

## Change in Duration of Sun Exposure 2 Years after Solid Organ Transplantation

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### Abstract

**Background:** Solid-organ transplant recipients (OTRs) have an increased risk of developing nonmelanoma skin cancer.

**Objective:** This study explored the longitudinal history of sun exposure in OTRs from a few months after transplantation to two-three years later.

**Methods:** OTRs, who previously completed a telephone survey in 2007 to 2009 were re-surveyed in summer 2011 about their skin cancer history and habits of sun exposure. The two sets of data were compared to assess change in sun exposure.

**Results:** OTRs were enrolled (baseline) a mean of 8 months (range of 6 to 17.0 months) after transplantation. The interval between enrollment and the follow-up survey was a mean of 14 months (range of 2 to 21.8 months).

Duration of self-reported weekday and weekend exposure increased from a mean of 2.05 hrs at baseline to a mean of 2.52 hours at follow-up. The mean difference in weekday exposure was 0.31 hrs (range -5.25 to 5.05 hrs) (t-test,  $p = 0.02$ , rank sum test,  $p = 0.017$ ) and in weekend exposure was 0.47 hrs (range -5.25 to 0.05) (t-test,  $p = 0.0007$ , rank sum test,  $p = 0.004$ ). Kidney transplant recipients increased the duration of weekday and weekend exposure significantly more than liver transplant recipients. ( $p = 0.05$ ) The number of sunburns experienced at baseline and follow-up remained consistent ( $p = 0.58$ ) with about 13% experiencing 1-5 sunburns each year.

**Conclusion:** OTRs did not limit outdoor sun exposure or experience fewer sunburns in the 14 months after their transplant. Research is needed to ascertain the impact of educational programs on skin protection behaviors.

Squamous cell carcinoma (SCC) occurs 65 to 250 times more frequently in solid organ transplant recipients (OTRs) than in the general population and basal cell carcinoma (BCC) occurs 10 times more frequently in OTRs than in the general population [1,2]. Compared to the general population, SCC also occurs at a younger age in transplant recipients. Multiple skin cancers are more common in OTRs and there is an increased risk of local recurrence, regional and distant metastasis and death. In New Zealand and Australia the risk of metastasis from SCC among transplant recipients is approximately 7% [3]. Although many SCCs of kidney transplant recipients (KTRs) are managed with ambulatory surgical procedures, KTRs can have substantial morbidity; impaired quality of life from disfigurement from the many surgical procedures, and anxiety and fear about the spread or return of the cancer with mortality from skin cancer [4]. The type of organ transplanted and the duration of immunosuppression affect the risk that an OTR will develop skin cancer. Heart and kidney transplant recipients are at a higher risk of developing skin cancer than liver transplant recipients [1].

Previous studies have shown that although OTRs are at a high risk of acquiring nonmelanoma skin cancer (NMSC), they do not make sun protection a priority, especially during recreational sun exposure [5]. Recreational sun exposure or exposure during vacations may play a more important role in OTRs developing skin cancer than in a healthy patient of the same age [6].

The objective of this study was to explore the change in sun exposure and sunburn by OTRs. The hypothesis was that, after their organ transplant, as OTRs begin to feel better and seek to improve their health by going outdoors to exercise, there will be greater opportunities to increase sun exposure and sustain sunburns. In our previous work, it was determined that KTRs began to seek more exercise by walking

outdoors about six months after receiving the transplant [7]. Therefore, this research examined sun exposure behaviors in the first two years after transplantation.

### Methods

#### Population and measures

During the summer months from 2007 to 2009, ten-minute telephone interviews were conducted with OTRs, who received a kidney, liver, or heart transplant at Northwestern Memorial Hospital, Chicago, IL. All those contacted in a series of three telephone calls at two week intervals agreed to participate. They were asked a series of questions about their organ transplant, demographic items, and recent summer sun exposure behaviors, including the number of hours they spent outside per day between 10 AM and 4 PM Monday to Friday (weekday exposure) and on Saturdays and Sundays (weekend exposure) and the number of sunburns sustained in the past twelve months. (Table 1) In previous studies with this population, the correlation between

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**Received** September 05, 2020; **Accepted** October 28, 2020; **Published** November 05, 2020

**Citation:** Hewitt S, Gordon EJ, Clayman ML, Alam M, Yoo S, et al. (2020) Change in Duration of Sun Exposure 2 Years after Solid Organ Transplantation. J Transplant Technol Res 1:105. doi:[10.4172/2161-0991.1000105](https://doi.org/10.4172/2161-0991.1000105)

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self-report of color of untanned skin and Fitzpatrick skin phototype, as determined by a dermatologist (JKR), had high validity ( $\kappa = 0.93$ ) with very fair being equivalent to Skin Type I; fair to II; olive or golden to III; light brown to IV, dark brown to V, and very dark to VI [8].

The 194 OTRs enrolled two to four years previously were then re-surveyed by phone in 2011 and responded to the same questions about their sun exposure behaviors. Eligibility criteria included being over the age of 18, having an organ transplant at Northwestern Memorial Hospital, Chicago, IL, previously enrolled at least six months after their first transplant in or before 2009. Exclusion criteria were deceased at time of recall, no valid telephone number and subjects who were unwilling to participate. The Institutional Review Board of Northwestern University approved the study. Participants gave verbal consent.

## Sun protection education

All OTRs reported receiving a hospital discharge binder. The binder stated that sun protection was important because OTRs were at risk to develop skin cancer. As part of their routine out-patient care, some health care providers (HCPs) reported telling OTRs to use sun protection when the OTR related that they were taking a vacation in a sunny climate.

## Statistical analysis

Descriptive statistics (frequencies, means, medians, standard deviations) were used to characterize the sample. Coding of outdoor hours was converted to number of hours using category midpoints. Change in the ordinal coding of outdoor hours between baseline and follow-up was assessed using a weighted kappa statistic. Change in the

Question	Response
Summer Outdoor Weekday Hours from 10AM to 4PM Monday through Friday	a) 30 min or less b) 31 min to about 1 hr c) more than 1 hr to about 2 hrs d) more than 2 hrs to about 3 hrs e) more than 3 hrs to about 4 hrs f) more than 4 hrs to about 5 hrs g) more than 5 hrs to about 6 hrs
Summer Outdoor Weekend Hours from 10AM to 4PM Saturday and Sunday	a) 30 min or less b) 31 min to about 1 hr c) more than 1 hr to about 2 hrs d) more than 2 hrs to about 3 hrs e) more than 3 hrs to about 4 hrs f) more than 4 hrs to about 5 hrs g) more than 5 hrs to about 6 hrs
Number of sunburns in the past 12 months	a) 0 times b) 1-5 times c) 6-10 times d) 11-15 times e) 16-20 times f) 20+ times
Age	(Years)
Gender	Male Female
Color of untanned skin (self-reported)	a) Very Fair b) Fair c) Olive/Golden d) Light Brown e) Dark Brown f) Very Dark
Ethnicity	a) White b) Black c) Asian, Middle Eastern, Indian, Pacific Islander d) Aleut, Eskimo, Native American
Type of Organ Transplant	a) Kidney b) Pancreas c) Liver d) Heart
Time Since Last Transplant to Baseline	(Months)
Time Since Last Transplant to Follow up	(Months)

**Table 1:** Survey questions.

Characteristic	Number
Age (years)	Mean 47 (range 23-74)
Gender	
Male	91
Female	51
Color of untanned skin	
Very Fair	10 (7%)
Fair	66 (47%)
Olive/golden	27 (19%)
Light Brown	33 (23%)
Dark Brown	6 (4%)
Very Dark	0
Ethnicity	
White	109 (77%)
Black	23 (16%)
Asian	9 (6%)
Native American	1 (1%)
Type of Organ	
Kidney	112 (79%)
Liver	28 (20%)
Heart	2 (1%)
Time since last transplant to baseline (months)	8 (range 6-17)
Time since last transplant to follow up (months)	14 (range 2-21.8)

**Table 2:** Participants Demographic Characteristics (n=142).

	Baseline N= 142	Follow-up N=142	p-value
<b>Number of Summer Outdoor Weekday Hours</b>			
Mean	1.44	1.75	0.020
Standard deviation	1.54	1.71	
Median	0.45	1.50	0.017
Range	0.25 to 5.50	0.25 to 5.50	
<b>Number of Summer Outdoor Weekend Hours</b>			
Mean	2.05	2.52	0.0007
Standard deviation	1.57	1.76	
Median	0.45	2.50	0.0004
Range	0.25 to 5.50	0.25 to 5.50	
<b>Number of Sunburns</b>			
0 times	124 (87.3)	121 (85.2)	0.58
1-5 times	18 (12.7)	19 (13.4)	
6-10 times	0	2 (1.4)	

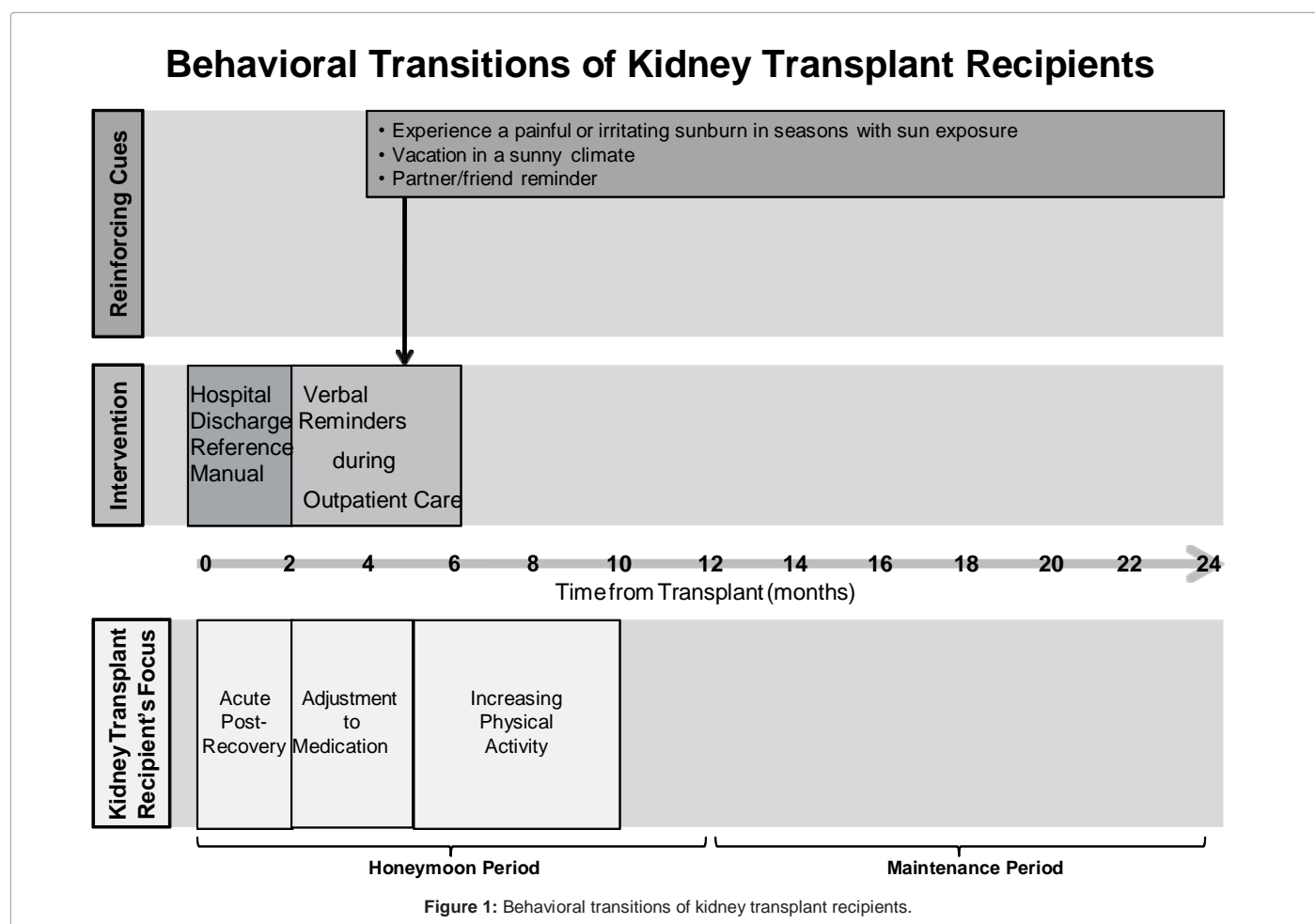
**Table 3:** Sun exposure and Sunburns of Organ Transplant Recipients from 8 to 14 months after transplantation.

number of outdoor hours between baseline and follow-up was analyzed using the paired t-test for mean and the Wilcoxon signed rank test for the median. Number of sunburns was compared between baseline and follow-up using McNemar's test.

## Results

Of the 194 OTRs called from 2007-2009, 156 had valid phone numbers when recalled in 2011. Of the valid phone numbers 142 responded to the questions, 2 declined, and 12 did not answer the telephone calls. The study population consisted of 51 females and 91 males (mean age 47, range 23-74). (Table 2) The time between most recent transplant and the date enrolled in the study (baseline) was a mean of 8 months with a range of 6 to 17.0 months. The time between most recent transplant and the follow-up call was a mean of 14 months with a range of 2 to 21.8 months.

Weighted kappa agreement statistics between the baseline and follow-up classification of outdoor hours was 0.40 (95% confidence interval (CI): 0.29 – 0.50) for weekday hours and 0.36 (95% CI: 0.27 – 0.40) for weekend hours.



Change in the number of outdoor hours is given in Table 3. There was an increase in the duration of self-reported weekday and weekend exposure. The mean difference in weekday exposure was 0.31 hrs (range -5.25 to 5.05 hrs) (t-test,  $p = 0.02$ , signed rank test,  $p = 0.017$ ). The mean difference in weekend exposure was 0.47 hrs (range -5.25 to 5.05) (t-test,  $p = 0.0007$ , rank sum test,  $p = 0.004$ ). Kidney transplant recipients increased the duration of weekend and weekend exposure significantly more than liver transplant recipients (t-test,  $p = 0.05$ ). The number of sunburns experienced at baseline and follow-up remained consistent ( $p = 0.58$ ) with about the same number experiencing 1-5 sunburns each year, and an insignificant increase in those experiencing 6-10 sunburns per year in the period after transplantation.

## Discussion

In this study, OTRs increased the duration of weekday and weekend outdoor exposure and some experienced 1-5 sunburns each year. Overall, this study showed that in the period two to three years after transplant, KTRs increased their exposure more than liver transplant recipients and the number of heart transplant recipients in the study was too small to support comparison. The findings of this study were informed by our prior cognitive interviews with kidney transplant recipients (KTRs) [7]. Readiness to perform new tasks was associated with being confident that the transplanted kidney was going to survive, and not feeling stressed. While assimilating changes and new routines during the first 6 months after transplantation, KTRs were reluctant to learn about cancer [7]. (Figure 1) Between 2 and 12 months after

the procedure, KTRs reported a sense of well-being and improved functional capacity after transplant, and were likely to be open to new health promoting behaviors such as walking outdoors.

Possible reasons for the increased sun exposure and consistency of reports of burning in this study include OTRs' lack of awareness of being at risk to develop skin cancer, lack of counseling about sun protection at the time patients were ready to act on the counseling, OTRs' attitudes about a tanned appearance, and OTRs lack of knowledge about how to use sunscreens and how to interpret sun protection factor. In a previous study, it was found that only twenty-two percent of OTRs were aware of their risk of developing skin cancer [9]. In the current study, all OTRs were given information about the risk of developing skin cancer and the need to practice sun protection as part of the extensive written binder of instructions provided at discharge from the hospital. This information was variably reinforced verbally by HCPs during ambulatory visits. Coping with the extensive medication regimen in the early months after transplantation may make recognition of the risk of developing skin cancer and adoption of sun protection challenging.

Following counseling in the year after transplantation, 67% of KTRs in a single United States tertiary care center used sunscreen regularly when they expected to be in the sun for prolonged periods in comparison with 26% before the transplant [10]. Similar findings were reported by a single Irish tertiary care center [11]. Males are less likely to use sun protective measures, such as sunscreen [1]. Approximately

20% of Canadian KTRs with fair skin were not using sun protection and 23% were intentionally tanning [12]. Intentional tanning by OTRs may have been an expression of their desire to have a healthy appearance [5,9]. Additionally, the “bronzed” hyperpigmentation due to end stage renal failure may fade after transplantation, thus, KTRs may desire to regain their “tanned appearance” [13].

Limitations of the study include the restriction of the follow-up period to 1-2 years after accrual. Since SCC tumors usually arise three to eight years after the use of immunosuppressive therapy, most of the subjects did not have adequate time to develop SCC [14,15]. The subjects with multiple transplantations (n=3) gave a history of skin cancer at entry into this study and none limited their outdoor exposure over the subsequent period. The sample size is too small to permit analysis; however, future research will explore the possible effect of developing an actinic keratosis or SCC on sun exposure and the use of sun protection by OTRs.

Since this research did not include a control group, who would have received no counseling or other forms of information at the time of transplantation, it is not possible to determine if the OTRs’ sun protection education was effective in reducing the amount of sun exposure compared to patients who did not receive such education. Also detailed information about the subjects’ sun protection behaviors was not obtained. However, as the proportion of OTRs responding that they had burned remained consistent, it does not seem that sun protection behaviors changed significantly. In addition, KTRs with skin of color, who comprised 22% of the subjects in this study have limited experience with sunburning. Focus groups of ethnic minorities reported skin irritation or dryness after sun exposure but did not use the term sunburn because their skin did not turn pink or red, [16] thus, the standard question assessing the number of times an individual had a red or painful sunburn may not be relevant for people with skin of color [17]. The self-report of sunburn by OTRs with skin of color may be an underestimate.

In 2006, the National Kidney Foundation determined that sun protection education delivery and content varied among transplantation centers. Clinicians rarely knew when to initiate education about skin cancer risks and prevention including timing and scope, and rarely demonstrated understanding of the importance of reminders for and repeated education of patients [14]. Sun protection counseling is not performed when OTRs are ready to implement the behavior nor is sufficient information provided to implement the behavior, thus, a new approach to sun protection counseling is needed. A repetitive sun protection education program for OTRs that includes formal, well timed skin cancer prevention information and sending reminders to OTRs at the beginning of summer may promote the use of sun protection by OTRs who are at risk to develop skin cancer.

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