

# Sun Protection Intervention

Subjects: Oncology

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Skin cancer is one of the most common types of cancer and the incidence of melanoma is continuously rising. One of the main risk factors for the development of skin cancer is ultraviolet (UV) radiation. Epidemiological data provide evidence of an increased risk of all types of skin cancer being associated with solar UV exposure. The contribution of UV exposure during childhood is critical. Due to the special structure of children's skin, in which skin stem cells are closer to the skin surface up to the age of 12, UV radiation can infiltrate and damage skin stem cells in children more quickly. Single events of intensive UV radiation, such as sunburn in childhood, can influence the risk of developing melanoma in adulthood. One focus of primary prevention of skin cancer development, therefore, lies in the careful management of UV exposure in children and adolescents.

Keywords: cancer prevention ; skin cancer ; UV-radiation ; UV-protection ; sun protection ; preschools ; children ; outcome evaluation ; dissemination ; primary prevention

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## 1. Overview

Skin cancer is one of the most common types of cancer and UV radiation is one of the main risk factors. Therefore, sun protection, especially in childhood, is strongly recommended. We examined the effectiveness of the 'Clever in Sun and Shade for Preschools' program (CLEVER) in promoting sun protection behavior among preschool staff (trial registration: DRKS00023468) and describe its dissemination. Within a cluster randomized trial with 24 preschools ( $n = 273$  staff members) stating a high need for sun protection measures, an educational workshop for preschool staff and a project kit with materials applicable in preschool groups was provided. Staff members of preschools taking part in CLEVER report significantly stronger sun protection behavior to avoid the sun (effect size [ES] 0.70, 95% confidence interval [CI] 0.04–0.71,  $p < 0.05$ ) and less perceived impediments to avoid the sun (ES  $-0.56$ , CI  $-0.82$ – $-0.17$ ,  $p < 0.01$ ) after 12 months as well as higher self-efficacy to avoid the sun (ES 1.09, CI 0.39–1.07,  $p < 0.001$ ) and to use sunscreen (ES 0.71, CI 0.03–0.88,  $p < 0.05$ ) after 1 month. Compared to the control group, there was no significant effect on sunscreen use and further psychosocial outcomes. The effectiveness of CLEVER may be underrated due to a high drop-out rate. Within three years, an enhanced free-of-charge program kit, including a media-based workshop and materials, had reached over 4000 preschools, i.e., 7.1% of all daycare centers in Germany. The results show that CLEVER can strengthen sun protection, offer high-quality information at low cost, and is easily disseminable.

## 2. Skin Cancer

Skin cancer is one of the most common types of cancer and the incidence of melanoma is continuously rising <sup>[1]</sup>. One of the main risk factors for the development of skin cancer is ultraviolet (UV) radiation <sup>[2][3]</sup>. Epidemiological data provide evidence of an increased risk of all types of skin cancer being associated with solar UV exposure <sup>[3][4]</sup>. The contribution of UV exposure during childhood is critical <sup>[5]</sup>. Due to the special structure of children's skin, in which skin stem cells are closer to the skin surface up to the age of 12, UV radiation can infiltrate and damage skin stem cells in children more quickly <sup>[6][7]</sup>. Single events of intensive UV radiation, such as sunburn in childhood, can influence the risk of developing melanoma in adulthood <sup>[8][9]</sup>. One focus of primary prevention of skin cancer development, therefore, lies in the careful management of UV exposure in children and adolescents <sup>[7][10]</sup>.

In accordance with recommendations of the World Health Organization <sup>[2][3]</sup>, the German guideline on skin cancer prevention recommends a reduction of UV exposure by limiting time outdoors around midday, seeking shade, wearing protective clothes, using sunscreen, and avoiding sunburns as primary prevention measures for children <sup>[11]</sup>. It lists a number of knowledge-related, behavioral, and environmental measures that need to be considered when promoting sun protection ([Table 1](#)).

Several studies have shown that primary prevention significantly reduces the incidence of 'white skin cancer' as well as malignant melanoma <sup>[12]</sup>. However, only few interventions have been designed for the setting of preschools <sup>[13]</sup>. Most of

these studies had limited effects on sun protection behavior [13][14][15], or limitations of the study design [16][17][18]. Examples for successful programs are 'Sun protection is fun!' with multiple interventions for preschool staff and parents as well as 'SunSmart' with a broader population-based focus [19][20][21]. Overall, the use of age-appropriate interventions using songs and games, for example, improves the knowledge of preschoolers [16][22]. Without the help of adults, however, children of this age are not able to transfer this knowledge into behavior. Including parents and preschool teachers in interventions is especially important for children at an early age, since they control the children's environment to a large extent, act as behavioral models, and ultimately are supporters for behavior change processes [13][23][24][25]. Current studies show that less than half of the parents of preschool children use sun protection measures correctly and preschool teachers often seem to lack access to adequate information material on sun protection [26][27]. However, measures that are aimed solely at parents and teachers have only limited effects on actual sun protection practices for children [13][28]. Several studies in Germany indicate a reasonable level of knowledge regarding risk factors of skin cancer and sun protection [29][30][31]. Up to 90% of parents are already aware of the increased risk of skin cancer when exposed to the sun [24][30]. This increased knowledge might be a positive effect of sun protection campaigns and awareness programs, but is not automatically transferred into sun protection behavior [32]. Although especially sun exposure avoidance and wearing textiles is recommended, surveys of parents and preschool staff show that primarily sunscreen and hats are used [33][34][35][36], and even parents with a good knowledge of skin cancer risk factors do not adequately protect their children if they have an uncritical attitude towards tanning [37]. Next to focusing on the individuals, the importance of changing relevant settings such as preschools for children has been highlighted [11][38][39]. Sun protection policies often focus on behavioral and environmental measures. Environmental measures are for example technical and organizational interventions, such as the establishment of outdoor areas providing shade in preschools and schools and the adaptation of organizational processes that keep children protected from the midday sun [11][20][40][41]. The UV Index as a risk communication tool, available as digital displays on electronic billboards or accessed via apps and websites, can be useful for improving sun-protective behavior by advising appropriate measures [42][43]. However, interventions aiming solely on the adoption of sun protection policies have limited effects on actual sun protection practices for children [13][28][44], and there is still more research needed on UV Index-related interventions [45]. Overall, interventions designed to last several years and including a large number of settings as well as components such as age-specific curricula and information and training material, have proved to be effective [21][46][47].

When planning a prevention program aimed at children, using a setting-based approach is internationally recommended as well as anchored in German law [39][48][49]. The setting-based approach includes the individual structures of different settings and uses a research-based theoretical framework that involves families, peers, schools, and community partners. Regarding sun protection, a general theoretical foundation, which comprises all determinants for the implementation of appropriate child-centered measures, is not yet available [37][50]. Further recommendations for program-planning comprise long-term and age-specific measures as well as measures that establish policies, institutional, and structural support [39].

In Germany, a 'Periods-of-Life-Program' for primary prevention of skin cancer was initiated by the Association of Dermatological Prevention (ADP) e. V. in cooperation with the World Health Organization [10]. It focuses on accompanying young people aged between 0 and 18 years as well as the people responsible for their education. Within a cooperation of German Cancer Aid, ADP e. V., the National Center for Tumor Diseases Dresden and the University of Cologne, the campaign 'Clever in Sun and Shade' pursues these efforts and combines setting programs for medical practices, preschools, schools, and leisure facilities with media campaigns, involving social and cultural norms as well as legislative and environmental context.

To offer a comprehensive program for preschools that can reduce the risk for skin cancer, the authors developed the 'Clever in Sun and Shade for Preschools'-program (CLEVER). The program combines theory-based individual as well as environmental interventions and addresses staff members, children and parents. It has been developed to provide materials that effectively promote sun protection and may be easily implemented and disseminated to face the challenges of limited personal and financial resources within both healthcare and educational systems. According to Rabin et al., "dissemination is defined as an active approach of spreading evidence-based interventions to the target audience via determined channels using planned strategies. Implementation is the process of putting to use or integrating evidence-based interventions within a setting" [51] (p. 444). Only few of the numerous cancer prevention interventions that have proven to be effective have been used extensively in practice [51][52]. How to bridge the gap between research and practice and to effectively disseminate and implement prevention programs needs to be explored in more detail [51][53].

### **3. Conclusions**

Only a limited number of sun protection programs are evidence-based and have been utilized in real-world preschool settings. Evaluation results of our CRT show that CLEVER is a very promising program to sustainably promote sun

protection in preschools. It is superior to the distribution of an information brochure concerning crucial outcomes, with medium to large effects on the actual behavior of staff members and important predeterminants of behavior change. The high drop-out rate limits the power of the study and may reduce generalizability. A further program development, the mail-only intervention with its media-based workshop, increases flexibility of the implementation and is already utilized. Over three years, the enhanced free-of-charge program kit has reached 7.1% of all daycare centers in Germany. The results show that CLEVER offers high-quality information at low cost and is easily disseminable. CLEVER engages in finding solutions for implementation barriers such as lack of time and change of staff. Additional low-threshold material to attract participants and to reinforce key behavioral messages is provided. The effectiveness of the current mail-only intervention, its implementation, adoption, and maintenance will be further evaluated.

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