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INVESTIGATIVE REPORT

# Face-to-face Sun Protection Training and Text Messages Improve Sun Protection Behaviour in Adolescent Organ Transplant Recipients: HIPPOlino Feasibility Study

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**Adolescent organ transplant recipients have an increased risk of developing skin cancer. The aim of this study was to evaluate the technical feasibility and acceptability of short messaging service-based sun protection recommendations for adolescent patients. Sun-protective knowledge and behaviour were also evaluated using standardized questionnaires and telephone interviews. Twenty-six organ transplant recipients aged 13–22 years participated in face-to-face sun protection training. Subsequently, participants received sun protection reminders via text messages for 4 weeks. Of the participants 95% reported that they checked text messages on a regular basis. Of the 26 organ transplant recipients 19 completed questionnaires before sun protection training and 4 weeks later; 16% (3/19) knew the meaning of the UV-index before training. After training, 74% (14/19) remembered that the term UV-index describes the maximum daily level of local UV radiation. Text message-based sun protection recommendations are well accepted and technically feasible in adolescent organ transplant recipients.** ***Key words: skin cancer; organ transplant recipients; adolescent; sun protection training; text messages.***

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Organ transplant recipients (OTR) have an increased risk of developing skin cancer (1). Ultraviolet radiation (UVR) is the main aetiological factor in the development of skin cancer, but immunosuppressive therapy increases the risk of non-melanoma skin cancer (NMSC) such as squamous cell carcinomas in OTR to 65 times that of the general population (2–4). Basal cell carcinomas or malignant melanomas also develop more frequently under immunosuppression (3, 5). The cumulative incidence of NMSC increases from 4% within the first 4 years after transplantation to 45% 30 years after transplantation (6).

Medical immunosuppression and exposure to UVR are important risk factors for the development and progression of NMSC in OTR (7). Hence, reduction of immunosuppression and limitation of both cumulative and acute intermittent UVR exposure are the main goals of long-term skin cancer prevention. A reduction in UVR can be achieved by increasing risk consciousness (i.e. increase in knowledge) and also by behavioural modification (8). However, several factors may undermine the objective of an improved ultraviolet (UV) protection behaviour. On the one hand, OTR are mostly aware of the dangers of UVR (8). On the other hand, only 35–51% of OTR reported regular sunscreen use (8, 9) and the majority (79%) believed that the appearance of a tan is attractive (9). "Hassle" and "lack of time" appear to be the most common barriers that discourage OTR from practicing sun protection behaviour (10, 11).

Face-to-face interactions between physicians and patients could be a promising approach to implement positive photoprotective behaviour, even over a prolonged period of time (12). Short message services (SMS) have already been used successfully to strengthen health-promoting behaviour, e.g. in people with diabetes mellitus, asthma, and HIV (13–16). We therefore sought to combine face-to-face sun protection training with the advantages of text message reminders as a low-cost and effective method to remind patients to enact sun protective behaviour in daily life. The present feasibility study aimed to assess its acceptability in adolescent OTR.

## METHODS

### *Objectives and research issues*

The primary objective of this study was to evaluate the acceptance and technical feasibility of SMS-based sun protection recommendations for adolescent OTR, following face-to-face sun protection training. In addition, the effects of both training and SMS reminders on sun protective knowledge and behaviour were evaluated.

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*Study population*

OTR had to provide written consent (or the consent of parents/legal guardians if < 18 years of age), have access to a mobile phone with text message features, and demonstrate the ability to retrieve text messages.

The study population consisted of volunteers from 2 1-week summer camps for young OTR conducted in Iselsberg-Stronach/Austria and in Überlingen/Germany in 2011 (Table SI[1]). Participants did not receive a stipend. The study was approved by the ethics review board of the University of Bremen.

All OTR participated in a 5-h dermatological sun protection training called HIPPOlino (the German mnemonic for a skin cancer intervention and prevention programme for OTR). A dermatologist (MMS) performed the training and examined all study participants for skin and mucosal disorders. Furthermore, theory-based topics were addressed, such as classification of skin types according to Fitzpatrick phototyping scale (determined by a dermatologist) (17), UVR, UV-index (UVI), sunscreen use, textile photoprotection, skin self-examinations (SSE) for areas of concern, evaluation of melanocytic skin lesions applying the mnemonic ABCDE (i.e. asymmetry, borders, colour, diameter, evolution). The newly acquired knowledge was intensified through practical exercises. In order to simplify UVI counselling for children, the so-called "sun protection traffic light" for daily text messaging was developed. The colours green, yellow and red represent different ranges of UVI (18) (Table SII[1]).

After the training, sun protection recommendations were sent on a daily basis for 4 weeks from July until September 2011. The content of these reminders was based on participant's local UVI. The respective UVI was delivered by the German Meteorological Service (19). The daily text messages consisted of 2 components: the first part started with the individual UVI traffic light and summarized the local weather forecast at 10.00 h as "rainy", "sunny", and "cloudy". The second part of the message contained a "prompt" behavioural message including suggestions for sun-safe clothing and wearing sunglasses (Table SII[1]). If the place of residence was located between 2 different UVI zones, the higher value was used.

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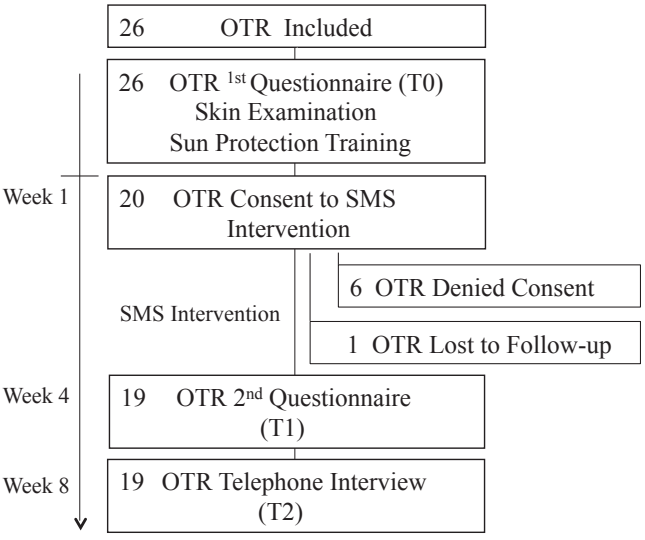


*Fig. 1.* Participants' progress throughout the study process. Duration of short message service (SMS) intervention: 4 weeks (on a daily basis). OTR: organ transplant recipients.

The feasibility study was evaluated using 2 different instruments. Eight weeks after initiation of the SMS intervention, a standardized telephone survey (T2, Fig. 1) was conducted on topics such as functionality of SMS delivery (e.g. "Did you receive the sun protection message on a daily basis?"), and sun protection behaviour during the intervention period (e.g. "How did you act on a sunny day with a high UV-index?"). In addition, the participants' demographic data as well as their sun protection knowledge (e.g. ABCDE-rule and the UVI) and behaviour (e.g. "What can you do to avoid sunburn?") were collected using a self-administered standardized questionnaire (pre/post-evaluation T0, T1, Fig. 1).

## RESULTS

The mean age of the 26 participants was 16.1 years (range 13–22 years) and 7 (27%) were female (Table I). The majority of the participants ($n = 24$) underwent kidney and/or liver transplantation due to several congenital abnormalities (Table SI[1]).

On examination of all study participants, no malignant lesions were found.

All participants completed the first questionnaire (T0) prior to sun protection training. Twenty-one of the young OTR (81%) reported being aware of the increased risk of developing skin cancer. Twenty-two used sunscreen, with 12 using sunscreen with a sun protection factor ≥ 30. While more than 85% (22/26) of participants reported applying sunscreen to the face, this percentage decreased with regard to other anatomical localizations such as the ears (13/26, 50%). Sixteen participants (62%) did not wear a hat/cap as sun protection and 8 (31%) did not have any sunglasses.

Sixty-five percent of the young OTR (17/26) reported being seen by a dermatologist at least once a year (see Table I). More than 80% stated that the skin check did not cover the whole body. One-quarter of the participants (7/26) denied any dermatological follow-up.

Table I. *Dermatological follow-up reported by participants. Data were collected using a self-administered standardized questionnaire before sun protection training*

| Characteristic | Transplant recipients ($n = 26$) |
|---|---|
| Sex, *n* (%) | |
| Female | 7 (27) |
| Male | 19 (73) |
| Age, years, mean | 16.1 |
| Reported frequency, *n* (%) | |
| 1/year | 8/26 (31) |
| Every 6 months | 5/26 (19) |
| More often | 4/26 (15) |
| None | 7/26 (27) |
| Missing | 2/26 (8) |
| Skin check includes, *n* (%) | |
| Scalp | 9/26 (35) |
| Oral cavity | 7/26 (27) |
| Genital area including intergluteal cleft | 6/26 (23) |
| Sole of the foot | 10/26 (39) |
| Interdigital area | 5/26 (19) |
| Is only performed if I ask for | 8/26 (31) |

*Results of the telephone survey at T2*

Twenty OTR consented to the SMS intervention. Eight weeks later, 19/20 participated in a telephone interview (T2, Fig. 1). Eighteen of these 19 participants (95%) stated that they had read the sun protection messages on a daily basis. A total of 16 participants reported that the weather forecasts in the text messages were in accordance with the local weather.

Ninety-five percent of participants (18/19) found the daily text messages very helpful to remember the contents of the sun protection training. According to 8 OTR (42%), the most important reminder was to apply plenty of sunscreen. Other participants remembered the ABCDE-mnemonic or the UVI together with the so-called "sun protection traffic light".

Most of the participants (11/19, 58%) also reported a change in their sun protective behaviour on a day with a high UVI (i.e. range $\geq 8$) following sun protection training and receipt of text messages (data not shown). Ten participants (53%) stated that they now increased sunscreen application. In addition, more areas of the body were covered with sunscreen (e.g. nose and ears). Other OTR said that they spent more time in the shade, especially during lunch-time. Four of 19 participants (21%) answered that sun protective clothing (e.g. a hat) or sunglasses would be of increasing importance.

Participants not reporting any changes in their sun protective behaviour (8/19, 42%) based their answers upon several factors. Some reported that UV exposure during the SMS intervention was limited due to bad weather. Others argued that they would never get sunburn. Two participants stated that they were aware of the increased risk of getting sunburn prior to sun protection training.

*Results of the questionnaire surveys*

Nineteen of the 26 participants (73%) completed both T0 and T1 questionnaires (Table II). Three of the 19 participants (16%) knew the UVI prior to sun protection training. In comparison, 4 weeks after the training, almost three-quarters of the participants (14/19) remembered that UVI describes the maximum daily level of local UVR (Table II).

Whereas none of the participants knew the meaning of the mnemonic ABCDE at T0, 7 (37%) were able to name at least 3 elements of this mnemonic 4 weeks after completion of the sun protection training.

With regard to sun protective behaviour, prior to sun protection training, 14 of 19 OTR could not correctly answer the question on how sunburns could be avoided (Table II). Five participants (26%) knew that it takes some hours to recognize sunburn. Four weeks after the training, this number had increased to 9 (47%). No behavioural changes were observed with regard to textile sun protection.

Table II. *Sun protective knowledge and behaviour. Results of post-study survey. Nineteen of the 26 participants completed both T0 and T1 questionnaires (before sun protection training and 4 weeks later, respectively)*

| | Adolescent organ transplant recipients ($n = 19$) | |
|---|---|---|
| Characteristic | T0 | T1 |
| Item 1: Sun protective knowledge, *n* (%) | | |
| Could explain UV-index | 3/19 (16) | 14/19 (74) |
| Could name some elements of mnemonic ABCDE[a] | 0/19 (0) (2 answers missing) | 7/19 (37)[b] |
| Item 2: Sun protective behaviour, *n* (%) | | |
| What can you do to avoid sunburn? (Please select 1 answer) | | |
| 1. To leave the sun if the skin becomes warm | 6/19 (31) | 6/19 (31) |
| 2. To leave the sun if the skin becomes red | 3/19 (16) | 1/19 (5) |
| 3. A sunburn comes up with a few hours delay | 5/19 (26) | 9/19 (47) |
| 4. I don't know/missing | 5/19 (26) | 3/19 (16) |

[a]Mnemonic ABCDE to judge naevi (asymmetry, border, colour, diameter, evolution).
[b]Seven of the 19 participants (37%) knew at least 3 of these elements.

## DISCUSSION

The present study demonstrated that SMS-based sun protection recommendations are technically feasible and well accepted by young OTR. Almost all participants read the text message reminders on a daily basis. Forty-two percent of participants reported that the application of sunscreen was the most important reminder. Comparable data have been found in studies on non-immunosuppressed people (20, 21).

Similar to the findings of Butt & Roberts (8), 81% of the young OTR in our study reported being aware of the increased risk of skin cancer. However, only 50% applied sunscreen to anatomical localizations beyond the face (e.g. the ears). More than 60% of respondents said that they would not wear a hat or cap as sun protection. These findings are in accordance with studies on non-immunosuppressed persons (22, 23).

The results of our feasibility study further indicate that the combination of participants' training plus SMS reminders had an impact beyond sun protection knowledge. Fifty-eight percent of the participants reported that the intervention influenced their sun protective behaviour (i.e. increased use of sunscreen, prolonged stay in the shade).

Text message reminders could assist in bridging the intention-behaviour gap by reminding participants to increase, for example, the application of sunscreen (20, 24). Armstrong et al. (21) used text messaging as a reminder for sunscreen application in 70 non-immunosuppressed patients. Daily adherence to apply sunscreen was significantly higher in the intervention group (daily text messaging reminders for 6 weeks) compared with the control group. Others studied the impact of computer-assisted patient educa-

tion and monthly telecommunication reminders on patient performance of skin self-examination and found a significant increase in this ability (25).

The high percentage of OTR without any dermatological follow-up was an unexpected finding (Table I). We hypothesize, that one of the main reasons is non-adherence/non-compliance with medical advice; at least in adolescent OTR during the transition period (26). According to our study, some parents mentioned that their adolescent daughters were reluctant to show all parts of their skin to a dermatologist.

Adolescent OTR represent a particularly high-risk group, which requires more emphasis on sun protection behaviour (i.e. sun-protective clothing, such as wide-brimmed hats, long pants, long-sleeved shirts, and sunglasses, staying in the shade or indoors, avoiding artificial UV-light). Hence, our text message reminders went beyond the limited issue of sunscreen. As a result, both sun protection knowledge and behaviour could be substantially improved, as evidenced by the high proportion of participants who reported that sun protection training and SMS reminders changed their sun protective behaviour. This point is further emphasized by the results of our telephone survey showing increased use of sunscreen among participants.

However, we did not succeed in increasing the awareness of sun protective clothing or sunglasses. Only one-fifth of the participants mentioned that these issues were of growing importance to them. Notably, the risk of skin cancer is usually not the main motivator for behaviour adaption in young people. Photo-ageing seems to be a more tangible problem, at least among young non-immunosuppressed female students (23). A possible strategy to address this problem is to focus efforts on variables other than skin cancer risk, such as UVR-associated consequences for outward appearance (e.g. age spots and wrinkles). Mahler and others demonstrated that UV facial photographs and a small introduction into causes and consequences of photodamaging (i.e. skin ageing) could result in significantly stronger sun protection intentions and behaviour (27, 28). Future interventions should focus more on the message that the regular application of sunscreen could retard skin ageing (29).

This study has several limitations. Neither the researchers nor the participants were blinded. Furthermore, factors such as self-report, social desirability and recall bias, common to behavioural studies, may have influenced our findings. The small size of the study population and the missing control group further limits our study results and their interpretation. On the other hand, the study group, although small, included adolescent OTR from all over Germany.

The long-term benefits of sun protection recommendations in OTR are not well established. Armstrong et al. (21) concluded that, at least in non-immunosuppressed patients, a daily reminder could maintain adherence to sunscreen application on a short-term basis (i.e. 6-week study). However, as far as we are aware, no randomized controlled trials to answer this question in adolescent OTR are available.

In summary, this study shows that SMS messaging on UV protection among young OTR appears to be feasible and well-accepted. The trial also illustrates the large discrepancy between sun protection knowledge and behaviour changes in this target group. Our findings are in line with previous trials on non-immunosuppressed people showing the benefit of face-to-face interactions in implementing positive photoprotective behaviour (12, 30).

Based on these findings, a national intervention trial was initiated in Germany in 2013. This trial will help to further elucidate the effectiveness of a combined intervention to improve sun protection adherence and to transfer sun-education messages to the daily life of young OTR.

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