FEATURE ARTICLE

CE 1.5 Contact Hour

Sun Protective Behavior Use in Organ Transplant Recipients

Current Practices in a High-Risk Population

Elizabeth K. Petitt, Nancy P. Wingo

ABSTRACT: Skin cancer is a major public health issue due to the impact of skin-cancer-related disease, death, and costs to the healthcare system. Organ transplant recipients (OTRs) have higher rates of nonmelanoma skin cancer occurrence, recurrence, and metastasis than the general population. Ultraviolet exposure remains the primary risk factor in the development of posttransplant nonmelanoma skin cancer. A review of the current literature to examine the use of sun protective behaviors (SPBs) in OTRs and to investigate factors influencing these behaviors was performed. After careful selection, we chose the 10 most relevant articles addressing the use of SPB in OTRs. Two important practice gaps identified were a lack of efficacious OTR skin cancer prevention education and the lack of SPB use reinforcement in OTRs. Strategies to address these gaps include (a) clinician use of risk stratification to identify those patients at the highest risk of skin cancer development, (b) clinician use of targeted educational tools known to promote behavioral change, and (c) reinforcement of SPB at follow-up appointments. Continued evidence-based analysis is needed to discover if improving the use of SPBs in OTRs can actually decrease their long-term skin cancer rate.

Key words: Sun Protective Behaviors, Sun Protection, Organ Transplant Recipients, Sunscreen Use, Skin Cancer, Skin Cancer Awareness

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Organ transplantation is a life-giving procedure for thousands of individuals afflicted with end-stage organ disease. In 2015, 30,970 individuals were recipients of a solid organ transplant, and more than 100,000 are awaiting transplantation (Organ Donation Statistics, 2016). In addition to an increase in the number of transplants performed annually, transplant life expectancy is also increasing (O'Reilly Zwald & Brown, 2011). In 2011, it was estimated that 170,000 transplant recipients were living in the United States (O'Reilly Zwald & Brown, 2011). According to the most recent statistics, that number has now increased to over 300,000 (Wu, Jiang, DeCaro, & Bordeaux, 2016).

Although organ transplantation itself is a lifesaving procedure, patients must endure lifelong, immunosuppressive antirejection therapy. Complications related to this therapy include malignancy and infection (Acuna et al., 2017). The rate of secondary malignancy in organ transplant recipients (OTRs) has been found to be two to four times greater than that of the general population and has been identified as a leading cause of OTR death (Acuna et al., 2017; Engels et al., 2011). The primary factors influencing the development of malignancy include the type, dose, and duration of immunosuppressive therapy; inhibition of tumor immunosurveillance; and, in some cases, activation of the tumor promoting arms of the immune system (Engels et al., 2011; Hanlon & Colegio, 2014; Kang & Pantel, 2013; Slaney, Rautela, & Parker, 2013). Viral infections such as human papillomavirus have also been implicated in the development of posttransplant malignancy (Engels et al., 2011; Greenberg & Zwald, 2011; Mittal & Colegio, 2017).

Nonmelanoma skin cancers (NMSCs), especially squamous cell carcinoma (SCC) and basal cell carcinoma, are the most common malignancies occurring in organ transplant patients (Chockalingam, Downing, & Tyring, 2015; Hanlon & Colegio, 2014; Rashtak et al., 2014). Ten to 45% of transplant patients will develop an NMSC by 10 years

after transplantation (Wu et al., 2016). According to Ruiz de Luzuriaga and Hsieh (2015), the ratio of SCC to basal cell carcinoma in OTRs is 4:1, which is the opposite of the occurrence in the general population. SCCs and other NMSCs will often act more aggressively in the setting of immunosuppression and can be more likely to occur in patients at a younger age (Ruiz de Luzuriaga & Hsieh, 2015). OTRs also have higher rates (7%–9%) of SCC recurrence and metastasis versus the general population (Trinh, Novice, Lekakh, Means, & Tung, 2014).

The quality of life of OTRs can be significantly impacted by disfigurement as a result of skin cancer surgery, the emotional anxiety of a cancer diagnosis, and fear of tumor recurrence or metastasis (Greenberg & Zwald, 2011; Robinson et al., 2011). Although immunosuppression and viral infections have been clearly identified as contributing to transplant recipient skin cancers, ultraviolet radiation (UVR) exposure remains one of the greatest risk factors (Greenberg & Zwald, 2011; Ismail et al., 2006; Mittal & Colegio, 2017). Rates of transplant NMSCs are often significantly increased in global regions with higher UVR indices, such as Australia (Mittal & Colegio, 2017; Robinson et al., 2011).

Modulation of immunosuppressive therapy and the use of sun protective behaviors (SPBs) to reduce UVR exposure are widely considered essential for skin cancer prevention in patients at a higher risk for skin cancer development (Wu et al., 2016). Seventy-five percent of SCCs in OTRs develop on sun-exposed areas of the body (e.g., head, neck, and dorsal hands; O'Reilly Zwald & Brown, 2011). Studies have shown that the regular use of sunscreen can reduce the number of sun-induced neoplasms (Ulrich et al., 2009). In one study, the consistent use of sunscreen over a 24-month period led to decreased incidence of both actinic keratoses and SCC in kidney transplant recipients (Ulrich et al., 2009). The use of SPBs in OTRs is important, because effective sun protection in this high-risk population may reduce the risk of developing skin cancer (Robinson & Rigel, 2004; Wu et al., 2016). Ultraviolet exposure reduction/avoidance and daily use of sunscreen are recommendations present in all OTR guidelines for skin cancer prevention (Mittal & Colegio, 2017; Ulrich et al., 2009).

PURPOSE OF THE LITERATURE REVIEW

The purpose of this review was to examine use of SPBs in OTRs and to identify factors that influence SPB use through an extensive review of the literature. As mentioned previously, OTRs have high rates of NMSC and are more than 65–100 times more likely to develop cutaneous SCC than immune-competent individuals (Mittal & Colegio, 2017; Skiveren, Mortensen, & Haedersdal, 2010). An awareness of the current level of SPB use by OTRs and identification and understanding of barriers to SPB use are essential to the optimal clinical care of these patients (Guevara et al., 2015). This review will also seek to identify any potential gaps in the current literature related to the care of this high-risk population.

Search Engines and Key Terms

The electronic databases used for searching the literature for this review included PubMed, CINHAL, and Scopus. Key terms utilized to focus the search included "sun protective behaviors," "sun protection," "organ transplant recipients," "transplant patients," "sunscreen use," "skin cancer," and "skin cancer awareness." Key terms were combined using Boolean terms "AND" and "OR."

Inclusion Criteria for Identified Sources

The primary inclusion criteria for articles selected were those addressing (a) SPB use (including use of sunscreen and sun protective clothing) in OTRs, (b) skin cancer awareness in OTRs, and (c) factors influencing SPB use. All OTRs were included, regardless of the type of solid organ transplant. Articles that focused primarily on the pathogenesis of skin cancer in transplant recipients or the general management of immunosuppressive therapy in OTRs were excluded.

Initial Article Yield

The search of PubMed using the key terms "sun protective behaviors and organ transplant recipients," "skin cancer awareness and transplant patients," "sunscreen use in transplant patients," and "skin cancer in transplant patients" yielded 101 articles. The search of CINAHL and Scopus using the same key terms yielded 14 and 30 articles, respectively. The total initial article yield was 145 articles.

Top 10 Sources Identified and Rationale for Use

The initial yield of articles was narrowed to 42 through use of primary inclusion criteria. The articles were further narrowed based on (a) relevance to the review purpose, (b) peer-reviewed journals, and (c) year of publication (within the last 5 years). A decision was later made to include some articles that were greater than 5 years old because of the seminal nature of the data. Use of these criteria resulted in the 10 selected articles (see Figure 1). The key findings of the 10 articles are presented as an evidence table (see Table 1). Most of the articles were cross-sectional surveys and questionnaire-based studies; there was a lack of higher-level evidence studies due to the qualitative nature of the study of behavior.

Synthesis of Evidence

The SPB use of OTRs is a subject that is of major concern to both dermatology and transplant providers. Although a large volume of literature addresses the current level of SPB use in these patients, less literature is available that proposes specific standardized interventions or practice guidelines to improve this use. Synthesis of the article evidence discussing SPB behavior use in OTRs identified three major themes: (a) suboptimal OTR compliance with the use of SPBs, (b) decreased OTR awareness and/or perceived

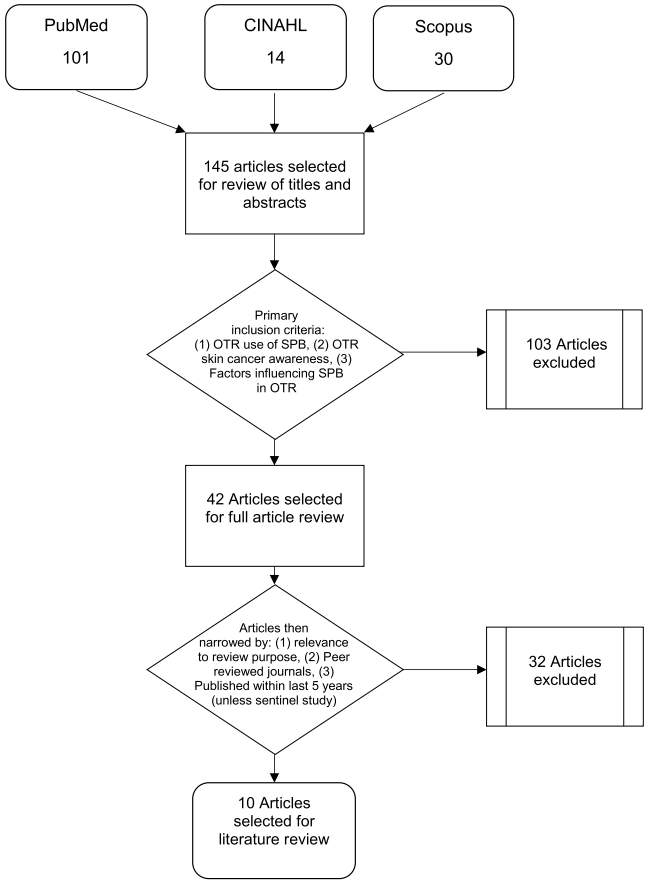

FIGURE 1. Literature review process for article selection from PubMed, CINAHL, and Scopus. OTR = organ transplant recipient; SPB = sun protective behaviors.

risk of skin cancer, and (c) factors influencing OTR use of SPBs are complex and multidimensional.

Transplant patient compliance with SPBs

According to recent cross-sectional studies, only about half of OTRs practice SPBs regularly (Iannacone et al., 2015; Imko-Walczuk et al., 2016). Skiveren et al. (2010) found that, for renal transplant patients, SPB is a low priority. Authors cited a low perceived risk of skin cancer and/or a higher perceived risk of organ rejection as possible reasons for low compliance (Skiveren et al., 2010). A survey comparing OTRs with the general U.S. public found that transplant patients were less likely to use sunscreen and sun protective clothing and practice sun avoidance (Robinson & Rigel, 2004). A 2012 cross-sectional, retrospective study with a similar sample size of OTRs found that patients in the United States who did not use sunscreen before transplantation continued poor compliance with sunscreen use after transplantation (Mihalis et al., 2013). A larger, more recent study of liver transplant patients surveyed in London also reported that only about half of OTRs were using SPBs (Thomas et al., 2013). A cross-sectional, questionnaire-based study in which most patients attended a specialty dermatology clinic for their follow-up visits reported more desirable outcomes in that almost all patients wore protective clothing, used sunscreen, and practiced sun avoidance (Ismail et al., 2006). The findings of most of these studies identified an overall need to increase the compliance of OTRs with SPBs.

Transplant patient awareness and perceived risk of skin cancer

Another prevailing theme of this review is that, overall, OTRs often have a low awareness and/or perceived risk of skin cancer. A recent literature review reports that only about 10% of OTRs are aware of their increased risk for skin cancer (Diao & Lee, 2014). Findings by Thomas et al. (2013) indicate that only a third of liver transplant patients in a posttransplant clinic could recall skin specific counseling before their transplant. Robinson and Rigel (2004) found that, whereas more than half of OTRs could recall receiving education to reduce sun exposure post-transplant, less than half recalled advice stating that they were at an increased risk for skin cancer after transplantation. A cross-sectional study of Polish renal transplant recipients found that, although half of the patients felt that they were in an at-risk group for developing skin cancer, very few could verbalize fully the reason sun protection was needed (Imko-Walczuk et al., 2016). Finally, in a British study of renal transplant patients in which most patients had been followed up by a dermatology clinic posttransplant, almost two thirds of the patients were aware that SPBs were needed because of their increased risk for skin cancer and almost all recalled being given sun protection advice (Ismail et al., 2006).

Interestingly, some studies showed that the theoretical knowledge of risk and skin cancer awareness of OTRs did not correlate with the use of SPBs (Diao & Lee, 2014; Imko-Walczuk et al., 2016). A qualitative study by Skiveren et al. (2010) using the Health Belief Model as a conceptual framework found that, although patients were aware of their increased risk of skin cancer, they generally had a low "perceived severity" of skin cancer risk versus kidney rejection (p. 335). The authors proposed that this perception contributed to nonadherence with SPBs. Another qualitative study of kidney transplant patients by Robinson, Friedewald, and Gordon (2016) showed that patients must perceive skin cancer as a real risk to be motivated to change behavior; the authors found that the use of skin cancer pictures and patient testimonials effectively influenced patients' beliefs that they really were at a personal risk of developing skin cancer. Coupled with information about the benefits of sun protection, the authors also showed these methods were effective in influencing patient belief that using SPBs played a significant role in reducing that risk (Robinson, Friedewald, & Gordon, 2016).

Other factors influencing transplant patient use of SPBs

A review of the literature also revealed factors other than skin cancer awareness and perception of risk that influenced

TABLE 1. Evidence Table

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
Diao & Lee (2014)	Not explicitly identified	Systematic literature review of qualitative and descriptive studies Purpose: examine SPB of four high-risk groups Method: PubMed/ MEDLINE search using key terms for each population. Used English articles	Four cohorts of high-risk populations: 1. Skin cancer survivors 2. Individuals with family history of melanoma 3. Individuals with physical characteristics associated with SCR 4. Organ transplant patients Setting: not specifically identified	- Importance of preventive behavior - Populations at risk - How sun protective beliefs impact behavior	- Health knowledge - Attitudes toward tanning - Health behaviors - Organ transplant - Sun protective beliefs - Primary prevention - Secondary prevention (skin self-examinations)	Synthesis of article findings	- One third of OTRs do not use sunscreen - Only one third of OTRs wear hats and protective clothing regularly - 88% of OTRs not aware of increased SCR - 79% of OTRs believe a tan is attractive - SPBs are practiced more in patients with skin types I–III - Study in Paris: 91% of OTRs had been informed of need for sun protection on at least three occasions but less than two thirds of patients practice SPB	Level of evidence: V Worth to practice: - High-risk populations are not following adequate sun protective measures - Behavior differs as a result of attitudes and beliefs depending on high-risk group - Points out that increased knowledge/ awareness alone may not induce SPB change - Attitude that tan is attractive is a potential barrier to use of SPB Limitation: a specific number of articles reviewed were not reported

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TABLE 1. Evidence Table, Continued

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
Robinson, Friedewald, Desai, & Gordon (2016)	HBM and Precaution Adoption Process Model	Qualitative Purpose: to study effects of increasing the perception of KTRs' personal SCR coupled with benefits of sun protection Methods: cognitive interview sessions after viewing three versions of an interactive Web-based electronic sun protection program (SunProtect) demographics with self-administered questionnaire	*N* = 30 14 women, 16 men White (10), Black (10), Hispanic/ Latino (10) Recruitment stratified by race/ethnicity Setting: Northwestern University Chicago	- Perception of SCR - Belief that sun protective methods could reduce SCR	Interpretation of risk Beliefs regarding sun protective measures Responses to videos	Analyzed for key patterns and themes using principles from interpretive phenomenological analysis	- Pictures and testimonials enhanced personal relevance of skin cancer and its prevention - Coupling presentation of knowledge about benefits of sun protection in reducing SCR with the personal risk of getting the disease was essential to KTRs' believing they could influence their health outcome with SPB - Feelings of vulnerability and perception of risk may vary by gender, race/ethnicity, and having chronic disease	Level of evidence: VI Worth to practice: understanding that patients must perceive skin cancer as a real risk as motivator for behavior change; clinical importance of emphasizing this risk Limitations: may not generalize to other KTR populations

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TABLE 1. Evidence Table, Continued

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
Skiveren et al. (2010)	HBM	Qualitative - Purpose: to identify factors that exert an influence on SPBs of RTRs Method: used a semistructured interview guide (which included social cognitive factors described in HBM); conducted 40- to 65-minute interviews	*N* = 10 RTRs Five women, five men Skin types I–III (*n* = 7) and private homes in Denmark (*n* = 3) Setting: Bispebjerg Hospital, Copenhagen, Denmark	- Attitudes regarding severity of NMSC - Attitudes regarding susceptibility to NMSC - Attitudes toward benefits of SPB - Barriers against SPB - UV exposure during sunny months	- Perceived severity of NMSC - Perceived susceptibility to NMSC - Perceived benefits of SPB - Perceived barriers against SPB - UV intensity was measured during interview period with UV Index scale (0–15)	Template analysis style used to analyze transcripts using predefined concepts from HBM	- Patients were aware of increased SCR - SPB had a low priority - Skin cancer had a low ``perceived severity'' compared with kidney rejection - Negative individual attitudes toward use of hats and sunscreen were a barrier to SPB	Level of evidence: VI Worth to practice: HBM could be used to identify and describe factors influencing decisions and SPB in RTRs Limitations: small sample size
Robinson & Rigel (2004)	None explicitly identified	Cohort study Purpose: to compare SPB and attitudes of OTRs with those of the general public	*N* = 200 OTRs (100 men, 100 women) registered with OTR registry and a random sample of 1,901 U.S. residents	- Opinions regarding appearance of suntans - Likelihood of sunburns	Attitudinal and behavioral measures: - Attitude toward appearance of a tan	Reference is made to whether findings were statistically significant, $p < .05$, but actual methods for analysis were not explicitly identified	- 22% of OTRs thought their SCR was higher than average - 79% of OTRs (vs. 69% of the U.S. public) believed tan was attractive	Level of evidence: IV Worth to practice: identifies that OTR attitude that tanning is attractive or ``healthy'' looking may be a barrier to effective SPB

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TABLE 1. Evidence Table, Continued

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
		Methods: telephone surveys were performed with standardized questions previously used in population surveys for U.S. public and OTRs using opinion survey sponsored by the American Academy of Dermatology	OTRs: - Mean age = 47 years - 83% White, 17% Black 8% skin types I–II 78% skin types III–IV May 2003 14% skin types V–VI Setting: Loyola University Health System	- Sensitivity of skin to sunlight - Belief of SCR	- Use of SPB - Sunburns experienced in the previous summer - Skin type - Perceived SCR Responses to questions measured as percentages		- 81% of OTRs (vs. 64% of the U.S. public) believed people look ''healthier'' with a tan - 35% of OTRs (vs. 40% of the U.S. public) used sunscreen regularly - 21% of OTRs (vs. 29% of the U.S. public) used sun protective clothing 29% of the U.S. public used sun protective clothing - 20% of OTRs (vs. 38% of the U.S. public) practice sun avoidance - 35% of OTRs reported sunburning; this number was similar to that of the U.S. public	OTRs' perception of SCR was very low; need to increase awareness of SCR

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TABLE 1. Evidence Table, Continued

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
Iannacone et al. (2015)	Not explicitly identified	Descriptive cross-sectional study - Purpose: to document the prevalence of sun protection and associated factors in OTRs Method: Patients were given a self-administered questionnaire about frequency of three SPMs	*N* = 446 Liver and kidney transplant patients enrolled in Skin Tumors in Allograft Recipients (STAR) Study from November 21012 to June 2014 Setting: Queensland, Australia Immunosuppressed × at least 1 year	- Skin color - Tendency to burn - Frequency of skin checks - Recreational sun exposure - Occupational sun exposure - Time since transplant - Age - Gender	Number of sun protective measures used: 0, 1, or multiple Measures included hats, long sleeves, and sunscreen Frequency of each SPM was recategorized into ''<50% of the time'' and ''>50% of the time'' Prevalence of multiple SPMs outdoors	Performed using SAS (Version 9.2; SAS Institute) Adjusted prevalence ratios (PRs) and 95% confidence intervals (CIs) were estimated using Poisson regression models - 52% regularly practiced multiple SPMs - 19% did not practice multiple SPMs - Sunburn-prone skin (PR = 1.43, 95% CI (1.06, 1.93)) and frequent whole-body skin examinations (PR = 1.48, 95% CI (1.19, 1.84)) were significantly associated with regular use of SPMs - Length of time since transplant did not show difference in behaviors	When outdoors: - 66% wore hats - 49% wore sunscreen	Level of evidence: VI Worth to practice: - Identifies potential that improved use of SPMs by OTRs may be influenced by recommending/ encouraging frequent skin examinations Illustrates need for improved SPMs with OTRs

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TABLE 1. Evidence Table, Continued

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
Imko-Walczuk et al. (2016)	None explicitly identified	Qualitative study Purpose: to assess the awareness of SCR as well as a possible correlation between theoretical knowledge of the risk and practical application of SPB Methods: patients divided into three groups (A, B, and C) based on their level of knowledge and awareness answered questionnaire about SPB	*N* = 182 83 women, 99 men Average age = 49.7 years Average time between transplantation and study = 6.3 years Conducted from December 2008 to June 2011 Setting: Poland Excluded: history of skin cancer - Education received before or after transplantation	- Level of awareness of risk - Education received - Sunscreen use - Sun avoidance - Use of protective clothing - Outdoor hobbies Responses then expressed as percentages per group and as a whole cohort	A = fully explain risk B = partly explain risk C = Did not know or could not explain risk Survey question answers: Never Sometimes Usually Daily Yes No	Fisher exact test to find the correlation between awareness in patients and application of the right preventative methods Level of statistical significance, $p < .01$	- Only 51% felt they had increased SCR - Only 11.5% of RTRs could fully explain reason sun protection is needed - However, skin cancer awareness did not correlate to use of different forms of SPBs - 53.9% of RTRs never applied any sunscreen - 36.2% thought they were more attractive with a tan	Level of evidence: VI Worth to practice: - Awareness of being in a group of increased SCR is still poor among RTRs - However, skin cancer awareness did not correlate to use of different forms of SPBs - Shows need for active education of SCR
Ismail et al. (2006)	None explicitly identified	Descriptive, cross-sectional questionnaire-based study Purpose: whether routine consultation with specialist OTR derm clinic improves understanding of SCR and compliance with SPBs	*N* = 399 *N* = 292 respondents 167 men, 125 women 89% of patients had attended the specialty dermatology clinic	- Photoprotective practices - SCR awareness	- When and where, if ever photoprotection information given - Current SPMs (sun screen, sun avoidance, use of protective clothing)	- Fisher's exact test and unpaired Student's *t* test used to compare response portions and means -1-*df* χ^2 test for linear trend	- 96% recall photoprotection advice - 92% report sunscreen use - 88% wear protective clothing - 96% use sun avoidance - 68% were aware of increased SCR as a reason for sun protection need	Level of evidence: VI Worth to practice: Skin cancer messaging and compliance with sun protective measures may be improved by providing education in dermatologic settings

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TABLE 1. Evidence Table, Continued

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
		Methods: questionnaire mailed to 399 white-skinned patients in renal transplant clinic	August 2004 to April 2005 Setting: London Excluded: skin types V–VI		- Understanding of why photoprotection is needed	- All *p* values obtained using two-sided tests of statistical significance		Per authors' percentages in this study much higher than eight previous studies
Thomas et al. (2013)	None explicitly identified	Qualitative study Purpose: assess un protection and skin cancer education given to liver transplant patients and whether they were adherent to the advice Assessment of skin conditions/skin cancer developed since transplant Methods: patient surveys	*N* = 607 offered surveys, 349 responded Subset of *n* = 280 patients reported their sun protection use Mean age = 51.1 years Average time since transplant = 7.1 years November 2011 to January 2012 Setting: Kings College Hospital London posttransplant clinic	- Provision of SCR education - Provision of advice regarding sun exposure - Sun protective measures: sunscreen use, hats/clothing use - Skin type - Skin conditions developed after transplantation		For quantitative data: Fisher exact test and χ^2 test for 2 × 2 contingency square. McNemar test for paired proportions	- Only 37.2% recalled education provided before transplantation - 65.6% of patients remembered caution to reduce sun exposure - 47.9% recalled advice on their risk of developing skin cancer after transplant - 78% of patients used mechanical sun protection - 66% used sun screen - 17 patients developed NMSC since transplant	Worth to practice: Level of evidence: VI - Iterates need for ongoing education of LTR during follow-ups - Identifies need to improve LTR knowledge of SCR - Timing of education may affect retention of knowledge

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TABLE 1. Evidence Table, Continued

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
Mihalis et al. (2013)	Not explicitly identified	Descriptive, cross-sectional, retrospective survey Purpose: to identify patient and healthcare factors associated with SPBs in OTR with a goal of increasing sunscreen use Methods: standardized questionnaire that gathered demographic information, frequency of sunscreen use, and sun exposure before and after transplant	*N* = 198 107 men, 91 women Mean age at transplantation = 44 years Mean time since transplantation = 13.4 years Between 2004 and 2008 Setting: national sample, United States Excluded: patients with a prior diagnosis of skin cancer	DV: increase in sunscreen use, frequency of posttransplantation sunscreen use, posttransplantation sun avoidance IV: gender, race, hair color, time since transplantation, age at transplantation, Fitzpatrick's skin type, pretransplant sun exposure, receiving advice to avoid sun, pretransplant	Outcome measures: sunscreen use and sun avoidance before and after transplantation; Likert scales ranging from never to always were converted to a numerical scale of 0–4. IVs with $p < .3$ on bivariate regression were included in the initial multivariate models	- Used multivariate linear regression - Descriptive statistics used to summarize characteristics of study population - A paired samples *t* test used to compare the increase in frequency of sunscreen use - Sunscreen use increased after transplantation	- Sunscreen use and organ transplant type - Factors associated with posttransplantation sunscreen use = pretransplant - Factors associated with posttransplantation sun avoidance: gender, skin type, healthcare provider counseling to avoid sun, pretransplant sunscreen use - Factors associated with posttransplantation sunscreen use: pretransplant sun exposure, advice to avoid sun, and pretransplantation sunscreen use	Level of evidence: VI Worth to practice: Help identify patients most in need of intervention (opportunity for targeted/extended clinical intervention/ counseling)

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TABLE 1. Evidence Table, Continued

Author(s; Year)	Conceptual Framework	Design and Methods	Sample and Setting	Major Variables Studied and Definitions	Measurement	Data Analysis	Findings	Level of Evidence and Appraisal: Worth to Practice
Donovan, Rosen, & Shaw (2004)	None explicitly identified	Qualitative study Purpose: to evaluate SPBs of transplant patients Methods: questionnaires given to patients attending dermatology clinic visit within multiorgan transplant program	*N* = 205 139 men, 66 women Mean age = 50.6 years 33.7% Skin types I–II Lung, liver, heart, and pancreas 3.4% had history of prior skin cancer September 2002 and December 2003 Setting: University of Toronto, Canada	A. Sun exposure behaviors B. Sunscreen knowledge and use C. Sun protection practices	A. Current, childhood, occupational sun exposure B. When applied and understanding of SPF C. Use of hats, clothing, and sunglasses	- Standard parametric and nonparametric techniques - Univariate analyses with chi-square tests - Level of significance set at $p = .05$ - Most patients used sun protective clothing - Patients with lighter skin more likely to use sunscreen	- 65% of patients older than the age of 50 years use sunscreen vs. 88% under the age of 50 years; men less likely than women to use sunscreen - 62% of OTRs were familiar with SPF - 23.3% admit to intentional tanning - Significant age-dependent differences in SPBs	Level of evidence: VI Worth to practice: May identify patient groups in need of additional education regarding SPB risk stratification

Note. DV = dependent variable; HBM = Health Belief Model; IV = independent variable; KTR(s) = kidney transplant recipient(s); LTR = liver transplant recipient; NMSC = nonmelanoma skin cancer; OTRs = organ transplant recipients; RTRs = renal transplant recipients; SCR = skin cancer risk; SPBs = sun protective behaviors; SPM(s) = sun protection measure(s); UV = ultraviolet.

OTR use of SPBs. Some of these factors included age, gender, skin type, attitudes toward tanning, frequency and setting of skin examinations, and type of sun protection education (Diao & Lee, 2014; Iannacone et al., 2015, Mihalis et al., 2013). Donovan et al. (2004) found that, although older patients were more likely to wear sun protective clothing and practice sun avoidance, they were less likely than younger patients to use sunscreen. They reported very little difference in use of sun protective clothing by gender. Conversely, Robinson, Friedewald, and Gordon (2016) identified that gender may play a role in "feelings of vulnerability" (p. 157) and perception of skin cancer risk. It has also been shown that lighter-skinned patients were more likely to use sunscreen (Donovan et al., 2004, Iannacone et al., 2015). Healthcare provider sun avoidance counseling and frequent whole-body skin examinations were significantly associated with posttransplant use of sunscreen and sun avoidance (Iannacone et al., 2015; Mihalis et al., 2013).

Several studies in the literature have found that patient attitudes toward tanning are a barrier to the practice of SPBs (Diao & Lee, 2014). A study of patients in a multiorgan transplant clinic found that some patients even admitted to intentional tanning (Donovan et al., 2004). This attitude toward tanning was supported in a survey of OTRs who reported that they felt people both "looked better" and "looked healthier" with a tan (Robinson & Rigel, 2004, p. 613). Negative attitudes toward use of sun protective measures, including sunscreen and sun protective clothing, have also been cited as barriers to the use of SPBs (Skiveren et al., 2010). Awareness of these barriers would allow clinicians to focus the scope of their educational and interventional efforts to enhance patient outcomes (Robinson, Friedewald, Desai, & Gordon, 2016; Trinh et al., 2014).

PRACTICE GAPS IN THE LITERATURE

The selected articles showed an overall lack of adherence with SPBs, a lack of OTR skin cancer awareness, and the multifactorial nature of influences affecting OTR use of SPBs. The findings of the literature review clearly indicate that OTRs need improved knowledge of skin cancer risk and increased compliance with SPBs (Ruiz de Luzuriaga & Hsieh, 2015).

DISCUSSION

Review of the literature confirms that organ transplant patients frequently exhibit risk-taking behavior in regard to sun exposure (Ruiz de Luzuriaga & Hsieh, 2015). The findings of the literature review also indicate that OTRs need improved skin cancer knowledge and awareness, and compliance with SPBs (Ruiz de Luzuriaga & Hsieh, 2015). Findings suggest an overall lack of clinician ability to consistently and effectively educate and promote behavior change in this patient population (Wu et al., 2016). Proposed strategies to aid clinicians in improving patient knowledge and SPB compliance include (a) improved use of educational tools aimed at behavioral change, (b) identification of OTRs at the highest risk for skin cancer, and (c) implementation of frequent follow-ups based on risk stratification.

Transplant Patient Education and Timing

Patient education specifically aimed at promoting behavior change could increase OTR compliance with SPBs. Traditionally, patient educational materials have consisted of pamphlets and/or written handouts in addition to verbal counseling. A number of studies investigating the efficacy of sun protection education in OTRs showed that less traditional, more visual patient education interventions/tools were able to improve the use of SPBs (Guevara et al., 2015; Robinson, Friedewald, Desai, et al., 2016; Wu et al., 2016). Effective educational interventions/tools identified in these studies included the use of skin cancer photographs, a mobile medical app, videos, and a culturally sensitive workbook (Robinson et al., 2011, 2014; Robinson, Friedewald, Desai, et al., 2016; Trinh et al., 2014). Video-based educational materials are increasingly being investigated as more effective educational tools than traditional written materials because of the portability and the ease of use of devices used for viewing (Trinh et al., 2014). People are increasingly comfortable with technology and are becoming more accustomed to receiving information in this more visually enticing format.

During a routine follow-up visit, one group of OTRs were shown a brief, 2-minute educational video discussing skin cancer facts and risks, and another group was given a traditional skin cancer educational pamphlet; the OTRs in the video group showed a significant improvement in overall skin cancer knowledge (Trinh et al., 2014). Patients in this study showed not only improved knowledge but also higher satisfaction and an increased likelihood of using the educational materials and SPBs. A mobile educational medical app, SunProtect, developed by Robinson, Friedewald, Desai, et al. (2016a) was administered to OTRs via computer tablets in offices when patients were 2–24 months posttransplant. Participants were then sent text message reminders every 2 weeks for 6 weeks. The theoretical foundation of the authors' study was the Theory of Reasoned Action and Planned Behavior (Robinson, Friedewald, Desai, et al., 2016). At the completion of the study, patients who received the mobile app intervention showed increased knowledge of skin cancer risk, use of SPBs, and acknowledgement that SPBs can reduce skin cancer risk (Robinson, Friedewald, Desai, et al., 2016). The increased accessibility to mobile devices in today's society creates an excellent opportunity to keep connected with patients and provided them ongoing education and SPB prompts.

Attention to the timing of this education can ensure that patients are receptive to the information and able to process it accordingly. Education provided at times when patients are not receptive could be less likely to induce

behavioral change. Posttransplant education often occurs in the immediate postoperative period, a time during which most OTRs are focused on recuperation and concerned about organ rejection (Robinson et al., 2014). One study showed that, immediately postoperatively, transplant patients tend to disregard risks associated with long-term immunosuppression (Imko-Walczuk et al., 2016). Similarly, OTRs often do not recall postoperative skin cancer risk counseling or dismiss it because of their more immediate perceived risk of organ rejection (Robinson et al., 2014). Robinson et al. (2014) proposed that the most effective window for sun protection behavior education is before the first summer after transplantation, because OTRs might perceive SPBs as more relevant at that time than at initial follow-ups soon after transplantation. Previous studies by Robinson et al. (2011) identified 1-year posttransplant as an effective time for education regarding skin cancer risk and SPB benefits.

Transplant Patient Perception of Skin Cancer Risk

As mentioned previously, patients must view skin cancer as a viable personal risk to effect behavior change (Robinson, Friedewald, & Gordon, 2016). Many patients may have an understanding of the potential risk of an event or adverse outcome, but that does not necessarily translate to the perception that it will happen to them personally. This concept of perceived risk is a major cornerstone in health behavior theories such as the Health Belief Model and the Precaution Adoption Process Model (Robinson, Friedewald, & Gordon, 2016). Guevara et al. (2015) showed that kidney transplant recipients who were shown photographs of skin cancers on individuals with similar skin types illustrated a progression from skin cancer knowledge to actual perceived risk of developing skin cancer. This was evidenced by findings of a "heightened sense of vulnerability to the consequences of unprotected sun exposure," which serves as a cue to action (Guevara et al., 2015, p. 189).

Forty percent of transplants occur in patients with skin of color (African Americans, Asians, Hispanic/Latinos, Native Americans, and Pacific Islanders), and although OTRs with skin of color do not represent the population at the highest risk for developing skin cancer, they are more likely to disregard sun protective counseling and skin cancer education (Robinson et al., 2014). This perception is often further perpetuated by the use of sun protection educational materials that do not portray skin cancer in people of color. In a study by Robinson et al. (2014), patients receiving culturally sensitive educational intervention showed a significant increase in knowledge about skin cancer, acknowledgement of personal risk of skin cancer development, and willingness to change SPBs.

Skin Cancer Risk Stratification in Transplant Patients

Identification and/or stratification of patients at the highest risk for developing skin cancers is another strategy that can assist clinicians in targeting their educational efforts for increased efficacy. Current OTR management guidelines recommend full-body dermatologic skin screening of patients before transplantation (Chockalingam et al., 2015). This practice could serve as an important opportunity for risk stratification as a first step in recognizing those high-risk patients in need of potential modulation of their immunosuppressive therapy as well as recommendations for increased frequency of follow-ups after transplant. The development and implementation of standardized, scored risk assessment tools could also help guide clinician educational efforts. A score known as "total sun burden" has been used to quantify the effects of OTR exposure to UVR to predict patient risk of developing NMSC (Terhorst, Drecoll, Stockfleth, & Ulrich, 2009, p. 88). Data used in the score included skin type, latitude of main residence of patient, and a parameter to assess total occupational and leisure UVR, such as UVR exposure during vacations (Terhorst et al., 2009). The authors then used the total sun burden score to sum the points across four periods of the patient's life (<20, 20–40, 41–60, and >60), furthering evidence that the amount of UVR is a primary risk factor for OTR development of NMSC (Terhorst et al., 2009, p. 88).

Recognition of the characteristics of high-risk patients is essential for clinicians. OTRs with Fitzpatrick's skin types I–III are well known to have an increased risk of developing NMSC (Greenberg & Zwald, 2011). Statistics show that 70% of fair-skinned transplant recipients will be affected by skin cancer within 20 years of transplantation (Baldwin & Au, 2016). In a cohort of transplant patients at a skin cancer screening clinic in Canada, patients were stratified by detailed history and skin examination and White men were identified to be the most at-risk group (Baldwin & Au, 2016). Other risk factors include (a) past exposure to UVR; (b) increased age at transplantation; (c) duration, degree, and type of immunosuppression; (d) type of organ transplant or previous organ transplant; (e) personal history of actinic keratosis, NMSC, or melanoma; and (f) human papillomavirus infection (Greenberg & Zwald, 2011). As previously discussed, many OTRs have negative attitudes toward SPBs and a favorable attitude toward tanning. Identification of these individuals is important, as their attitude puts them at an increased risk for noncompliance with SPB use.

Adherence to Recommended Follow-Up Visits

Another strategy to improve OTR compliance with SPBs is to encourage patients to adhere to recommended follow-up intervals. Greenberg and Zwald (2011) reported that it is paramount that dermatology providers use frequent follow-ups to provide repetitious and effective education regarding skin cancer risk and SPB use. Analysis of the literature on preventative education for alcohol and tobacco cessation supports that although effects of primary interventions on behavior are reduced after 48 months, brief

multicontact intervention with patients showed stronger evidence of maintaining behavior change for several years (Wu et al., 2016). Studies have shown that patients attending specialty dermatology clinics for follow-up regularly showed significantly increased recall of photoprotection advice and increased compliance with SPBs (Greenberg & Zwald, 2011; Ismail et al., 2006). Further research is needed to ascertain if the strong association between consistent use of SPBs and frequent visits to monitor for skin cancer is related to individual OTRs motivation to protect themselves from skin cancer or if frequent follow-ups by clinicians encourage optimal SPBs (Iannacone et al., 2015).

Recommendations for follow-up intervals for dermatologic examination and management of OTRs are based on patient history and risk stratification. Intervals range from annual follow-up for low-risk individuals with no history of NMSC to monthly visits for patients with a history of metastatic SCC (Bangash & Colegio, 2012; see Figure 2). Follow-up intervals for patients with melanoma range from 1 to 3 months depending on length of time since diagnosis (Bangash & Colegio, 2012). As previously stated, prevention should be emphasized at every follow-up visit and should include education about skin cancer risk, use of sunscreen and sun protective clothing, ultraviolet exposure avoidance, and skin self-examination (Bangash & Colegio, 2012).

CONCLUSION

Management of NMSC is an important clinical consideration for all dermatology providers caring for OTRs. Although it is well known that OTRs have an increased rate of NMSC, there continues to be a lack of effective patient education, use of skin cancer risk stratification, and adherence to recommended follow-up appointments within this high-risk population (Bangash & Colegio, 2012). Variability in skin cancer screening guidelines and protocols for OTRs also presents a challenge in managing OTRs (Acuna et al., 2017; Mittal & Colegio, 2017). A multidisciplinary clinical approach with a focus on SPBs is the optimal model for management of NMSC in OTRs (Acuna et al., 2017). Clinicians caring for OTRs need to provide frequent and efficacious patient educational interventions to promote long-lasting, positive behavior change (Guevara et al., 2015; Robinson, Friedewald, & Gordon, 2016). Frequent communication between dermatology and transplant providers regarding type and incidence of skin cancer occurrence in OTRs is also essential for successful management and improved outcomes (Bangash & Colegio, 2012; Colegio & Billingsley, 2011). Although some promising studies show that effective skin cancer prevention education can improve SPB use in OTRs, little evidence addressing the effect of SPB use on skin cancer rates is available (Guevara et al., 2015; Robinson,

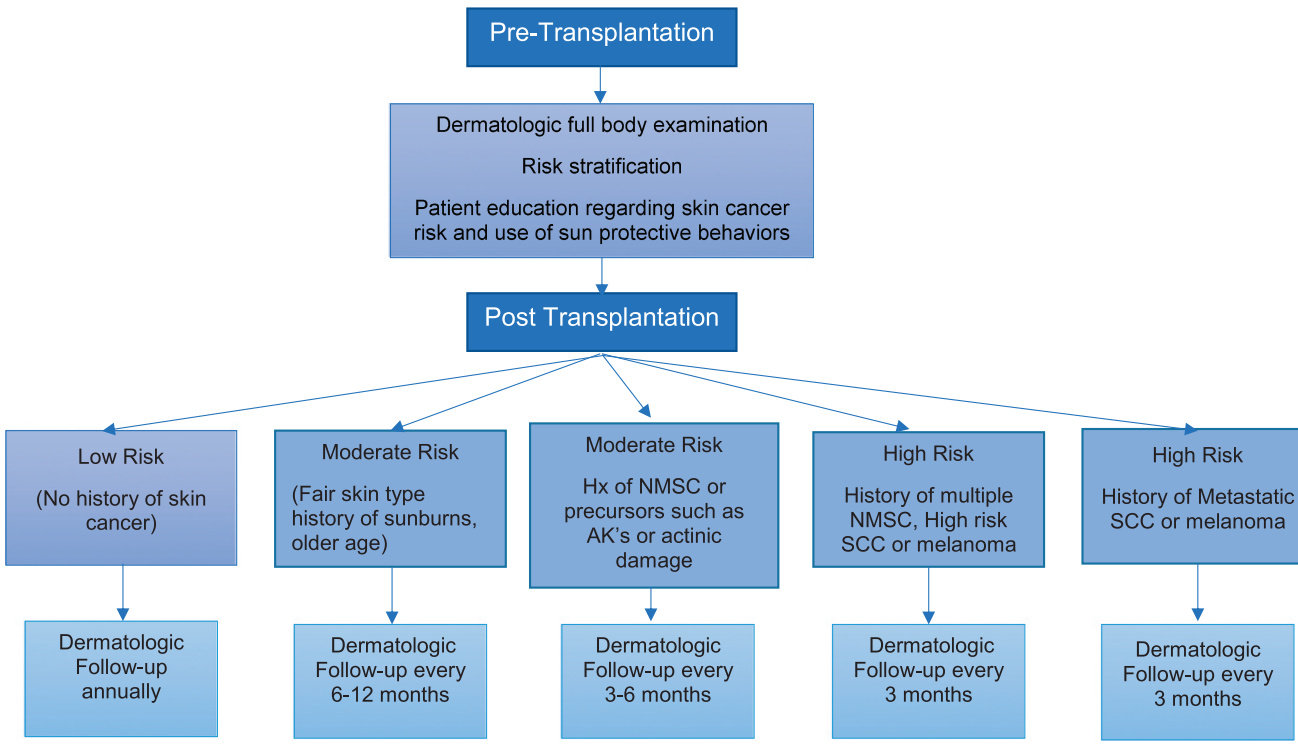

FIGURE 2. Dermatologic evaluation and management of OTRs. AK = actinic keratosis; NMSC = nonmelanoma skin cancer; SCC = squamous cell carcinoma. Adapted from ``Management of Non-Melanoma Skin Cancer in Immunocompromised Solid Organ Transplant Recipients,'' by H. K. Bangash and O. R. Colegio, 2012, *Current Treatment Options in Oncology, 13,* p.357. Copyright by Springer Science+Business Media.

Friedewald, & Gordon, 2016). Because of the significant personal and societal impact of skin cancer mortality and morbidity on OTRs, future clinical practice guidelines focusing on patient education and posttransplant surveillance need to be evidence based. ■

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