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Factors Affecting Sunscreen Use and Sun Avoidance in a U.S. National Sample of Organ Transplant Recipients

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Abstract

Background—Organ transplant recipients have an increased risk of non-melanoma skin cancers (NMSC) due to immunosuppressive therapy following transplantation. Use of sunscreen has been shown to reduce this risk.

Objectives—This study sought to identify patient and healthcare factors associated with sun protective behaviours in organ transplant recipients after transplantation with the goal of increasing overall sunscreen use.

Methods—This study utilized a cross-sectional, retrospective survey from a national sample of one hundred and ninety eight organ transplant recipients in the US from 2004–2008 with no prior diagnosis of skin cancer. The main outcome measures were sunscreen use and sun avoidance before and after transplantation. Frequency of sunscreen use and sun exposure was obtained by self-report on Likert scales ranging from never to always, and these responses were converted to a numerical scale from 0 to 4.

Results—Overall sunscreen use increased after transplantation (from 1.4 to 2.1, $p < 0.001$). Sex, Fitzpatrick skin type, receiving advice to avoid sun from a healthcare provider, and pre-transplantation sunscreen use were significantly associated with frequency of post-transplantation sunscreen use in multivariate models. Pre-transplantation sun exposure, advice to avoid sun, and pre-transplantation sunscreen use were significantly associated with sun avoidance post-transplantation.

Conclusions—Both patient features and clinician advice are associated with sun protective behaviours after organ transplantation. These results help physicians target expanded sun protection counseling to those patients most in need of such intervention.

Introduction

Non-melanoma skin cancers (NMSC), including basal cell carcinoma (BCC) and squamous cell carcinoma (SCC), are extremely common in organ transplant recipients (OTRs), and account for approximately 30–65% of all post-transplantation malignancies.¹ These tumours occur early and often after transplantation, and represent not only significant morbidity to

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patients but also substantial cost for their care.² Post-transplantation malignancies are a major cause of mortality for OTRs and may become the leading cause of post-transplantation mortality in the future as therapies to prevent organ rejection are improved.³ Currently, approximately 140,000 OTRs live in the United States,² and the number of transplantations is increasing.⁴ NMSC will likely continue to pose a significant and increasing burden to transplant patients, providers, and the healthcare system.

It is well established that sun exposure is a significant risk factor for the development of NMSC in OTRs.⁵ UV radiation likely directly damages DNA, decreases local immunosurveillance, and suppresses systemic immunity.⁶ In addition to cumulative sun damage, OTRs are at significantly increased risk of NMSC due to immunosuppression following transplantation. It is estimated that they have a 65-fold greater incidence of SCC and approximately 10-fold increased risk of BCC than the general population.⁷ The increased risk of NMSC and the established relationship between sun exposure and NMSC presents a situation in which a modifiable patient behaviour may play a direct role in preventing a likely outcome.

Clinical guidelines for OTRs recommend sun protective behaviors to decrease risk of skin cancer.^{8,9} These behaviours include sunscreen use, sun avoidance, and wearing protective clothing. Although it is difficult to measure the impact of these interventions, observational studies suggest that sunscreen use is protective in OTRs. An Italian study of 282 kidney transplant recipients found that no sunscreen usage was an univariate, but not multivariate, risk factor for skin cancer.¹⁰ Though not peer reviewed, one prospective, case-control study has demonstrated that daily application of sunscreen protected against the development of new NMSC in OTRs.¹¹ The group who applied daily sunscreen had a 53% reduction in the number of AKs while the control group had a 43% increase. The sixty patients in the sunscreen group developed no new SCCs and two new BCCs during the trial, and the sixty patients in the control group developed eight SCCs and nine BCCs. Future interventional trials may be needed to support this finding.

Despite this evidence, several barriers exist to improving safe sun practices. Sunscreen use among OTRs is not universal (estimates vary from 35–57%^{12,13,14}), and the majority of OTRs reported that a tan makes a person look more attractive and healthy¹² and that sunscreen application is a “hassle” and too time consuming.¹⁵ Nonetheless, renal transplant recipients do increase sunscreen use after transplantation,¹⁶ which suggests a window of opportunity for intervention. Also, patients with access to a specialist transplant dermatology clinic have a significantly higher rate of sunscreen use (estimated to be 92%) compared to patients who do not,¹⁷ highlighting that aspects of care affect healthy behaviours.

Certain factors are associated with an increased risk of NMSC in OTRs including fair skin, cumulative sun exposure, younger age at transplantation, and duration of immunosuppression.¹⁸ Overall, little is known about the factors that may contribute to higher use of sunscreen and increased photoprotective behaviours after transplantation. This study aims to quantify changes in sunscreen use before and after transplantation in a national cohort of organ transplant recipients outside the specialized environment of an interventional trial. Specifically, this analysis is designed to identify patient characteristics and other modifiable factors that may be associated with increased sunscreen use and sun avoidance behaviours. Ultimately, the goal is to identify high risk OTRs who may benefit from additional or expanded counseling on photoprotective behaviours.

Materials and Methods

All subjects provided informed consent according to the procedures approved by the University of California, San Francisco Committee on Human Research and in accordance with the Declaration of Helsinki. Data were collected from a national sample of a total of 694 OTRs from 2004 to 2008. Patients at any stage post-transplantation were recruited through physician contact and direct-to-patient advertisement which included magazine advertisements, a booth at the Transplant Games, and direct mailings to patients via transplant organizations. Physicians were recruited to refer patients through advertisements in transplant and dermatology journals and through direct mailings to members of professional dermatology organizations. Subjects who opted to contact the study coordinators were enrolled in person, by mail, or by telephone.

This study was designed to provide a basis for strategies to increase sun protective behaviours in patients who might not otherwise practise them. Because patients with a personal history of skin cancer are at particularly high risk for subsequent NMSC, and are also known to practise increased sun protective behaviours,¹⁹ 496 participants who reported a history of skin cancer, including Bowen's disease, were excluded. Thus, the final study sample consisted of 198 patients with no personal history of skin cancer, in order to best approximate the first dermatology appointment after transplantation.

Patients completed a standardized questionnaire that gathered data on sex, age, age at transplantation, race, Fitzpatrick skin type, hair colour, eye colour, time since transplantation, type of organ transplanted, history of skin cancer, pre-transplantation sun exposure, post-transplantation and pre-transplantation sunscreen use, post-transplantation sun avoidance, and whether they received advice from a health professional to avoid the sun. Frequency of sunscreen use before and after transplantation and sun exposure before transplantation were reported on a five-point Likert scale, from "Never" to "Always" (see Fig. 1). This was converted to a five-point continuous scale for linear regression.

Descriptive statistics were used to summarize characteristics of the study population. For regression analysis, hair colour was collapsed into brown/black and red/blonde; eye colour into brown/hazel and blue/gray/green; race into white and non-white; transplanted organ type into abdominal (kidney/liver/pancreas) and thoracic (heart/lung); and Fitzpatrick skin type into types I/II, III/IV, and V/VI. Pre-transplantation sunscreen use was collapsed into never/seldom and sometimes/often/always wears sunscreen as the distribution was skewed to the left. Pre-transplantation sun exposure was collapsed into never/seldom/sometimes and often/always exposed to the sun as the distribution was skewed to the right.

The primary dependent variables were increase in sunscreen use, frequency of post-transplantation sunscreen use, and post-transplantation sun avoidance. Based on previous studies and this group's clinical experience, the following *a priori* independent variables were hypothesized to be associated with increased sun protective behaviours: sex, race, hair colour, eye colour, time since transplantation, age at transplantation, Fitzpatrick skin type, pre-transplantation sun exposure, receiving advice to avoid sun, pre-transplantation sunscreen use, and organ transplant type. A paired samples t test was used to compare the increase in frequency of sunscreen use before and after transplantation. Independent variables with $p < 0.3$ on bivariate regression were included in the initial multivariate models. Backward stepwise linear regression was applied to determine independent variables that were significantly associated with frequency of post-transplantation sunscreen use. Backward stepwise logistic regression was applied for post-transplantation sun avoidance. Likelihood ratio tests were used to compare models for goodness of fit. To account for missing data, missing values were imputed, and models using imputed values

were compared to models using the original data. A two-sided $P < 0.05$ was considered significant. The study population included a higher percentage of women than in the OTR population in general, so the multivariate models included gender to control for this variable. Statistical analysis was performed using Stata 11 (Stata Corporation, College Station, TX).

Results

Of the 198 subjects identified, 107 were male and 97 were female with a mean age at transplantation of 44.0 ± 13.4 years (Table 1). At the time of the survey, the average time since transplantation was 9.8 ± 7.4 years. The kidney was the most common organ transplanted in the study population (84.3%), followed by liver (8.1%) and heart (5.4%). Most of the population had Fitzpatrick skin type III/IV (54.2%); 20.8% had Fitzpatrick skin type I/II and 25% were type V/VI. With regard to photoprotective counseling, 81.4% of patients reported that a healthcare provider had told them to avoid the sun after their transplant. The variable with the most missing values was whether a patient had been advised to avoid the sun, with fifteen missing observations (7.5% of observations); all other variables were missing less than 3% of observations.

Increase in Sunscreen Use

Patients reported using sunscreen significantly more often after transplantation than before (average scale score increased from 1.4 to 2.1, $p < 0.001$). Patients who never or seldom used sunscreen before transplantation increased sunscreen use post-transplantation significantly less than patients who sometimes, often, or always used sunscreen before transplantation (Fig. 2, $p = 0.01$). Of the 39% of patients who never used sunscreen before transplant, only 37% increased use after transplant. Of the 26% who often or always used sunscreen before transplant, 88% increased or maintained their sunscreen use after transplant.

Frequency of Post-Transplantation Sunscreen Use

Using multivariate linear regression, female sex ($p = 0.046$), lighter Fitzpatrick skin type ($p = 0.02$), having received advice to avoid sun ($p = 0.03$), and often or always using sunscreen prior to transplantation ($p < 0.001$) were significantly associated with a higher frequency of post-transplantation sunscreen use (Table 3, first three factors associated with approximately a half-point increase in the scale response on average; prior sunscreen use associated with average of 1.8 additional points on scale). Accounting for missing values via multiple imputation yields no differences in the multivariate linear regression.

By extrapolating adjusted means from the regression model back to the Likert scale of 0=Never, 1=Seldom, 2=Sometimes, 3=Often, 4=Always, these data can be used to predict average sunscreen use for OTRs, based on gender, pre-transplantation sunscreen use, Fitzpatrick skin type, and provider counseling (Table 4). The average fair-skinned female who frequently used sunscreen before transplantation often used sunscreen after transplantation if she was not advised to avoid the sun (average 3.35), but nearly always used sunscreen after transplantation if she was advised to avoid sun (avg. 3.87). In contrast, the average darker-skinned man who infrequently used sunscreen prior to transplantation almost never used sunscreen post-transplantation if he was not advised to avoid sun (avg. 0.45), but improved to seldom using sunscreen post-transplantation if he had been advised to avoid the sun (avg. 0.97).

Post-Transplantation Sun Avoidance

Patients who spent less time in the sun before transplantation were significantly more likely to avoid sun exposure after transplantation (Table 3, OR 4.6, 95% Confidence Interval (CI) 2.2–9.1, $p < 0.001$). Patients who were advised to avoid the sun were more likely to avoid the

sun after transplantation (OR 2.7, 95% CI 1.2–6.5, $p=0.02$), and patients who always or often used sunscreen before transplantation were also more likely to avoid the sun after transplantation (OR 2.2, 95% CI 1.1–4.4, $p=0.03$). Adding imputed values for variables with missing values yields no differences in the logistic regression.

Discussion

Transplant recipients are at increased risk of NMSC due to cumulative UV exposure and immunosuppressive drug use. Given the proven benefits of sunscreen use for preventing NMSC in OTRs, additional counseling on sun protective behaviours is beneficial in this population. OTRs increased their sunscreen use after transplantation on average; however, positive change depended on several factors. Female sex, fair Fitzpatrick skin type, receiving advice to avoid sun, and higher frequency of pre-transplantation sunscreen use were found to be significantly associated with post-transplantation sunscreen use in multivariate models. Patients who infrequently used sunscreen before transplantation were not using sunscreen as frequently as would be desired post-transplantation and may be ideal targets for additional intervention. Furthermore, avoidance of sun after transplantation was associated with sun exposure before transplantation, receiving advice to avoid sun, and pre-transplantation frequency of sunscreen use. Notably, race was not significantly associated with photoprotective behaviours, but fair Fitzpatrick skin type was associated with sunscreen use. This is likely because Fitzpatrick skin type depends on the patient's propensity to burn, while race and ethnicity depend on numerous factors, many of which are cultural and independent of photosensitivity. In addition, the majority of the population was Caucasian (83%), which may limit the ability to delineate differences based on race. Taken together, these data highlight an opportunity for targeted clinical intervention to increase sun protective behaviours in this high risk group of transplant patients.

One prior study has been conducted on sunscreen use before and after transplantation using a cohort of 270 renal transplant recipients from a single Irish national transplant centre.¹⁶ Moloney *et al.* reported that younger age was the only significant variable associated with sunscreen use after transplantation. They did not find an association between sex or Fitzpatrick skin type and post-transplantation sunscreen use. Interestingly, age-related variables were not significantly associated with any of the primary outcomes tested in this data set. The analysis by Moloney *et al.* included patients with a personal history of skin cancer, which has been shown in previous studies to be associated with higher rates of sunscreen use. The current study was limited to patients without skin cancer, potentially explaining differences in results. In addition, this cohort was a multiethnic set including subjects of all six Fitzpatrick skin types, while Moloney *et al.* included only Fitzpatrick types I–IV. No comment was made on whether nonwhite subjects were included in their study.

Self-report presents a limitation to this study. At this time, it is the only available source of information on sunscreen use and sun avoidance in the transplant population. Recall bias may influence patients' recollection of sunscreen use and sun avoidance prior to transplantation since they may over- or under-report these behaviours depending on current circumstances. Because the average time between transplantation and completion of the survey was 9.8 years, patients may have experienced events since transplantation, such as a diagnosis of AK, that affect their sunscreen use. The time since transplantation and lack of data on AK diagnoses represent limitations to this study's ability to best approximate the first dermatology appointment post-transplantation. In addition, the Likert scale is limited in that terms such as "seldom" and "sometimes" do not capture a quantitative measure of sun protective behaviour. However, the frequencies reported by patients in this study are similar to those reported in similar surveys and are of clinical relevance to the dermatologist.^{12–14}

With regard to patients' receipt of advice to avoid sun, bias may be introduced in the variation across providers in the way they counsel patients about risk factors and behaviours that may lower risk. There may be variation in risk counseling by Fitzpatrick skin type, with lighter-skinned patients receiving more aggressive counseling, or by number and dose of immunosuppressive medications. Different centres may also vary in the nature and delivery of photoprotective advice. Furthermore, the study only includes patients who responded to the questionnaire, which may bias the population. Finally, the study only includes patients from the US and is therefore generalisable only to this population; this study lacks the ability to characterize behavior by region or UVR exposure. If this study were conducted in another part of the world, there may be pronounced differences in sunscreen use and sun avoidance related to different skin types and socioeconomic status as well as cultural or social differences.

The SUN PLUS model (Fig. 3) is a simple tool for clinicians to identify high-risk transplant patients who may benefit from focused or expanded sun protection counseling, based on the findings from this study and others. These patients include those who have not already been counseled by a healthcare provider, males, and those who infrequently used sunscreen before transplantation. Fitzpatrick skin type is not included in this model; however, it is important to note that patients who burn more easily are more likely to frequently use sunscreen after transplantation. From an intervention standpoint, if the end goal is to increase the absolute use of sunscreen by all patients, then patients who are less likely to burn should also be targeted for expanded intervention. However, given that the ultimate goal is to reduce the number of post-transplantation NMSC, there is insufficient evidence for a benefit of sunscreen in reducing NMSC in darker Fitzpatrick skin types.

Several studies have shown the value of face-to-face interactions in instituting positive health changes including positive photoprotective behaviours.^{20,21,22} SUN PLUS is a mnemonic to help physicians remember key components of both focused and expanded counseling for OTRs. SUNPLUS is suggested by the data in this study and current guidelines for OTRs; however, it requires validation in future studies such as behavioral intervention trials. All OTRs may benefit from receiving focused counseling, "SUN," which includes information on Self examination, Using sun protection correctly, and Non-melanoma skin cancer education. Self examination guidelines in OTR are similar to those in the general population including evaluating one's own skin on a regular basis. Using sun protection correctly encompasses using a proper amount of broad spectrum sunscreen (including UVA and UVB coverage) and applying it early and often, wearing protective clothing and hats, limiting time in the sun, and avoiding artificial tanning beds.⁸ Because OTRs are at increased risk for NMSC, it is important to raise awareness about these malignancies including discussing the importance of establishing regular dermatologic care for surveillance as well as reporting any new, growing, bleeding, or non-healing skin lesions.

Patients who are less likely to use photoprotection may benefit from expanded counseling, "SUN PLUS," which includes all the components of the focused counseling, SUN, "plus" four other components including a Personalized behaviour plan, Lesson follow-up, Uncovering misconceptions, and Summarizing. Creating Personalized behaviour plans for patients involves identifying activities that expose patients to the sun and discussing specific ways to incorporate photoprotection into their daily lives. For instance, a physician might advise a golfer to reapply sunscreen at the sixth and twelfth holes. For Lesson follow-up, a mailing after the appointment to reinforce messages received in clinic has been shown to increase photoprotective behaviours;¹⁵ a phone call, email, or newsletter may also be beneficial. Allowing time for patients' questions may Uncover misconceptions that are inhibiting maximal compliance with photoprotection. Finally, having patients Summarize

the information in their own words will ensure understanding. Consideration must be given to the tone of the consultation. If patients perceive recommendations as fear-inducing or threatening, they may be less likely to make positive changes.²³ Educational messages that affirm patients' positive traits and ability to reduce their risk of post-transplantation skin cancer may be more successful in creating positive behavioural changes.²⁴

Overall, this study contributes a model for factors related to sunscreen use and sun avoidance in OTRs. Specific factors, including female sex, fair Fitzpatrick skin type, pre-transplantation sunscreen use, and receiving advice to avoid the sun were significantly associated with sun protective behaviours in a national sample of transplant patients without a prior history of skin cancer. These data fill a gap in what is known about patient and care-related factors and their association with improving photoprotective behaviours. The clinical counseling model SUN PLUS allows physicians to tailor their clinic consultations to target those patients most in need of expanded intervention. Future studies may examine the role of counseling strategies in improving sun protection behaviours and reducing skin cancer in this high risk population.

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References

1. Rubel J, Milford EL, Abdi R. Cutaneous neoplasms in renal transplant recipients. *Eur J Dermatol.* 2002; 12(6):532–5. [PubMed: 12459521]
2. Berg D, Otley CC. Skin cancer in organ transplant recipients: Epidemiology, pathogenesis, and management. *J Am Acad Dermatol.* 2002; 47(1):1–20. [PubMed: 12077575]
3. Buell J, Gross TG, Woodle ES. Malignancy after transplantation. *Transplantation.* 2005; 80(2 Suppl):254–64.
4. Port F, Merion RM, Goodrich NP, Wolfe RA. Recent trends and results for organ donation and transplantation in the United States, 2005. *Am J Transplant.* 2006; 6(5 Pt 2):1095–100. [PubMed: 16613589]
5. Bouwes Bavinck J, de Boer A, Vermeer BJ, et al. Sunlight, keratotic skin lesions, and skin cancer in renal transplant recipients. *Br J Dermatol.* 1993; 129:242–9. [PubMed: 8286220]
6. Schwarz A, Schwarz T. Molecular determinants of UV-induced immunosuppression. *Exp Dermatol.* 2002; 11(1 Suppl):9–12. [PubMed: 12444952]
7. Jensen P, Hansen S, Moller B, et al. Skin cancer in kidney and heart transplant recipients and different long-term immunosuppressive therapy regimens. *J Am Acad Dermatol.* 1999; 40:177–86. [PubMed: 10025742]
8. Feuerstein I, Geller AC. Skin cancer education in transplant recipients. *Prog Transplant.* 2008; 18(4):232–42. [PubMed: 19186575]
9. J, Reichrath. Dermatologic management, sun avoidance and vitamin D status in organ transplant recipients (OTR). *Photochem Photobiol.* 2010; 101(2)
10. Savoia P, Stroppiana E, Cavaliere G, et al. Skin cancers and other cutaneous diseases in renal transplant recipients: a single Italian center observational study. *Eur J Dermatol.* 2011; 21(2):242–7. [PubMed: 21382788]

11. Ulrich C, Jurgensen JS, Degen A, et al. Prevention of non-melanoma skin cancer in organ transplant patients by regular use of a sunscreen: a 24 months, prospective, case control study. *Brit J Dermatol.* 2009; 161(3):78–84. [PubMed: 19775361]
12. Robinson J, Rigel DS. Sun protection attitudes and behaviors of solid-organ transplant recipients. *Dermatol Surg.* 2004; 30(4 Pt 2):610–5. [PubMed: 15061844]
13. Seukeran D, Newstead CG, Cunliffe WJ. The Compliance of Renal Transplant Recipients with Advice about Sun Protection Measures. *Br J Dermatol.* 1998; 138:301–03. [PubMed: 9602879]
14. Butt A, Roberts DL. Renal Transplant Recipients and Protection from the Sun: Need for Education. *Lancet.* 1997; 349(9046):179–80. [PubMed: 9111550]
15. Clowers-Webb H, Christenson LJ, Phillips PK, et al. Educational Outcomes Regarding Skin Cancer in Organ Transplant Recipients: Randomized Intervention of Intensive vs Standard Education. *Arch Dermatol.* 2006; 142:712–18. [PubMed: 16785373]
16. Moloney F, Almarzouqi E, O’Kelly P, et al. Sunscreen Use Before and After Transplantation and Assessment of Risk Factors Associated With Skin Cancer Development in Renal Transplant Recipients. *Arch Dermatol.* 2005; 141:978–82. [PubMed: 16103326]
17. Ismail F, Mitchell L, Casabonne D, et al. Specialist dermatology clinics for organ transplant recipients significantly improve compliance with photoprotection and levels of skin cancer awareness. *Brit J Dermatol.* 2006; 155:916–25. [PubMed: 17034519]
18. Terhorst D, Drecoll U, Stockfleth E, Ulrich C. Organ transplant recipients and skin cancer: assessment of risk factors with focus on sun exposure. *Br J Dermatol.* 2009; 161(3):85–89. [PubMed: 19775362]
19. Zivkovi M, Dediol I, Ljubi i I, Situm M. Sun behaviour patterns and perception of illness among melanoma patients. *J Eur Acad Dermatol Venereol.* 2011; 110.1111/j.1468-3083.2011.04154.x
20. Falk M, Magnusson H. Sun protection advice mediated by the general practitioner: An effective way to achieve long-term change of behaviour and attitudes related to sun exposure. *Scand J Prim Health Care.* 2011; 29(3):135–43. [PubMed: 21682578]
21. Robinson J, Silk KJ, Parrott RL, et al. Healthcare providers’ sun-protection promotion and at-risk clients’ skin-cancer-prevention outcomes. *Prev Med.* 2004; 38:251–57. [PubMed: 14766106]
22. Bandi P, Cokkinides VE, Weinstock MA, Ward EM. Physician sun protection counseling: prevalence, correlates, and association with sun protection practices among US adolescents and their parents, 2004. *Prev Med.* 2010; 51(2):172–77. [PubMed: 20478331]
23. Cho H. Unintended effects of fear appeals: The role of stage of change, threat, and efficacy. *Diss Abstr Int Section A.* 2000; 60(9-A):3184.
24. Jessop D, Simmonds LV, Sparks P. Motivational and behavioural consequences of self-affirmation interventions: A study of sunscreen use among women. *Psychol Health.* 2009; 24(5):529–44. [PubMed: 20205010]

What is already known about this topic?

- Organ transplant recipients (OTRs) are at increased risk of skin cancer.
- Many OTRs report inadequate photoprotective behaviours.
- Younger age may predict sunscreen use after transplantation.

What does this study add?

- First US national study examining factors associated with photoprotection in OTRs before and after transplantation.
- First study to only use OTRs with no prior history of skin cancer.
- Better understanding of risk factors for poor photoprotection.
- Model for identifying patients in need of extended counseling.

SUN EXPOSURE:		
How does your skin react to the sun?		
☐ Always burns easily, never tans	☐ Always burns easily, tans a little	☐ Burns moderately, tans gradually
☐ Burns a little, always tans well	☐ Rarely burns, tans profusely	☐ Never burns
SUNBLOCK USAGE:		
BEFORE YOUR TRANSPLANT:		
How often do/did you use sunblock when you were out in the sun for 15 minutes or more?		
☐ Always	☐ Often	☐ Sometimes
☐ Seldom	☐ Never	
How often do/did you spend time in the sun?		
☐ Often	☐ Sometimes	☐ Seldom
☐ Never		
AFTER YOUR TRANSPLANT:		
Do you now try to avoid the sun?		
☐ Yes	☐ No	
How often do you use sunblock now?		
☐ Always	☐ Often	☐ Sometimes
☐ Seldom	☐ Never	
Did a health care provider advise you to avoid sun exposure after your transplant?		
☐ Yes	☐ No	

Figure 1.

Questionnaire Items. The four page questionnaire elicited responses on demographics, transplantation history, immunosuppressive medications, sun exposure, sunscreen usage, medical history, physician contact information, cancer history, and family cancer history. Demonstrated items are those related to sun exposure and sunscreen usage.

Figure 2.
Post-transplantation sunscreen use by pre-transplantation sunscreen use.

Figure 3.
Clinical counseling model for organ transplant recipients: SUN PLUS.

Table 1

Characteristics of the sample.

Demographic characteristic	Count (%) or Mean $\pm$ SD
Sex- Male	107 (54%)
Age at transplantation	44 $\pm$ 13.4
Time from transplantation to survey	9.8 years $\pm$ 7.4
<i>Race/Ethnicity</i>	
Caucasian	159 (83.3%)
Black	10 (5.2%)
Hispanic	19 (10%)
Other	3 (1.6%)
<i>Fitzpatrick Skin Type</i>	
I and II	40 (20.8%)
III and IV	104 (54.2%)
V and VI	48 (25%)
<i>Hair Colour</i>	
Brown/Black	148 (78.7%)
Red/Blonde	40 (21.3%)
<i>Eye Colour</i>	
Brown/Hazel	112 (59.6%)
Blue/Gray/Green	76 (40.4%)
<i>Organ Transplanted</i>	
Heart	7 (3.5%)
Heart/Lung	1 (0.5%)
Kidney	167 (84.3%)
Kidney/Pancreas	7 (3.5%)
Liver	16 (8.1%)
Advised to avoid sun	149 (81.4%)
<i>Pre-transplantation sunscreen use</i>	
Never	77 (39.7%)
Seldom	33 (17%)
Sometimes	34 (17.5%)
Often	32 (16.5%)
Always	18 (9.3%)
<i>Scale score</i>	1.39 $\pm$ 1.4
<i>Post-transplantation sunscreen use</i>	
Never	54 (27.4%)

Demographic characteristic	Count (%) or Mean $\pm$ SD
Seldom	20 (10.2%)
Sometimes	28 (14.2%)
Often	42 (21.3%)
Always	53 (26.9%)
<i>Scale score</i>	<i>2.10 $\pm$ 1.6</i>
<i>Pre-transplantation sun exposure</i>	
Never	7 (3.7%)
Seldom	31 (16.2%)
Sometimes	79 (41.2%)
Often	68 (35.4%)
Always	7 (3.7%)
Avoids sun post-transplantation	117 (59.4%)

Table 2
Bivariate association of patient and care characteristics with post-transplantation sun protective behaviours.

Characteristic	Post-transplantation sunscreen use			Post-transplantation sun avoidance		
	Average Difference in Scale	95% CI	P	OR	95% CI	P
Sex- Male (vs. Female)	-0.9	-1.3 - -0.4	<0.001	2.3	1.3 - 4.2	0.01
Race- White (vs. non-White)	0.8	0.2 - 1.3	0.01	1.3	0.6 - 2.6	0.5
Hair Colour- Red/Blonde (vs. Brown/Black)	0.5	-0.2 - 1.1	0.1	1.3	0.6 - 2.6	0.6
Eye Colour- Blue/Gray/Green (vs. Brown/Hazel)	0.3	-0.2 - 0.8	0.2	2.1	1.1 - 3.9	0.02
Time from transplantation to survey (per year)	0.01	-0.02 - 0.04	0.7	1.0	1.0 - 1.0	0.6
Age at transplantation (per year)	-0.01	-0.02 - 0.01	0.4	1.0	1.0 - 1.0	0.3
Fitzpatrick skin type- Lighter (vs. Darker)	0.4	0.2 - 0.6	<0.001	1.1	0.9 - 1.4	0.3
Pre-transplantation sun exposure- More (vs. Less)	-0.3	-0.8 - 0.1	0.2	4.2	2.2 - 7.7	<0.001
Advised to avoid sun (vs. not)	0.7	0.1 - 1.3	0.1	2.3	1.1 - 5.0	0.03
Pre-transplantation sunscreen use- More (vs. Less)	2.1	1.7 - 2.4	<0.001	2.5	1.4 - 4.6	0.003
Transplant organ type- Thoracic (vs. Abdominal)	-0.2	-1.4 - 0.9	0.7	1.5	0.4 - 6.3	0.6

Table 3

Multivariate models of variables associated with post-transplantation sun protective behaviours.

Characteristics by outcome*			
Post-transplantation sunscreen use	Adjusted Average Difference in Scale	95% CI	P value
Sex (Male)	−0.4	−0.8 – −0.01	0.04
Fitzpatrick Skin Type	0.4	0.1 – 0.6	0.02
Advice to avoid sun	0.5	0.1 – 1.0	0.03
Pre-transplantation sunscreen use	1.8	1.4 – 2.2	<0.001
Post-transplantation sun avoidance	Odds Ratio	95% CI	P value
Pre-transplantation sun exposure	4.6	2.2 – 9.1	<0.001
Advice to avoid sun	2.7	1.2 – 6.5	0.02
Pre-transplantation sunscreen use	2.2	1.1 – 4.4	0.03

Table 4

Adjusted means from multivariate linear regression model for post-transplantation sunscreen use by gender, pre-transplantation sunscreen use, and provider counseling (coefficient with 95% CI).

Sunscreen Use Pre-Transplant		Female		Male	
		Received advice	No advice	Received advice	No advice
Sometime/often/always	Fitzpatrick skin type I or II	3.9 (3.5 – 4.3)	3.4 (2.8 – 3.9)	3.5 (3.0 – 4.0)	3.0 (2.3 – 3.6)
	Fitzpatrick skin type V or VI	3.2 (2.7 – 3.7)	2.7 (2.1 – 3.2)	2.8 (2.3 – 3.2)	2.3 (1.7 – 2.8)
Never/seldom	Fitzpatrick skin type I or II	2.1 (1.6 – 2.5)	1.5 (1.0 – 2.1)	1.7 (1.2 – 2.1)	1.2 (0.5 – 1.8)
	Fitzpatrick skin type V or VI	1.4 (0.9 – 1.8)	0.8 (0.3 – 1.4)	1.0 (0.6 – 1.3)	0.5 (–0.1 – 0.9)

Averages can be extrapolated back to the Likert scale of 0=Never, 1=Seldom, 2=Sometimes, 3=Often, 4=Always.