report sunburn. This generational pattern may reflect reduced public awareness of skin cancer prevention compared to the 1990s, when there was considerable media attention on ozone layer depletion and UV-related risks.<sup>38</sup> Younger generations are additionally exposed to misinformation about sunscreen safety, including vitamin D concerns<sup>39</sup> and alleged carcinogenic side effects,<sup>40</sup> combined with appearance norms favoring tanning, amplified through social media.<sup>41</sup> This trend requires close monitoring. In our study, female adolescent and adult survivors were more likely to protect from sun. This is consistent with previous findings,<sup>13,16,20</sup> mirroring general evidence that women tend to be more health-conscious and seek preventive information more actively.<sup>42</sup> Survivors with migration background were less likely to protect from sun and less likely to report sunburn. This may be partially explained by skin phototype (30% of those with migration background report a skin type 4-6 compared to 18% of those without migration background), but also by culturally different sunseeking and sun protection habits.<sup>18</sup> Radiotherapy was not associated with better sun protection, aligning with previous findings,<sup>15</sup> yet was linked to lower sunburn odds in adolescents and adults, as was HSCT among adults. This points to sun avoidance rather than sun protection.

Only 16% of survivors reported a PSE within the past 12 months, which is slightly higher than the 13% observed in the general Swiss population.<sup>43</sup> Compliance with the COG's latest PSE recommendations was higher among HSCT recipients (29%) than among those treated with radiotherapy (17%). The latter figure is consistent with 11-31% reported in North American cohorts.<sup>44-46</sup> Low PSE attendance may result from limited knowledge of prior treatments and associated risks.<sup>44,47</sup> While still low, higher attendance among HSCT survivors likely reflects their ongoing, multidisciplinary follow-up care due to greater morbidity burden<sup>48,49</sup> and frequent dermatological problems,<sup>50</sup> which may increase screening

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opportunities. Further investigations, such as in interviewing survivors about barriers they encounter to attend skin examinations, can provide valuable insights. Older adults were more likely to report PSE attendance, potentially reflecting increasing health awareness with older age.<sup>51</sup> Regional differences were also evident: survivors from French- and Italian-speaking regions reported higher PSE attendance. This may relate to differences in preventive care culture since those regions have longer-standing organized screening programs such as mammography.<sup>52</sup>

This study provides comprehensive, population-based estimates of sun protection, sunburn, and PSE among CCS across the full age spectrum and over two decades of data collection. It extends prior work by assessing adherence to COG recommendations after both radiotherapy and HSCT. Limitations include self-reporting, which may introduce a social desirability bias. Incomplete availability of some outcomes and exposures, particularly PSE in children and skin type, limits the study's statistical power. We did not assess actual sun exposure and skin self-examination, which the COG recommends monthly and which can reduce melanoma mortality by 63%.<sup>53</sup> Our cohort is predominantly of Western European ancestry, which may limit generalizability to more diverse populations.

Our findings highlight the need for system-level strategies to embed sun protection and skin cancer screening into survivorship care. Integrating dermatology referrals and annual reminders for radiation or HSCT recipients within survivorship care plans<sup>54</sup> (e.g., Survivorship Passport) as well as patient or provider activation regarding skin cancer risk after childhood cancer<sup>55</sup> can improve knowledge and recommendation adherence. Education efforts should emphasize the importance of sun protection for all survivors.<sup>55</sup>

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290 Healthcare practitioners engaged in follow-up care should support survivors to attend yearly

291 PSE, particularly after radiotherapy or HSCT, and encourage consistent sun protection,

292 especially among adolescents and male survivors, and younger generations.

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## References

1. National Cancer Registration Agency. Data from: Cancer incidence 1982-2021. 2024.
2. Ferlay J, Ervik M, Lam F, et al. Global Cancer Observatory: Cancer Today. International Agency for Research on Cancer. Accessed 10 Feb, 2025, <https://gco.iarc.who.int/today>
3. WHO & IARC. Data from: Estimated cumulative risk (%), Incidence, Both sexes, age [0-74], in 2022. Switzerland vs Europe. 2022.
4. Armstrong BK, Kricker A. The epidemiology of UV induced skin cancer. *Journal of Photochemistry and Photobiology B: Biology*. 2001;63(1):8-18. doi:10.1016/S1011-1344(01)00198-1
5. Watt TC, Inskip PD, Stratton K, et al. Radiation-Related Risk of Basal Cell Carcinoma: A Report From the Childhood Cancer Survivor Study. *JNCI: Journal of the National Cancer Institute*. 2012;104(16):1240-1250. doi:10.1093/jnci/djs298
6. Boull C, Chen Y, Im C, et al. Keratinocyte carcinomas in survivors of childhood cancer: A report from the childhood cancer survivor study. *J Am Acad Dermatol*. 2024;91(6):1125-1135. doi:10.1016/j.jaad.2024.07.1520
7. Teepen JC, Kok JL, Kremer LC, et al. Long-Term Risk of Skin Cancer Among Childhood Cancer Survivors: A DCOG-LATER Cohort Study. *JNCI: Journal of the National Cancer Institute*. 2019;111(8):845-853. doi:10.1093/jnci/djy212
8. Rotz SJ, Stratton K, Leisenring W, et al. Melanoma Among Adult Survivors of Childhood Cancer: A Report From the Childhood Cancer Survivor Study. *J Clin Oncol*. 2025;0(0):JCO-24-01519. doi:10.1200/jco-24-01519
9. Children's Oncology Group. *Skin Health after Cancer Treatment (Version 6.0)*. 2023. <https://www.survivorshipguidelines.org/>
10. Shellenberger R, Nabhan M, Kakaraparthi S. Melanoma screening: A plan for improving early detection. *Ann Med*. 2016;48(3):142-148. doi:10.3109/07853890.2016.1145795
11. Wickenheiser MR, Bordeaux JS, Robinson JK. Melanoma Screening by Physicians. *JAMA Dermatology*. 2014;150(10):1045. doi:10.1001/jamadermatol.2014.1326
12. Geller AC, Emmons KM. The Time Has Come to Enhance Skin Cancer Screening for Adult Childhood Cancer Survivors. *J Natl Cancer Inst*. 2019;111(8):760-761. doi:10.1093/jnci/djy213
13. Buchanan N, Leisenring W, Mitby PA, et al. Behaviors associated with ultraviolet radiation exposure in a cohort of adult survivors of childhood and adolescent cancer. *Cancer*. 2009;115(S18):4374-4384. doi:10.1002/cncr.24581
14. Krull KR, Huang S, Gurney JG, et al. Adolescent behavior and adult health status in childhood cancer survivors. *J Cancer Surviv*. 2010;4(3):210-217. doi:10.1007/s11764-010-0123-0

SCCSS Sun protection

15. Fluehr M, Kwok G, Stapleton JL, Masterson M, Devine KA. Factors Associated With Sun Protection Behaviors Among Childhood Cancer Survivors. *J Pediatr Hematol Oncol*. 2023;45(3):e323-e327. doi:10.1097/mp.0000000000002618
16. Darabos K, Barakat LP, Schapira M, Hill-Kayser C, Schwartz LA. Association of Demographic and Cancer-Specific Factors on Health Behavior Recommendations Specific to Cancer Prevention and Control Among Adolescent and Young Adult Survivors of Childhood Cancer. *J Adolesc Young Adult Oncol*. 2021/12/01 2020;10(6):619-628. doi:10.1089/jayao.2020.0130
17. Tercyak KP, Donze JR, Prahlad S, Mosher RB, Shad AT. Multiple behavioral risk factors among adolescent survivors of childhood cancer in the Survivor Health and Resilience Education (SHARE) Program. *Pediatr Blood Cancer*. 2006;47(6):825-830. doi:10.1002/pbc.20602
18. Chaibuttr C, Pruksaeakanan C, Wongdama S, Prasertsook S, Kumpangsin T, Boonchai W. Characteristics and common ultraviolet filter usage of sunscreens purchased online: Cross-cultural analysis across 5 continents. *Photodermatol Photoimmunol Photomed*. 2023;39(1):27-38. doi:10.1111/phpp.12808
19. Rebholz CE, Rueegg CS, Michel G, et al. Clustering of health behaviours in adult survivors of childhood cancer and the general population. *Br J Cancer*. 2012;107(2):234-242. doi:10.1038/bjc.2012.250
20. Cheung Y, Yang L, Ma JC, et al. Health behaviour practices and expectations for a local cancer survivorship programme: a cross-sectional study of survivors of childhood cancer in Hong Kong. *Hong Kong Med J*. 2022;28(1):33.
21. Kuehni CE, Rueegg CS, Michel G, et al. Cohort Profile: The Swiss Childhood Cancer Survivor Study. *Int J Epidemiol*. 2012;41(6):1553-1564. doi:10.1093/ije/dyr142
22. Michel G, von der Weid NX, Zwahlen M, Adam M, Rebholz C, Kuehni CE. The Swiss Childhood Cancer Registry: rationale, organisation and results for the years 2001-2005. *Swiss Med Wkly*. 2007;137(3536):502-509.
23. Federal Statistics Office. Bevölkerung nach Migrationsstatus [Population and migration status]. Accessed 17 April, 2024, <https://rb.gy/nf754k>
24. Federal Statistics Office. Bildungssystem [Education system]. Accessed 19 April, 2024, <https://shorturl.at/Ez5zD>
25. United Nations. Standard country or area codes for statistical use (M49). Accessed 23 October, 2025, <https://unstats.un.org/unsd/methodology/m49/>
26. Steliarova-Foucher E, Stiller C, Lacour B, Kaatsch P. International classification of childhood cancer. *Cancer*. 2005;103(7):1457-1467.
27. Gupta V, Sharma VK. Skin typing: Fitzpatrick grading and others. *Clin Dermatol*. 2019;37(5):430-436. doi:10.1016/j.clindermatol.2019.07.010
28. Yang Y, Land KC. *Age-period-cohort analysis: New models, methods, and empirical applications*. Taylor & Francis; 2013.

# SCCSS Sun protection

29. McKenzie DP, Thomas C. Relative risks and odds ratios: Simple rules on when and how to use them. *Eur J Clin Invest.* 2020;50(8)doi:10.1111/eci.13249
30. Levy-Shraga Y, Cohen R, Ben Ami M, Yeshayahu Y, Temam V, Modan-Moses D. Sun Exposure and Protection Habits in Pediatric Patients with a History of Malignancy. *PLoS One.* 2015;10(9):e0137453. doi:10.1371/journal.pone.0137453
31. Ackermann S, Vuadens A, Levi F, Bulliard J. Sun protective behaviour and sunburn prevalence in primary and secondary schoolchildren in western Switzerland. *Swiss Med Wkly.* 2016;doi:10.4414/smww.2016.14370
32. Coste A, Backes C, Mazzei A, et al. Prevalence and determinants of sunburns and sun protection behaviors among children: A nationwide cross-sectional survey in Switzerland. *ISEE Conference Abstracts.* 2022(1)doi:doi:10.1289/isee.2022.P-1080
33. Reinau D, Meier CR, Gerber N, Surber C. Evaluation of a sun safety education programme for primary school students in Switzerland. *Eur J Cancer Prev.* 2014;23(4)
34. Friedli A, Fournier E, Hutson T. Sun exposure and challenges of sun protection in adolescents and young adults: A prevalence observational study. *Med Int.* 2024;4(6)doi:10.3892/mi.2024.195
35. forsa. *Bewusstsein und Schutzmaßnahmen vor UV-Strahlung anlässlich der EURO 2024 [Awareness and protection against UV-radiation in the context of the EURO 2024].* 2024.
36. Christen S, Weishaupt E, Vetsch J, et al. Perceived information provision and information needs in adolescent and young adult cancer survivors. *Eur J Cancer Care.* 2019;28(1):e12892. doi:10.1111/ecc.12892
37. Mytton OT, Donaldson L, Goddings A-L, et al. Changing patterns of health risk in adolescence: implications for health policy. *Lancet Public Health.* 2024;9(8):e629-e634. doi:10.1016/S2468-2667(24)00125-7
38. Slaper H, Velders GJM, Daniel JS, De Gruijl FR, Van Der Leun JC. Estimates of ozone depletion and skin cancer incidence to examine the Vienna Convention achievements. *Nature.* 1996;384(6606):256-258. doi:10.1038/384256a0
39. Neale RE, Khan SR, Lucas RM, Waterhouse M, Whiteman DC, Olsen CM. The effect of sunscreen on vitamin D: a review. *Br J Dermatol.* 2019;181(5):907-915. doi:10.1111/bjd.17980
40. O'Connor C, Rafferty S, Murphy M. A qualitative review of misinformation and conspiracy theories in skin cancer. *Clin Exp Dermatol.* 2022;47(10):1848-1852. doi:10.1111/ced.15249
41. Mingoia J, Hutchinson AD, Gleaves DH, Wilson C. The impact of a social media literacy intervention on positive attitudes to tanning: A pilot study. *Comput Human Behav.* 2019/01/01/ 2019;90:188-195. doi:10.1016/j.chb.2018.09.004
42. Manierre MJ. Gaps in knowledge: Tracking and explaining gender differences in health information seeking. *Soc Sci Med.* 2015/03/01/ 2015;128:151-158. doi:10.1016/j.socscimed.2015.01.028

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43. Federal Statistics Office. Letzte Hautuntersuchung [Last skin examination].  
<https://www.bfs.admin.ch/bfs/de/home/statistiken/gesundheits.assetdetail.30305980.html>
44. Geller AC, Keske RR, Haneuse S, et al. Skin Cancer Early Detection Practices among Adult Survivors of Childhood Cancer Treated with Radiation. *J Invest Dermatol*. 2019;139(9):1898-1905 e2. doi:10.1016/j.jid.2019.02.033
45. Stapleton JL, Tatum KL, Devine KA, et al. Skin Cancer Surveillance Behaviors Among Childhood Cancer Survivors. *Pediatr Blood Cancer*. 2016;63(3):554-557. doi:10.1002/pbc.25811
46. Yan AP, Chen Y, Henderson TO, et al. Adherence to Surveillance for Second Malignant Neoplasms and Cardiac Dysfunction in Childhood Cancer Survivors: A Childhood Cancer Survivor Study. *J Clin Oncol*. 2020/05/20 2020;38(15):1711-1722. doi:10.1200/JCO.19.01825
47. Kadan-Lottick NS, Robison LL, Gurney JG, et al. Childhood Cancer Survivors' Knowledge About Their Past Diagnosis and Treatment. *JAMA*. 2002;287(14):1832. doi:10.1001/jama.287.14.1832
48. Hashmi S, Carpenter P, Khara N, Tichelli A, Savani BN. Lost in Transition: The Essential Need for Long-Term Follow-Up Clinic for Blood and Marrow Transplantation Survivors. *Biol Blood Marrow Transplant*. 2015;21(2):225-232. doi:10.1016/j.bbmt.2014.06.035
49. Armenian SH, Sun C-L, Kawashima T, et al. Long-term health-related outcomes in survivors of childhood cancer treated with HSCT versus conventional therapy: a report from the Bone Marrow Transplant Survivor Study (BMTSS) and Childhood Cancer Survivor Study (CCSS). *Blood*. 2011;118(5):1413-1420. doi:10.1182/blood-2011-01-331835
50. Tangthanapalakul A, Chaijitraruch N, Techavichit P, et al. Dermatologic manifestations in pediatric patients after liver and HSCT: A 20-year retrospective cohort study. *Pediatr Transplant*. 2021;25(3)doi:10.1111/ptr.13916
51. Becker CM, Arnold W. Health promoting behaviors of older Americans versus young and middle aged adults. *Educ Gerontol*. 2004;30(10):835-844. doi:10.1080/03601270490507277
52. Eichholzer M, Richard A, Rohrmann S, et al. Breast cancer screening attendance in two Swiss regions dominated by opportunistic or organized screening. *BMC Health Serv Res*. 2016;16(1)doi:10.1186/s12913-016-1760-4
53. Berwick M, Begg CB, Fine JA, Roush GC, Barnhill RL. Screening for Cutaneous Melanoma by Skin Self-Examination. *J Natl Cancer Inst*. 1996;88(1):17-23. doi:10.1093/jnci/88.1.17
54. Murphy P, Levine A, Lerma T, Young S, Hwang J, Goldsby R. A portable survivorship care plan: a tool that helps educate and improve knowledge in childhood cancer survivors. *Support Care Cancer*. 2021;29(1):169-177. doi:10.1007/s00520-020-05422-z
55. Geller AC, Coroiu A, Keske RR, et al. Advancing Survivors Knowledge (ASK Study) of Skin Cancer Surveillance After Childhood Cancer: A Randomized Controlled Trial in the Childhood Cancer Survivor Study. *J Clin Oncol*. 2023/04/20 2023;41(12):2269-2280. doi:10.1200/JCO.22.00408

SCCSS Sun protection

**Table 1.** Characteristics of childhood cancer survivors included in sun exposure and physician skin examination study

|                                                   | Children (5-15 years)<br>N = 1,048 | Adolescents (16-19 years)<br>N = 572 | Adults (≥ 20 years)<br>N = 1,959 |
|---------------------------------------------------|------------------------------------|--------------------------------------|----------------------------------|
| <b>Socio-demographic characteristics</b>          |                                    |                                      |                                  |
| <i>Age at time of questionnaire, median [IQR]</i> | 12 [10-14]                         | 18 [17-19]                           | 27 [23-33]                       |
| <i>Year of birth [IQR]</i>                        | 2003 [1999-2007]                   | 1992 [1991-1994]                     | 1982 [1976-1988]                 |
| <i>Year of study participation</i>                |                                    |                                      |                                  |
| 2007-2013                                         | 450 (43%)                          |                                      |                                  |
| 2007-2009                                         |                                    | 257 (45%)                            | 1,076 (55%)                      |
| 2010-2013                                         |                                    | 179 (31%)                            | 413 (21%)                        |
| 2015-2017                                         | 314 (30%)                          | 73 (13%)                             | 232 (12%)                        |
| 2021-2022                                         | 284 (27%)                          | 63 (11%)                             | 238 (12%)                        |
| <i>Female</i>                                     | 464 (44%)                          | 273 (48%)                            | 937 (48%)                        |
| <i>Migration background</i>                       | 229 (22%)                          | 119 (21%)                            | 341 (17%)                        |
| <i>UN Geographic region*</i>                      |                                    |                                      |                                  |
| Northern/Western/Eastern Europe                   | 835 (80%)                          | 465 (82%)                            | 1590 (83%)                       |
| Southern Europe                                   | 118 (11%)                          | 79 (14%)                             | 207 (11%)                        |
| Rest of the world                                 | 45 (4%)                            | 23 (4%)                              | 20 (1%)                          |
| <i>Language</i>                                   |                                    |                                      |                                  |
| German                                            | 728 (70%)                          | 399 (70%)                            | 1382 (71%)                       |
| French                                            | 276 (26%)                          | 155 (27%)                            | 516 (26%)                        |
| Italian                                           | 44 (4%)                            | 18 (3%)                              | 61 (3%)                          |
| <i>Parental highest education*</i>                |                                    |                                      |                                  |
| Primary education                                 | 81 (8%)                            | 33 (5.8%)                            | 193 (9.9%)                       |
| Secondary education                               | 361 (34%)                          | 344 (60.1%)                          | 1001 (51.1%)                     |
| Tertiary education                                | 577 (55%)                          | 171 (29.9%)                          | 657 (33.5%)                      |
| <b>Cancer-related characteristics</b>             |                                    |                                      |                                  |
| <i>ICCC3 main group</i>                           |                                    |                                      |                                  |
| Leukemias                                         | 417 (40%)                          | 188 (33%)                            | 548 (28%)                        |
| Lymphomas                                         | 66 (6%)                            | 84 (15%)                             | 466 (24%)                        |
| CNS tumors                                        | 169 (16%)                          | 104 (18%)                            | 291 (15%)                        |
| Neuroblastoma                                     | 93 (9%)                            | 31 (5%)                              | 52 (3%)                          |
| Retinoblastoma                                    | 61 (6%)                            | 14 (2%)                              | 28 (1%)                          |
| Renal tumor                                       | 84 (8%)                            | 44 (8%)                              | 71 (4%)                          |
| Hepatic tumor                                     | 15 (1%)                            | 3 (<1%)                              | 12 (<1%)                         |
| Malignant bone tumors                             | 18 (2%)                            | 19 (3%)                              | 117 (6%)                         |
| Soft tissue sarcomas                              | 65 (6%)                            | 36 (6%)                              | 124 (6%)                         |
| Germ cell tumors                                  | 23 (2%)                            | 15 (3%)                              | 127 (7%)                         |
| Other                                             | 4 (<1%)                            | 8 (1%)                               | 68 (4%)                          |
| Langerhans cell histiocytosis                     | 33 (3%)                            | 26 (5%)                              | 55 (3%)                          |
| <i>Age at diagnosis, median [IQR]</i>             | 3 [2-5]                            | 6 [3-10]                             | 12 [6-16]                        |
| <i>Time since diagnosis, median [IQR]</i>         | 8 [7-10]                           | 11 [8-15]                            | 18 [11-23]                       |
| <i>Year of diagnosis, median [IQR]</i>            | 2010 [2003-2011]                   | 2000 [1995-2004]                     | 1990 [1985-2000]                 |
| <i>Radiotherapy</i>                               | 197 (19%)                          | 164 (29%)                            | 749 (38%)                        |
| <i>Chemotherapy</i>                               | 859 (82%)                          | 454 (79%)                            | 1456 (74%)                       |
| <i>HSCT</i>                                       | 82 (8%)                            | 38 (7%)                              | 115 (6%)                         |
| <i>Relapse</i>                                    | 37 (4%)                            | 15 (3%)                              | 55 (3%)                          |

\* Percentages are based upon the available N, not adding up to 100%. UN = United Nations, ICCC3 = International Classification of Childhood Cancer, 3<sup>rd</sup> edition, CNS = Central nervous system, HSCT = Hematopoietic stem cell transplantation

# SCCSS Sun protection

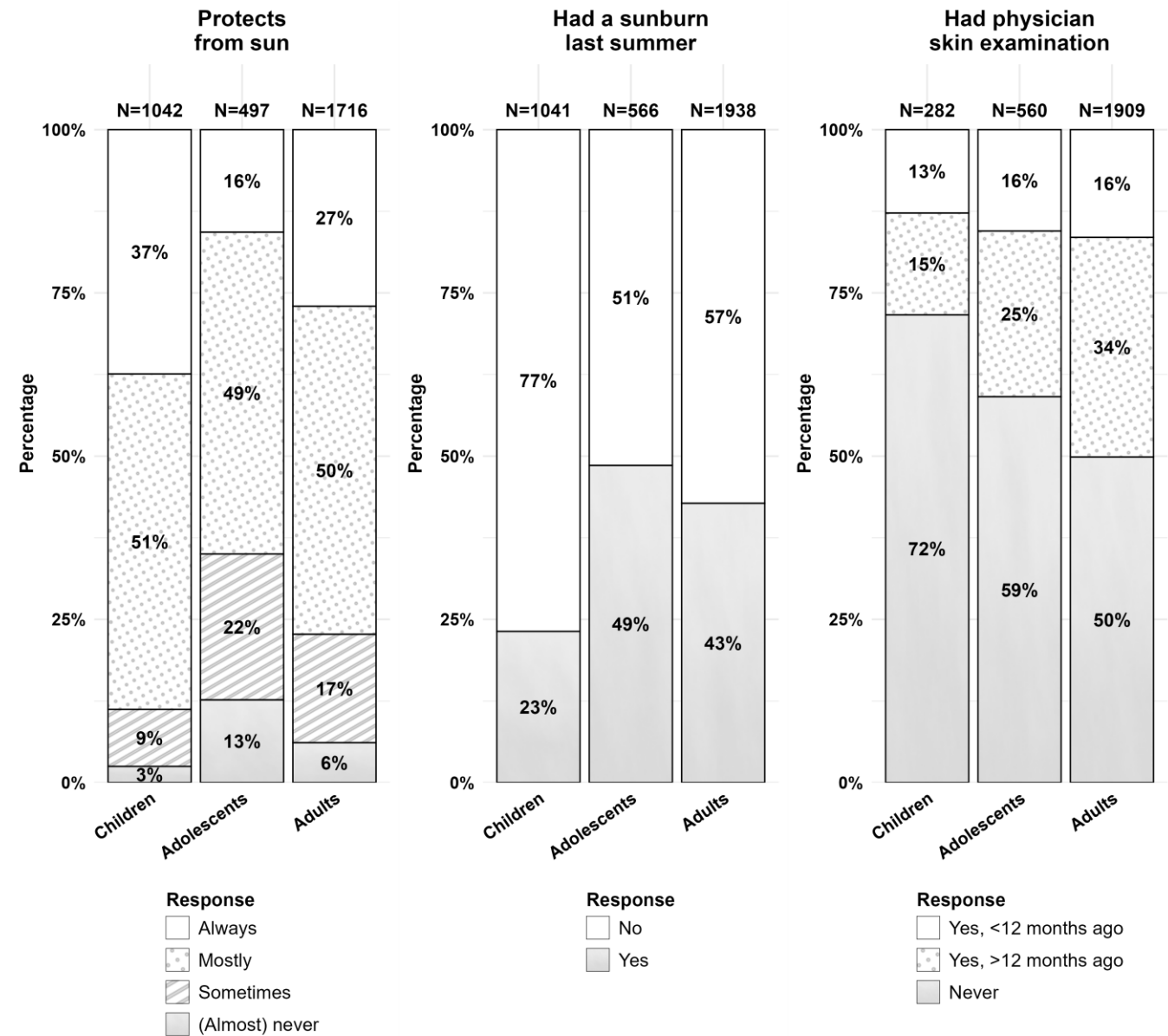
**Table 2.** Factors associated with sun protection, sunburn, and physician skin examinations in multivariable logistic regression in child, adolescents, and adults CCS

|                                             | Children (5-15 years) |            |        | Adolescents (16-19 years) |           |        | Adults (≥20 years) |           |        |
|---------------------------------------------|-----------------------|------------|--------|---------------------------|-----------|--------|--------------------|-----------|--------|
|                                             | OR                    | 95%CI      | p      | OR                        | 95%CI     | p      | OR                 | 95%CI     | p      |
| <b>Sun protection</b>                       |                       |            |        |                           |           |        |                    |           |        |
|                                             | N = 1,013             |            |        | N = 476                   |           |        | N = 1,626          |           |        |
| Age at study                                | 0.73                  | 0.66;0.82  | <0.001 | 0.91                      | 0.77;1.08 | 0.294  | 1.01               | 0.98;1.04 | 0.543  |
| Male <sup>a</sup>                           | 0.72                  | 0.47;1.09  | 0.122  | 0.38                      | 0.25;0.57 | <0.001 | 0.51               | 0.40;0.65 | <0.001 |
| Migration background <sup>b</sup>           | 0.64                  | 0.39;1.07  | 0.083  | 0.60                      | 0.35;1.01 | 0.053  | 0.58               | 0.43;0.79 | 0.001  |
| French/Italian language region <sup>c</sup> | 1.25                  | 0.80;2.00  | 0.331  | 1.05                      | 0.67;1.66 | 0.822  | 1.01               | 0.77;1.32 | 0.967  |
| Parental education <sup>d</sup>             |                       |            |        |                           |           |        |                    |           |        |
| Secondary                                   | 1.98                  | 0.98;3.93  | 0.053  | 1.34                      | 0.58;3.11 | 0.489  | 1.30               | 0.87;1.94 | 0.193  |
| Tertiary                                    | 1.98                  | 0.99;3.84  | 0.048  | 1.92                      | 0.79;4.65 | 0.149  | 1.55               | 1.01;2.36 | 0.042  |
| Radiotherapy <sup>e</sup>                   | 1.34                  | 0.78;2.45  | 0.310  | 1.58                      | 1.01;2.52 | 0.050  | 1.20               | 0.93;1.56 | 0.155  |
| HSCT <sup>f</sup>                           | 1.09                  | 0.50;2.75  | 0.842  | 1.59                      | 0.67;4.11 | 0.314  | 1.01               | 0.60;1.77 | 0.962  |
| Birth year                                  | 0.94                  | 0.89;0.99  | 0.027  | 0.95                      | 0.91;1.00 | 0.047  | 0.97               | 0.94;0.99 | 0.004  |
| <b>Sun burn</b>                             |                       |            |        |                           |           |        |                    |           |        |
|                                             | N = 1,013             |            |        | N = 542                   |           |        | N = 1,837          |           |        |
| Age at study                                | 1.28                  | 1.18;1.38  | <0.001 | 1.03                      | 0.89;1.18 | 0.719  | 1.01               | 0.99;1.03 | 0.411  |
| Male <sup>a</sup>                           | 0.98                  | 0.73;1.33  | 0.916  | 0.73                      | 0.52;1.03 | 0.076  | 1.05               | 0.86;1.27 | 0.632  |
| Migration background <sup>b</sup>           | 0.53                  | 0.34;0.81  | 0.004  | 0.72                      | 0.44;1.17 | 0.187  | 0.48               | 0.36;0.63 | <0.001 |
| French/Italian language region <sup>c</sup> | 0.95                  | 0.68;1.31  | 0.740  | 1.11                      | 0.75;1.63 | 0.605  | 0.85               | 0.68;1.05 | 0.137  |
| Parental education <sup>d</sup>             |                       |            |        |                           |           |        |                    |           |        |
| Secondary                                   | 1.09                  | 0.58;2.13  | 0.801  | 1.08                      | 0.48;2.46 | 0.853  | 1.18               | 0.82;1.70 | 0.379  |
| Tertiary                                    | 0.90                  | 0.49;1.76  | 0.759  | 1.33                      | 0.58;3.12 | 0.501  | 1.47               | 1.01;2.14 | 0.044  |
| Radiotherapy <sup>e</sup>                   | 0.67                  | 0.43;1.01  | 0.065  | 0.63                      | 0.43;0.93 | 0.022  | 0.77               | 0.63;0.94 | 0.012  |
| HSCT <sup>f</sup>                           | 0.61                  | 0.30;1.14  | 0.143  | 1.45                      | 0.72;2.95 | 0.303  | 0.62               | 0.39;0.95 | 0.031  |
| Birth year                                  | 1.14                  | 1.10;1.19  | <0.001 | 1.04                      | 0.99;1.08 | 0.101  | 1.07               | 1.05;1.09 | <0.001 |
| <b>Physician skin examination</b>           |                       |            |        |                           |           |        |                    |           |        |
|                                             | N = 275               |            |        | N = 538                   |           |        | N = 1,807          |           |        |
| Age at study                                | 0.27                  | 0.07;0.94  | 0.044  | 1.02                      | 0.83;1.24 | 0.874  | 1.04               | 1.01;1.07 | 0.019  |
| Male <sup>a</sup>                           | 0.97                  | 0.45;2.10  | 0.942  | 1.38                      | 0.85;2.27 | 0.194  | 0.65               | 0.50;0.83 | 0.001  |
| Migration background <sup>b</sup>           | 0.87                  | 0.33;2.08  | 0.757  | 1.28                      | 0.67;2.36 | 0.435  | 1.35               | 0.95;1.89 | 0.086  |
| French/Italian language region <sup>c</sup> | 2.21                  | 0.99;4.93  | 0.051  | 1.08                      | 0.63;1.81 | 0.773  | 1.39               | 1.06;1.82 | 0.016  |
| Parental education <sup>g</sup>             |                       |            |        |                           |           |        |                    |           |        |
| Secondary                                   |                       |            |        | 1.55                      | 0.51;5.80 | 0.471  | 0.96               | 0.62;1.50 | 0.844  |
| Tertiary                                    | 3.27                  | 1.20;10.79 | 0.032  | 1.58                      | 0.51;6.09 | 0.460  | 1.28               | 0.82;2.02 | 0.289  |
| Radiotherapy <sup>e</sup>                   | 2.62                  | 0.94;6.86  | 0.054  | 1.15                      | 0.67;1.93 | 0.596  | 1.01               | 0.77;1.32 | 0.935  |
| HSCT <sup>f</sup>                           | 3.75                  | 1.39;9.83  | 0.008  | 2.06                      | 0.87;4.55 | 0.083  | 2.07               | 1.29;3.27 | 0.002  |
| Birth year                                  | 0.31                  | 0.08;1.09  | 0.072  | 1.00                      | 0.94;1.06 | 0.927  | 1.01               | 0.99;1.04 | 0.339  |

<sup>a</sup> reference: female, <sup>b</sup> reference: no migration background, <sup>c</sup> reference: German language region, <sup>d</sup> reference: primary education, <sup>e</sup> reference: no radiotherapy; <sup>f</sup> reference: no HSCT, <sup>g</sup> due to the lower n in this analysis, we combined primary and secondary education into in category for children; for adolescents and adults, we kept it separate; HSCT = hematopoietic stem cell transplantation

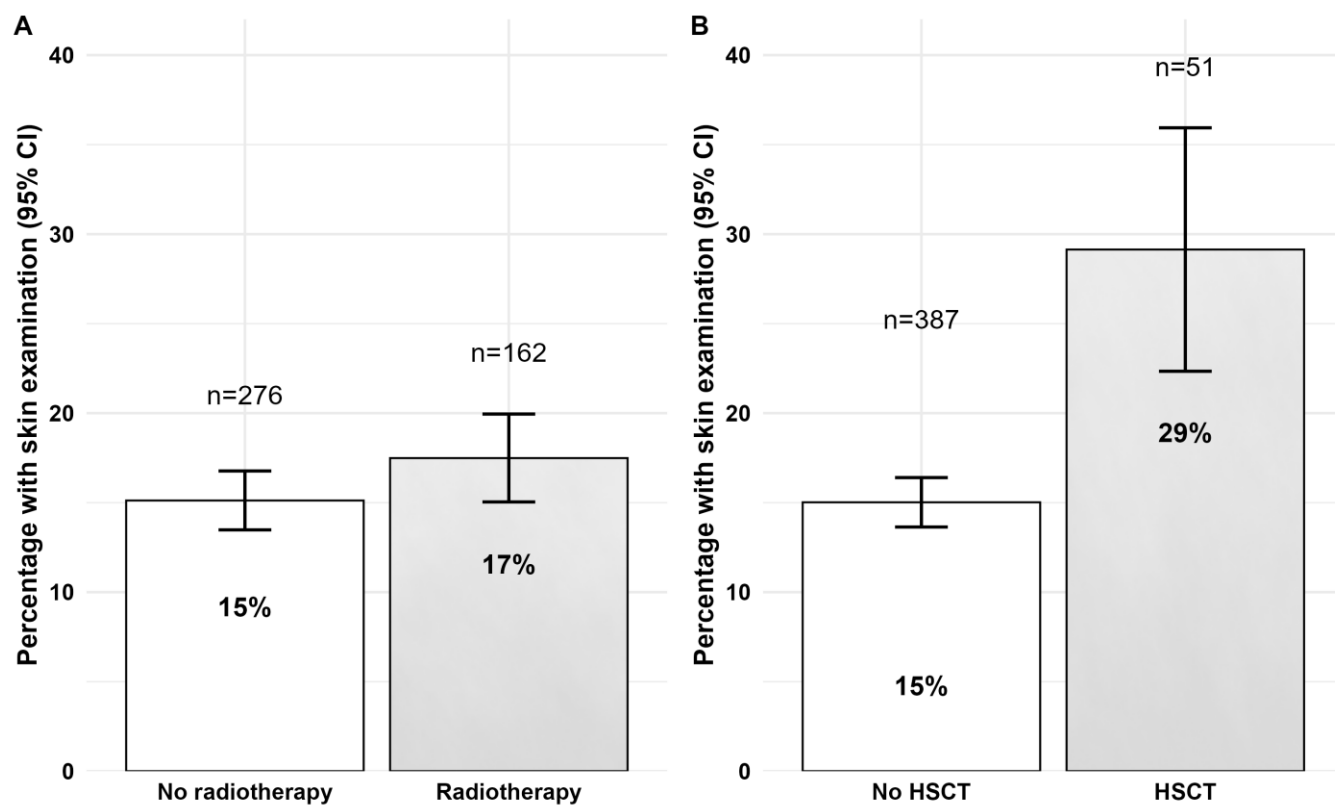
# SCCSS Sun protection

**Figure 1.** Prevalence of sun protection, sunburn, and physician skin examinations among childhood cancer survivors stratified by age group



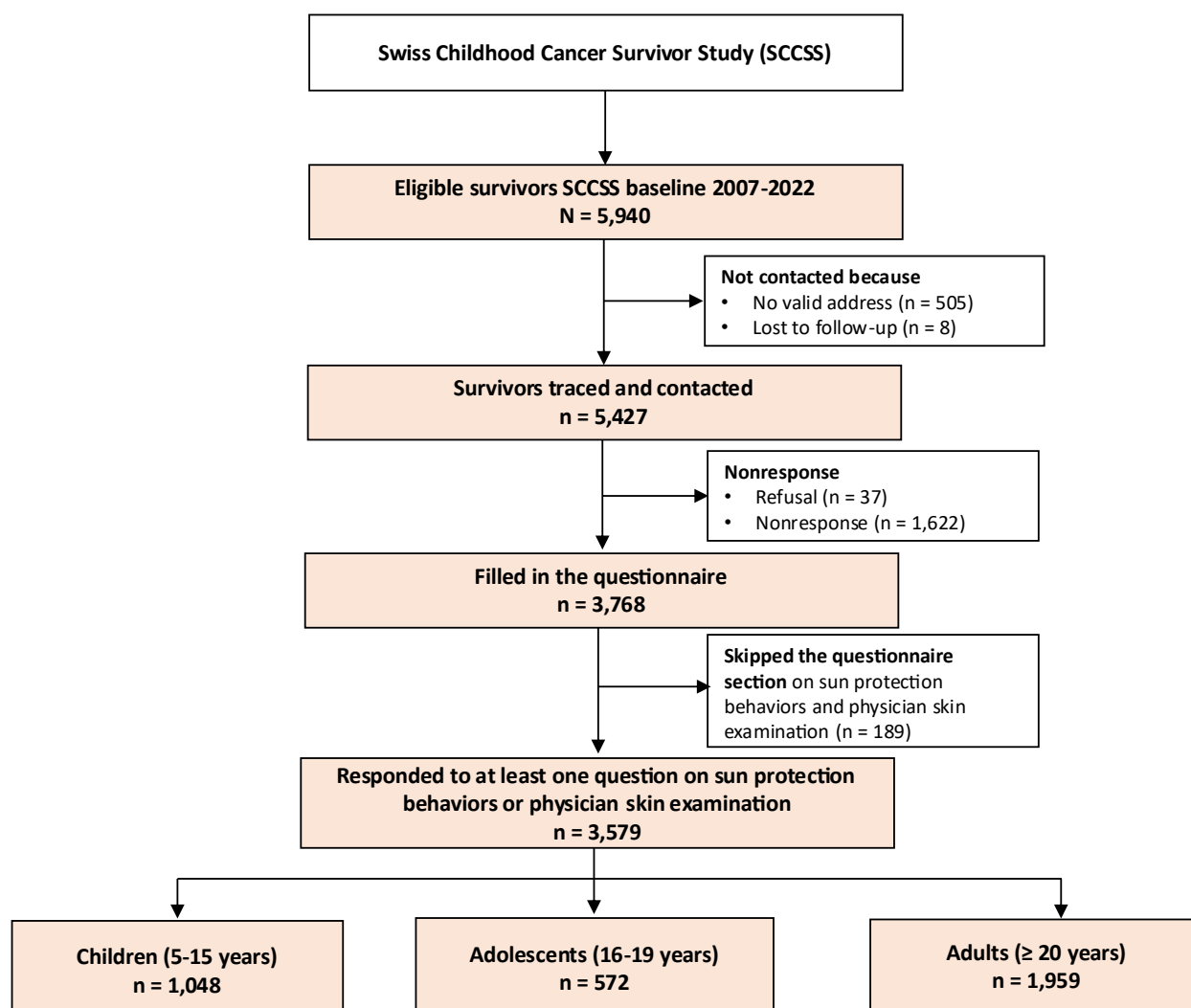
SCCSS Sun protection

**Figure 2.** Compliance with physician skin examination attendance within the last 12 months as recommended by the Children's Oncology Group for childhood cancer survivors treated with radiotherapy (Panel A) and HSCT (Panel B)



## Supplementary information

### Supplementary Figure 1. Study population tree of the SCCSS study on sun protection behaviors and physician skin examination



SCCSS Sun protection

**Supplementary Table 1.** Overview sun protection behaviors and physician skin examination questions, response options, and categorization

| Outcome variables            | Question                                                                                                                                                                                                          | Response option                                                                    | Coding for regression analysis |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------|
| Sun protection               | How consequentially to you protect yourself (for parent questionnaire: your child) from sun? For example, applying sunscreen, wearing clothing and/or a hat, shading, considering day time for one's sun exposure | 1: Always<br>2: Most of the time<br>3: Every now and then<br>4: Never              | 1 and 2: Yes<br>3 and 4: No    |
| Sunburn                      | Have you (for parent questionnaire: your child) had one or more sunburns the previous summer?                                                                                                                     | 1: No<br>2: Yes                                                                    | 1: No<br>2: Yes                |
| Preventive skin examinations | Have you (your child) ever had your skin or moles medically examined?                                                                                                                                             | 1: Yes, less than 12 months ago<br>2: Yes, more than 12 months ago<br>3: No, never | 1 and 2: Yes<br>3: No          |

*Please note: Not all questions were included in all surveys or in all age groups. <sup>a</sup> In earlier surveys, response options were only "yes" and "no"*

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**Supplementary Table 2.** Model fit indices of multivariable logistic regression models including birth year compared to multivariable logistic regression models including year of study

| Model                             | AIC   | BIC   |
|-----------------------------------|-------|-------|
| <b>Children (5-15 years)</b>      |       |       |
| Sun protection with birth year    | 658   | 708   |
| Sun protection with year of study | 659   | 713   |
| Sunburn with birth year           | 1,055 | 1,104 |
| Sunburn with year of study        | 1,057 | 1,111 |
| Skin exam with birth year         | 200   | 232   |
| Skin exam with study year         | 201   | 230   |
| <b>Adolescents (16-19 years)</b>  |       |       |
| Sun protection with birth year    | 593   | 635   |
| Sun protection with year of study | 584   | 630   |
| Sunburn with birth year           | 753   | 796   |
| Sunburn with year of study        | 756   | 808   |
| Skin exam with birth year         | 466   | 509   |
| Skin exam with year of study      | 470   | 521   |
| <b>Adults (≥ 20 years)</b>        |       |       |
| Sun protection with birth year    | 1,675 | 1,729 |
| Sun protection with year of study | 1,676 | 1,736 |
| Sunburn with birth year           | 2,371 | 2,426 |
| Sunburn with year of study        | 2,375 | 2,441 |
| Skin exam with birth year         | 1,577 | 1,632 |
| Skin exam with year of study      | 1,579 | 1,645 |

SCCSS Sun protection

578 **Supplementary Table 3.** Prevalence of sun protection behaviors and physician skin  
579 examinations among childhood cancer survivors

|                                                             | Children (5-15 years) |       | Adolescents (16-19 years) |       | Adults (≥ 20 years) |       | Overall          |       |
|-------------------------------------------------------------|-----------------------|-------|---------------------------|-------|---------------------|-------|------------------|-------|
|                                                             | N                     | 95%CI | N                         | 95%CI | N                   | 95%CI | N                | 95%CI |
| <i>Sun protection</i>                                       | <b>n = 1,048</b>      |       | <b>n = 499</b>            |       | <b>n = 1,727</b>    |       | <b>n = 3,274</b> |       |
| Always                                                      | 390 (37%)             | 34-40 | 78 (16%)                  | 13-19 | 464 (27%)           | 25-29 | 932 (28%)        | 27-30 |
| Mostly                                                      | 535 (51%)             | 48-54 | 245 (49%)                 | 45-53 | 862 (50%)           | 48-52 | 1642 (50%)       | 48-52 |
| Sometimes                                                   | 91 (9%)               | 7-11  | 111 (22%)                 | 19-26 | 285 (17%)           | 15-18 | 487 (15%)        | 14-16 |
| (Almost) never                                              | 26 (3%)               | 2-4   | 63 (13%)                  | 10-16 | 105 (6%)            | 5-7   | 194 (6%)         | 5-7   |
| Missing                                                     | 6 (1%)                |       | 2 (<1%)                   |       | 11 (1%)             |       | 19 (<1%)         |       |
| <i>Sun protection (dichotomized)</i>                        | <b>n = 1,048</b>      |       | <b>n = 499</b>            |       | <b>n = 1,727</b>    |       | <b>n = 3,274</b> |       |
| No                                                          | 117 (11%)             | 9-13  | 174 (35%)                 | 31-39 | 390 (23%)           | 21-25 | 681 (21%)        | 19-22 |
| Yes                                                         | 925 (89%)             | 86-90 | 323 (65%)                 | 60-69 | 1326 (77%)          | 75-79 | 2574 (79%)       | 77-80 |
| Missing                                                     | 6 (1%)                |       | 2 (0.4%)                  |       | 11 (1%)             |       | 19 (<1%)         |       |
| <i>Sunburn(s) last summer</i>                               | <b>n = 1,048</b>      |       | <b>n = 572</b>            |       | <b>n = 1,959</b>    |       | <b>n = 3,579</b> |       |
| No                                                          | 800 (77%)             | 74-79 | 291 (51%)                 | 47-55 | 1109 (57%)          | 54-59 | 2200 (62%)       | 60-63 |
| Yes                                                         | 241 (23%)             | 21-26 | 275 (49%)                 | 44-52 | 829 (43%)           | 40-45 | 1345 (38%)       | 36-39 |
| Missing                                                     | 7 (1%)                |       | 6 (1%)                    |       | 21 (1%)             |       | 34 (1%)          |       |
| <i>Physician skin examination</i>                           | <b>n = 284</b>        |       | <b>n = 572</b>            |       | <b>n = 1,959</b>    |       | <b>n = 2,815</b> |       |
| Yes, < 12 months ago                                        | 36 (13%)              | 9-17  | 87 (16%)                  | 12-18 | 315 (16%)           | 15-18 | 438 (16%)        | 14-17 |
| Yes, ≥ 12 months ago                                        | 44 (16%)              | 12-20 | 142 (25%)                 | 21-29 | 642 (33%)           | 31-25 | 828 (30%)        | 28-31 |
| No, never                                                   | 202 (72%)             | 66-76 | 331 (59%)                 | 54-62 | 952 (50%)           | 46-51 | 1485 (54%)       | 51-55 |
| Missing                                                     | 2 (1%)                |       | 12 (2%)                   |       | 50 (3%)             |       | 64 (2%)          |       |
| <i>Physician skin examination within the last 12 months</i> | <b>n = 284</b>        |       | <b>n = 572</b>            |       | <b>n = 1,959</b>    |       | <b>n = 2,815</b> |       |
| No                                                          | 246 (87%)             | 82-90 | 473 (84%)                 | 79-86 | 1594 (84%)          | 80-83 | 2313 (82%)       | 81-84 |
| Yes                                                         | 36 (13%)              | 9-17  | 87 (16%)                  | 12-18 | 315 (16%)           | 15-18 | 438 (16%)        | 14-17 |
| Missing                                                     | 2 (1%)                |       | 12 (2%)                   |       | 50 (3%)             |       | 64 (2%)          |       |

580 Please note: Not all questions were asked in all surveys or in all age categories so that we report the available *n* for each variable.

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**Supplementary Table 4.** Proportion of childhood cancer survivors who attended a physician skin examination within the last 12 months as recommended by the Children's Oncology Group 2023 Follow-Up Care Guidelines stratified by radiotherapy and HSCT exposure

|                    | Total N <sup>a</sup> | N <sup>b</sup> | % <sup>c</sup> | 95% CI | p <sup>d</sup> |     |
|--------------------|----------------------|----------------|----------------|--------|----------------|-----|
| <b>Children</b>    |                      |                |                |        |                | 591 |
| Radiotherapy       | 43                   | 9              | 21             | 8-34   | 0.08           | 592 |
| No radiotherapy    | 239                  | 27             | 11             | 7-15   |                | 593 |
| HSCT               | 28                   | 10             | 36             | 17-55  | <0.001         | 594 |
| No HSCT            | 254                  | 26             | 10             | 6-14   |                | 595 |
| <b>Adolescents</b> |                      |                |                |        |                | 596 |
| Radiotherapy       | 160                  | 28             | 18             | 12-23  | 0.42           | 597 |
| No radiotherapy    | 400                  | 59             | 15             | 11-18  |                | 598 |
| HSCT               | 36                   | 10             | 28             | 12-43  | 0.04           | 599 |
| No HSCT            | 524                  | 77             | 15             | 12-18  |                | 600 |
| <b>Adults</b>      |                      |                |                |        |                | 601 |
| Radiotherapy       | 723                  | 125            | 17             | 15-20  | 0.47           | 602 |
| No radiotherapy    | 1186                 | 190            | 16             | 14-18  |                | 603 |
| HSCT               | 111                  | 31             | 28             | 20-36  | <0.001         | 604 |
| No HSCT            | 1798                 | 284            | 16             | 14-17  |                | 605 |
| <b>Overall</b>     |                      |                |                |        |                | 606 |
| Radiotherapy       | 926                  | 162            | 17             | 15-20  | 0.11           | 607 |
| No radiotherapy    | 1825                 | 276            | 15             | 13-17  |                | 608 |
| HSCT               | 175                  | 51             | 29             | 22-36  | <0.001         | 609 |
| No HSCT            | 2576                 | 387            | 15             | 14-16  |                | 610 |

<sup>a</sup> Total N corresponding to the number of CCS responding to the question on skin examinations with(out) this treatment

<sup>b</sup> Number of CCS reporting to have attended a preventive skin examination within the last 12 months

<sup>c</sup> % of CCS who attended a preventive skin exam within the last 12 months

<sup>d</sup> p-level of chi-square test comparing those received treatment and those who did not receive treatment

HSCT = hematopoietic stem cell transplantation

# SCCSS Sun protection

## Supplementary Table 5. Factors associated with sun protection, sunburn, and physician skin examination in modified Poisson regression in child, adolescents, and adults childhood cancer survivors

|                                             | Children (5-15 years) |           |        | Adolescents (16-19 years) |           |        | Adults (≥20 years) |           |        |
|---------------------------------------------|-----------------------|-----------|--------|---------------------------|-----------|--------|--------------------|-----------|--------|
|                                             | RR                    | 95%CI     | p      | RR                        | 95%CI     | p      | RR                 | 95%CI     | p      |
| <b>Sun protection</b>                       |                       |           |        |                           |           |        |                    |           |        |
|                                             | <b>N = 1,013</b>      |           |        | <b>N = 476</b>            |           |        | <b>N = 1,626</b>   |           |        |
| Age at study                                | 0.97                  | 0.96;0.98 | <0.001 | 0.97                      | 0.92;1.03 | 0.301  | 1.00               | 0.99;1.01 | 0.967  |
| Male <sup>a</sup>                           | 0.97                  | 0.93;1.01 | 0.143  | 0.73                      | 0.64;0.84 | <0.001 | 0.87               | 0.82;0.91 | <0.001 |
| Migration background <sup>b</sup>           | 0.95                  | 0.89;1.01 | 0.080  | 0.83                      | 0.66;1.03 | 0.093  | 0.87               | 0.79;0.95 | 0.001  |
| French/Italian language region <sup>c</sup> | 1.02                  | 0.98;1.07 | 0.350  | 1.02                      | 0.88;1.18 | 0.783  | 1.00               | 0.94;1.06 | 0.967  |
| Parental education <sup>d</sup>             |                       |           |        |                           |           |        |                    |           |        |
| Secondary                                   | 1.12                  | 1.00;1.26 | 0.059  | 1.13                      | 0.78;1.64 | 0.522  | 1.06               | 0.96;1.18 | 0.223  |
| Tertiary                                    | 1.12                  | 1.00;1.26 | 0.058  | 1.27                      | 0.86;1.85 | 0.226  | 1.10               | 0.99;1.22 | 0.065  |
| Radiotherapy <sup>e</sup>                   | 1.03                  | 0.98;1.09 | 0.287  | 1.15                      | 1.01;1.31 | 0.037  | 1.04               | 0.99;1.10 | 0.146  |
| HSCT <sup>f</sup>                           | 1.01                  | 0.93;1.08 | 0.874  | 1.14                      | 0.92;1.42 | 0.226  | 1.00               | 0.90;1.12 | 0.961  |
| Birth year                                  | 0.99                  | 0.99;1.00 | 0.048  | 0.98                      | 0.96;1.00 | 0.068  | 0.99               | 0.98;1.00 | 0.007  |
| <b>Sunburn</b>                              |                       |           |        |                           |           |        |                    |           |        |
|                                             | <b>N = 1,013</b>      |           |        | <b>N = 542</b>            |           |        | <b>N = 1,837</b>   |           |        |
| Age at study                                | 1.20                  | 1.13;1.26 | <0.001 | 1.01                      | 0.94;1.09 | 0.730  | 1.00               | 0.99;1.01 | 0.971  |
| Male <sup>a</sup>                           | 0.99                  | 0.80;1.22 | 0.914  | 0.85                      | 0.72;1.02 | 0.075  | 1.02               | 0.93;1.13 | 0.636  |
| Migration background <sup>b</sup>           | 0.63                  | 0.46;0.87 | 0.005  | 0.84                      | 0.65;1.10 | 0.212  | 0.65               | 0.54;0.78 | <0.001 |
| French/Italian language region <sup>c</sup> | 0.96                  | 0.76;1.22 | 0.754  | 1.05                      | 0.87;1.27 | 0.603  | 0.92               | 0.82;1.03 | 0.164  |
| Parental education <sup>d</sup>             |                       |           |        |                           |           |        |                    |           |        |
| Secondary                                   | 1.06                  | 0.66;1.71 | 0.802  | 1.05                      | 0.66;1.68 | 0.837  | 1.12               | 0.89;1.41 | 0.343  |
| Tertiary                                    | 0.93                  | 0.58;1.49 | 0.766  | 1.16                      | 0.72;1.88 | 0.532  | 1.25               | 0.99;1.59 | 0.058  |
| Radiotherapy <sup>e</sup>                   | 0.74                  | 0.54;1.02 | 0.068  | 0.79                      | 0.63;0.98 | 0.029  | 0.86               | 0.77;0.96 | 0.010  |
| HSCT <sup>f</sup>                           | 0.69                  | 0.41;1.17 | 0.165  | 1.19                      | 0.88;1.60 | 0.259  | 0.76               | 0.58;1.00 | 0.047  |
| Birth year                                  | 1.10                  | 1.07;1.14 | <0.001 | 1.02                      | 1.00;1.04 | 0.088  | 1.03               | 1.02;1.04 | <0.001 |
| <b>Physician skin examination</b>           |                       |           |        |                           |           |        |                    |           |        |
|                                             | <b>N = 275</b>        |           |        | <b>N = 538</b>            |           |        | <b>N = 1,807</b>   |           |        |
| Age at study                                | 0.34                  | 0.11;1.06 | 0.063  | 1.01                      | 0.87;1.19 | 0.861  | 1.03               | 1.01;1.06 | 0.018  |
| Male <sup>a</sup>                           | 0.96                  | 0.54;1.73 | 0.899  | 1.32                      | 0.87;1.99 | 0.190  | 0.70               | 0.57;0.86 | 0.001  |
| Migration background <sup>b</sup>           | 0.92                  | 0.41;2.06 | 0.835  | 1.23                      | 0.74;2.04 | 0.421  | 1.27               | 0.97;1.67 | 0.081  |
| French/Italian language region <sup>c</sup> | 1.85                  | 1.01;3.42 | 0.048  | 1.07                      | 0.69;1.64 | 0.762  | 1.31               | 1.05;1.63 | 0.017  |
| Parental education <sup>g</sup>             |                       |           |        |                           |           |        |                    |           |        |
| Secondary                                   |                       |           |        | 1.45                      | 0.54;3.85 | 0.461  | 0.96               | 0.68;1.37 | 0.839  |
| Tertiary                                    | 2.70                  | 1.03;7.11 | 0.044  | 1.47                      | 0.54;4.04 | 0.451  | 1.22               | 0.85;1.74 | 0.281  |
| Radiotherapy <sup>e</sup>                   | 2.16                  | 1.10;4.26 | 0.026  | 1.13                      | 0.72;1.76 | 0.601  | 1.01               | 0.81;1.25 | 0.935  |
| HSCT <sup>f</sup>                           | 2.61                  | 1.39;4.89 | 0.003  | 1.79                      | 0.95;3.34 | 0.070  | 1.75               | 1.24;2.46 | 0.002  |
| Birth year                                  | 0.39                  | 0.12;1.21 | 0.103  | 1.00                      | 0.95;1.06 | 0.923  | 1.01               | 0.99;1.03 | 0.331  |

<sup>a</sup> reference: female, <sup>b</sup> reference: no migration background, <sup>c</sup> reference: German language region, <sup>d</sup> reference: primary education, <sup>e</sup> reference: no radiotherapy; <sup>f</sup> reference: no HSCT, <sup>g</sup> due to the lower n in this analysis, we combined primary and secondary education into in category for children; for adolescents and adults, we kept it separate, HSCT = hematopoietic stem cell transplantation

SCCSS Sun protection

**Supplementary Table 6.** Skin type descriptives of pediatric, adolescent, and adult childhood cancer survivors

|                                          | Children (5-15 years)<br>n = 598 | Adolescents (16-19 years)<br>n = 572 | Adults (≥ 20 years)<br>n = 470 | Overall<br>N = 1,640 |
|------------------------------------------|----------------------------------|--------------------------------------|--------------------------------|----------------------|
| <i>Skin type 5 levels</i>                |                                  |                                      |                                |                      |
| Skin type 1                              | 25 (4%)                          | 18 (3%)                              | 20 (4%)                        | 63 (4%)              |
| Skin type 2                              | 159 (27%)                        | 142 (25%)                            | 125 (27%)                      | 426 (26%)            |
| Skin type 3                              | 282 (48%)                        | 285 (51%)                            | 237 (51%)                      | 804 (49%)            |
| Skin type 4                              | 112 (19%)                        | 107 (19%)                            | 80 (17%)                       | 299 (18%)            |
| Skin type 5                              | 14 (2%)                          | 12 (2%)                              | 5 (1%)                         | 31 (2%)              |
| Missing                                  | 6 (1%)                           | 8 (1%)                               | 3 (1%)                         | 17 (1%)              |
| <i>Skin type 3 levels (for analysis)</i> |                                  |                                      |                                |                      |
| Skin type 1-2                            | 184 (31%)                        | 160 (28%)                            | 145 (31%)                      | 489 (30%)            |
| Skin type 3                              | 282 (48%)                        | 285 (51%)                            | 237 (51%)                      | 804 (50%)            |
| Skin type 4-5                            | 126 (21%)                        | 119 (21%)                            | 85 (18%)                       | 330 (20%)            |
| Missing                                  | 6 (1%)                           | 8 (1%)                               | 3 (1%)                         | 17 (1%)              |

# SCCSS Sun protection

**Supplementary Table 7.** Sensitivity analysis: Factors associated with sun protection, sunburn, and physician skin examinations in multivariable logistic regression in child, adolescents, and adults childhood cancer survivors, including skin type

|                                             | Children (5-15 years) |            |        | Adolescents (16-19 years) |           |        | Adults (≥20 years) |           |        |
|---------------------------------------------|-----------------------|------------|--------|---------------------------|-----------|--------|--------------------|-----------|--------|
|                                             | OR                    | 95%CI      | p      | OR                        | 95%CI     | p      | OR                 | 95%CI     | p      |
| <b>Sun protection</b>                       |                       |            |        |                           |           |        |                    |           |        |
|                                             | <b>N = 576</b>        |            |        | <b>N = 470</b>            |           |        | <b>N = 224</b>     |           |        |
| Age at study                                | 0.80                  | 0.71;0.89  | <0.001 | 0.95                      | 0.80;1.13 | 0.538  | 1.03               | 0.98;1.09 | 0.224  |
| Male <sup>a</sup>                           | 0.97                  | 0.56;1.67  | 0.908  | 0.42                      | 0.27;0.64 | <0.001 | 0.66               | 0.34;1.25 | 0.203  |
| Migration background <sup>b</sup>           | 0.80                  | 0.42;1.55  | 0.492  | 0.66                      | 0.38;1.15 | 0.142  | 0.37               | 0.15;0.93 | 0.035  |
| French/Italian language region <sup>c</sup> | 0.84                  | 0.46;1.58  | 0.573  | 0.87                      | 0.55;1.40 | 0.572  | 1.56               | 0.80;3.16 | 0.202  |
| Parental education <sup>d</sup>             |                       |            |        |                           |           |        |                    |           |        |
| Secondary                                   | 2.71                  | 0.98;7.30  | 0.050  | 1.01                      | 0.43;2.39 | 0.973  | 0.93               | 0.26;3.13 | 0.912  |
| Tertiary                                    | 1.89                  | 0.73;4.65  | 0.176  | 1.31                      | 0.53;3.21 | 0.559  | 1.29               | 0.37;4.24 | 0.682  |
| Radiotherapy <sup>e</sup>                   | 2.14                  | 0.96;5.47  | 0.083  | 1.71                      | 1.08;2.74 | 0.025  | 1.55               | 0.78;3.18 | 0.215  |
| HSCT <sup>f</sup>                           | 0.84                  | 0.32;2.64  | 0.746  | 1.53                      | 0.64;4.03 | 0.361  | 0.71               | 0.21;2.50 | 0.578  |
| Skin type (ref. 1-2)                        |                       |            |        |                           |           |        |                    |           |        |
| Skin type 3                                 | 0.25                  | 0.10;0.57  | 0.002  | 0.48                      | 0.28;0.81 | 0.008  | 0.59               | 0.28;1.23 | 0.166  |
| Skin type 4-6                               | 0.12                  | 0.04;0.28  | <0.001 | 0.24                      | 0.12;0.44 | <0.001 | 0.21               | 0.09;0.51 | 0.001  |
| <b>Sunburn</b>                              |                       |            |        |                           |           |        |                    |           |        |
|                                             | <b>N = 576</b>        |            |        | <b>N = 537</b>            |           |        | <b>N = 445</b>     |           |        |
| Age at study                                | 1.14                  | 1.06;1.23  | 0.001  | 1.02                      | 0.88;1.18 | 0.806  | 0.93               | 0.91;0.96 | <0.001 |
| Male <sup>a</sup>                           | 1.03                  | 0.70;1.52  | 0.866  | 0.82                      | 0.57;1.18 | 0.286  | 1.05               | 0.70;1.57 | 0.819  |
| Migration background <sup>b</sup>           | 0.60                  | 0.36;0.99  | 0.050  | 0.93                      | 0.56;1.55 | 0.783  | 0.40               | 0.22;0.72 | 0.002  |
| French/Italian language region <sup>c</sup> | 0.71                  | 0.46;1.09  | 0.118  | 0.87                      | 0.58;1.30 | 0.503  | 1.19               | 0.77;1.86 | 0.433  |
| Parental education <sup>d</sup>             |                       |            |        |                           |           |        |                    |           |        |
| Secondary                                   | 1.00                  | 0.45;2.35  | 0.992  | 0.81                      | 0.34;1.93 | 0.628  | 0.82               | 0.37;1.82 | 0.622  |
| Tertiary                                    | 0.67                  | 0.30;1.53  | 0.330  | 1.02                      | 0.42;2.47 | 0.973  | 1.18               | 0.53;2.62 | 0.685  |
| Radiotherapy <sup>e</sup>                   | 0.50                  | 0.28;0.88  | 0.019  | 0.57                      | 0.38;0.85 | 0.006  | 1.03               | 0.67;1.59 | 0.879  |
| HSCT <sup>f</sup>                           | 0.46                  | 0.18;1.02  | 0.073  | 1.61                      | 0.78;3.42 | 0.203  | 0.77               | 0.35;1.67 | 0.503  |
| Skin type (ref. 1-2)                        |                       |            |        |                           |           |        |                    |           |        |
| Skin type 3                                 | 0.57                  | 0.37;0.87  | 0.009  | 0.60                      | 0.39;0.91 | 0.017  | 0.99               | 0.62;1.57 | 0.959  |
| Skin type 4-6                               | 0.19                  | 0.10;0.36  | <0.001 | 0.16                      | 0.09;0.28 | <0.001 | 0.47               | 0.26;0.84 | 0.012  |
| <b>Physician skin examination</b>           |                       |            |        |                           |           |        |                    |           |        |
|                                             | <b>N = 270</b>        |            |        | <b>N = 531</b>            |           |        | <b>N = 442</b>     |           |        |
| Age at study                                | 0.85                  | 0.72;0.99  | 0.044  | 1.01                      | 0.83;1.23 | 0.935  | 1.02               | 0.98;1.05 | 0.307  |
| Male <sup>a</sup>                           | 1.00                  | 0.46;2.18  | 0.995  | 1.39                      | 0.85;2.30 | 0.190  | 0.49               | 0.29;0.83 | 0.009  |
| Migration background <sup>b</sup>           | 0.94                  | 0.36;2.26  | 0.890  | 1.44                      | 0.74;2.68 | 0.270  | 1.07               | 0.49;2.22 | 0.859  |
| French/Italian language region <sup>c</sup> | 2.43                  | 1.06;5.61  | 0.036  | 0.99                      | 0.57;1.69 | 0.983  | 1.18               | 0.67;2.05 | 0.557  |
| Parental education <sup>g</sup>             |                       |            |        |                           |           |        |                    |           |        |
| Secondary                                   |                       |            |        | 1.49                      | 0.49;5.64 | 0.510  | 0.74               | 0.29;2.06 | 0.545  |
| Tertiary                                    | 4.10                  | 1.47;13.92 | 0.012  | 1.47                      | 0.47;5.67 | 0.536  | 0.89               | 0.35;2.48 | 0.821  |
| Radiotherapy <sup>e</sup>                   | 2.55                  | 0.91;6.78  | 0.064  | 1.12                      | 0.66;1.88 | 0.663  | 1.00               | 0.57;1.74 | 0.993  |
| HSCT <sup>f</sup>                           | 3.63                  | 1.33;9.56  | 0.010  | 2.02                      | 0.85;4.44 | 0.091  | 1.88               | 0.72;4.50 | 0.170  |
| Skin type (ref. 1-2)                        |                       |            |        |                           |           |        |                    |           |        |
| Skin type 3                                 | 0.57                  | 0.23;1.41  | 0.219  | 0.59                      | 0.34;1.04 | 0.066  | 0.95               | 0.54;1.70 | 0.866  |
| Skin type 4-6                               | 1.40                  | 0.49;3.98  | 0.526  | 0.67                      | 0.33;1.33 | 0.260  | 0.49               | 0.19;1.11 | 0.101  |

<sup>a</sup> reference: female, <sup>b</sup> reference: no migration background, <sup>c</sup> reference: German language region, <sup>d</sup> reference: primary education, <sup>e</sup> reference: no radiotherapy; <sup>f</sup> reference: no HSCT, <sup>g</sup> due to the lower n in this analysis, we combined primary and secondary education into in category for children; for adolescents and adults, we kept it separate, HSCT = hematopoietic stem cell transplantation

# SCCSS Sun protection

**Supplementary Table 8.** Sensitivity analysis: Factors associated with sun protection, sunburn, and physician skin examinations in multivariable logistic regression in child, adolescents, and adults CCS, including year of study instead of birth year as exposure

|                                             | Children (5-15 years)      |            |        | Adolescents (16-19 years) |           |        | Adults (≥20 years) |           |        |
|---------------------------------------------|----------------------------|------------|--------|---------------------------|-----------|--------|--------------------|-----------|--------|
|                                             | OR                         | 95%CI      | p      | OR                        | 95%CI     | p      | OR                 | 95%CI     | p      |
| <b>Sun protection</b>                       |                            |            |        |                           |           |        |                    |           |        |
|                                             | <b>N = 1,013</b>           |            |        | <b>N = 476</b>            |           |        | <b>N = 1,626</b>   |           |        |
| Age at study                                | 0.78                       | 0.71;0.85  | <0.001 | 0.95                      | 0.80;1.13 | 0.558  | 1.04               | 1.02;1.07 | <0.001 |
| Male <sup>a</sup>                           | 0.72                       | 0.47;1.09  | 0.125  | 0.37                      | 0.24;0.56 | <0.001 | 0.51               | 0.40;0.65 | <0.001 |
| Migration background <sup>b</sup>           | 0.63                       | 0.38;1.05  | 0.069  | 0.58                      | 0.34;0.98 | 0.043  | 0.58               | 0.43;0.80 | 0.001  |
| French/Italian language region <sup>c</sup> | 1.28                       | 0.82;2.04  | 0.293  | 1.19                      | 0.75;1.90 | 0.461  | 1.01               | 0.77;1.33 | 0.947  |
| Parental education <sup>d</sup>             |                            |            |        |                           |           |        |                    |           |        |
| Secondary                                   | 1.96                       | 0.97;3.89  | 0.057  | 1.25                      | 0.53;2.95 | 0.602  | 1.30               | 0.87;1.93 | 0.197  |
| Tertiary                                    | 1.95                       | 0.97;3.79  | 0.054  | 1.71                      | 0.69;4.22 | 0.243  | 1.55               | 1.01;2.36 | 0.042  |
| Radiotherapy <sup>e</sup>                   | 1.33                       | 0.77;2.43  | 0.326  | 1.53                      | 0.97;2.45 | 0.073  | 1.21               | 0.94;1.56 | 0.149  |
| HSCT <sup>f</sup>                           | 1.10                       | 0.50;2.78  | 0.827  | 1.56                      | 0.65;4.08 | 0.333  | 1.02               | 0.61;1.79 | 0.931  |
| Year of study <sup>g</sup>                  |                            |            |        |                           |           |        |                    |           |        |
| 2010-2013                                   |                            |            |        | 0.44                      | 0.28;0.68 | <0.001 | 0.84               | 0.61;1.16 | 0.288  |
| 2015-2017                                   | 0.96                       | 0.58;1.63  | 0.892  |                           |           |        |                    |           |        |
| 2021-2022                                   | 0.55                       | 0.33;0.92  | 0.021  | 0.49                      | 0.26;0.91 | 0.023  | 0.60               | 0.43;0.84 | 0.003  |
| <b>Sunburn</b>                              |                            |            |        |                           |           |        |                    |           |        |
|                                             | <b>N = 1,013</b>           |            |        | <b>N = 542</b>            |           |        | <b>N = 1,837</b>   |           |        |
| Age at study                                | 1.12                       | 1.05;1.19  | <0.001 | 1.01                      | 0.87;1.17 | 0.883  | 0.95               | 0.94;0.96 | <0.001 |
| Male <sup>a</sup>                           | 0.98                       | 0.73;1.34  | 0.920  | 0.72                      | 0.51;1.02 | 0.067  | 1.04               | 0.86;1.26 | 0.697  |
| Migration background <sup>b</sup>           | 0.54                       | 0.35;0.82  | 0.005  | 0.71                      | 0.44;1.15 | 0.172  | 0.46               | 0.35;0.62 | <0.001 |
| French/Italian language region <sup>c</sup> | 0.93                       | 0.66;1.28  | 0.647  | 1.13                      | 0.76;1.66 | 0.551  | 0.87               | 0.70;1.09 | 0.221  |
| Parental education <sup>d</sup>             |                            |            |        |                           |           |        |                    |           |        |
| Secondary                                   | 1.09                       | 0.58;2.13  | 0.804  | 1.08                      | 0.48;2.47 | 0.853  | 1.18               | 0.82;1.70 | 0.376  |
| Tertiary                                    | 0.90                       | 0.49;1.76  | 0.759  | 1.33                      | 0.58;3.14 | 0.504  | 1.49               | 1.03;2.17 | 0.037  |
| Radiotherapy <sup>e</sup>                   | 0.67                       | 0.43;1.02  | 0.067  | 0.63                      | 0.43;0.93 | 0.021  | 0.75               | 0.61;0.92 | 0.006  |
| HSCT <sup>f</sup>                           | 0.61                       | 0.30;1.14  | 0.138  | 1.47                      | 0.73;3.00 | 0.286  | 0.62               | 0.39;0.96 | 0.035  |
| Year of study <sup>g</sup>                  |                            |            |        |                           |           |        |                    |           |        |
| 2010-2013                                   |                            |            |        | 1.03                      | 0.68;1.54 | 0.903  | 1.12               | 0.86;1.47 | 0.397  |
| 2015-2017                                   | 1.57                       | 1.07;2.31  | 0.021  | 1.05                      | 0.58;1.87 | 0.879  | 1.34               | 0.99;1.82 | 0.060  |
| 2021-2022                                   | 3.73                       | 2.57;5.47  | <0.001 | 1.80                      | 1.00;3.31 | 0.052  | 2.57               | 1.89;3.52 | <0.001 |
| <b>Physician skin examinations</b>          |                            |            |        |                           |           |        |                    |           |        |
|                                             | <b>N = 275<sup>i</sup></b> |            |        | <b>N = 538</b>            |           |        | <b>N = 1,807</b>   |           |        |
| Age at study                                | 0.86                       | 0.73;1.00  | 0.057  | 1.02                      | 0.83;1.26 | 0.841  | 1.02               | 1.00;1.04 | 0.020  |
| Male <sup>a</sup>                           | 0.98                       | 0.46;2.11  | 0.958  | 1.38                      | 0.85;2.27 | 0.199  | 0.65               | 0.51;0.84 | 0.001  |
| Migration background <sup>b</sup>           | 0.83                       | 0.32;1.98  | 0.690  | 1.27                      | 0.66;2.34 | 0.451  | 1.38               | 0.98;1.94 | 0.064  |
| French/Italian language region <sup>c</sup> | 2.40                       | 1.09;5.32  | 0.029  | 1.12                      | 0.65;1.89 | 0.674  | 1.38               | 1.04;1.81 | 0.022  |
| Parental education <sup>d</sup>             |                            |            |        |                           |           |        |                    |           |        |
| Secondary                                   |                            |            |        | 1.50                      | 0.50;5.66 | 0.503  | 0.96               | 0.62;1.50 | 0.848  |
| Tertiary                                    | 3.55                       | 1.32;11.61 | 0.020  | 1.53                      | 0.49;5.92 | 0.497  | 1.27               | 0.81;2.01 | 0.306  |
| Radiotherapy <sup>e</sup>                   | 2.42                       | 0.87;6.27  | 0.076  | 1.14                      | 0.67;1.91 | 0.620  | 1.02               | 0.78;1.33 | 0.880  |
| HSCT <sup>f</sup>                           | 3.82                       | 1.42;9.93  | 0.006  | 2.09                      | 0.88;4.63 | 0.078  | 2.05               | 1.27;3.23 | 0.003  |
| Year of study                               |                            |            |        |                           |           |        |                    |           |        |
| 2010-2013                                   |                            |            |        | 0.82                      | 0.46;1.46 | 0.511  | 1.31               | 0.93;1.83 | 0.123  |
| 2015-2017                                   |                            |            |        | 0.86                      | 0.36;1.91 | 0.721  | 1.23               | 0.82;1.81 | 0.303  |
| 2021-2022                                   |                            |            |        | 1.05                      | 0.46;2.24 | 0.909  | 1.03               | 0.67;1.54 | 0.887  |

<sup>a</sup> reference: female, <sup>b</sup> reference: no migration background, <sup>c</sup> reference: German language region, <sup>d</sup> reference: primary education, <sup>e</sup> reference: no radiotherapy; <sup>f</sup> reference: no HSCT, <sup>g</sup> year of study reference category for children is 2007-2013 and for adolescents and adults 2007 to 2009; <sup>h</sup> due to the lower n in this analysis, we combined primary and secondary education into in category for children; for adolescents and adults, we kept it separate; <sup>i</sup> Since we only asked preventive skin examinations for children in 2021/2022, we did not include it study year as exposure for preventive skin examinations in this age group, HSCT = hematopoietic stem cell transplantation