# **ORIGINAL ARTICLE**

# Changes in the pattern of sun exposure and sun protection in young children from tropical Australia 🕬

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**Background:** Australia has one of the highest rates of skin cancer globally. Lifetime risk is associated with childhood sun exposure.

**Objective:** We sought to investigate whether skin cancer prevention programs have resulted in improvements in sun-exposure and sun-protection behavior among young children in tropical Australia.

*Methods:* Two cohorts of 12-to 35-month-old children from Townsville, Australia, were compared: cohort 1 was recruited from hospital birth records (1991) and cohort 2 was recruited via local child-care centers (1999-2002). Children's phenotypic characteristics were assessed. Parents completed questionnaires detailing children's demographic characteristics, and sun-exposure and sun-protective practices.

**Results:** Although cohort 2 of 1-year-old children spent more time in the sun than cohort 1 (median 2.2 vs 2.8 h/d; P = .002), a higher proportion almost always wore sunscreen and a swim-shirt year round. Although more 1-year-old children in cohort 2 had experienced a sunburn (35.5% vs 51.2%; P = .007), both cohort 2 age groups experienced fewer hours of sun exposure to the back of the trunk (P < .001), were less likely to have been sunburned on the back/shoulders (age 1 year 34.8% vs 10.1% and age 2 years 52% vs 10.1%; P < .001), and acquired fewer melanocytic nevi at these sites (P < .001).

Limitations: There was potential for socially desirable responses (information bias).

*Conclusion:* Although duration of sun exposure in early childhood did not decrease during an 8-year period, reported use of personal sun protection did. The observed increase in popularity of swim-shirts and sunscreen between cohorts coincided with the development of significantly fewer melanocytic nevi in these children. (J Am Acad Dermatol 10.1016/j.jaad.2012.10.057.)

*Key words:* early childhood; melanocytic nevi; skin cancer prevention; sun exposure; sun protection; sunburn; trends over time; tropical Australia.

ueensland, Australia, has one of the highest rates of skin cancer<sup>1</sup> with melanoma incidence continuing to increase.<sup>2</sup> The risks of developing melanoma and melanocytic nevi (MN),

the strongest risk factor for melanoma,<sup>3</sup> are directly linked to high levels of sun exposure in early childhood.<sup>4-6</sup> Evaluation of prevention campaigns suggests sun-protective behaviors have improved<sup>7-9</sup> but

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<sup>52</sup> Q1 Conflicts of interest: None declared.

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**CAPSULE SUMMARY** 

The risk of developing melanoma and

of sun exposure in early childhood.

year period in Townsville, Australia,

reported sun-protective practices

improved and children developed

in infants and young children is

ultraviolet radiation.

significantly fewer melanocytic nevi.

Maintaining the focus on reducing sun

exposure and increasing sun protection

important, particularly in regions of high

childhood did not decrease over an 8-

Although sun exposure in early

melanocytic nevi is linked to high levels

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111 it is uncertain whether this will translate into a 112 reduction in melanoma incidence.

113 National Skin Cancer Prevention goals for 114 Australia target children and adolescents for primary prevention<sup>10</sup> and align with those of the World 115 Health Organization<sup>11</sup> to minimize sun damage and 116 foster lifelong sun-protective behaviors.<sup>10</sup> These are 117

118 best achieved through multi-119 faceted skin cancer programs<sup>9</sup> advocating use of 120 121 shade, sunscreen, hats, and 122 clothing, and sun avoidance 123 at peak ultraviolet (UV) radiation times,<sup>7,12</sup> some of 124 125 which are underused, particularly in childhood.<sup>10,13</sup> 126

127 MN, the precursor lesions 128 of up to 60% of melanomas,<sup>14</sup> 129 are the most important biomarker for melanoma.3,15 130 131 Children raised in 132 Queensland, Australia, de-133 velop MN earlier and in 134 higher numbers than children raised elsewhere.5,16,17 135 136 As nevus development is re-137 lated to sun exposure during

childhood,<sup>5,16</sup> MN offer a short-term measure of the 138 139 efficacy of sun protection thereby facilitating objec-140 tive assessment of skin cancer prevention 141 programs.<sup>13</sup>

> Few studies have evaluated trends in childhood sun protection using modifiable biomarkers such as MN.<sup>13</sup> We assessed changes in sun-safety practices during a period of more than 8 years to inform current and future skin cancer prevention activities.

### **METHODS**

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Sun-protective practices of 2 cohorts of 12-to 35month-old children from Townsville, Australia, were compared more than years apart: in 1991 and in 1999 through 2002. Townsville (latitude 19°16'S) in North Queensland, Australia, has a dry, tropical climate and high levels of ambient solar UV radiation throughout the year.<sup>18</sup>

### Recruitment

158 The first cohort was recruited in 1991 from hos-159 pital birth records of the 2 main maternity hospitals in 160 Townsville, Australia. A letter and questionnaire 161 were sent to mothers, inviting them to participate. 162 Cohort 1 included all children younger than 3 years 163 from the original article.<sup>5</sup> This subset was selected to 164 match the approximate age of cohort 2. There were 165 201 children who fulfilled the inclusion criteria:

Caucasian (at least 3 grandparents of European origin), with parents who intended to remain in the study area and provided written consent. Cohort 1 included 201 children (n = 95 age 1 year [12-23 months] and n = 106 age 2 years [24-35 months]).

The second cohort was recruited via 26 local child-care centers in Townsville. Australia. between

### 1999 and 2002. In all, 25 (96.2%) child-care centers participated. Center directors provided enrollment lists (first name, date of birth, and attendance pattern of children age <3 years). A study information sheet, questionnaire, and consent form were sent to parents of eligible children via childcare centers. The inclusion criteria for cohort 2 were the same as for cohort 1 plus regular attendance at a participating child-care center between November 1999 and July 2002. Cohort 2 included 463 children aged 12 to 35 months (n = 394 age

1 year [12-23 months] and n = 69 age 2 years [24-35 months]). Cohort 2 formed the baseline group for a randomized controlled intervention trial to determine whether the development of MN in early childhood can be prevented or delayed by using sun-protective clothing.<sup>13</sup>

### **Demographics**

Age (months), sex, place of birth, and time spent in the tropics were determined from birth and childrecords questionnaires. care and parent Socioeconomic status of the child's suburb was classified using the Socioeconomic Indexes for Areas (3 levels).<sup>19</sup> Parents' education levels were determined from questionnaires, and ethnicity was assessed according to the number of the child's Caucasian grandparents.

### Clinical examination (phenotype and MN)

Hair and eye color were recorded by reference to standard charts as described previously<sup>5</sup> and categorized for analysis following the method of Kelly et al.<sup>17</sup> Skin reflectance of the inner upper aspect of the arm was determined using a reflectance spectrophotometer (Colormet 3.1, Newfoundland, Canada, at 680 nm Q4 [cohort 1]; Evans Electroselenium Ltd, model 99; Diffusion Systems Ltd, London, United Kingdom at 685 nm [cohort 2]) for melanin discrimination and

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then categorized as fair/medium/olive based on previously defined cutpoints.<sup>20</sup> Freckling was recorded as present or absent. Baseline spectrophotometer measurements were missing for 56 children in cohort 2 because of instrument repairs. Subjective assessment of skin color was assigned to these children (53 fair, 3 medium).

At baseline full-body examinations for MN of all sizes (30 body sites excluding the buttocks, genitals, and scalp) were conducted using a standard international protocol.<sup>21</sup> The presence or absence of MN, body site distribution (back of trunk), and mean number of MN were recorded by one of the authors (S. H.), after training by dermatologists in the recognition of MN.

### Questionnaires

238 Participants' parents completed a comprehensive 239 baseline questionnaire covering the child's demo-240 graphic and pigmentary characteristics, sunburn 241 history, and sun-exposure and sun-protective prac-242 tices throughout the year. Habitual sun exposure was 243 determined using charts where parents marked on a 244 line divided into hourly intervals, the time their child 245 usually spent outside in the sun between 6 AM and 7 246 PM. Information about the hours spent outside on 247 typical weekdays and weekend days and the fre-248 quency of sun exposure at locations such as the 249 beach and pool were collected along with "playing 250 outside in the sun during the warmer months of the 251 year" (classified according to UV index of 252 Townsville, Australia). Sunburn history was assessed 253 Q5 according to frequency and nature of sunburn "redness without peeling," "redness with peeling," and 254 255 "pain and blistering." Parents were asked to mark the 256 site of sunburn on a body-site diagram from which 257 the frequency of sunburn on the back and shoulders 258 was derived. 259

The variable "sun-protective practice" was derived from scores for frequency of sunscreen and swim-shirt use in the summer and winter months (never = 0, less than half the time = 1, half the time = 2, more than half the time = 3, almost always = 4) recorded by parents in both summer and winter months. Data relating to frequency of hat use in the summer and winter months were only recorded for cohort 2.

Both studies were approved by James Cook University Human Ethics Committee and written consent was provided by parents/guardians of participants.

### Statistical analysis

Numeric variables with a skewed distribution were described using median values and

interquartile ranges; approximately normally distributed numeric variables were described using means and SD. Bivariate analysis of demographic factors, skin phenotypic factors, and sun-exposure and sunprotective practice analysis used standard statistical tests ( $\chi^2$  test, *t* test, nonparametric Mann-Whitney, and Kruskal-Wallis tests as appropriate).

Multivariate linear regression analyses were used to assess the effect of the 2 cohorts on: (1) the average number of hours spent outside in the sun on a typical day in the previous year; and (2) the total number of MN. Both outcome measures were skewed and were log-transformed to meet the normality assumptions of the model. Both multivariate analyses included the following characteristics: cohort (1991 or 1999), gender, age in months, socioeconomic index of advantage according to Australian Bureau of Statistics<sup>19</sup> (categorized as low, medium, high), ethnicity (Caucasian or not), level of parental education (neither, one, or both parents tertiary qualified), born in the tropics, hair color (black/brown, fair/blond, red), eye color Q6 (brown/black, hazel, blue/green), measurement of skin reflectance (olive, medium, fair), propensity to burn (tends to burn, does not tend to burn), and tanning ability (deep, moderate, slight, never). Four characteristics (ethnicity n = 31; skin reflectance n = 49; propensity to burn n = 107; tanning ability n = 68) had 5% or more missing values. For those characteristics, separate missing categories were created and the model adjusted accordingly.

Statistical analysis was conducted using software (SPSS for Windows, Release 18, IBM Corp, Armonk, NY). All significance tests were 2-sided at the .05 level. A P value of less than .05 was considered significant a priori.

### RESULTS

### Description of participating children

Of the 201 children in cohort 1, 51.6% of 1-yearolds (mean age 18.8  $\pm$  3 months) and 49.1% of 2-year-olds (mean age 29.6  $\pm$  4.1 months) were boys (Table I). Of the 463 children in cohort 2, 54.6% of [T1] 1-year-olds (mean age 16.9  $\pm$  3.4 months) and 50.7% of 2-year-olds (mean age 27  $\pm$  2.9 months) were boys (Table I). Children in both cohorts were predominantly Caucasian, born in the tropics, and from higher socioeconomic groups. More children in cohort 2 had fair skin, whereas children in cohort 1 were more likely to develop a moderate tan (Table I).

### Sun exposure

The median number of hours spent in the sun on a typical day was higher in cohort 2 although this did not reach significance among the 2-year-olds **Q7** 

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Table I. Demographic and pigmentary characteristics of 2 cohorts of young children of same age recruited more than 8 years apart in tropical Australia

Age 1 y (12-25 110)				Age 2-y		
Risk factor	Cohort 1 (1991) N = 95	Cohort 2 (1999-2002) N = 394	P value	Cohort 1 (1991) N = 106	Cohort 2 (1999-2002) N = 69	P value
Demographic characteristics						
Mean age, mo (±SD)	18.8 (3.0)	16.9 (3.4)	.0005*	29.6 (4.1)	27 (2.9)	.0005*
Median age, mo (IQR)	19 (17-22)	16.8 (14-20)		30 (25-33.25)	27 (25-29)	
Boys	49 (51.6%)	215 (54.6%)	.6†	52 (49.1%)	35 (50.7%)	.829 <sup>†</sup>
Girls	46 (48.4%)	179 (45.4%)		54 (50.9%)	34 (49.3%)	
SES of residence <sup>‡</sup>						
Children living in low SES suburb	10 (10.6%)	115 (29.3%)	.0005 <sup>†</sup>	14 (13.2%)	20 (29.0%)	.0005
Children living in medium SES suburb	83 (83.3%)	216 (55.0%)		92 (86.8%)	35 (50.7%)	
Children living in high SES suburb	1 (1.1%)	62 (15.8%)		0 (0%)	14 (20.3%)	
Ethnicity						
Caucasian ( $\geq$ 3 European grandparents)	93 (97.9%)	347 (88.1%)	.004†	103 (97.2%)	64 (92.8%)	.266 <sup>§</sup>
Non-Caucasian ( $\geq 2$ Non-European	2 (2.1%)	47 (11.9%)		3 (2.8%)	5 (7.2%)	
grandparents)	. ,				. ,	
Combined education level of parents						
Neither parent tertiary qualified	59 (62.1%)	232 (61.6%)	.859 <sup>†</sup>	71 (67%)	45 (67.2%)	.972 <sup>†</sup>
One tertiary-educated parent	25 (26.3%)	93 (24.7%)		22 (20.8%)	13 (19.4%)	
Two tertiary-educated parents	11 (11.6%)	51 (13.6%)		13 (12.3%)	9 (13.4%)	
(The length of the length of t	0 (0%)	40 (10.2%)	.001 <sup>†</sup>	0 (0%)	10 (14.5%)	.0005§
len born in tropics	95 (100%)	354 (89.8%)		106 (100%)	59 (85 5%)	
Mean (+SD) duration living in tropics mo	188 (30)	15.8 (4.7)	0005*	296 (4 1)	254 (59)	0005*
Vertian duration living in tropics, mo (IOB)	19 (17-22)	16 (13-19)	.0005	30 (25-33 25)	26 (24-29)	.0005
Pigmentary characteristics	13 (17 22)	10 (13 15)		50 (25 55.25)	20 (212))	
Hair color						
Black	0 (0%)	1 (0.3%)	063§	0 (0%)	0 (0%)	941 <sup>§</sup>
Brown	14 (14 70%)	05 (24 1%)	.005	31 (20.20%)	10 (070)	.941
Blondo/fair	79 (97 10%)	95 (24.1%) 271 (68.8%)		73 (68 0%)	19 (27.5%)	
	2 (2 20%)	271 (00.0%)		73 (08.9%) 2 (1.0%)	49 (7 1.070) 1 (1 /10%)	
Eve color	5 (5.270)	27 (0.9%)		2 (1.970)	1 (1.470)	
Brown/black	10 (10 004)	112 (29 404)	1228	20 (20 204)	14 (20 20/)	026
	10 (10.9%)	112 (20.4%) 26 (0.1%)	.122*	50 (28.5%) 15 (14.20%)	14 (20.5%) 6 (9.704)	.050°
	14 (14.7%)	30 (9.1%) 245 (62.20()		15 (14.2%)	0 (0.7%) AE (6E 204)	
Green	05 (00.5%)	245 (02.2%)		0 (004)	45 (05.2%)	
lines unner schott of sim reflectance	0 (0%)	1 (0.5%)		0 (0%)	4 (5.6%)	
inner upper aspect of arm renectance						
Categories	14 (15 10()	2 (0.00()	0005	0 (7 00()	0 (00()	018
OIIVe/dark (<64%)	14 (15.1%)	3 (0.8%)	.0005	8 (7.8%)	0 (0%)	.01
Medium (64%-66.9%)	11 (11.8%)	14 (3.9%)		11 (10.7%)	2 (3.2%)	
Fair ( $\geq 67\%$ )	68 (73.1%)	340 (95.2%)		84 (81.6%)	60 (96.8%)	
Freckling	00 (07 40()		aaat			aaat
Absent	83 (87.4%)	376 (95.4%)	.003 '	// (/2.6%)	61 (88.4%)	.0131
Present	12 (12.6%)	18 (4.6%)		29 (27.4%)	8 (11.6%)	
Propensity to sunburn			t			t
Rarely/never burns	2 (3.7%)	71 (19.2%)	.005 '	10 (14.1%)	13 (20.6%)	.316'
lends to burn	52 (96.3%)	298 (80.8%)		61 (85.9%)	50 (79.4%)	
Tanning ability			Ŧ			e
Deep tan	4 (4.3%)	16 (4.7%)	.0005 <sup>+</sup>	5 (4.8%)	2 (3.6%)	.0005 <sup>§</sup>
Moderate tan	53 (56.4%)	72 (21.1%)		68 (64.8%)	9 (16.4%)	
Slight/light/minimal tan	10 (10.6%)	210 (61.4%)		10 (9.5%)	37 (67.3%)	
Navan davalana a tan	27 (28 7%)	44 (12 9%)		22 (21.0%)	7 (12.7%)	

383 Pearson  $\chi^2$  test.

<sup>‡</sup>SES of suburb was based on Socioeconomic Indexes for Areas indicators (Australian Bureau of Statistics 1996), 384 <sup>§</sup>Fisher exact test.

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# **Table II.** Changes in sun exposure habits of young children of same age in 2 cohorts recruited more than 8 years apart in tropical Australia

Cohort 1         Cohort 2         Cohort 1         Cohort 2         Cohort 1         Cohort 2         P value           (199) N = 9         (199) N = 9         (199) N = 106         (199) N = 106         P value           (190) A = 0         (190) N = 106         (199) N = 106         P value         (101) N = 106         P value           (190) A = 0         (190) N = 106         (190) N = 10		Age 1 y (12-23 mo)			Age 2 y (24-35 mo)		
ium expoure of children while playing outside isow often child plays outside in sun larely/never 6 (6.3%) 31 (7.9%) .0.61* 3 (2.8%) 7 (10.1%) .047 <sup>4</sup> -2 times/mc 0 (0%) 2 (2.9%) .006 <sup>1</sup> 3 (2.8%) 7 (10.1%) .047 <sup>7</sup> -4 times/mc 2 (15.3%) 61 (4.6%) 0 (0%) 2 (2.9%) .25 (2.5%) 14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .14 (20.3%) .16 (20.9%) .25 (		Cohort 1 (1991) N = 95	Cohort 2 (1999-2002) N = 394	P value	Cohort 1 (1991) N = 106	Cohort 2 (1999-2002) N = 69	P value
low often child plays outside in sun arely/never 6 (6.3%) 31 (7.9%) .061* 3 (2.8%) 7 (10.1%) .047 <sup>1</sup> -2 times/mo 0 (0%) 20 (5.1%) 0 (0%) 2 (2.9%) -2 times/wk 8 (8.4%) 57 (14.5%) 14 (13.2%) 3 (4.3%) -2 times/wk 24 (25.3%) 69 (17.5%) 25 (23.6%) 14 (120.3%) twost every day 54 (56.8%) 198 (50.4%) 62 (58.5%) 42 (60.9%) to, of hours spent outside in sun on typical day in previous year tean (1250) 2.4 (1.7) 3.1 (2.0) .002 <sup>4</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>4</sup> tedian (IQR) 2.2 (0.9-3.6) 2.78 (1.6-4.3) 2.3 (1.5-3.8) 3 (1.7-4.6) Uutdoor swimming and related aquatic activities low often does child swim at outdoor pol2 arely/never 40 (42.1%) 99 (25.2%) .0005* 38 (35.8%) 15 (21.7%) .03* -2 times/wk 14 (14.7%) 124 (31.6%) 22 (20.8%) 31 (44.9%) -2 times/wk 12 (12.6%) 52 (13.2%) 6 (5.7%) 4 (5.8%) low often does child go to beach? arely/never 55 (58.4%) 161 (41.0%) .0005 <sup>1</sup> 60 (56.6%) 17 (24.6%) .0005 -2 times/wk 17 (74%) 95 (24.2%) 3 (2.8%) 30 (43.5%) -2 times/wk 11 (1.1%) 6 11 (41.0%) .0005 <sup>1</sup> 60 (156.6%) 17 (24.6%) .0005 -2 times/wk 11 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) Lames/wk 11 (1.1%) 6 (1.5%) 0 (0.9%) 0 (0%) Lames/wk 11 (1.1%) 6 (1.5%) 0 (0.9%) 0 (0%) -2 times/wk 11 (1.1%) 6 (1.5%) 0 (0.9%) 0 (0%) Lames/wk 11 (1.1%) 72 (10.6-200) .039 <sup>4</sup> 60 (12-146) 77 (30-196) 253 <sup>4</sup> playing in water in warmer half of year (IQR) Lever 66 sublurn causing "redness without peeling" Lever 63 (66.5%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) 657* es 33 (35.5%) 200 (51.2%) 54 (5.1%) 31 (4.9%) 10 (9.4%) 6 (8.7%) = times/y 5 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) = times/y 5 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) = times/y 5 (3.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) = times/y 5 (3.3	Sun exposure of children while playing	) outside					
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-4 times/me 0 (0%) 20 (51%) 0 (0%) 2 (2.5%) -2 times/wk 8 (8.4%) 57 (14.5%) 14 (13.2%) 3 (4.3%) -4 times/wk 24 (25.3%) 69 (17.6%) 25 (23.6%) 14 (20.3%) toor speent outside in sun on typical day in previous year lean (±5D) 2 4 (17) 3.1 (2.0) 0.02 <sup>4</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>4</sup> lean (±5D) 2 4 (17) 3.1 (2.0) .002 <sup>4</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>4</sup> lean (±5D) 2 4 (17) 3.1 (2.0) .002 <sup>4</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>4</sup> lean (±5D) 2 4 (17) 3.1 (2.0) .002 <sup>4</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>4</sup> lean (±5D) 2 4 (17) 3.1 (2.0) .002 <sup>4</sup> 3.2 (3.2.%) 10 (14.5%) Putdoor swimming and related aquatic arely/never 40 (42.1%) 99 (25.2%) .0005 <sup>4</sup> 38 (35.8%) 15 (21.7%) .0.3 <sup>*</sup> -2 times/wk 12 (12.6%) 52 (13.2%) 8 (7.5%) 9 (13.0%) -4 times/wk 12 (12.6%) 52 (13.2%) 8 (7.5%) 9 (13.0%) Imost every day 5 (5.3%) 47 (12.0%) 6 (5.7%) 4 (13.0%) -2 times/wk 12 (12.6%) 52 (13.2%) 4 (2.8%%) 12 (13.0%) -2 times/wk 12 (12.6%) 52 (21.2%) 3 (24.8%) 17 (24.6%) .0005 <sup>4</sup> -2 times/wk 12 (11.9%) 5 (24.2%) 3 (2.8%) 17 (24.6%) .0005 -2 times/wk 11 (11.9%) 6 (1.5%) 0 (0%) 10 (0%) -2 times/wk 11 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) Imost every day 0 (0%) 2 (2.5%) 1 (0.9%) 0 (0%) fedian total No. of hours spent 42 (8-144.1) 72 (10.6-200) .039 <sup>4</sup> 60 (12-146) 77 (30-196) .253 <sup>4</sup> playing in water with back exposed during warmer half of year (IQR) unburn ver been sunburned lever 63 (66.3%) 191 (48.8%) .007 <sup>4</sup> 49 (47.6%) 30 (44.1%) .557 <sup>e</sup> s times/w 11 (1.9%) 54 (5.3%) 10 (9.4%) 4 (3.8%) .016%) 2 (1.1%) 54 (5.3%) 10 (9.4%) 4 (3.8%) 10 (44.9%) 2 (2.5%) 2 (2.9%) 3 (2.8%) 2 (2.9%) 3 (4.1%) 55.9% 3 (3.55%) 10 (0.94%) 4 (3.8%) 10 (9.4%) 6 (8.5%) 3 (4.5%) 2 times/w 14 back exposed during warmer half of year (IQR) unburn ver been sunburned loe 60 (64.5%) 191 (48.8%) .007 <sup>4</sup> 49 (47.6%) 30 (44.1%) .557 <sup>e</sup> 3 times/y 5 (5.3%) 116 (49.9%) .021 <sup>4</sup> 51 (48.1%) 30 (43.5%) .915 <sup>4</sup> 3 times/y 5 (5.3%) 196 (49.9%) .021 <sup>4</sup> 51 (48.1%) 30 (43.5%) .915 <sup>4</sup> 3 times/y 5 (5.3%) 196 (49.9%) .021 <sup>4</sup> 51 (48.1%) 30 (43.5%) .915 <sup>4</sup> 3 times/y 5 (5.3%) 196 (49.9%) .021 <sup>4</sup> 51 (48.1	1-2 times/mo	3 (3.2%)	18 (4.6%)		2 (1.9%)	1 (1.4%)	
2 times/wk 8 (8.4%) 57 (14.5%) 14 (13.2%) 3 (4.3%) 4 times/wk 24 (25.3%) 69 (17.6%) 25 (23.6%) 14 (20.3%) tho of hours spent outside in sun on typical day in previous year team (±SD) 2.4 (1.7) 3.1 (2.0) .002 <sup>4</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>4</sup> team (±SD) 2.4 (1.7) 3.1 (2.0) .002 <sup>4</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>4</sup> team (±SD) 2.4 (1.7) 3.1 (2.0) .002 <sup>5</sup> 2.3 (1.5-3.8) 3 (1.7-4.6) Tutdoor swimming and related aquatic activities low often does child swim at outdoor pol? arely/never 40 (42.1%) 99 (25.2%) 83 (35.8%) 15 (21.7%) .0.3* 2 times/wk 14 (14.7%) 124 (31.6%) 22 (20.8%) 91 (14.5%) 2 times/wk 12 (12.6%) 52 (13.2%) 8 (7.5%) 9 (13.0%) timost every day 5 (5.3%) 47 (12.0%) 6 (5.7%) 4 (5.8%) limost every day 5 (5.3%) 47 (12.0%) 6 (5.7%) 4 (5.8%) limost every day 0 (5.3%) 129 (32.8%) 42 (39.6%) 30 (43.5%) 2 times/wk 7 (7.4%) 95 (24.2%) 3 (2.8%) 22 (31.9%) 4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) 10.0% 2 times/wk 7 (7.4%) 95 (24.2%) 3 (2.8%) 22 (31.9%) 4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) 10.0% 4 times/wk 7 (7.4%) 95 (24.2%) 3 (2.8%) 22 (31.9%) 4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) 10.0% 4 times/wk 7 (7.4%) 95 (24.2%) 3 (2.8%) 22 (31.9%) 4 times/wk 9 (0.6%) 2 (0.5%) 1 (0.9%) 0 (0%) 10.0% 4 times/wk 9 (0.43.2) 0 (0-0) .0005 <sup>4</sup> 60 (12-146) 77 (30-196) .253 <sup>4</sup> playing in water in warmer half of year (URN) unburn ver been sunburned 10 (60 (64.5%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* beer 63 (66.3%) 196 (49.9%) .021 <sup>1</sup> 51 (48.1%) 30 (43.5%) .557* beer 63 (66.6%) .548 (4.6%) .007* 4	3-4 times/mo	0 (0%)	20 (5.1%)		0 (0%)	2 (2.9%)	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1-2 times/wk	8 (8.4%)	57 (14.5%)		14 (13.2%)	3 (4.3%)	
Imost every day 54 (56.8%) 198 (50.4%) 62 (58.5%) 42 (60.9%) to, of hours spent outside in sun on typical day in previous year lean (=SD) 2.4 (1.7) 3.1 (2.0) .002 <sup>†</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>‡</sup> leadian (IQR) 2.2 (0.9-3.6) 2.78 (1.6-4.3) 2.3 (1.5-3.8) 3 (1.7-4.6) Dutdoor swimming and related aquatic activities tow often does child swim at outdoor pool? arely/never 40 (42.1%) 99 (25.2%) .0005 <sup>*</sup> 38 (35.8%) 15 (21.7%) .03 <sup>*</sup> -2 times/mk 14 (14.7%) 124 (31.6%) 22 (20.8%) 31 (44.9%) -2 times/mk 12 (12.6%) 52 (13.2%) 8 (7.5%) 9 (13.0%) Imost every day 5 (5.3%) 47 (12.0%) 6 (5.5%) 9 (13.0%) Imost every day 5 (5.3%) 47 (12.0%) 6 (5.5%) 9 (13.0%) Imost every day 5 (5.3%) 47 (12.0%) 6 (0.5%) 9 (13.0%) Imost every day 5 (5.3%) 16 (1.4%) .0005 <sup>†</sup> 60 (56.6%) 17 (24.6%) .0005 -2 times/mk 12 (12.6%) 52 (13.2%) 42 (39.6%) 30 (43.5%) -2 times/mk 7 (7.4%) 95 (24.2%) 3 (2.8%) 22 (31.9%) 4 times/wk 11 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -2 times/wk 11 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) Imost every day 0 (0%) 2.(0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2.(0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2.(0.5%) 1 (0.9%) 0 (0%) Median total No. of hours spent 42 (8-14.1) 7 2 (10.6-200) .039 <sup>‡</sup> 60 (12.146) 77 (30-196) .253 <sup>‡</sup> playing in water in warmer half of year (IQR) unburn ver been sunburned lo 60 (64.5%) 191 (48.8%) .007 <sup>*</sup> 49 (47.6%) 30 (44.1%) .657 <sup>*</sup> es 33 (35.5%) 200 (51.2%) 54 (52.4%) 30 (43.5%) .915 <sup>†</sup> Ince-twice only 26 (27.4%) 170 (43.3%) 42 (39.6%) 31 (44.9%) -2 times/y 5 (5.3%) 18 (4.6%) 101 (9.6,2%) 31 (44.9%) -2 times/y 5 (5.3%) 18 (4.6%) 101 (9.6,2%) 30 (43.5%) .915 <sup>†</sup> Ince-twice only 26 (27.4%) 170 (43.3%) 42 (39.6%) 31 (44.9%) -2 times/y 5 (5.3%) 196 (49.9%) .021 <sup>†</sup> 51 (48.1%) 30 (43.5%) .915 <sup>†</sup> ince-twice only 26 (27.4%) 170 (43.3%) 42 (39.6%) 31 (44.9%) -2 times/y 5 (5.3%) 196 (49.9%) .021 <sup>†</sup> 51 (48.1%) 30 (43.5%) .915 <sup>†</sup> ince-twice only 26 (27.4%) 170 (43.3%) 42 (39.6%) 31 (44.9%) -2 times/y 5 (5.3%) 372 (94.7%) .799 <sup>†</sup> 101 (96.2%) 68 (98.6%) .649 <sup>‡</sup> was "veer painful with bistering	3-4 times/wk	24 (25.3%)	69 (17.6%)		25 (23.6%)	14 (20.3%)	
b. of hours spent outside in sun on typical day in previous year Aean $(\pm 5D)$ 2.4 (1.7) 3.1 (2.0) .002 <sup>+</sup> 2.7 (1.7) 3.2 (2.1) .082 <sup>±</sup> Aedian (1QR) 2.2 (0.9-3.6) 2.78 (1.6-4.3) 2.3 (1.5-3.8) 3 (1.7-4.6) Dutdoor swimming and related aquatic activities tow often does child swim at outdoor pool? arely/never 40 (42.1%) 99 (25.2%) .0005 <sup>+</sup> 38 (35.8%) 15 (21.7%) .03 <sup>+</sup> 2 times/wk 14 (14.7%) 124 (31.6%) 32 (30.2%) 10 (14.5%) -2 times/wk 12 (12.6%) 52 (13.2%) 8 (7.5%) 9 (13.0%) Imost every day 5 (5.3%) 47 (12.0%) 6 (5.7%) 4 (5.8%) Iow often does child go to beach? arely/never 65 (68.4%) 161 (41.0%) .0005 <sup>+</sup> 60 (56.6%) 17 (24.6%) .0005 -2 times/wk 12 (12.6%) 59 (22.28%) 42 (23.6%) 20 (43.5%) -2 times/wk 7 (7.4%) 95 (24.2%) 3 (2.8%) 20 (43.5%) -2 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Imost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Inhore twere half of year (IQR) unburn ver been sunburned Io 60 (64.5%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .557* es 3 33 (35.5%) 200 (51.2%) 5 4 (52.4%) 38 (55.9%) xperienced at loss 1 sunburn that "burned with peeling" Iever 63 (66.3%) 196 (49.9%) .021 <sup>+</sup> 51 (48.1%) 30 (43.5%) .915 <sup>+</sup> "burned with peeling" Iever 63 (66.6%) 196 (49.9%) .021 <sup>+</sup> 51 (48.1%) 30 (43.5%) .915 <sup>+</sup> year (10.7%) 2 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) .799 <sup>+</sup> 3 times/y 1 (1.1%) 9 (2.3%) 3 (2.8%) 1 (1.4%) xperienced at least 1 sunburn that "burned with peeling"	Almost every day	54 (56.8%)	198 (50.4%)		62 (58.5%)	42 (60.9%)	
typical day in previous year           Atean ( $\pm 5D$ )         2.4 (1.7)         3.1 (2.0)         .002 <sup>±</sup> 2.7 (1.7)         3.2 (2.1)         .082 <sup>±</sup> Atedian (IQR)         2.2 (0.9-3.6)         2.78 (1.6-4.3)         2.3 (1.5-3.8)         3 (1.7-4.6)         .082 <sup>±</sup> Dutdoor swimming and related aquatic activities         bow often does child swim at outdoor         3 (1.7-4.6)         .03 (1.7-6)         .03 (1.7-6)         .03 (1.7-6)         .03 (1.7-6)         .03 (1.7-6)         .03 (1.7-6)         .03 (1.7-6)         .03 (1.7-6)         .0005         .0005         .0005         .0005         .0005         .0005	No. of hours spent outside in sun on						
$\begin{array}{c} \mbox{dean} (128) & 2.4 (1.7) & 3.1 (2.0) & .002^{\dagger} & 2.7 (1.7) & 3.2 (2.1) & .082^{\dagger} \\ \mbox{decian} (10R) & 2.2 (0.9-3.6) & 2.78 (1.6-4.3) & 2.3 (1.5-3.8) & 3 (1.7-4.6) \\ \mbox{variable} \\ \mbox{decian} (10R) & 2.2 (0.9-3.6) & 2.78 (1.6-4.3) & 2.3 (1.5-3.8) & 3 (1.7-4.6) \\ \mbox{variable} \\ \mbox{decian} (128) & 2.2 (0.25.3%) & 71 (18.1%) & 32 (30.2\%) & 10 (14.5\%) \\ \mbox{arely/never} & 40 (42.1\%) & 99 (25.2\%) & .0005^{\ast} & 38 (35.8\%) & 15 (21.7\%) & .03^{\ast} \\ \mbox{arely/never} & 24 (25.3\%) & 71 (18.1\%) & 32 (30.2\%) & 10 (14.5\%) \\ \mbox{arely/never} & 24 (25.3\%) & 71 (12.0\%) & 6 (5.7\%) & 9 (13.0\%) \\ \mbox{arely/never} & 25 (5.3\%) & 47 (12.0\%) & 6 (5.7\%) & 4 (5.8\%) \\ \mbox{arely/never} & 25 (68.4\%) & 161 (41.0\%) & .0005^{\dagger} & 60 (56.6\%) & 17 (24.6\%) & .0005 \\ \mbox{arely/never} & 25 (68.4\%) & 161 (41.0\%) & .0005^{\dagger} & 60 (56.6\%) & 17 (24.6\%) & .0005 \\ \mbox{arely/never} & 25 (68.4\%) & 161 (41.0\%) & .0005^{\dagger} & 00 (5\%) & 0 (3\%) \\ \mbox{arely/never} & 25 (68.4\%) & 161 (41.0\%) & .0005^{\dagger} & 00 (56.6\%) & 17 (24.6\%) & .0005 \\ \mbox{arely/never} & 25 (23.2\%) & 129 (32.8\%) & 42 (39.6\%) & 30 (43.5\%) \\ \mbox{arely/never} & 25 (23.2\%) & 10 (9.6\%) & 0 (0\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 2 (0.5\%) & 1 (0.9\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 2 (0.5\%) & 1 (0.9\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 2 (0.5\%) & 1 (0.9\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 2 (0.5\%) & 1 (0.9\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 0 (0\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 0 (0\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 0 (0\%) & 0 (0\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 0 (0\%) & 0 (0\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 0 (0\%) & 0 (0\%) & 0 (0\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 0 (0\%) & 0 (0\%) & 0 (0\%) & 0 (0\%) & 0 (0\%) \\ \mbox{arely/never} & 0 (0\%) & 0 $	typical day in previous year						
Aedian (UQR)       2.2 (0.9-3.6)       2.78 (1.6-4.3)       2.3 (1.5-3.8)       3 (1.7-4.6)         Dutdoor swimming and related aquatic activities low often does child swim at outdoor pool?       38 (35.8%)       15 (21.7%)       0.3*         arely/never       40 (42.1%)       99 (25.2%)       .0005*       38 (35.8%)       15 (21.7%)       .0.3*         - 2 times/mo       24 (25.3%)       71 (18.1%)       32 (30.2%)       10 (14.5%)	Mean (±SD)	2.4 (1.7)	3.1 (2.0)	.002‡	2.7 (1.7)	3.2 (2.1)	.082 <sup>‡</sup>
butdoor swimming and related aquatic activities           tow often does child swim at outdoor pool?           tarely/never         40 (42.1%)         99 (25.2%)         ,0005*         38 (35.8%)         15 (21.7%)         ,03*           2 times/mo         24 (25.3%)         71 (18.1%)         32 (30.2%)         10 (14.5%)         2         10 (14.5%)         2         10 (14.5%)         10 (15.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (14.5%)         10 (16.5%)         10 (14.5%)	Median (IQR)	2.2 (0.9-3.6)	2.78 (1.6-4.3)		2.3 (1.5-3.8)	3 (1.7-4.6)	
low often does child swim at outdoor pool? arely/never 40 (42.1%) 99 (25.2%) .0005 <sup>±</sup> 38 (35.8%) 15 (21.7%) .03 <sup>±</sup> 2 times/mo 24 (25.3%) 71 (18.1%) 22 (30.2%) 10 (14.5%) -2 times/wk 14 (14.7%) 124 (31.6%) 22 (30.8%) 31 (44.9%) -4 times/wk 12 (12.6%) 52 (13.2%) 8 (7.5%) 9 (13.0%) Jmost every day 5 (5.3%) 47 (12.0%) 6 (5.7%) 4 (5.8%) low often does child go to beach? arely/never 65 (68.4%) 161 (41.0%) .0005 <sup>±</sup> 60 (56.6%) 17 (24.6%) .0005 -2 times/mo 22 (23.2%) 129 (32.8%) 42 (39.6%) 30 (43.5%) -2 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -4 times/wk 1 (1.1%) 6 (0.5%) 11 (0.9%) 0 (0%) -4 times/wk 2 (28.144.1) 72 (10.6-200) .039 <sup>±</sup> 60 (12-146) 77 (30-196) .253 <sup>±</sup> playing in water in warmer half of year (UQR) Aedian total No. of hours spent 9 (043.2) 0 (0-0) .0005 <sup>±</sup> 9 (0-52.9) 0 (0-0) .0005 playing in water with back exposed during warmer half of year (UQR) unburn ver been sunburned loe 60 (64.5%) 191 (48.8%) .007 <sup>±</sup> 49 (47.6%) 30 (44.1%) .657 <sup>±</sup> es 33 (35.5%) 200 (51.2%) 54 (52.4%) 38 (55.9%) ×perienced sunburn causing "redness without peeling" lever 63 (66.3%) 196 (49.9%) .021 <sup>±</sup> 51 (48.1%) 30 (43.5%) .915 <sup>±</sup> ince-twice only 26 (27.4%) 170 (43.3%) 42 (39.6%) 31 (44.9%) ≥ 3 times/y 5 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) ≥ 3 times/y 5 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) ≥ 3 times/y 5 (5.3%) 38 (4.6%) 10 (9.4%) 6 (8.7%) ≥ 3 times/y 5 (5.3%) 38 (4.6%) 10 (9.4%) 6 (8.7%) ≥ 3 times/y 5 (5.3%) 38 (4.6%) 10 (9.4%) 6 (8.7%) ≥ 3 times/y 5 (5.3%) 38 (4.6%) 10 (9.4%) 6 (8.7%) ≥ 3 times/y 5 (10.0%) 389 (99.0%) 1.0 <sup>±</sup> 105 (10.0%) 69 (10.0%) 1.0 <sup>±</sup> po (0%) 4 (1.0%) 00%) 4 (1.0%) 00%)	Outdoor swimming and related aquation	c activities					
pool?           tarely/never         40 (42.1%)         99 (25.2%)         .0005*         38 (35.8%)         15 (21.7%)         .03*           -2 times/wk         14 (14.7%)         124 (31.6%)         22 (20.8%)         31 (44.9%)           -4 times/wk         12 (12.6%)         52 (13.2%)         87 (75%)         9 (13.0%)           Ivmost every day         5 (5.3%)         47 (12.0%)         6 (5.7%)         4 (5.8%)           low often does child go to beach?         arely/never         65 (68.4%)         161 (41.0%)         .0005 <sup>†</sup> 60 (56.6%)         17 (24.6%)         .0005           -2 times/mo         22 (23.2%)         129 (32.8%)         42 (33.6%)         22 (31.9%)         -           -2 times/mo         22 (32.9%)         1 (0.9%)         0 (0%)         .0005         40 (12.1%)         .0005           -2 times/mk         1 (1.1%)         6 (1.5%)         0 (0%)         0 (0%)         .00%         .00%           -2 times/wk         1 (0.1%)         2 (0.5%)         1 (0.9%)         0 (0%)         .00%         .00%         .00%           -2 times/wk         1 (1.1%)         6 (15.4%)         0 (0.0%)         .007*         9 (0.2.1%)         .00%         .007*           Addian total No. of hours	How often does child swim at outdoor						
arely/never       40 (42.1%)       99 (25.2%)       ,0005* 38 (35.8%)       15 (21.7%)       ,03*         -2 times/mo       24 (25.3%)       71 (18.1%)       32 (30.2%)       10 (14.5%)         -2 times/wk       12 (12.6%)       52 (13.2%)       8 (7.5%)       9 (13.0%)         -4 times/wk       12 (12.6%)       52 (13.2%)       8 (7.5%)       9 (13.0%)         umost every day       5 (5.3%)       47 (12.0%)       6 (5.7%)       4 (5.8%)         owo often does child go to beach?	pool?						
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Rarely/never	40 (42.1%)	99 (25.2%)	.0005*	38 (35.8%)	15 (21.7%)	.03*
2-2 times/wk 14 (14.7%) 124 (31.6%) 22 (20.8%) 31 (44.9%) 4-4 times/wk 12 (12.6%) 52 (13.2%) 8 (7.5%) 9 (13.0%) tow often does child go to beach? tarely/never 65 (68.4%) 161 (41.0%) .0005 <sup>†</sup> 60 (56.6%) 17 (24.6%) .0005 -2 times/wk 7 (7.4%) 95 (24.2%) 32 (23.6%) 30 (43.5%) 2- times/wk 7 (7.4%) 95 (24.2%) 3 (2.8%) 22 (31.9%) 4- times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -2 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) -4 times/wk 2 (8-144.1) 72 (10.6-200) .039 <sup>†</sup> 60 (12-146) 77 (30-196) .253 <sup>†</sup> playing in water in warmer half of year (IQR) Median total No. of hours spent 42 (8-144.1) 72 (10.6-200) .039 <sup>†</sup> 60 (12-146) 77 (30-196) .253 <sup>†</sup> Playing in water with back exposed during warmer half of year (IQR) unburn ver been sunburned lo 60 (64.5%) 191 (48.8%) .007 <sup>*</sup> 49 (47.6%) 30 (44.1%) .657 <sup>*</sup> es 33 (35.5%) 200 (51.2%) 54 (52.4%) 38 (55.9%) xperienced sunburn causing "redness without peeling" lever 63 (66.3%) 196 (49.9%) .021 <sup>†</sup> 51 (48.1%) 30 (43.5%) .915 <sup>†</sup> Nice-twice only 26 (27.4%) 196 (49.9%) .021 <sup>†</sup> 51 (48.1%) 30 (43.5%) .915 <sup>†</sup> 2 times/y 5 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) ≥ 3 times/y 1 (1.1%) 9 (2.3%) 3 (2.8%) 2 (2.9%) xperienced at least 1 sunburn that "burned with peeling" lo 91 (95.8%) 372 (94.7%) .799 <sup>†</sup> 101 (96.2%) 68 (98.6%) .649 <sup>†</sup> es 4 (4.2%) 21 (5.3%) 4 (3.8%) 1 (1.4%) xperienced at least 1 sunburn that was "very-painful with blistering" lo 91 (95.8%) 372 (94.7%) .799 <sup>†</sup> 101 (96.2%) 68 (98.6%) .649 <sup>†</sup> es 0 (0%) 4 (1.0%) 0 (0%) 1.0 <sup>†</sup> 10 (0%) 0 (0%) 1.0 <sup>†</sup>	1-2 times/mo	24 (25.3%)	71 (18.1%)		32 (30.2%)	10 (14.5%)	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1-2 times/wk	14 (14.7%)	124 (31.6%)		22 (20.8%)	31 (44.9%)	
Innost every day 5 (5.3%) 47 (12.0%) 6 (5.7%) 4 (5.8%) low often does child go to beach? larely/never 65 (68.4%) 161 (41.0%) .0005 <sup>†</sup> 60 (56.6%) 17 (24.6%) .0005 -2 times/wk 7 (7.4%) 95 (24.2%) 3 (2.8%) 22 (31.9%) -4 times/wk 1 (1.1%) 6 (1.5%) 0 (0%) 0 (0%) Innost every day 0 (0%) 2 (0.5%) 1 (0.9%) 0 (0%) Median total No. of hours spent 42 (8-144.1) 72 (10.6-200) .039 <sup>‡</sup> 60 (12-146) 77 (30-196) .253 <sup>‡</sup> playing in water in warmer half of year (IQR) Median total No. of hours spent 9 (0-43.2) 0 (0-0) .0005 <sup>‡</sup> 9 (0-52.9) 0 (0-0) .0005 playing in water with back exposed during warmer half of year (IQR) unburn ver been sunburned lo 60 (64.5%) 191 (48.8%) .007 <sup>*</sup> 49 (47.6%) 30 (44.1%) .657 <sup>*</sup> les 33 (35.5%) 200 (51.2%) 54 (52.4%) 38 (55.9%) xperienced sunburn causing "redness without peeling" lever 63 (66.3%) 196 (49.9%) .021 <sup>‡</sup> 51 (48.1%) 30 (43.5%) .915 <sup>‡</sup> lever 7 63 (66.3%) 196 (49.9%) .021 <sup>‡</sup> 51 (48.1%) 30 (43.5%) .915 <sup>‡</sup> lever 63 (66.3%) 196 (49.9%) .021 <sup>‡</sup> 51 (48.1%) 30 (43.5%) .915 <sup>‡</sup> lever 7 63 (66.3%) 196 (49.9%) .021 <sup>‡</sup> 51 (48.1%) 30 (43.5%) .915 <sup>‡</sup> lever 7 63 (66.3%) 196 (49.9%) .021 <sup>‡</sup> 51 (48.1%) 30 (43.5%) .915 <sup>‡</sup> lever 8 1 sunburn that "burnet_wite peeling" lever 9 19 (95.8%) 372 (94.7%) .799 <sup>‡</sup> 101 (96.2%) 68 (98.6%) .649 <sup>‡</sup> xperienced at least 1 sunburn that "burnet_with peeling" lo 91 (95.8%) 372 (94.7%) .799 <sup>‡</sup> 101 (96.2%) 68 (98.6%) .649 <sup>‡</sup> xperienced at least 1 sunburn that "burnet_with peeling" lo 91 (95.8%) 372 (94.7%) .799 <sup>‡</sup> 101 (96.2%) 68 (98.6%) .649 <sup>‡</sup> xperienced at least 1 sunburn that was "very-painful with blistering" lo 95 (100%) 389 (99.0%) 1.0 <sup>‡</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup> e interver 95 (100%) 389 (99.0%) 1.0 <sup>‡</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup> e interver 95 (100%) 389 (99.0%) 1.0 <sup>‡</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup> e interver 95 (100%) 389 (99.0%) 1.0 <sup>‡</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup> e interver 95 (100%) 389 (99.0%) 1.0 <sup>‡</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup> e interver 95 (100%) 189 (99.0%) 1.0 <sup>‡</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup> e interver 95 (100%) 189 (99.0%) 1.0 <sup>‡</sup>	3-4 times/wk	12 (12.6%)	52 (13.2%)		8 (7.5%)	9 (13.0%)	
tow often does child go to beach?         tarel/never       65 (68.4%)       161 (41.0%) $.0005^{\dagger}$ 60 (56.6%)       17 (24.6%)       .0005         -2 times/wk       7 (7.4%)       95 (24.2%)       32 (28%)       22 (31.9%)	Almost every day	5 (5.3%)	47 (12.0%)		6 (5.7%)	4 (5.8%)	
tarely/never       65 (68.4%)       161 (41.0%)       .0005 <sup>†</sup> 60 (56.6%)       17 (24.6%)       .0005         -2 times/mo       22 (23.2%)       129 (32.8%)       42 (39.6%)       30 (43.5%)       -         -2 times/wk       7 (7.4%)       95 (24.2%)       3 (2.8%)       22 (31.9%)       -         -4 times/wk       1 (1.1%)       6 (1.5%)       0 (0%)       0 (0%)       -       -         -4 times/wk       1 (1.1%)       6 (1.5%)       0 (0%)       0 (0%)       - <td>How often does child go to beach?</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	How often does child go to beach?						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Rarely/never	65 (68.4%)	161 (41.0%)	.0005†	60 (56.6%)	17 (24.6%)	.0005
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1-2 times/mo	22 (23.2%)	129 (32.8%)		42 (39.6%)	30 (43.5%)	
-4 times/wk       1 (1.1%)       6 (1.5%)       0 (0%)       0 (0%)       0 (0%)         Median total No. of hours spent       42 (8-144.1)       72 (10.6-200) $0.039^{\pm}$ 60 (12-146)       77 (30-196)       .253^{\pm}         Playing in water in warmer half of year (IQR)       9 (0-43.2)       0 (0-0) $0.005^{\pm}$ 9 (0-52.9)       0 (0-0) $0.005^{\pm}$ 9 (0-52.9)       0 (0-0) $0.005^{\pm}$ 9 (0-52.9)       0 (0-0) $0.005^{\pm}$ 9 (0-60) $0.005^{\pm}$ 9 (0-62.9)       0 (0-0) $0.005^{\pm}$ 9 (0-62.9)       0 (0-0) $0.005^{\pm}$ 9 (0-62.9)       0 (0-0) $0.005^{\pm}$ 9 (0-52.9)       0 (0-0) $0.005^{\pm}$ 9 (0-62.9)       0 (0-0) $0.005^{\pm}$ 9 (0-62.9)       0 (0-0) $0.005^{\pm}$ 9 (0-52.9)       0 (0-0) $0.05^{\pm}$ $0.05^{\pm}$ $0.05^{\pm}$ $0.05^{\pm}$ $0.05^{\pm}$ $0.05^{\pm}$ $0.05^{\pm}$ $0.05^{\pm}$ $0.65^{\pm}$ $0.65^{\pm}$ $0.65^{\pm}$ $0.65^{\pm}$ $0.62^{\pm}$ <td>1-2 times/wk</td> <td>7 (7.4%)</td> <td>95 (24.2%)</td> <td></td> <td>3 (2.8%)</td> <td>22 (31.9%)</td> <td></td>	1-2 times/wk	7 (7.4%)	95 (24.2%)		3 (2.8%)	22 (31.9%)	
Immost every day       0 (0%)       2 (0.5%)       1 (0.9%)       0 (0%)         Aedian total No. of hours spent       42 (8-144.1)       72 (10.6-200) $0.39^{\ddagger}$ 60 (12-146)       77 (30-196)       .253 <sup>‡</sup> playing in water in warmer half of year (IQR)       9 (0-43.2)       0 (0-0)       .0005 <sup>‡</sup> 9 (0-52.9)       0 (0-0)       .0005         playing in water with back exposed during warmer half of year (IQR)       9 (0-43.2)       0 (0-0)       .0005 <sup>‡</sup> 9 (0-52.9)       0 (0-0)       .0005         ver been sunburned       9       0       60 (64.5%)       191 (48.8%)       .007 <sup>*</sup> 49 (47.6%)       30 (44.1%)       .657 <sup>*</sup> ices       33 (35.5%)       200 (51.2%)       54 (52.4%)       38 (55.9%)       .915 <sup>†</sup> Nace-twice only       26 (27.4%)       170 (43.3%)       .021 <sup>†</sup> 51 (48.1%)       30 (43.5%)       .915 <sup>†</sup> once-twice only       26 (27.4%)       170 (43.3%)       42 (39.6%)       31 (44.9%)       .915 <sup>†</sup> ≥ 3 times/y       1 (1.1%)       9 (2.3%)       3 (2.8%)       2 (2.9%)       .649 <sup>†</sup> was "very-painful with pelling"       91 (95.8%)       372 (94.7%)       .799 <sup>†</sup> 101 (96.2%)       68 (98.6%)       .649 <sup>†</sup> 0	3-4 times/wk	1 (1.1%)	6 (1.5%)		0 (0%)	0 (0%)	
Median total No. of hours spent playing in water in warmer half of year (IQR)       42 (8-144.1)       72 (10.6-200) $.039^{\ddagger}$ 60 (12-146)       77 (30-196) $.253^{\ddagger}$ Median total No. of hours spent playing in water with back exposed during warmer half of year (IQR) unburn       9 (0-43.2)       0 (0-0) $.0005^{\ddagger}$ 9 (0-52.9)       0 (0-0) $.0005^{\ddagger}$ No. of hours spent playing in water with back exposed during warmer half of year (IQR) unburn       9 (0-43.2)       0 (0-0) $.0005^{\ddagger}$ 9 (0-52.9)       0 (0-0) $.0005^{\ddagger}$ No. of hours spent playing in water with back exposed during warmer half of year (IQR) unburn       9 (0-43.2)       0 (0-0) $.0005^{\ddagger}$ 9 (0-52.9)       0 (0-0) $.0005^{\ddagger}$ None-twice nore without peeling"       60 (64.5%)       191 (48.8%) $.007^{*}$ 49 (47.6%)       30 (44.1%) $.657^{*}$ Noce-twice only       63 (66.3%)       196 (49.9%) $.021^{\dagger}$ 51 (48.1%)       30 (43.5%) $.915^{\dagger}$ Noce-twice only       26 (27.4%)       170 (43.3%)       42 (39.6%)       31 (44.9%) $.253^{*}$ > 2 times/y       5 (5.3%)       18 (4.6%)       10 (9.4%)       6 (8.7%) $.649^{\dagger}$ Normed with peeling"       91 (95.8%)       372 (94.7%) $.799^{\dagger}$	Almost every day	0 (0%)	2 (0.5%)		1 (0.9%)	0 (0%)	
playing in water in warmer half of year (IQR)         Median total No. of hours spent       9 (0-43.2)       0 (0-0) $.0005^{\ddagger}$ 9 (0-52.9)       0 (0-0) $.0005$ playing in water with back exposed during warmer half of year (IQR)       unburn $.0005^{\ddagger}$ 9 (0-52.9)       0 (0-0) $.0005^{\ddagger}$ warmer half of year (IQR)       unburn $.0005^{\ddagger}$ 9 (0-52.9)       0 (0-0) $.0005^{\ddagger}$ ver been sunburned $.000^{\ast}$ 49 (47.6%)       30 (44.1%) $.657^{\ast}$ lo $60$ $64.5\%$ 191 (48.8%) $.007^{\ast}$ 49 (47.6%)       30 (43.1%) $.657^{\ast}$ ses       33 (35.5%)       200 (51.2%)       54 (52.4%)       38 (55.9%) $.915^{\ddagger}$ ver       63 (66.3%)       196 (49.9%) $.021^{\dagger}$ 51 (48.1%)       30 (43.5%) $.915^{\ddagger}$ hore-twice only       26 (27.4%)       170 (43.3%)       42 (39.6%)       31 (44.9%) $.23^{\ast}$	Median total No. of hours spent	42 (8-144.1)	) 72 (10.6-200)	.039 <sup>‡</sup>	60 (12-146)	77 (30-196)	.253 <sup>‡</sup>
year (IQR) Median total No. of hours spent playing in water with back exposed during warmer half of year (IQR) unburn ver been sunburned lo 60 (64.5%) 191 (48.8%) .007* 49 (47.6%) 30 (44.1%) .657* ies 33 (35.5%) 200 (51.2%) 54 (52.4%) 38 (55.9%) xperienced sunburn causing "redness without peeling" lever 63 (66.3%) 196 (49.9%) .021 <sup>†</sup> 51 (48.1%) 30 (43.5%) .915 <sup>†</sup> nce-twice only -2 times/y 5 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) $\ge 3$ times/y 1 (1.1%) 9 (2.3%) 3 (2.8%) 2 (2.9%) xperienced at least 1 sunburn that "burned with peeling" lo 91 (95.8%) 372 (94.7%) .799 <sup>†</sup> 101 (96.2%) 68 (98.6%) .649 <sup>†</sup> es 4 (4.2%) 21 (5.3%) 4 (3.8%) 1 (1.4%) xperienced at least 1 sunburn that was "very-painful with blistering" lo 95 (100%) 389 (99.0%) 1.0 <sup>†</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup>	playing in water in warmer half of						
Adedian total No. of hours spent playing in water with back exposed during warmer half of year (IQR) sunburn ver been sunburned lo       9 (0-43.2)       0 (0-0)       .0005 <sup>‡</sup> 9 (0-52.9)       0 (0-0)       .0005         Normal System Ver been sunburned lo       60 (64.5%)       191 (48.8%)       .007*       49 (47.6%)       30 (44.1%)       .657*         System Ver been sunburn causing "redness without peeling"       33 (35.5%)       200 (51.2%)       54 (52.4%)       38 (55.9%)       .915 <sup>†</sup> Nnce-twice only       26 (27.4%)       170 (43.3%)       42 (39.6%)       31 (44.9%)       .915 <sup>†</sup> -2 times/y       5 (5.3%)       18 (4.6%)       10 (9.4%)       6 (8.7%)       .915 <sup>†</sup> a times/y       1 (1.1%)       9 (2.3%)       3 (2.8%)       2 (2.9%)       .649 <sup>†</sup> es       4 (4.2%)       21 (5.3%)       4 (3.8%)       1 (1.4%)       .649 <sup>†</sup> es       4 (4.2%)       21 (5.3%)       4 (3.8%)       1 (1.4%)       .649 <sup>†</sup> es       9 (0%)       369 (99.0%)       1.0 <sup>†</sup> 105 (100%)       69 (100%)       1.0 <sup>†</sup> es       0 (0%)       0 (0%)       0 (0%)       1.0 <sup>†</sup> 0 (0%)       1.0 <sup>†</sup>	year (IQR)						
playing in water with back exposed during warmer half of year (IQR) sunburn iver been sunburned $000000000000000000000000000000000000$	Median total No. of hours spent	9 (0-43.2)	0 (0-0)	.0005 <sup>‡</sup>	9 (0-52.9)	0 (0-0)	.0005
during warmer half of year (IQR) sunburn iver been sunburnedlo $60 (64.5\%)$ $191 (48.8\%)$ $.007^*$ $49 (47.6\%)$ $30 (44.1\%)$ $.657^*$ lo $60 (64.5\%)$ $191 (48.8\%)$ $.007^*$ $49 (47.6\%)$ $30 (44.1\%)$ $.657^*$ lo $54 (52.4\%)$ $38 (55.9\%)$ $54 (52.4\%)$ $38 (55.9\%)$ $.57*$ is perienced sunburn causing "redness without peeling" $.021^+$ $51 (48.1\%)$ $30 (43.5\%)$ $.915^+$ lever $63 (66.3\%)$ $196 (49.9\%)$ $.021^+$ $51 (48.1\%)$ $30 (43.5\%)$ $.915^+$ once-twice only $26 (27.4\%)$ $170 (43.3\%)$ $42 (39.6\%)$ $31 (44.9\%)$ -2 times/y $5 (5.3\%)$ $18 (4.6\%)$ $10 (9.4\%)$ $6 (8.7\%)$ $= 3 times/y$ $1 (1.1\%)$ $9 (2.3\%)$ $3 (2.8\%)$ $2 (2.9\%)$ xperienced at least 1 sunburn that "burned with peeling" $10 (9.4\%)$ $68 (98.6\%)$ $.649^+$ lo $91 (95.8\%)$ $372 (94.7\%)$ $.799^+$ $101 (96.2\%)$ $68 (98.6\%)$ $.649^+$ xperienced at least 1 sunburn that was "very-painful with blistering" $1.0^+$ $0 (0\%)$ $1.0^+$ $0 (0\%)$ $1.0^+$ lo $95 (100\%)$ $389 (99.0\%)$ $1.0^+$ $105 (100\%)$ $69 (100\%)$ $1.0^+$	playing in water with back exposed						
Sumburn display the been sunburnedNo $60 (64.5\%)$ $191 (48.8\%)$ $.007^*$ $49 (47.6\%)$ $30 (44.1\%)$ $.657^*$ 'es $33 (35.5\%)$ $200 (51.2\%)$ $54 (52.4\%)$ $38 (55.9\%)$ $.657^*$ 'experienced sunburn causing ''redness without peeling'' $.021^+$ $51 (48.1\%)$ $30 (43.5\%)$ $.915^+$ lever $63 (66.3\%)$ $196 (49.9\%)$ $.021^+$ $51 (48.1\%)$ $30 (43.5\%)$ $.915^+$ Ince-twice only $26 (27.4\%)$ $170 (43.3\%)$ $42 (39.6\%)$ $31 (44.9\%)$ -2 times/y $5 (5.3\%)$ $18 (4.6\%)$ $10 (9.4\%)$ $6 (8.7\%)$ $\geq 3$ times/y $1 (1.1\%)$ $9 (2.3\%)$ $3 (2.8\%)$ $2 (2.9\%)$ xperienced at least 1 sunburn that ''burned with peeling'' $91 (95.8\%)$ $372 (94.7\%)$ $.799^+$ $101 (96.2\%)$ $68 (98.6\%)$ $.649^+$ lo $91 (95.8\%)$ $372 (94.7\%)$ $.799^+$ $101 (96.2\%)$ $68 (98.6\%)$ $.649^+$ es $4 (4.2\%)$ $21 (5.3\%)$ $4 (3.8\%)$ $1 (1.4\%)$ ies $95 (100\%)$ $389 (99.0\%)$ $1.0^+$ $105 (100\%)$ $69 (100\%)$ $1.0^+$ lo $95 (100\%)$ $389 (99.0\%)$ $1.0^+$ $105 (100\%)$ $69 (100\%)$ $1.0^+$	during warmer half of year (IQR)						
Siver been sunburned         lo       60 (64.5%)       191 (48.8%)       .007*       49 (47.6%)       30 (44.1%)       .657*         'es       33 (35.5%)       200 (51.2%)       54 (52.4%)       38 (55.9%)       .915*         kxperienced sunburn causing ''redness without peeling''       63 (66.3%)       196 (49.9%)       .021 <sup>+</sup> 51 (48.1%)       30 (43.5%)       .915*         lever       63 (66.3%)       196 (49.9%)       .021 <sup>+</sup> 51 (48.1%)       30 (43.5%)       .915*         Once-twice only       26 (27.4%)       170 (43.3%)       42 (39.6%)       31 (44.9%)       .91*         -2 times/y       5 (5.3%)       18 (4.6%)       10 (9.4%)       6 (8.7%)       .91*         ≥ 3 times/y       1 (1.1%)       9 (2.3%)       3 (2.8%)       2 (2.9%)       .649*         ies       4 (4.2%)       21 (5.3%)       4 (3.8%)       1 (1.4%)       .649*         ies       4 (4.2%)       21 (5.3%)       4 (3.8%)       1 (1.4%)       .649*         ies       91 (95.8%)       372 (94.7%)       .799*       101 (96.2%)       68 (98.6%)       .649*         ies       91 (95.8%)       389 (99.0%)       1.0*       105 (100%)       69 (100%)       1.0*	Sunburn						
lo $60 (64.5\%)$ $191 (48.8\%)$ $.007^*$ $49 (47.6\%)$ $30 (44.1\%)$ $.657^*$ 'res $33 (35.5\%)$ $200 (51.2\%)$ $54 (52.4\%)$ $38 (55.9\%)$ $31 (44.9\%)$ 'redness without peeling'' $63 (66.3\%)$ $196 (49.9\%)$ $.021^{\dagger}$ $51 (48.1\%)$ $30 (43.5\%)$ $.915^{\dagger}$ 'nce-twice only $26 (27.4\%)$ $170 (43.3\%)$ $42 (39.6\%)$ $31 (44.9\%)$ $.915^{\dagger}$ -2 times/y $5 (5.3\%)$ $18 (4.6\%)$ $10 (9.4\%)$ $6 (8.7\%)$ $\geq 3 times/y$ $1 (1.1\%)$ $9 (2.3\%)$ $3 (2.8\%)$ $2 (2.9\%)$ 'xperienced at least 1 sunburn that 'burned with peeling'' $91 (95.8\%)$ $372 (94.7\%)$ $.799^{\dagger}$ $101 (96.2\%)$ $68 (98.6\%)$ $.649^{\dagger}$ lo $91 (95.8\%)$ $372 (94.7\%)$ $.799^{\dagger}$ $101 (96.2\%)$ $68 (98.6\%)$ $.649^{\dagger}$ was "very painful with blistering" $0 (0\%)$ $21 (5.3\%)$ $4 (3.8\%)$ $1 (1.4\%)$ lo $95 (100\%)$ $389 (99.0\%)$ $1.0^{\dagger}$ $105 (100\%)$ $69 (100\%)$ $1.0^{\dagger}$ es $0 (0\%)$ $4 (1.0\%)$ $0 (0\%)$ $0 (0\%)$ $0 (0\%)$ $0 (0\%)$	Ever been sunburned						
res33 (35.5%)200 (51.2%)54 (52.4%)38 (55.9%)Experienced sunburn causing "redness without peeling"63 (66.3%)196 (49.9%) $.021^{\dagger}$ 51 (48.1%)30 (43.5%) $.915^{\dagger}$ Ince-twice only63 (66.3%)196 (49.9%) $.021^{\dagger}$ 51 (48.1%)30 (43.5%) $.915^{\dagger}$ Ince-twice only26 (27.4%)170 (43.3%)42 (39.6%)31 (44.9%)-2 times/y5 (5.3%)18 (4.6%)10 (9.4%)6 (8.7%)= 3 times/y1 (1.1%)9 (2.3%)3 (2.8%)2 (2.9%)Experienced at least 1 sunburn that "burned with peeling"91 (95.8%)372 (94.7%) $.799^{\dagger}$ 101 (96.2%)68 (98.6%) $.649^{\dagger}$ Io91 (95.8%)372 (94.7%) $.799^{\dagger}$ 101 (96.2%)68 (98.6%) $.649^{\dagger}$ was "very painful with blistering"95 (100%)389 (99.0%) $1.0^{\dagger}$ 105 (100%)69 (100%) $1.0^{\dagger}$ Io95 (100%)389 (99.0%) $1.0^{\dagger}$ 0 (0%) $0$ (0%) $0$ (0%) $0$	No	60 (64.5%)	191 (48.8%)	.007*	49 (47.6%)	30 (44.1%)	.657*
Experienced sunburn causing "redness without peeling"       63 (66.3%) 196 (49.9%) .021 <sup>†</sup> 51 (48.1%) 30 (43.5%) .915 <sup>†</sup> lever       63 (66.3%) 196 (49.9%) .021 <sup>†</sup> 51 (48.1%) 30 (43.5%) .915 <sup>†</sup> once-twice only       26 (27.4%) 170 (43.3%) 42 (39.6%) 31 (44.9%)         -2 times/y       5 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%)         ≥ 3 times/y       1 (1.1%) 9 (2.3%) 3 (2.8%) 2 (2.9%)         ixperienced at least 1 sunburn that       "burned with peeling"         lo       91 (95.8%) 372 (94.7%) .799 <sup>†</sup> 101 (96.2%) 68 (98.6%) .649 <sup>†</sup> es       4 (4.2%) 21 (5.3%) 4 (3.8%) 1 (1.4%)         xperienced at least 1 sunburn that       95 (100%) 389 (99.0%) 1.0 <sup>†</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup> lo       95 (100%) 389 (99.0%) 1.0 <sup>†</sup> 0 (0%) 0 (0%)	Yes	33 (35.5%)	200 (51.2%)		54 (52.4%)	38 (55.9%)	
lever       63 (66.3%)       196 (49.9%)       .021 <sup>†</sup> 51 (48.1%)       30 (43.5%)       .915 <sup>†</sup> Once-twice only       26 (27.4%)       170 (43.3%)       42 (39.6%)       31 (44.9%)         -2 times/y       5 (5.3%)       18 (4.6%)       10 (9.4%)       6 (8.7%)         ≥ 3 times/y       1 (1.1%)       9 (2.3%)       3 (2.8%)       2 (2.9%)         ixperienced at least 1 sunburn that       "burned with peeling"       91 (95.8%)       372 (94.7%)       .799 <sup>†</sup> 101 (96.2%)       68 (98.6%)       .649 <sup>†</sup> es       4 (4.2%)       21 (5.3%)       4 (3.8%)       1 (1.4%)       400%         xperienced at least 1 sunburn that       95 (100%)       389 (99.0%)       1.0 <sup>†</sup> 105 (100%)       69 (100%)       1.0 <sup>†</sup> es       0 (0%)       4 (1.0%)       0 (0%)       0 (0%)       1.0 <sup>†</sup>	Experienced sunburn causing "redness without peeling"						
Once-twice only       26 (27.4%)       170 (43.3%)       42 (39.6%)       31 (44.9%)         -2 times/y       5 (5.3%)       18 (4.6%)       10 (9.4%)       6 (8.7%)         ≥ 3 times/y       1 (1.1%)       9 (2.3%)       3 (2.8%)       2 (2.9%)         ixperienced at least 1 sunburn that       "burned with peeling"       91 (95.8%)       372 (94.7%)       .799 <sup>†</sup> 101 (96.2%)       68 (98.6%)       .649 <sup>†</sup> ies       4 (4.2%)       21 (5.3%)       4 (3.8%)       1 (1.4%)       .649 <sup>†</sup> xperienced at least 1 sunburn that       95 (100%)       389 (99.0%)       1.0 <sup>†</sup> 105 (100%)       69 (100%)       1.0 <sup>†</sup> ies       0 (0%)       4 (1.0%)       0 (0%)       0 (0%)       1.0 <sup>†</sup> 105 (100%)       69 (100%)       1.0 <sup>†</sup>	Never	63 (66.3%)	196 (49.9%)	.021 <sup>†</sup>	51 (48.1%)	30 (43.5%)	.915 <sup>†</sup>
-2 times/y 5 (5.3%) 18 (4.6%) 10 (9.4%) 6 (8.7%) ≥ 3 times/y 3 (2.8%) 2 (2.9%) xperienced at least 1 sunburn that "burned with peeling" lo 91 (95.8%) 372 (94.7%) .799 <sup>†</sup> 101 (96.2%) 68 (98.6%) .649 <sup>†</sup> 4 (4.2%) 21 (5.3%) 4 (3.8%) 1 (1.4%) xperienced at least 1 sunburn that was "very painful with blistering" lo 95 (100%) 389 (99.0%) 1.0 <sup>†</sup> 105 (100%) 69 (100%) 1.0 <sup>†</sup> es 0 (0%) 4 (1.0%) 0 (0%) 0 (0%)	Once-twice only	26 (27.4%)	170 (43.3%)		42 (39.6%)	31 (44.9%)	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1-2 times/y	5 (5.3%)	18 (4.6%)		10 (9.4%)	6 (8.7%)	
Experienced at least 1 sunburn that       91 (95.8%) $372 (94.7\%)$ $.799^{\dagger}$ $101 (96.2\%)$ $68 (98.6\%)$ $.649^{\dagger}$ lo       91 (95.8%) $372 (94.7\%)$ $.799^{\dagger}$ $101 (96.2\%)$ $68 (98.6\%)$ $.649^{\dagger}$ lo       91 (95.8%) $372 (94.7\%)$ $.799^{\dagger}$ $101 (96.2\%)$ $68 (98.6\%)$ $.649^{\dagger}$ xperienced at least 1 sunburn that       4 (3.8%)       1 (1.4%)       1 (1.4%)         was "very painful with blistering"       95 (100%) $389 (99.0\%)$ $1.0^{\dagger}$ $105 (100\%)$ $69 (100\%)$ $1.0^{\dagger}$ lo       95 (100%) $389 (99.0\%)$ $1.0^{\dagger}$ $0 (0\%)$ $0 (0\%)$ $0 (0\%)$ $0 (0\%)$	$\geq$ 3 times/y	1 (1.1%)	9 (2.3%)		3 (2.8%)	2 (2.9%)	
$ \begin{array}{c} \text{lo} & 91 \ (95.8\%) & 372 \ (94.7\%) & .799^{\dagger} & 101 \ (96.2\%) & 68 \ (98.6\%) & .649^{\dagger} \\ \text{es} & 4 \ (4.2\%) & 21 \ (5.3\%) & 4 \ (3.8\%) & 1 \ (1.4\%) \\ \text{experienced at least 1 sunburn that} & \\ \text{was "very painful with blistering"} \\ \text{lo} & 95 \ (100\%) & 389 \ (99.0\%) & 1.0^{\dagger} & 105 \ (100\%) & 69 \ (100\%) & 1.0^{\dagger} \\ \text{es} & 0 \ (0\%) & 4 \ (1.0\%) & 0 \ (0\%) & 0 \ (0\%) \\ \end{array} $	Experienced at least 1 sunburn that "burned with peeling"				·		
Yes       4 (4.2%)       21 (5.3%)       4 (3.8%)       1 (1.4%)         Experienced at least 1 sunburn that       95 (100%)       389 (99.0%)       1.0 <sup>†</sup> 105 (100%)       69 (100%)       1.0 <sup>†</sup> lo       95 (100%)       389 (99.0%)       1.0 <sup>†</sup> 105 (100%)       69 (100%)       1.0 <sup>†</sup> lo       0 (0%)       4 (1.0%)       0 (0%)       0 (0%)       0 (0%)       1.0 <sup>†</sup>	No	91 (95.8%)	372 (94.7%)	.799 <sup>†</sup>	101 (96.2%)	68 (98.6%)	.649 <sup>†</sup>
Experienced at least 1 sunburn that         was "very painful with blistering"         lo       95 (100%)       389 (99.0%)       1.0 <sup>†</sup> 105 (100%)       69 (100%)       1.0 <sup>†</sup> es       0 (0%)       4 (1.0%)       0 (0%)       0 (0%)       0 (0%)	Yes	4 (4.2%)	21 (5.3%)		4 (3.8%)	1 (1.4%)	
Io         95 (100%)         389 (99.0%)         1.0 <sup>†</sup> 105 (100%)         69 (100%)         1.0 <sup>†</sup> ies         0 (0%)         4 (1.0%)         0 (0%)         0 (0%)         0 (0%)	Experienced at least 1 sunburn that was "very-painful with blistering"	( ··	()		(,	· · · · · ·	
'es         0 (0%)         4 (1.0%)         0 (0%)         0 (0%)	No	95 (100%)	389 (99.0%)	1.0 <sup>†</sup>	105 (100%)	69 (100%)	1.0 <sup>†</sup>
	Yes	0 (0%)	4 (1.0%)		0 (0%)	0 (0%)	
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### Table II. Cont'd

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	A	ge 1 y (12-23 mo)	Age 2 y (24-35 mo)			
	Cohort 1 (1991) N = 95	Cohort 2 (1999-2002) N = 394	P value	Cohort 1 (1991) N = 106	Cohort 2 (1999-2002) N = 69	P value
Ever sunburned on back or shoulders?						
No	60 (65.2%)	354 (89.9%)	.0005*	49 (48.0%)	62 (89.9%)	.0005
Yes	32 (34.8%)	40 (10.1%)		53 (52.0%)	7 (10.1%)	
Acquired MN						
Acquired MN on back of trunk						
No	56 (60.2%)	334 (84.8 %)	.0005*	26 (25.2%)	42 (60.9%)	.0005
Yes	37 (39.8%)	60 (15.2%)		77 (74.8%)	27 (39.1%)	
No. of MN on back of trunk						
Mean (±SD)	0.62 (1.0)	0.21 (0.6)	.0005 <sup>‡</sup>	2.45 (3.4)	0.67 (1.3)	.0005
Median (IQR)	0 (0-1)	0 (0-0)		2 (0-3)	0 (0-1)	
Range	0-7	0-6		0-23	0-9	
Acquired any MN on body						
No	6 (6.3%)	72 (18.3%)	.004*	0 (0%)	5 (7.2%)	.009 <sup>†</sup>
Yes	89 (93.7%)	322 (81.7%)		106 (100%)	64 (92.8%)	

IQR, Interquartile range; MN, melanocytic nevi.

\*Pearson  $\chi^2$  test.

<sup>†</sup>Fisher exact test.

<sup>‡</sup>Nonparametric Mann-Whitney test.

<sup>§</sup>Kruskal-Wallis test.

574 [T2] (Table II). The median number of hours spent play-575 ing in the water in the warmer months was higher in 576 cohort 2 although this did not reach significance in 577 the 2-year-olds (Table II). A higher proportion of 578 children in cohort 2 went to the beach (P < .001) and 579 swam in outdoor pools ( $P \leq .03$ ) (Table II). "Playing 580 in water with back exposed during warmer half of 581 year" was more frequent among the children in 582 cohort 1 (both P < .001) (Table II). 583

By the time they were 2 years old, more than half 584 the children had been sunburned (52.4% in 1991; 585 55.9% in 1999) (Table II) although there was a higher 586 percentage of 1-year-olds in cohort 2 (51.2%) than in 587 cohort 1 (35.5%) with a recorded sunburn (P = .007) 588 (Table II). A lower proportion of children in cohort 2 589 had ever been sunburned on the back or shoulders 590 (both P < .001), acquired MN on the back of trunk 591 (both P < .001), or acquired any MN on their bodies 592 (P < .01) (Table II). 593

Multivariate analysis confirmed that children in cohort 2 had spent, on average, more hours outside in the sun on a typical day in the previous year than children in cohort 1 (regression coefficient 0.17; 95% confidence interval 0.04-0.30; P = .014; logtransformed outcome) when adjusted for all potential confounders.

### Sun-protection measures

Although fewer than half the children almost always used sunscreen when outdoors during summer, this was higher among cohort 2 (1-yearolds, 23.4% vs 48.1%, P < .001; 2-year-olds, 20.0% vs 43.3%, P = .001) (Table III). Overall the use of [T3] sunscreen during the winter months was lower than in summer, and although a higher proportion of children in cohort 2 used this sun-protective measure in winter, the difference between cohorts was not significant among the 2-year-olds (Table III). Significantly more children in cohort 2 almost always wore protective swimwear (a shirt or Lycra suit that Q8 protects the trunk) while swimming outdoors (both seasons P < .001) (Table III). A Lycra cover-up suit was worn when swimming outdoors by 65.9% of 1year-olds and 69.6% of 2-year-olds in cohort 2; these data were not available for cohort 1 (Table IV). Hat [T4] use data were only collected for cohort 2; a legionnaires hat was the most common hat type worn Q9 outdoors (1-year-olds, 44.9%; 2-year-olds, 54.4%). Furthermore, 63.8% of 1-year-olds and 73.5% of 2year-olds almost always wore a hat when outdoors during summer whereas 53.5% of 1-year-olds and 60.3% of 2-year-olds did so during winter (Table IV).

Multivariate analysis confirmed that children in cohort 2 had, on average, acquired fewer MN than children in cohort 1 (regression coefficient -0.62; 95% confidence interval -0.80 to -0.44; P < .001; log-transformed outcome) when adjusted for all potential confounders.

### DISCUSSION

The major findings from this study were that the sun-protective measures undertaken appeared to 658

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### Table III. Changes in sun-protective practices in children of same age in 2 cohorts recruited more than 8 years apart in tropical Australia

	Age 1 y (12-23 mo)			Age 2 y (24-35 mo)		
	Cohort 1 (1991) N = 95	Cohort 2 (1999-2002) N = 394	P value*	Cohort 1 (1991) N = 106	Cohort 2 (1999-2002) N = 69	P value
Use of sun protection						
Summer sunscreen use						
Children who almost always wear sunscreen outdoors during summer	22 (23.4%)	188 (48.1%)	.0005	21 (20.0%)	29 (43.3%)	.001
Children who wear sunscreen less often	72 (76.6%)	203 (51.9%)		84 (80.0%)	38 (56.7%)	
Winter sunscreen use						
Children who almost always wear sunscreen outdoors during winter	16 (16.8%)	110 (28.3%)	.023	17 (16.3%)	18 (26.9%)	.096
Children who wear sunscreen less often	79 (83.2%)	279 (71.7%)		87 (83.7%)	49 (73.1%)	
Summer swim-shirt use						
Wears shirt or Lycra suit that protects trunk while swimming outdoors during summer						
Rarely/never	15 (18.8%)	92 (23.7%)	.0005	23 (23.2%)	12 (17.6%)	.000
Sometimes	24 (30.0%)	29 (7.5%)		31 (31.3%)	3 (4.4%)	
Almost always	41 (51.3%)	268 (68.9%)		45 (45.5%)	53 (77.9%)	
Winter swim-shirt use						
Wears shirt or Lycra suit that protects trunk if swims outdoors during winter						
Rarely/never	11 (19.3%)	73 (27.5%)	.001	23 (28.8%)	7 (17.1%)	.001
Sometimes	16 (28.1%)	26 (9.8%)		22 (27.5%)	2 (4.9%)	
Almost always	30 (52.6%)	166 (62.6%)		35 (43.8%)	32 (78.0%)	

\*Pearson  $\chi^2$  test.

improve over the study decade, even though time 690 spent in the sun did not decrease. Children in cohort 2 spent more time in the sun on a typical day and playing in water in the warmer months than those in cohort 1. A higher proportion went to the beach and 694 swam in outdoor pools, although children in cohort 1 were more likely to play in water with their backs exposed during the warmer months. By age 2 years, more than half the children in this extreme UV radiation environment<sup>22</sup> had already been sunburned, although a smaller proportion of children 699 700 in cohort 2 had been sunburned on the back of the trunk or acquired MN.

702 Although overall sunburn rates did not decrease, 703 the increased popularity of sun-protective swimwear, 704 protecting the torso, reduced the frequency of sun-705 burn on the back of the trunk, and may explain why 706 children in cohort 2 developed fewer MN at this body 707 site. The reduction of this biomarker is promising 708 given MN are the key risk markers for melanoma 709 development.<sup>3</sup> The only other publication reporting a 710 reduction in MN prevalence with increased sun pro-711 tection involved 7-year-old Swedish children.<sup>23</sup> 712 Overall, there was no reduction in sun exposure 713 over the study decade, despite skin cancer prevention 714 campaigns. Although more children in cohort 2 swam 715 outdoors and went to the beach, most almost always

wore swim-shirts, and therefore spent less time playing in water with their back exposed. This suggests that some sun-safe messages are being heeded, although it may be at the cost of increased time spent in the sun, highlighting the importance of emphasizing the multifaceted nature of effective sun protection.

Other studies among infants and toddlers have yielded similar findings.<sup>10</sup> For example, in a survey of participants aged 0 to 45 months from southeast Queensland, Australia, a third had been sunburned by age 11 months and 82% had been burned by age 45 months.<sup>24</sup> Fewer children in our study experienced sunburn, possibly because of: the younger age of our cohorts; different definitions of sunburn; or the difference in geographic location (19°S vs 26°S).

A literature review found sunscreen was the most frequently used sun-protection method in children.<sup>10</sup> In the study reported here, hats and protective swimwear were worn more often than sunscreen. Children aged 1 to 3 years attending child care in Brisbane, Australia (27°S), in 2000 reportedly wore hats more often than children in this study.<sup>25</sup> In contrast, more children in cohort 2 wore legionnaire or wide-brimmed hats than children attending childcare centers across Queensland, Australia, in 2002.<sup>26</sup>

Sun exposure is associated with nevus development,<sup>27</sup> a key determinant of melanoma risk.<sup>3,14</sup> 760

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		Age 1 y		Age 2 y
Usual type of head covering worn outdoors				
Nothing	Not available for	16 (4.1%)	Not available for	2 (2.9%)
Сар	cohort 1 (1999)	72 (18.3%)	cohort 1 (1999)	8 (11.8%)
Wide-brimmed hat		129 (32.7%)		21 (30.9%)
Legionnaires hat		177 (44.9%)		37 (54.4%)
Hat wearing: frequency during summer				
Never wears hat in summer	Not available for	16 (4.1%)	Not available for	2 (2.9%)
Wears hat less than half time	cohort 1 (1999)	21 (5.4%)	cohort 1 (1999)	1 (1.5%)
Wears hat about half time		44 (11.2%)		5 (11.2%)
Wears hat more than half time		61 (15.6%)		10 (14.7%)
Almost always		250 (63.8%)		50 (73.5%)
Hat wearing: frequency during winter				
Never wears hat in winter	Not available for	23 (5.9%)	Not available for	4 (5.9%)
Wears hat less than half time	cohort 1 (1999)	44 (11.3%)	cohort 1 (1999)	6 (8.8%)
Wears hat about half time		67 (17.1%)		9 (13.2%)
Wears hat more than half time		48 (12.3%)		8 (11.8%)
Almost always		209 (53.5%)		41 (60.3%)
Hat-wearing score				
Mean (SD)	Not available for	14.5 (7.5)	Not available for	16.4 (6.9)
Median (IQR)	cohort 1 (1999)	16 (8-24)	cohort 1 (1999)	16 (12-24)
Range		0-24		0-24
Usual swimwear worn				
Nothing (naked)	Not available for	5 (1.3%)	Not available for	2 (2.9%)
Underpants	cohort 1 (1999)	15 (3.8%)	cohort 1 (1999)	3 (4.3%)
Shorts only		4 (1.0%)		0 (0%)
Shorts and shirt		35 (8.9%)		8 (11.6%
2-Piece swimsuit (bikini) only		23 (5.9%)		2 (2.9%)
Full-piece swimsuit only		44 (11.2%)		5 (7.2%)
Full-piece swimsuit/briefs and shirt		7 (1.8%)		0 (0%)
Lycra cover-up suit		259 (65.9%)		48 (69.6%)

IQR, Interquartile range.

Thus it is particularly relevant that fewer children in cohort 2 than cohort 1 developed MN on the back of the trunk, especially as children raised in Townsville, Australia, develop more MN earlier in life than children raised elsewhere.5,16 

These data suggest increased sun protection alone (less direct sun exposure) may have slowed MN development without reducing time spent outdoors. The ability to modify the rate of acqui-sition of MN by sun protection has previously been reported. Sunscreen reduced MN development in 1 study.<sup>28</sup> had no effect in another.<sup>29</sup> and was associated with higher nevus counts in others.<sup>30,31</sup> Wearing sun-protective swimwear has also been shown to be a factor in the prevention of MN,<sup>32,33</sup> whereas legionnaire hats have been associated with lower nevus counts and hat use in general has been associated with fewer MN on the head and neck.25 

> Study limitations include the possibility of information bias in questionnaire data as parents may

have altered their responses to overreport sun protection to reflect socially desirable behavior.<sup>34</sup> However, nondifferential bias would have resulted in underestimation rather than overestimation of differences between cohorts. Recruitment of the 2 cohorts differed: cohort 1 was recruited from birth records whereas cohort 2 was recruited from childcare centers. However, nowadays most Australian Q10 children attend some formal child care. Comparison of the 2 cohorts showed few differences, but children from child-care centers may have been subjected to better sun-protection practices where an established sun-safe policy was in place. It has previously been shown that child-care centers with written sunprotection policies provide better sun protection for young children in their care.<sup>26</sup> The results of this study cannot be generalized to any other group or to the Australian population.

Early childhood is a vulnerable period, not only biologically but also behaviorally, as infants and young children are incapable of deciding about or

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J Am Acad Dermatol Volume **III**, Number **I** 

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implementing sun-protection measures.<sup>35</sup> Thus it is
important to encourage parents and supervisors to
provide sun protection by reinforcing their knowledge<sup>24</sup> and modifying their health-related attitudes
and beliefs about sun safety, to lay the foundations for
the future sun-safe behavior of the children in their
care.<sup>36</sup>
The results of this study suggest the need for a

The results of this study suggest the need for a change of approach and continued momentum in public health campaigns, particularly encouraging the use of sun-protective clothing. Assessing the trend in sun-protective practices over time provides some direction for future skin cancer prevention. This study has identified the importance of maintaining the focus of such programs on children.

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