# Sun exposure among teenage and young adult cancer survivors in the United Kingdom

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# Sun exposure among teenage and young adult cancer survivors in the United Kingdom

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|---|---|
| TYACS | Teenage and young adult cancer survivors |
| TYA | Teenagers and young adults |
| COG | Childrens Oncology Group |
| GP-TYAs | general population controls |

**Abstract**

Skin cancers are a common form of second malignant neoplasm among teenage and young adult cancer survivors (TYACS). The Children's Oncology Group specify that TYACS should adhere to safe sun practices and be screened for skin cancer annually. Cross-sectional self-report data collected by our group indicate over a third of TYACS (n=229; mean age: 19.8yrs) intentionally sunbathe, with many reporting sunburn. TYACS sunbathing, sunburn and sunbed use are similar to the the general population ($p>0.05$). These data suggest TYACS require intervention to limit sun exposure and improve their sun safety habits.

## Introduction

In the UK the cancer survival rate among teenagers and young adults (TYA) exceeds 80% [1]. However, TYA cancer survivors (TYACS) are at risk of developing second primary skin cancer [2-4]. Immunosuppression and treatment with high dose radiotherapy have been identified as specific risk factors for developing a later skin cancer [4-6]. Data from the Childhood Cancer Survivor Study indicates among those diagnosed with second primary non-melanoma skin cancer 46% had multiple occurrences and 38% reported returning to hospital more than twice to have the carcinoma treated or surgically removed [7].

Due to the high incidence and burden of secondary skin cancer among TYACS, the Children's Oncology Group (COG) specify that TYACS should adhere to safe sun practices (i.e. wearing sunscreen and protective clothing), avoid UV exposure (sunbathing, tanning and sunbed use) and be screened for skin cancer annually [8, 9]. These guidelines are based on evidence that skin damage induced from excessive sun exposure is linked to the development of skin cancer and that early diagnosis of skin cancer can lead to smaller tumors, potentially less intensive treatment, and better outcomes [10]. However data on TYACS' sun exposure in the UK is non-existent. Therefore the aim of this study was to explore the incidence of, and factors associated with, sunbathing, sunburn and indoor tanning among TYACS and general population controls (GP-TYAs) in the UK. This information is crucial for developing interventions aimed at improving sun protection and skin screening among TYACS.

## Methods

TYACS and GP-TYAs, aged between 13 and 24 years, were invited to complete a Health and Lifestyle Questionnaire which contained three survey items assessing incidence of sun-bathing and sunburn last summer and the use of indoor sunbeds over the past year. TYACS both on (i.e. receiving active cancer treatment) and off treatment were eligible to participate and were recruited online via CLIC Sargent or through outpatient clinics at University College London Hospital. GP-TYAs were recruited in two waves through online channels, schools and UCL participation networks. These items were taken from a sun health behaviour instrument previously used to assess sun-related behaviours in Scottish adolescents [11]. The full contents of the health and lifestyle questionnaire has been published elsewhere [12].

Descriptive statistics were produced to determine the proportion of TYACS and GP-TYAs in each group reporting intentional tanning, sunburn or sunbed use and the

proportion meeting current COG sun safety lifestyle guidelines on UV exposure. Statistical comparisons between each group were made using chi-square tests and logistic regression analysis for categorical variables and ANOVAs for continuous variables. Multivariable models were adjusted for age and gender. Only data from Wave 1 of GP-TYA recruitment was available for analysis.

## Results

From the original sample (n= 295 TYACS; n= 370 Wave 1 GP-TYAs) complete data on sun exposure was available from 229 TYACS (n=76 on treatment; n=149 off treatment) and 311 GP-TYAs. Participant characteristics and sun-exposure behaviours are reported in Table 1. Over a third of TYACS (35.5%, n=27 on treatment; 45.6%, n=68 off treatment) and GP-TYAs (49.8%, n=155) reported intentionally tanning with approximately 40% reporting sunburn (pinkness/redness from being in the sun) in the past year (42.1%, n=32 on treatment; 41.6%, n=62 off treatment) and 47.6% (n=148) of GP-TYAs. Very few young people within any group used sunbeds (6.6%, 6% and 8.4% respectively). As shown in Table 2, less than a third of participants were meeting COG sun safety guidelines on UV exposure. After adjusting for age and gender there were no significant differences ($p>0.05$) in the behaviours of young people on cancer treatment, off cancer treatment, and in the general population.

## Discussion

This study demonstrates TYACS in the United Kingdom have a similar sun-exposure behaviours to GP-TYAs in that they often sunbathe and burn in the sun. Encouragingly (given that it is illegal for under 18's to use indoor tanning booths in the UK) very few young reported using indoor sunbeds.

These findings reflect studies of childhood cancer survivors in the United States which indicate high levels of sun exposure is common [13, 14]. For example, data from project REACH indicate 60% of TYACS (n=153, mean age: 26 years, time since diagnosis: 14 years) report more than 8 hours of sun exposure per week with very little or no use of protection [14]. Deliberate tanning and sunburn among TYACS and GP-TYAs is concerning given existing data which indicate that neither group are particularly adherent to sun protection [14, 15]. There are data which indicate that young people counteract skin protection behaviours by purposely sun-bathing and that TYACS treated with radiotherapy (despite acknowledging their increased risk of skin cancer) do not perceive UV exposure as a risk factor for skin cancer [13]. These data signify psycho-educational interventions which highlight TYACS increased risk

of skin cancer and the importance of sun-protection habits are warranted. A randomised controlled trial group-based educational day intervention which included risk counselling demonstrated a positive effect on sun safe practices among 75 adolescent survivors of childhood cancer [16]. Whether health messages aimed at increasing TYACS awareness of secondary skin cancer and perceived benefit of skin protection could be feasibly incorporated into routine survivorship care, for example long-term follow up clinics appointments, remains to be explored.

However whilst increasing TYACS knowledge of the risks of sun exposure is a necessary intentional tanning among GP-TYAs is driven by a number of physical, attitudinal and environmental factors [11, 17, 18]. Interventions targeting sun exposure among TYACS should incorporate principles of behavioural science and consider existing interventions conducted in the general population which have shown promise. For example appearance based interventions [19], mass-media campaigns [20], community-based interventions [21], and policy changes [22]. Such interventions tailored to TYACS should be formally tested and be accompanied by robust outcome measures in order to effectively determine the impact upon behaviour and health.

This study has a number of limitations; i) Data gathered was self-reported and therefore subject to recall bias and inaccuracies due to under and over reporting, ii) TYACS and GP-TYA groups differed significantly therefore limiting the validity of comparisons and iii) the external validity of the results should also be interpreted with caution. As participation was voluntary selective bias is present as it is highly likely that TYACS who participated in this study are engaged in leading a healthy lifestyle. Furthermore, only data on sun-exposure was gathered. Future studies should aim to gather both objective and self-report data on the sun-protection habits (sunscreen use, wearing protective clothing, wearing a hat, wearing sunglasses, and shade-seeking), tanning attitude and skin cancer awareness of TYACS. Thought must also be given to when sun protection interventions should be initiated among TYACS. The finding that TYACS receiving cancer therapy still report sunbathing and sunburn suggests interventions introduced early during treatment may be beneficial.

The results of this study demonstrate there is a need to intervene in limiting sun exposure among TYACS. A recent review of National Institute of Health grant funding indicate that intervention research which targets dermatologically clinically relevant outcomes (primarily sunburn and tanning) across all points of the cancer continuum

from prevention to survivorship is required [23]. Our data demonstrates need for such intervention research among TYACS within the UK.


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### *Conflicts of Interests*

The authors declare that there are no competing interests.

## References


1. Maher, E.J., et al., *UK CANCER SURVIVORSHIP: WHAT THE DATA TELLS US ABOUT THE NUMBER OF CHILDREN, TEENAGERS AND YOUNG ADULTS LIVING WITH AND BEYOND CANCER.* Asia-Pacific Journal of Clinical Oncology, 2014. **10**: p. 113-113.
2. Yang, G.B., et al., *Risk and survival of cutaneous melanoma diagnosed subsequent to a previous cancer.* Arch Dermatol, 2011. **147**(12): p. 1395-402.
3. Meadows, A.T., et al., *Second Neoplasms in Survivors of Childhood Cancer: Findings From the Childhood Cancer Survivor Study Cohort.* Journal of Clinical Oncology, 2009. **27**(14): p. 2356-2362.
4. Friedman, D.L., et al., *Subsequent neoplasms in 5-year survivors of childhood cancer: the Childhood Cancer Survivor Study.* J Natl Cancer Inst, 2010. **102**(14): p. 1083-95.
5. Watson, M., D.M. Holman, and M. Maguire-Eisen, *Ultraviolet Radiation Exposure and Its Impact on Skin Cancer Risk.* Seminars in oncology nursing, 2016. **32**(3): p. 241-254.
6. Daniels, L.A., et al., *Long-term risk of secondary skin cancers after radiation therapy for Hodgkin's lymphoma.* Radiother Oncol, 2013. **109**(1): p. 140-5.
7. Perkins, J.L., et al., *Nonmelanoma Skin Cancer in Survivors of Childhood and Adolescent Cancer: A Report From the Childhood Cancer Survivor Study.* Journal of Clinical Oncology, 2005. **23**(16): p. 3733-3741.
8. Group, C.O., *Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent and Young Adult Cancers* 2013, Childrens Oncology Group Monrovia, CA
9. Eshelman, D., et al., *Facilitating Care for Childhood Cancer Survivors: Integrating Children's Oncology Group Long-Term Follow-Up Guidelines and Health Links in Clinical Practice.* Journal of Pediatric Oncology Nursing, 2004. **21**(5): p. 271-280.
10. Kricker, A., et al., *Basal cell carcinoma and squamous cell carcinoma growth rates and determinants of size in community patients.* J Am Acad Dermatol, 2014. **70**(3): p. 456-64.
11. Kyle, R.G., et al., *Scottish adolescents' sun-related behaviours, tanning attitudes and associations with skin cancer awareness: a cross-sectional study.* BMJ Open, 2014. **4**(5).

12. Pugh, G., et al., *The Health Behavior Information Needs and Preferences of Teenage and Young Adult Cancer Survivors.* Journal of Adolescent and Young Adult Oncology, 2017. **6**(2): p. 318 - 326
13. Zwemer, E., et al., *Sun exposure in young adult cancer survivors on and off the beach: results from Project REACH.* Journal of Cancer Survivorship, 2012. **6**(1): p. 63-71.
14. Tercyak, K.P., et al., *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): p. 825-30.
15. Levy-Shraga, Y., et al., *Sun Exposure and Protection Habits in Pediatric Patients with a History of Malignancy.* PLoS One, 2015. **10**(9): p. e0137453.
16. Mays, D., et al., *Improving short-term sun safety practices among adolescent survivors of childhood cancer: a randomized controlled efficacy trial.* J Cancer Surviv, 2011. **5**(3): p. 247-54.
17. Kirk, L. and S. Greenfield, *Knowledge and attitudes of UK university students in relation to ultraviolet radiation (UVR) exposure and their sun-related behaviours: a qualitative study.* BMJ Open, 2017. **7**(3): p. e014388.
18. Dadlani, C. and S.J. Orlow, *Planning for a brighter future: a review of sun protection and barriers to behavioral change in children and adolescents.* Dermatol Online J, 2008. **14**(9): p. 1.
19. Williams, A.L., et al., *Appearance-based interventions to reduce ultraviolet exposure and/or increase sun protection intentions and behaviours: a systematic review and meta-analyses.* Br J Health Psychol, 2013. **18**(1): p. 182-217.
20. Doran, C.M., et al., *Benefit Cost Analysis of Three Skin Cancer Public Education Mass-Media Campaigns Implemented in New South Wales, Australia.* PLoS ONE, 2016. **11**(1): p. e0147665.
21. Sandhu, P.K., et al., *Community-wide Interventions to Prevent Skin Cancer: Two Community Guide Systematic Reviews.* Am J Prev Med, 2016. **51**(4): p. 531-9.
22. Services., U.D.o.H.a.H., *The Surgeon General's Call to Action to Prevent Skin Cancer.* Reducing the Risk of Skin Cancer. 2014, Washington (DC): Office of the Surgeon General (US).
23. Perna, F.M., et al., *Research on skin cancer–related behaviors and outcomes in the nih grant portfolio, 2000-2014: Skin cancer intervention across the cancer control continuum (sci-3c).* JAMA Dermatology, 2017. **153**(5): p. 398-405.

**Table 1. Demographic characteristics and sun health behaviours**

| | TYA Cancer Survivors On Treatment<br><br>n=76<br>% (n) | TYA Cancer Survivors Off Treatment<br><br>n=149<br>% (n) | General Population TYAs<br><br>n=311<br>% (n) | Difference |
|---|---|---|---|---|
| **Age** (Mean±SD) | 19±3.02 | 20.0±2.85 | 17 ± 3.18 | 2.70±0.26[a]<br>p<0.001 |
| **Gender** | | | | |
| Females | 57.9 (44) | 62.4 (93) | 78.1 (243) | |
| Males | 42.1 (32) | 37.6 (56) | 21.9 (68) | |
| **Cancer Diagnosis** | | | | |
| Lymphoma | 23.7 (18) | 36.2 (54) | - | |
| Leukaemia | 34.2 (26) | 23.5 (35) | - | |
| Bone tumour | 6.6 (5) | 12.1 (18) | - | |
| Soft tissue sarcoma | 17.1 (13) | 5.4 (8) | - | |
| CNS tumour | 11.8 (9) | 6.7 (10) | - | |
| Germ cell tumour | 0 (0) | 4.7 (7) | - | |
| Carcinoma | 3.9 (3) | 4.7 (7) | - | |
| Melanoma | 1.3 (1) | 0.7 (1) | - | |
| Other | 3.9 (3) | 8.1 (12) | - | |
| **Age at diagnosis (Mean±SD)** | **17.44±3.21** | **16.47±4.1** | | 0.97±0.57<br>p= 0.09 |
| 0-12 years | 5.3 (4) | 12.7 (19) | - | |
| 13-18 years | 44.7 (34) | 53.0 (79) | - | |
| 19-24 years | 38.2 (29) | 28.8 (43) | - | |
| Missing data | 11.8 (9) | 5.4 (8) | - | |
| **Treatment[b]** | | | | |
| Surgery | 56.1 (32) | 54.6 (59) | - | |
| Radiotherapy | 50.9 (28) | 46.2 (48) | - | |
| Chemotherapy | 94.4 (67) | 97.1 (134) | - | |
| Hormone therapy | 5 (2) | 5.9 (5) | - | |
| Active surveillance | 2.6 (1) | 8.2 (7) | - | |
| Other | 7.8 (6) | 14.0 (21) | - | |
| **Time Since Treatment[c]** | | | | |
| <3 months from finishing treatment | - | 14.8 (22) | - | |
| 4-11 months since finishing treatment | - | 18.8 (28) | - | |
| 1-5 years since finishing treatment | - | 47.0 (70) | - | |
| >5 years since finishing treatment | - | 4 (6) | - | |
| On active surveillance | - | 11.4 (17) | - | |
| I don't know | - | 0.7 (1) | - | |
| Missing data | - | 3.4 (5) | - | |
| **Sun Health Behaviours** | | | | [d] |
| Sun-bathed regularly last summer to get a tan | 35.5 (27) | 45.6 (68) | 49.8 (155) | p=0.68 |
| Suffered sun-burn or erythema (pinkness/redness from being in the sun) | | | | |
| *Yes, only on one occasion* | 28.9 (22) | 29.5 (44) | 34.4 (107) | p=0.788 |
| *Yes, on more than one occasion* | 13.2 (10) | 12.1 (18) | 13.2 (41) | |
| Used a sun-bed in the past 12 months | 6.6 (5) | 6 (9) | 8.4 (26) | p=0.63 |

[a]Comparison between TYACS and GP-TYACS. Mean difference in age between TYACS-OT and TYACS-OFT was 1.03±0.41 years (p=0.12).

[b]Where percentages do not equal 100% this was due to participants selecting all that applied

[c]Data from those off treatment only (n=149)

[d]Chi-Square Test Output

**Table 2. Adjusted and unadjusted odds ratios for the association between treatment status and health behaviour**

| | Proportion meeting current COG guidelines on sun exposure* % (n) | Un-Adjusted | | Adjusted | |
|---|---|---|---|---|---|
| | | Odds Ratio (95% CI) | Odds Ratio (95% CI) | Odds Ratio (95% CI) | Odds Ratio (95% CI) |
| **Sun Safety (n=536)** | | | | | |
| GP-TYAs | 19.9 (62) | 1 | | 1 | |
| OFT—TYA | 27.5 (41) | 0.65 (0.41, 1.03) | 1 | 0.76 (0.45, 1.29) | 1 |
| OT-TYA | 34.2 (26) | 0.47 (0.27, 0.83) | 0.94 (0.51,1.74) | 0.56 (0.31, 1.04) | 1.03 (0.55,1.93) |

*TYA, teenager and young adult; GP-TYAs, general population TYAs.; OFT-TYAs, off-treatment TYAs, OT-TYAs on treatment TYAs. Odds-ratios adjusted for age and gender, all regressions p<0.005. *Not meeting current COG guidelines on sun exposure was classified as reporting one or more of sunbathing, sun-burn or indoor sun-bed use. Sunbathing refers to sunbathing regularly last summer to get a tan (i.e. intentionally staying out in the sun with the desire for skin to go browner or more golden in colour), sun-burn refers to skin going red or pink due to being in the sun.*