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Getting in early: primary skin cancer prevention at 55 German kindergartens

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Summary

Background Skin neoplasms are the most frequent types of neoplasms in white populations, and their incidence is increasing. Epidemiological studies have shown that the major environmental aetiological factor for their development is sunlight exposure. Sun protection programmes are urgently needed to raise awareness of the health hazards of ultraviolet radiation. In 2010 the 'SunPass' project was implemented at 55 kindergartens in Germany. This is the first nationwide environmental education programme for sun safety designed to teach children in kindergartens and their caregivers how to protect themselves from overexposure to the sun.

Objectives An interventional lecture, site inspections and a certification were part of the programme. Effects of these interventions were studied.

Methods The gain in knowledge and changed sun-behavioural attributes were quantified by questionnaires administered before and after the 'SunPass' interventions.

Results The total number of children was 5424. Sun-protection behaviour after the intervention improved significantly ($P < 0{\cdot}001$). Among parents, 22·2% reported one to five sunburns of their child since birth. There was a significant increase in hat use by children in kindergartens ($P = 0{\cdot}029$), as well as some significantly improved shade practices. There was a significantly increased demand for protective clothing for children ($P < 0{\cdot}001$). The change in sunscreen use in kindergartens was not significant.

Conclusions Although some aims of the 'SunPass' project were not fulfilled, such as the precise knowledge of skin types and a change of sunscreen use, the study had some positive outcomes in increasing the awareness of skin cancer and its prevention possibilities. The findings of the present study suggest that relatively brief interventions in kindergartens lead to improved sun protection of children. The whole investigation reaching over 5400 children and their parents underlines the importance of learning appropriate sun-protective behaviour in early childhood in order to decrease the risk for skin cancer.

Skin neoplasms, henceforth referred to as cutaneous malignant melanoma (CMM) and nonmelanoma skin cancer (NMSC), are the most frequent types of neoplasms in white populations, NMSC (actinic keratosis, basal and squamous cell carcinoma) occurring 18–20 times more often than CMM.[1] Among all caucasian populations an extensive increase of incidence rates of CMM and NMSC has been noticed.[1] The incidence of NMSC has increased at between 3% and 8% every year in white populations since the 1960s, and the incidence of CMM has increased by 3–7%.[2] Exact numbers of NMSC are not known because they are not always reported to skin cancer registries.[3] Not only is CMM the most rapidly increasing malignancy worldwide, the number of deaths from skin neoplasms has also increased in most fair-skinned populations.[4,5] Calculations to date suggest that one in five Americans will develop skin cancer in a lifetime.[6] Furthermore, the economic

burden cannot be ignored. In 2004 more than $1·7 billion was spent worldwide to treat skin neoplasms; the indirect costs, associated with lost productivity, added up to more than $3·8 billion.[7]

Solar ultraviolet (UV) radiation leads to the carcinogenesis of skin cancer.[8] Epidemiological studies have shown that the major environmental aetiological factor for the development of CMM and NMSC is sunlight exposure.[9,10] Green *et al.*[11] clearly demonstrated that the incidence of NMSC is elevated in individuals with a high cumulative exposure to UV radiation. As UVB is absorbed by the DNA, it can directly damage DNA by causing mutagenic lesions. UVA has been related to oxidative DNA damage. This damage leads to the development of skin cancer.[12]

In particular, most epidemiological studies found that sun exposure in childhood and intense intermittent sun exposure are likely to be the major environmental risk factors for the development of melanoma. Irregular and intense exposure to sunlight significantly increases the risk.[13–16] Chronic exposure (total cumulative exposure to UV radiation) was associated with the occurrence of NMSC.[13] Sun exposure as the primary risk factor can easily be influenced by appropriate sun-protective behaviour. Thus, primary prevention is extremely important, knowing that appropriate sun-protective behaviour during childhood could lower the incidence of NMSC by nearly 80%.[17]

The World Health Organization[18] has stated: 'Sun protection programs are urgently needed to raise awareness of the health hazards of UV radiation, and to achieve changes in lifestyle that will arrest the trend towards more and more skin cancers.' Child protection from solar radiation has been found to be widely inadequate, also in kindergarten settings.[19–21] Primary prevention strategies for skin cancer should focus on increasing parents' and caregivers' knowledge and awareness, changing sun-protection behaviours and applying programme policies.[19]

Few programmes have targeted very young children under the age of 5 years. A Swedish lecture programme, reaching nearly 1800 nurseries, effectively increased sun awareness in the preschool sector.[22] The results of 'Block the sun, not the fun', an American skin cancer prevention programme for preschools and daycare centres, suggested significant changes in sun-protection knowledge and attitudes of centre directors and in the use of sunscreen at child care centres.[23] The more recent U.S. 'Sunny Days, Healthy Ways' sun safety curriculum for children in kindergarten to fifth grade did not improve children's knowledge or skin darkening in kindergarten and grade 1, but showed increased sun safety knowledge and attitudes in older children.[24] There have been effective community-directed campaigns, engaging in sun protection in younger children. New England's 'SunSafe' project, involving schools, child care settings, primary care offices and beach settings, was effective in changing sun-protection practices at beaches for children.[25,26] In Australia, the country with the highest incidence of skin cancer in the world, 'SunSmart', a population-based skin cancer prevention programme operating since 1988, includes extensive public education efforts, including television advertising as well as structural and environmental change strategies in multiple public settings, i.e. schools. Sun-protection behaviour and sunburn rates showed substantial general improvement over time.[27] Similarly, the Environmental Protection Agency's 'SunWise' school programme in the U.S.A., a national environmental and health education programme for sun safety of children in primary and secondary schools, has shown significant increases in knowledge as well as sun-protection behaviour.[28]

Due to these facts and the lack of primary interventional programmes in Germany, the pilot study 'SunPass' was developed and conducted from 2008 to 2009 in a kindergarten in Berlin with 150 children aged 0–6 years, staff members ($n = 12$) and parents ($n = 46$). This certification and training programme resulted in clearly improved sun protection of the children as well as a significant improvement in knowledge of sun-related issues.[29] Kindergartens have a role in determining children's attitudes and behaviours. It is important to intervene here as early as possible, knowing that young – consequently particularly vulnerable – children spend much time in kindergartens, especially during the most harmful hours of UV radiation. The 'SunPass' certification programme, developed by the European Skin Cancer Foundation, is a brief, standardized sun-protection education programme, according to the currently recommended sun-protection regimen.[30–32] In 2010 the 'SunPass' project was implemented at 55 kindergartens in Germany. This is the first nationwide environmental education programme for sun safety designed to teach children in kindergartens and their caregivers how to protect themselves from overexposure to the sun.

Materials and methods

The interventional 'SunPass' study was carried out in the summer of 2010 at 55 kindergartens in nine cities throughout Germany. Six skin tumour centres took part in the study. The total number of children involved was 5424. Leaflets and information sheets about the 'SunPass' programme, as well as sun protection arrangements, were distributed at participating kindergartens.

Observations

Site inspections with several sun-related criteria were conducted by the dermatological coordinator at the beginning and end of the programme (mainly June and September, respectively). Among others, observations included the number of children dressing with appropriate clothing and hats, the percentage of shaded area in outdoor settings, and the use of sunscreen. Date and UV index were also recorded.

Intervention

The interventional lecture 'good sun, bad sun' for parents and caregivers followed the first site inspection, focusing on

sun-related topics and issues, with an approximate length of 1 h, and held by dermatologists or associates of the tumour institutes. Special attention was given to the 'sun protection arrangements' that had to be fulfilled once the kindergarten aimed at receiving the 'SunPass Kindergarten 2010' certification. Behavioural recommendations included limiting time spent in the sun, avoiding the sun during the hours of highest UV radiation (11:00–15:00 h), wearing protective clothing (hats, shirts, trousers – covering knees, elbows and shoulders) and sunglasses, seeking shade when outdoors, and using sunscreen with a sun protection factor of 30 or higher, to be applied half an hour before experiencing direct sunlight. A 'sun protection agent' was chosen from the kindergarten staff, responsible for various tasks: teaching others how to carry out a playful training programme for children with a colouring session of the mascot Paul's story (Fig. 1), conducting monthly site inspections on sun-related matters, and handing out a sample of liposomal-based sunscreen to each child. Posters were distributed with the training story of a turtle disregarding sun-protection efforts, and becoming severely sunburnt. Once the turtle Paul followed a regimen to protect himself from the sun, he played happily outside.

Questionnaires

The gain in knowledge and changed sun-behavioural attributes were quantified by pre- and postintervention questionnaires, differing for parents and kindergarten teachers. Parent questionnaires included demographic characteristics of the child, their sun-protection practices, sunburn history, holidays in sunny countries and knowledge about skin cancer risk factors. Staff surveys asked for information about sun-protection practices for children and staff in the kindergarten, knowledge of skin types (after Fitzpatrick[33]) and the UV index. A total of 2286 parents filled out the questionnaire before the intervention, and a total number of 448 from kindergarten workers was received. Postintervention questionnaires were distributed 1 week after the intervention to those who took part. In total, 1101 parents and 330 kindergarten teachers completed these.

Statistical analysis was completed using the statistical software Predictive Analysis SoftWare (PASW; SPSS, Chicago, IL, U.S.A.). Descriptive statistics (relative frequencies) were used for the results of the questionnaires. With the intention of increasing compliance of parents and staff, no personal data were included within the questionnaires. Therefore, we treated the combined sample as an uncombined one, as the paired structure was unknown. Pre- and postintervention comparisons were made using the χ^2 test (two-tailed exact linear-by-linear association χ^2 test). Pooled percentages of the preintervention questionnaires were used to describe demographic data.

Our study was exempt from ethical committee approval because no personal data or personal examinations were involved. Only training sessions and questionnaires on a voluntary basis were carried out.

Certification

Certificates were awarded by the dermatological coordinators in September (Fig. 2).

Results

Parents

The children were aged between 0 and 12 years (mean 3·8). Of the parents, 84·1% stated that their child was fair skinned (skin types I and II[33]). An alarming 22·2% of parents reported one to five sunburns of their child since birth, 0·7% of children had five to 10 sunburns, and 0·4% had had > 10 sunburns. There was no significant change concerning the use of sunscreen on children ($P = 0{\cdot}052$). The number of parents who did not use sunscreen on their children decreased from 4·3% to 2·6%. Before the intervention 89% of parents used

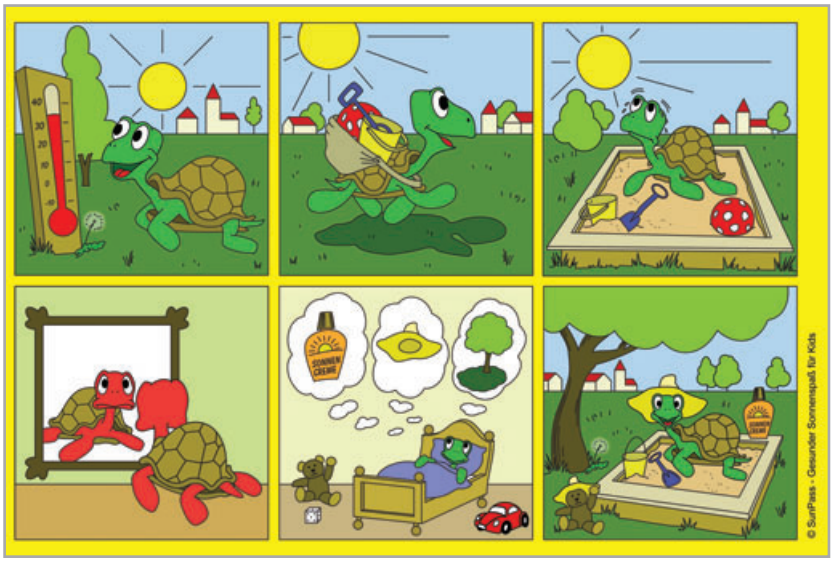

Fig 1. These posters were distributed at kindergartens and used for education sessions with the children. According to the story of Paul, the turtle, children were supposed to learn how using sun protection as shown by the turtle (wear a hat, apply sunscreen, play in the shade) can prevent an unpleasant sunburn. Kindly provided by the European Skin Cancer Foundation.

Fig 2. These certification signposts were given to kindergartens participating in the 'SunPass' project and implementing the sun-protection regimen. Kindly provided by the European Skin Cancer Foundation.

sunscreen once per day or several times daily; after the intervention this figure was 90·6%. Table 1 shows a significant increase in sun-protection behaviour after the intervention ($P < 0·001$).

Kindergarten workers

Before the intervention 7·1% of staff members said their institution supported and demanded the use of headgear (sun hats) for children; after the intervention this percentage increased to 22·3% ($P < 0·001$). After the intervention headgear worn by 'all or most of the children' increased from 72·4% to 80·5%; headgear worn by 'some or very few children' and 'half of all children' decreased ($P = 0·029$). There was a significant change concerning the consequences if a child was playing outside without any headgear ($P = 0·001$). After the intervention the institutions gave out hats by 12·8% more to those playing outside unprotected. After the training course no precautions were taken by 3·9%, compared with 6·9% before the training. Before the intervention 19% received a hat from the kindergarten or had to stay in the shade, the number increased to 27·6% after the intervention. The institutions demanded the use of headgear for staff members after the training in 8·2%, compared with 3·7% before the initiative ($P = 0·034$). Encouragement of headgear use for staff members by their institution increased significantly, from 20·8% to 36·7% ($P < 0·001$). Whereas before the intervention 42·9% demanded protective clothing (covering elbows, shoulders and knees) to be worn by children, the percentage increased afterwards to 56·7% ($P < 0·001$). The kindergarten workers were asked if all members of staff actively supported the efforts towards sun protection at regular interactions with the children: 74% were doing so before the intervention, and 88·8% afterwards ($P < 0·001$). Differences in minimizing the time spent outside during hours of strongest UV radiation before and after the intervention are shown in Table 2. Significantly more staff members answered that outside activities took place outside the time of strongest UV radiation ($P = 0·024$). After the intervention a smaller number of staff members reported that there was no effort to limit time spent outside during the hours of strongest UV radiation ($P = 0·03$). In kindergartens the scenario that children come to the institutions already treated with sunscreen was significantly more supported after the intervention ($P = 0·013$). On the other hand, less than half of the kindergartens applied sunscreen to the children before they went outside. This did not significantly change after the intervention ($P = 0·715$). Also children were not encouraged more after the intervention to put sunscreen on themselves ($P = 0·425$). There was a non-significant tendency towards more shaded areas ($P = 0·14$). The percentage of staff declaring that the area outside consisted of 80% shade increased from 15·6% to 22·7%, probably due to the 5·4% increase in establishing artificial shaded areas

Table 1 Sun protection of children

	Relative frequency, %	
Arrangements made by parents	Before the intervention	After the intervention
No sun protection arrangements	0·9	0·8
One sun protection arrangement	16·9	12·7
Two sun protection arrangements	18·7	16·4
All three sun protection arrangements	63·5	70·1

The sun protection arrangements were: (i) wear protective clothing covering shoulders, elbows, knees and head; (ii) seek shade; and (iii) avoid hours of strongest ultraviolet radiation. There was a significant increase in sun protection behaviour of parents after the intervention ($P < 0·001$). P-values are based on linear-by-linear association χ^2 test (exact test, two-tailed) for differences prior to and after the training sessions.

Table 2 Minimizing time spent outside during hours of strongest ultraviolet (UV) radiation

	Relative frequency, %		
Arrangements	Before the intervention	After the intervention	P-value
Outside activities take place outside time of strongest UV radiation	58·7	66·8	0·024
Excursions take place very early or late during the day	34·2	36	0·593
Lunch and snacks are taken inside	62·7	66·8	0·253
Lunch and snacks are taken in the shade	41·7	38·2	0·334
No limitations	19	13	0·030

Differences between kindergartens pre- and postintervention regarding minimizing exposure at the times of day with strongest UV radiation. After the intervention significantly more kindergartens stated that outside activities take place outside the times of strongest UV radiation and fewer kindergartens implemented none of the arrangements. P-values are based on linear-by-linear association χ^2 test (exact test, two-tailed) for differences prior to and after the training sessions.

($P = 0{\cdot}127$). Around 50% of the kindergartens claimed that their outside area included 50% shade. There was a highly significant increase in knowledge about the UV index: from 40·5% to 83·8% ($P < 0{\cdot}001$). Before the intervention 36·5% of staff members questioned did not know the four most important skin types[33] and their individual risk for sunburns in comparison with a reduced 21·3% after the intervention ($P < 0{\cdot}001$). The percentage of staff members naming the skin types correctly increased only slightly, by 0·3% ($P = 1$). Most of the above-mentioned results are summarized in Table 3.

Observation protocol

From the 55 kindergarten 41 protocols were received. The first site inspection was made mainly in June with UV indices varying between 3 and 7. The second one carried out by dermatological staff was in September, with indices between 0 and 4. In Jena, the second site inspections at all seven kindergartens were carried out during rainy weather. These extremely differing climatic circumstances made pre- and postintervention site inspection comparison unfeasible. The protocols from the dermatological staff as well as those completed by the kindergarten workers were so inconsistent that statistical testing could not be applied. In Berlin, of the 11 supervised kindergartens, four bought a new canopy for better protection in the playground.

Discussion

The study 'SunPass' in 2010 was the direct follow-up of the pilot study in 2008/09. The interventional study stayed effective on a bigger scale, resulting in significantly improved sun protection of the children by parents and kindergarten staff, as well as a better knowledge of sun-related topics by kindergarten members (Tables 1–3). Although some aims of the 'SunPass' project were not fulfilled, the study had a positive outcome in increasing the awareness of skin cancer and its prevention possibilities. Staff members reported that training sessions for children were well received. The teaching of the children led to a change in their own sun-protective behaviour. Most of the children by themselves asked for sun hats and sunscreen before participating in outdoor activities.

The findings of the present study suggest that relatively brief interventions in kindergartens lead to improved sun protection of children, and agree with results of studies carried out in Sweden and America.[22,23,25,26] The present study showed that the change in clothing and sun-protective behaviour was greater than in sunscreen use, differing from the pilot study where the opposite was observed.[29] It seems that training sessions in the present follow-up study were used effectively to strengthen the important fact that sunscreen should not be the only sun-protection practice used but that a combination of all known practices is the best protection. The nonsignificant change in sunscreen use by parents could be due to the fact that sunscreen was already widely used (90%).

After the intervention kindergarten members more often supported that children come to the kindergarten with sunscreen already applied. This was also shown in the pilot study.

However, it was seen that kindergarten members did not use sunscreen more often in their institutions. Differing from our findings Crane *et al.*[23] showed a significant change in sunscreen use at 27 child care centres. These distinctions could be due to

Table 3 Kindergarten teachers: pre- and post-intervention questionnaire comparison

Content of question	Relative frequency, %		P-value
	Before the intervention	After the intervention	
Support and demand use of headgear	7·1	22·3	< 0·001
Headgear worn by all or most of the children	72·4	80·5	0·029
Give out hats to those playing outside without headgear	26·3	39·1	0·001
Do nothing when a child is playing outside without headgear	6·9	3·9	0·001
Give out hat or ask child to stay in the shade when a child is playing outside without headgear	19	27·6	0·001
Demand headgear for staff members	3·7	8·2	0·034
Encouragement of headgear use for staff members	20·8	36·7	< 0·001
Demand protective clothing worn by children	42·9	56·7	< 0·001
Active support of efforts towards sun protection at regular interaction with children	74	88·8	< 0·001
Support that children come to the institution with sunscreen applied	81	87·8	0·013
Apply sunscreen to children 20 min before going outside	44·6	46·2	0·715
Encourage children to put sunscreen on themselves before going outside	47·5	50·5	0·425
Ouside shaded area 80%	15·6	22·7	0·14
Knowledge of UV index	40·5	83·8	< 0·001
Knowledge of skin types	19	13	< 0·001

Summary of key results of the kindergarten staff questionnaires. P-values are based on linear-by-linear association χ^2 test (exact test, two-tailed) for differences prior to and after the training sessions.

the fact that in the present study in several kindergartens, staff were not permitted to use sunscreen on children (i.e. because of possibility of allergic reaction). Furthermore, the questionnaire included an explicit question on whether children are treated with sunscreen 20 min before going outside, according to the recommended practice. Thus, institutions that apply sunscreen to children just before going outside or when already outside were possibly not recorded here.

After the intervention significantly more institutions demanded that headgear be worn by their staff, but the proportion stayed below 10%. In agreement with our findings, a study from New South Wales indicated that staff members tend to see sun-protection practices as primarily directed at children, hence applying them less to themselves.[34] It needs further efforts to investigate personal barriers to staff members carrying out appropriate sun protection for themselves.

The results show that the knowledge of the UV index and skin types improved significantly, but it seems that precise knowledge of skin types could not be communicated. The possibility here is that the postintervention questionnaires were handed out at several kindergartens to the entire staff and not only to those attending the training. This could have modified the results as the paired structure was unknown. Furthermore, social desirability could have biased the outcome, as this study relied on self-reporting. Observation protocols were completed very inconsistently, making it unfeasible for statistical examination. Kindergarten workers often blamed their workload and the lack of sufficient staff for this deficiency. Nevertheless, it could have acted as a reinforcement of the checking of the sun-protection practices carried out in the respective institutions.

Because of the overall poor attendance of parents to the training sessions, some kindergartens showed the training session presentation at the parent–teacher meeting. Institutions offering child care during the training showed better attendance. Parents should also be the focus of prevention efforts because their sun-protection practices directly influence children's behaviours. Also interesting is the possibility that prevention programmes directed primarily at children can influence the behaviour of parents, hence in addition decreasing their risk of developing skin cancer. In a study on a dental health education programme for children, mothers of the children studied also showed an improvement in their own dental health status.[35] The above-mentioned approaches are advisable for future studies.

Kindergartens typically have a high staff turnover. To maintain the impact of this intervention 'boosters' in the form of annual repeated training sessions may have to be applied. Multiyear studies with repeated training sessions for staff members can positively influence sun protection of children in kindergartens with a further improvement after 2 years of repetition.[36] The certification might maintain the impact of this intervention by raising public awareness and reinforcing the 'sun protection arrangements'.

The whole investigation reaching over 5400 children and their parents underlines the importance of learning appropriate sun-protective behaviour in early childhood in order to decrease the risk for skin cancer.

What's already known about this topic?

- Skin cancer prevention programmes in early childhood are needed to reduce incidence rates and raise awareness.
- Primary prevention programmes have shown improved sun-protection behaviour.

What does this study add?

- This first nationwide skin cancer prevention programme in 55 German kindergartens led to improved sun-protection behaviour (particularly regarding clothing and exposure) as well as improved knowledge on sun-related topics in the study participants.

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