Multimodal transplant-clinic-based skin cancer prevention education for organ transplant recipients

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Multimodal Transplant-clinic–based Skin Cancer Prevention Education for Organ Transplant Recipients: Feasibility Study

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Background. We studied the feasibility of transplant-clinic staff routinely providing primary prevention advice to lung transplant recipients at high risk of skin cancer. **Methods.** Patients enrolled by a transplant-clinic study nurse completed baseline questionnaires and received sun-safety brochures. For the 12-mo intervention, transplant physicians were alerted to provide standard sun-protection advice (use of hat, long sleeves, and sunscreen outdoors) by sun-advice prompt cards attached to participants' medical charts at each clinic visit. Patients indicated receiving advice from their physician and from study personnel via an exit-card postclinic, and at final study clinics, they also reported their sun behaviors by questionnaire. Feasibility of the intervention was measured by patients' and clinic staff's study engagement; effectiveness was assessed by calculating odds ratios (ORs) for improved sun protection, using generalized estimating equations. **Results.** Of 151 patients invited, 134 consented (89%), and 106 (79 %) (63% male, median age 56 y, 93% of European descent) completed the study. Odds of receiving sun advice from transplant physicians and study nurses rose after the intervention compared with baseline (ORs, 1.67; 95% confidence interval [CI], 0.96-2.96 and 3.56; 95% CI, 1.38-9.14, respectively). After 12 mo of regular transplant-clinic advice, odds of sunburn decreased (OR, 0.59; 95% CI, 0.13-2.60), and odds of applying sunscreen (OR, 1.93; 95% CI, 1.20-3.09) almost doubled. **Conclusions.** Encouragement of primary prevention of skin cancer among organ transplant recipients by physicians and nurses during routine transplant-clinic visits is feasible and appears to be effective.

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Organ transplant recipients (OTRs) have an increased risk of developing skin cancer because of their long-term immunosuppressive therapy and past exposure to solar UV radiation.[1] Keratinocyte cancers, namely, squamous cell carcinomas and basal cell carcinomas, are common among OTRs of European ancestry after prolonged immunosuppression, with the highest incidence rates seen in OTRs living in sunny climates. For example, kidney transplant recipients living in subtropical or tropical Queensland, Australia, have squamous cell carcinoma incidence rates that are an order of magnitude higher than kidney transplant recipients of similar genetic stock living in the United Kingdom.[2] Thoracic transplant recipients, who receive more intense immunosuppressive therapy than kidney transplant recipients, have even higher skin cancer rates[3,4]—around 24 per 1000 person-years in the United States[5] and as high as 371 per 1000 person-years in lung transplant recipients (LuTRs) in Queensland.[6]

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Primary prevention of skin cancer in high-risk OTRs through encouraging sun protection measures has been shown to be feasible and effective,[7,8] although transferability to the clinic of preventive interventions to date has not been demonstrated. Indeed, despite the acknowledged importance of preventive education to reduce OTRs' skin cancer risk,[7-10] protocols for providing sun protection advice are absent from standard-of-care practice for transplant physicians. Often, it falls to dermatologists in specialist skin clinics (who may see OTRs periodically or not at all depending on local policy and available resources) to promote sun protection behavior in OTRs.[11]

A further problem is that skin cancer prevention advice may be given opportunistically or too late, after the first skin cancers posttransplant have already been diagnosed. In a Queensland survey, only half of kidney or liver recipients with a past history of skin cancer or actinic keratoses regularly used >1 sun protection measure, and 19% did not use any sun protection while outdoors.[12]

We hypothesized that effective universal education about the importance of sun protection habits among OTRs at risk of skin cancer could be delivered in multimodal fashion and regularly by transplant clinicians and clinic staff during OTRs' routine attendance at transplant clinics. One previous study in Chicago, United States, was based on the same premise, namely, that kidney transplant recipients would be more receptive to sun protection information when incorporated into a routine visit to a nephrologist or transplant surgeon than to a dermatologist.[13] This US intervention entailed 2 weekly text or email messages reminding transplant recipients recruited by a letter from their nephrologist about sun protection. Compared with standard care, the intervention resulted in increased knowledge about skin cancer risk and in self-reported sun protection, but the study duration was 6 wk only, with no measure of longer-term behavior change.[13]

In contrast, we aimed to involve transplant-clinic staff directly in encouraging their patients' use of sun protection at each clinic visit, so it became part of routine care. Because we did not know if this novel strategy would be acceptable to clinic staff and to OTRs themselves, we performed a feasibility study whose primary aim was to assess the acceptability of transplant staff regularly providing sun protection advice to OTRs. Given the documented extreme risk of skin cancer in LuTRs in Queensland,[6] we conducted the intervention in the state's lung transplant center with the agreement and assistance of senior clinic physicians and clinic nurses. Our secondary aim was to assess the potential effectiveness of this transplant-clinic intervention by assessing LuTRs' uptake of primary prevention advice, indicated by changes in self-reported frequency of use of sun protection measures during a >12-mo study period.

MATERIALS AND METHODS

Study Population

This was a prospective study of LuTRs treated at the thoracic-transplant outpatient clinic of The Prince Charles Hospital, Brisbane, in compliance with Strengthening the Reporting of Observational Studies in Epidemiology guidelines. Eligible participants were aged 18 y or older and capable of giving consent. A transplant-clinic nurse employed part-time for the feasibility study approached LuTRs attending clinic and invited them to participate in the study with no additional incentives. Participants were enrolled over an accumulated 3-mo recruitment period from February 2020–March 2020 to May 2020–July 2020 (with a recruitment hiatus due to COVID-19 hospital restrictions). Study protocols gained institutional ethics committee approval (LNR/2019/QPCH/56137); written informed consent was obtained from all participants.

Data Collection

Upon enrollment, LuTRs completed a self-administered baseline questionnaire about personal characteristics relevant to skin cancer including demographic factors, skin phototype, transplantation details, past skin cancer, and sun exposure and protection behaviors in the last 12 mo.

Transplant-clinic Intervention

At the outset, the study nurse or project staff member gave each participating LuTR a sun-safety brochure with advice about adopting multiple sun protection measures, namely, regular use of hats, sunscreen, long sleeves, sunglasses, and shade. At subsequent clinic visits for a 12-mo period for each enrolled LuTR, a sun-advice prompt card attached to the front of their medical chart alerted transplant physicians to advise their patients explicitly about their need to use multiple sun protection measures during the consultation. They could further personalize this information depending on patients' history of actinic skin disease. In addition, each LuTR received encouragement of the same sun protection measures by the transplant study nurse or study personnel. Following each clinic visit during the study period, LuTRs were asked to complete a short survey card to report if they had received skin cancer prevention education from their transplant physicians (yes/no) and clinical study staff (yes/no) during that visit. At their final 12-mo study clinic, a brief self-administered questionnaire was used to collect information about sunburns and sun protection behaviors during the previous 12 mo.

Telehealth Intervention

In response to COVID-related clinic restrictions, telehealth consultations replaced regular face-to-face clinics. For study LuTRs who had telehealth consultations, postclinic surveys were conducted by project staff by telephone to ascertain whether sun advice had been delivered by transplant physicians during these consultations (yes/no).

Statistical Analysis

Because this was a feasibility study, no formal sample size calculation was carried out. We aimed to recruit at least 100 LuTRs so that the final enrolled numbers would be sufficiently large to assess feasibility and acceptability of the intervention and to inform sample size calculation for a future definitive intervention study.

Feasibility of the study was measured by recruitment success and LuTRs' participation, with completion of baseline and follow-up questionnaires. Acceptability to LuTRs was measured by asking them about the usefulness of sun protection information received and the proportion of study dropouts. Acceptability to clinic staff was measured by their compliance with the sun-advice protocol as indicated by the proportion of LuTRs who received sun-protection advice from nurses or doctors in the course of the study. We defined the study as feasible if we achieved ≥50% recruitment during the 3 mo

recruitment period and if study LuTRs completed baseline and final questionnaires. We specified that the sun-advice intervention was acceptable if ≥70% participants indicated that the advice was useful, if the dropout rate was <10%, and if ≥50% of participants received sun protection advice from both a doctor and nurse at each visit, including the final 12-mo visit.

Effectiveness of intervention was measured by numbers who reported receiving advice from transplant-clinic nurses and doctors from baseline to study's end and ultimately by changes in self-reported frequency of sunburn and sun protection behaviors. To assess effectiveness, we calculated odds ratios (ORs) and 95% confidence intervals (CIs) using logistic regression models with generalized estimating equations. We used participant identification number as a cluster variable. ORs were adjusted for age and sex. Analyses were performed using SAS version 9.4 (SAS Institute Inc, Cary, NC).

RESULTS

Recruitment and Feasibility

Of 151 LuTRs invited, 134 consented to participate (89% recruitment). Those who declined to take part (median age 52 y, 59% male) were not significantly different in age and sex from those who consented, and the main reasons for declining were lack of time and health status at time of recruitment. The median number of study consultations with exit cards returned per patient was 3 (range, 1–15). By the third study visit, 84% and 62% of patients had received sun protection advice from clinic nurses and transplant physicians, respectively. During the 12-mo follow-up, 106 (79%) of participants completed both questionnaires (median follow-up, 11.5 mo; interquartile range, 1.6–15.9 mo) and were included in the analysis. Of 28 who did not complete full follow-up, 8 died, 1 relocated, and 17 failed to complete a final questionnaire (**Figure S1, SDC**, http://links.lww.com/TXD/A533). Of these 17, 6 (4%) dropped out (2 withdrew, 4 completed only 1 exit card), and 13 were still completing exit cards but did not have a scheduled clinic visit before study closure date for completion of their final questionnaire.

Participant Characteristics

The 106 participating LuTRs were mostly male (67, 63%), of median age of 56 y, predominantly (99, 93%) of British or European descent and with skin prone to sunburn (82, 78%) (Table 1). Median period since transplantation was 3 y (**Table S1, SDC**, http://links.lww.com/TXD/A533). Around half (52, 49%) reported previous skin cancer (36 [60%] of whose first skin cancer occurred posttransplant). Of the 52 who reported previous skin cancers, the majority (30, 58%) had <5. At baseline, 60 (56%) participating LuTRs reported using sunscreen, 80 (75%) wore a hat and 52 (49%) long sleeves most of the time outdoors in summer, and 5 (5%) participants had experienced severe sunburns in the previous 12 mo (Table 1). There were no significant differences in characteristics between those who completed the study and those who did not except that LUTRs who did not complete had a significantly longer duration since transplantation (median 6.5 versus 3 y; $P = 0.017$) (**Table S1, SDC**, http://links.lww.com/TXD/A533).

Acceptability of the Intervention to LuTRs and Transplant-clinic Staff

Of the 106 LuTRs, 81 (76%) reported receiving sun protection advice from the study nurse and 62 (58%) from the transplant physician during their first study clinic attendance after enrollment (Table 2), with 90 (85%) finding the information useful. On their final study clinic visit, 99 (93%) received sun protection advice from the clinical study nurse or study personnel, and 75 (71%) reported they received sun protection advice from the physician in their consultation (and 94 [89%] reported the information useful). With regard to the additional "burden" imposed by the intervention, the transplant practitioners in the study stated that, given the toll from skin cancer, it was a good investment of a few extra minutes at the end of each consultation.

TABLE 1.

Baseline characteristics of 106 lung transplant recipients

Characteristics	n (%)
Age group, y	
<60	66 (62)
≥60	40 (38)
Sex	
Male	67 (63)
Female	39 (37)
Ethnicity[a]	
European/UK ancestry	99 (93)
Non-European ancestry	7 (7)
Natural hair color	
Black/brown	82 (77)
Blonde/red	24 (23)
Skin reaction to sun without sunscreen[a]	
Always burn	82 (78)
Rarely/never burn	21 (20)
Previous skin cancers	
No	54 (51)
Yes	52 (49)
Daily occupational activities	
Mainly indoors	66 (62)
Both indoors and outdoors	38 (36)
Mainly outdoors	2 (2)
Sport and leisure activities	
Mainly indoors	37 (35)
Both indoors and outdoors	57 (54)
Mainly outdoors	10 (9)
Missing	2 (2)
Sunburn that causes pain for 24 h or more in last 12 mo	
No	101 (95)
Yes	5 (5)
Worn long sleeves outside in the sun in summer[a]	
Never	17 (16)
<50% of the time	36 (34)
≥50% of the time	38 (36)
All the time	14 (13)
Worn a hat outside in the sun in summer[a]	
Never	7 (7)
<50% of the time	18 (17)
≥50% of the time	33 (31)
All the time	47 (44)
Applied sunscreen outside in the sun in summer	
Never	15 (14)
<50% of the time	31 (29)
≥50% of the time	33 (31)
All the time	27 (25)

[a]Columns may not add up to the total because of missing values.

TABLE 2.

Sun protection advice received from transplant nurse and transplant physician at final (after 12 mo) study clinic vs first study clinic

	N = 106				
	Final study clinic			OR (95% CL)	
First study clinic	Yes, n (%)	No, n (%)	Total, n (%)	Crude	Adjusted[a]
Received sun advice from nurse					
Yes	76 (72)	5 (5)	81 (76)	3.12 (1.28-7.57)	3.56 (1.38-9.14)
No	23 (22)	2 (2)	25 (24)	1.00 (ref)	1.00 (ref)
Total	99 (93)	7 (7)			
Received sun advice from physician					
Yes	46 (43)	16 (15)	62 (58)	1.67 (0.96-2.91)	1.67 (0.94-2.96)
No	29 (27)	15 (14)	44 (42)	1.00 (ref)	1.00 (ref)
Total	75 (71)	31 (29)			

[a]Adjusted for age and sex.
CL, confidence limits; OR, odds ratio; ref, reference.

TABLE 3.

Self-reported sun protection behaviors by patients at baseline and after 12 mo

	N = 106				
	After intervention		Total, n (%)	OR (95% CL)	
Baseline	Yes, n (%)	No, n (%)		Crude	Adjusted[a]
Had sunburn					
Yes	0 (0)	5 (5)	5 (5)	0.59 (0.13-2.60)	0.59 (0.13-2.62)
No	3 (3)	98 (92)	101 (95)	1.00 (ref)	1.00 (ref)
Total	3 (3)	103 (97)			
	≥50% of the time	<50% of the time			
Worn long sleeves					
≥50% of the time	40 (38)	12 (12)	52 (50)	1.41 (0.92-2.18)	1.46 (0.91-2.32)
<50% of the time	21 (20)	31 (30)	52 (50)	1.00 (ref)	1.00 (ref)
	61 (59)	43 (41)			
	≥50% of the time	<50% of the time			
Worn a hat					
≥50% of the time	74 (71)	6 (6)	80 (77)	1.74 (1.00-3.02)	1.75 (1.01-3.06)
<50% of the time	15 (14)	9 (9)	24 (23)	1.00 (ref)	1.00 (ref)
Total	89 (86)	15 (14)			
	≥50% of the time	<50% of the time			
Applied sunscreen					
≥50% of the time	53 (50)	7 (7)	60 (57)	1.81 (1.19-2.76)	1.93 (1.20-3.09)
<50% of the time	21 (20)	24 (23)	45 (43)	1.00 (ref)	1.00 (ref)
Total	74 (70)	31 (30)			

[a]Adjusted for age and sex.
CL, confidence limits; OR, odds ratio; ref, reference.

Effectiveness of the Intervention

The odds of receiving sun protection advice from a transplant physician at the end of the 12-mo intervention period was significantly higher than the odds of receiving it at the baseline visit (OR, 1.67; 95% CI, 0.96-2.96), whereas the odds of receiving sun protection advice from the clinic study nurse or study personnel increased over threefold (OR, 3.56; 95% CI, 1.38-9.14) during the course of the study (Table 3). During the suspension of in-person clinics due to COVID in the early months of the feasibility study, 17 LuTRs received telehealth consultations with follow-up telephone calls by study staff; 5 (29%) reported receiving sun protection advice from their transplant physician.

After 3 study clinics, LuTRs who had received sun advice from a clinic doctor had a nonsignificantly reduced risk of sunburn (adjusted OR, 0.27; 95% CI, 0.02-3.74). After 12-mo intervention, participants were almost half as likely to experience a severe sunburn in the preceding year (OR, 0.59; 95% CI, 0.13-2.60) compared with baseline (Table 3), although the reduction was not statistically significant. The odds of using at least 2 modes of sun protection when outdoors in the summer had increased significantly by the end of the intervention, with enrolled LuTRs nearly twice as likely to apply sunscreen (OR, 1.93; 95% CI, 1.20-3.09) and wear a hat (OR, 1.75; 95% CI, 1.01-3.06) as at the start of the study, whereas use of long sleeves rose moderately (OR, 1.46; 95% CI, 0.91-2.32) (Table 3).

DISCUSSION

In this novel feasibility study, we found that providing sun protection education to LuTRs for 12 mo as part of their routine transplant-clinic care was highly acceptable to patients: LuTR recruitment was high at 89%, the dropout rate was 4%, and the majority of participants indicated that the sun protection advice was useful to them at baseline (85%) and remained so at the final study visit (89%). The intervention was also acceptable to transplant physicians because their adherence in providing sun protection advice to study LuTRs, as reported by the patients themselves, increased significantly during the course of the study from 58% at baseline clinic to 71% at final study clinic. Secondary evaluation of the effectiveness of the intervention on the patient's sun protective behaviors showed that the odds of using all forms of personal sun protection, namely, hat-wearing, long sleeves, and sunscreen application, significantly improved during the study period. In addition, fewer LuTRs experienced a severe sunburn in the 12-mo intervention period compared with the preceding 12 mo.

A previous randomized, controlled study[8] that aimed to provide text/email sun protection education to OTRs recruited through nephrologists indirectly by mailed invitations (supplemented by follow-up calls for expression of interest by research coordinators) reported much lower participation rates (32%) than the present study. After 6 wk of fortnightly advice by text or email, the intervention group showed improved skin cancer knowledge and attitudes toward sun protection when compared with the standard-of-care group.[8] This short-term improvement is consistent with our demonstration of LuTRs' adoption of greater sun protection, but we further showed that a preventive advice protocol delivered >12 mo by transplant-clinic staff resulted in improved and sustained preventive behaviors with decreased severe sunburn events.

In addition to the longer intervention period and direct advice from LuTRs' own transplant physicians, we believe the multimodal delivery was important: provision of authoritative printed material at the outset provided a foundation on which personal advice and possible discussion about skin

cancer risk could build. Our study focused on LuTRs because of their very high skin cancer risk, but our findings could be generalized to other OTRs who are at risk of skin cancer and require primary prevention advice. Adoption of sun protection practices by OTRs is more likely when they not only have objective knowledge about the raised skin cancer risk of OTRs in general but also identify with the message and perceive the risk as personal and therefore understand their own need to adopt preventive behavior.[14] Indeed, one of the main strengths of our intervention was its focus on primary prevention in transplant clinics as a fundamental means of skin cancer control in OTRs. This strategy therefore complements the necessary early detection and treatment of skin cancers and their precursors in dermatology clinics. Even though this feasibility study was conducted in a subtropical location where skin cancer risk is particularly high, skin cancer is universally high among white-skinned OTRs and thus so is the need for primary prevention interventions. An unavoidable limitation regarding the effectiveness of the intervention was that the main outcomes were patient-reported and therefore subject to error and recall bias.

Our intervention in the transplant clinic required investment to support a nurse and study coordinator to achieve consistent delivery of sun protection advice because transplant-clinic staff are frequently constrained by lack of time. We expect this cost would be more than offset by skin cancer reduction in the long-term, although this would require economic modeling for verification. Even with dedicated nursing staff, collection of postclinic cards from LuTRs to capture advice received was not guaranteed because of the busy and complex nature of outpatient transplant clinics, and exiting study participants may not have been followed up; thus, our results are conservative. There was also an investment of time required by the transplant practitioners in the clinic, but they considered the sun protection advice part of the 5 to 10 min preventive healthcare component added toward the end of consultations. The generalizability of our overall findings to telehealth transplant clinics is uncertain, however, because of the limited number of LuTRs in our study who attended virtual clinics. However, it is notable that despite the brevity of the telehealth study segment early in the study, and the much shorter duration of telehealth consultations, nearly a third of LuTRs reported that their transplant physician reminded them about sun protection.

In conclusion, we assessed the feasibility of providing sun protection education to LuTRs as part of routine transplant-clinic visits to be acceptable to both patients and staff, given extra resources were in place to assist with the delivery of the clinic intervention. Moreover, the advice was welcomed and acted upon by LuTRs in that their sun protection habits significantly improved during the >12-mo intervention period. Our findings suggest that a larger study is warranted to confirm the cost-effectiveness of encouraging primary prevention of skin cancer among OTRs during each transplant-clinic visit.

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