UV exposure of New Zealand schoolchildren

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Introduction

New Zealand (NZ) experiences relatively high summertime ambient erythemal UV exposure (Mckenzie et al., 1999). Excess UV exposure received in early life may be a risk factor for skin cancer, particularly melanoma (IARC, 1998). This study aimed to measure the personal UV exposure of NZ primary schoolchildren, their concurrent activities and sun protective practices. These data would then be used to inform health promotion interventions targeted at preventing excess, harmful UV exposure during early life.

Method

Primary and Intermediate schools were randomly selected from five geographically different regions of NZ. Two groups of students were identified based on age groups used in similar studies (Wright and Reeder, 2005). Students in Year 4 (Y4) and Year 8 (Y8) were selected since these two age groups provided a suitable variation in children's behaviour while attending different year levels in the NZ school system. Consenting students were asked to wear a UV monitor and fill in an activity diary for one week during the fieldwork period between October 2004 and April 2005. A research assistant was present daily to assist with UV monitor use and diary completion. The UV monitor, consisting of an AlGaN photodiode with on-board data logging capability, was attached to the lapel of the outer layer of clothing (Figure 1) and measured erythemal UV exposure at 8-second intervals (Allen and McKenzie, 2005). A UV monitor was also used to measure on-site ambient UV levels.

Figure 1. UV monitor attached to the lapel

Completion of the activity diary entailed naming each activity undertaken to the nearest 10 minute interval and ticking whether it occurred inside or in a vehicle; in shade or sun; types of sun protection used and clothing worn. Activities were classified according to seven categories: indoor, outdoor passive (e.g. eating, reading), outdoor active (e.g. swimming, cricket), outdoor travel (e.g. walking, biking), outside in the shade and outdoor unclassified (e.g. at lake). A sun protection score was computed for each student's activities using an adapted version of the St John's Ambulance Rule of Nines and percent coverage afforded by each sun protection/clothing product, where scores ranged from 0% (naked) to 100% (fully clothed wearing a hat, sunscreen and sunglasses). Mid- and post-fieldwork calibrations were conducted for all UV monitors. Personal UV data were linked to activity diary entries and integrated for each activity using a monitor-specific calibration equation. Activity diary entries were combined with UV exposure data using software developed in house. All other analyses were carried out using SAS 9.1.2 (Copyright © 2006 SAS Institute Inc., SAS Campus Drive, Cary, North Carolina 27513, USA).

Results

School and student response rates were 77% (23 schools) and 59% (345 students) respectively. The distribution of total daily personal UV exposure is presented in Figure 2. Most total daily personal UV exposures were less than 2 SED (Standard Erythemal Dose, 1 SED = 100 J m^{-2}), however, some students received in excess of 5 SED/day (n=29) and as much as 8.5-9 SED/day (n=4). Mean total daily personal UV exposure was 0.9 SED per day and mean total daily personal UV exposure as a percent of the ambient was 3%.

UV exposure, activity and sun protection scores

Passive pursuits, such as sitting and reading, ranked highest in terms of mean personal UV exposure with 0.19 SED/hr (Table 1). Physically active pursuits, such as running and playing cricket, recorded the lowest sun protection scores, where a 63.6% score represents, at best, a t-shirt and shorts. Before collapsing activities into these high level categories, specific high UV exposure activities identified included participation in physical education, athletics, lunch, walked home, cricket, working, morning tea and play time.

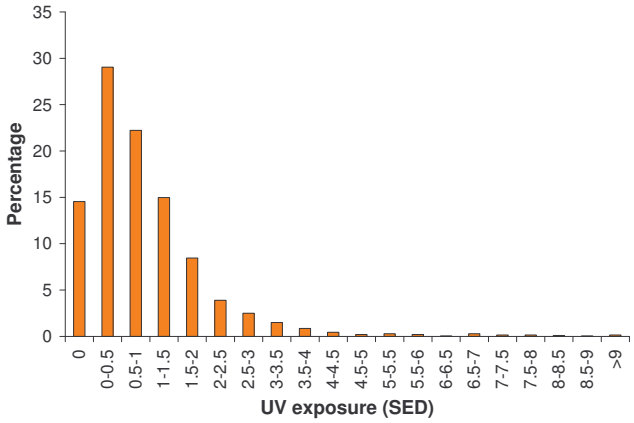

Figure 2. Distribution of personal total daily UV exposure received between 7h00 - 20h00 (NZST+1)

Factors influencing schoolchildren's UV exposure

In a model containing year level, sex, day of the week and activity as well as interactions between year-sex, sex-activity and year-activity, accounting for clustering within schools and allowing for repeated measures, differences in personal UV exposure could be explained by the nature of the activity, where passive pursuits were associated with higher UV exposure rates than active and travel pursuits. Boys experienced higher UV exposure rates than girls. Year level, as a proxy for age, was also important and Y8 students experienced higher UV exposure rates than Y4 students. Moreover, the activities of younger students, although labelled the same, resulted in different UV exposures compared to older students, either as a result of reporting differences or a real difference in UV exposure patterns. Timing was also important, personal UV exposure was higher on weekdays than during the weekend.

Conclusions

The mean total daily personal UV exposure was relatively low, however, some children still received sufficient UV, depending on skin type (Table 2), to elicit sunburn on some study days. Passive pursuits were associated with higher UV exposure rates than other pursuits and, depending on the sun protection used, may be risky. Personal UV exposure rates were highest on weekdays, suggesting that schools have an important part to play in ensuring that schoolchildren do not receive excess UV exposure at school during daylight saving months.

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Table 1. UV exposure, activity and sun protection scores

Outdoor Activity	Mean personal UV exposure (SED/hr)	Mean sun protection score (%)
Passive pursuits	0.19	73.4
Active pursuits	0.12	63.6
In shade	0.10	72.0
Travel pursuits	0.08	71.8
Unclassified	0.08	72.2
Specific activities:		
Physical education	0.35	71.1
Athletics	0.26	74.3
Lunch	0.26	73.2
Walked home	0.26	70.6
Cricket	0.25	79.2
Working	0.24	77.3
Morning tea	0.20	73.2
Play time	0.19	75.1

Table 2. Cumulative UV exposure estimated to elicit sunburn on untanned skin. Source: Fitzpatrick (1988)

Skin type	Description of skin type	UV exposure (SED)
I	Fair skin, fair/red hair, light eyes, freckles, always burns on minimal sun exposure	2-3
II	Fair skin, fair/red hair, freckles, burns very readily	2.5-3
III	White or light brown skin, brown hair, may burn	3-5
IV	Light brown skin, brown eyes, burns rarely	4.5-6
V-VI	Brown or black skin, dark hair, brown eyes, rarely burns	6-20

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