Appendix 7: Evidence tables

Table A: Provision of shade evidence tables

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
Author Boldeman et al.[8] **Year** 2004 **Study aim** To assess the effect of physical outdoor environments on ultraviolet radiation (UVR) and the protective impact of intentionally protective planning of children's outdoor environments **Study design** Observational study **Internal validity** - **External validity** +	**Country** Sweden **Setting** Educational setting Clear weather conditions and the highest temperature was 15.4 and 16.2º centigrade (°C) on the first two days and then between 19.2 and 26.3 º C **Source population** Two pre-schools in Haninge, Sweden **Eligible population** Children aged 1-6 at one private pre-school (attended by 34 children - site 1) and one public pre-school (attended by 108 children - site 2) **Selected population** 30 of 108 children at site 2 were selected by staff and all 34 children at site 1.	**Method of allocation** Schools were classified based on the pre-schools physical outdoor environment. **Intervention** Play equipment and areas most frequently used by the children were positioned under a grove of pine trees (i.e. mainly in the shade) in the middle of the day (site 2). **Comparator** Same access to shade as the intervention site, but play equipment and play areas most frequently used by children were exposed to the sun in the middle of the day (site 1). **Intervention period** May to June 2002 (11 work days) **Sample size** n=64 children **Baseline comparisons**	**Sun protection practices** Outcome not assessed **Sun exposure** Commercial spore dosimeters were used to measure dosimeter exposure per day based on 11 days measurement. Two dosimeters (one on each shoulder) were attached to each child. They were attached on arrival at school and removed before going home. Exposure was measured in joules/metre^2 (based on International Commission on Illumination (CIE) standard) and minimal erythema dose (MED). The mean value for each pair of dosimeters was used. Details of children's arrival and departure times, absences, and time spent outdoors were recorded and time spent outdoors calculated. Data on global ultraviolet radiation at the geographical	**Sun exposure** The average time spent outdoors was 207 minutes per day at site 1, with a dosimeter ultraviolet radiation exposure of 222 J/m^2) per day. At site 2 the average time spent outdoors was 260 minutes per day with ultraviolet radiation exposure of 175 J/m^2) per day. Site 1: available UV radiation of time spent outdoors; weighted mean 15.3% (CI[a]: 14.3 to 17.5) Site 2: weighted mean 13.3% (CI: 9.9 to 14.6) ($p<0.05$) Children at site 2 were exposed to 13% less ultraviolet radiation than children at site 1 ($p<0.05$). Subgroup analysis by age and sex On both sites, the mean ultraviolet radiation exposure was less for older children compared to young children. Exposure was lower among girls than boys, especially at site 2. 1-4 years: 6% lower exposure at site 2 5-6 years: 41% less ultraviolet exposure at site 2	**Limitations identified by author** The main limitation with this study was that it was an observational study investigating current shade, it did not evaluate the impact of provision of shade. Unknown confounding variables may have been important. Various confounding variables identified by the authors include: (1) dilution of the results due to young boys cycling on a sunny spot at site 2, (2) reportedly lower UV exposure among girls possibly due to long hair interfering with the dosimeters, (3) the difference in UV exposure was small, and (4) areas immediately outside school were sunny at both sites, and young children may have preferred to stay close by. **Limitations identified by review team** (1) It was unclear from the

	Age 1-4 years: n=42 5-6 years: n=22 **Female** n=38 **Race/ethnicity** Not reported **Socioeconomic status** Not reported **Skin type** Not reported **Other** Site 1: children stayed indoors until noon when outdoor activities began; Site 2: the youngest children stayed indoors between 11am and 2pm and older children were out most of the day. However the available ultraviolet radiation exposure of children's outdoor stays at the two sites were very similar as the sunlight was weaker at the times children at site 2 were outdoors.	Locations of the two sites and outdoor activities were similar. Weather conditions and available global UVR were similar at both sites: site 1: 33,290 J/m^2; site 2: 33,350 J/m^2. **Study sufficiently powered?** Not reported	position of the two sites were obtained from the Swedish Meteorological and Hydrological Institute. The average relative ultraviolet radiation exposure of the children was calculated as a proportion of the total available ultraviolet radiation from 8.30am to 6.30pm. **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Post-intervention (11th day) **Method of analysis** Differences in ultraviolet radiation exposure (available global ultraviolet radiation and measured personal ultraviolet exposure) between	Exposure was lower amongst all subgroups at site 2 compared to site 1, except 1-4 year old boys (23.1% versus 16.7%). **Attrition details** One dosimeter was lost at site 1, and two pairs were excluded from the analysis at site 2 (one child was mostly absent, and the other's hair shielded the dosimeters) (123 dosimeters were available for analysis).	information provided how the two pre-schools were selected and how they compared to others in the area, and (2) sample sizes were small. **Evidence gaps and/or recommendations for future research** Further research is required to determine potential variations in the protective impact of different environments in varying topographies, climates, and latitudes. The authors recommend that when designing children's pre-school playgrounds, policy makers and city planners consider appearance and availability of shady environments. **Source of funding** Funded by the Swedish Radiation Protection Authority

			the different groups of children at each site were calculated using t-tests. Subgroup analyses were conducted by gender and age.		
Author Boldemann et al.[7] **Year** 2006 **Study aim** To assess the impact of different preschool outdoor environments on children's spontaneous physical activity and sun exposure. **Study design** Observational study **Internal validity** - **External validity** +	**Country** Sweden **Setting** Educational setting Weather cloudy and rainy at start and end of assessment period with clear skies or variable cloudiness on the other days. Temperature ranged from 8.6 to 25.3º C. **Source population** Preschools in south, central, and north of Stockholm, Sweden **Eligible population** The selection of schools was based upon previous experience of the authors and information from local authorities regarding the outdoor environment. 4 to 6 year old children (n=268) attending 11 pre-schools in Stockholm, Sweden were asked to participate. **Selected population** Eleven pre-schools (199 children whose parents gave consent) with variable outdoor environments	**Method of allocation** The outdoor environments were classified as high or low quality environments for play and shade by the researchers based on three criteria. The preschool outdoor areas were classified, based on their play potential and shade, into high or low play environment: They scored 1,2, or 3 for each of the following total outdoor area: (1)(a) small (<2000 m^2), (b) medium (2000-6000 m^2), (c) large (>6000 m^2); (2) overgrown surface (trees, shrubbery) and broken ground: (a) little/nonexistent, (b) half of area; and (3) integration of play structures or other defined play areas with vegetation. Environments with common features of vegetation along the edges close to buildings and fences and/or scanty vegetation adjacent to play structures/areas scored 1. Environments with (a) play structures/areas adjacent to trees and shrubbery or integrated in areas with the character of wild nature, or (b) open spaces located	**Sun protection practices** Outcome not assessed **Sun exposure** A polysulphone dosimeter was attached to the right shoulder to assess erythemally effective UV radiation exposure (based on 12 days of measurement). The fraction of visible free sky was also measures and details of children's arrival and departure times and time outdoors were recorded and time spent outdoors calculated. The outdoor UV fraction for each child was calculated as individual exposure as a proportion of total available UVR from 8.30am to 6.30pm (J/m^2). **Long-term outcomes** Outcome not assessed **Adverse consequences** Adverse or unintended effects Use of pedometers to measure indoor and outdoor activity (step counts per minute) **Knowledge, attitudes, beliefs**	**Sun exposure** Mean UVR exposure ranged from 83 J/m^2 (CI: 67 to 98) to 292 J/m^2 (CI[a]: 232 to 351). The mean exposure to UV radiation was lower in high environment than low environment schools: high outdoor play environment (n=5) mean outdoor UV fraction 14.6% versus low environment mean 24.3% (p<0.001). Four variables were significantly associated with UV exposure: free sky, environment category (high, low), inter-site attendance and outdoor education. When analysed in the linear mixed model only free sky remained significant (p<0.001). A high environment category reduced UV exposure by 50-100 J/m^2 per day in a child staying 7 hours at preschool and spending half of the time outdoors. There was no difference in UV exposure by gender. **Adverse consequences** In high environments the mean step count was 21.5 steps/minute and in low environments 17.7 steps/minutes (p<0.001). Four preschool variables (including environment) and 5 individual variables were significantly correlated with step count/minute. When these were jointly	**Limitations identified by author** Pedometry does not measure the intensity of an activity in terms of calorie expenditure and does not register certain activities. Furthermore, other variables such as staffing levels may have affected the levels of activity. **Limitations identified by review team** This was an observational study investigating current shade, it did not evaluate the impact of provision of shade. Unknown confounding variables may have been important and the reliability of the method used to classify the environmental shade is unclear. **Evidence gaps and/or recommendations for future research** None specified **Source of funding** Funded by the Centre for Public Health, Stockholm County Council, the Swedish Council for Environment, Agricultural Sciences and

	(education at three sites was almost entirely outdoors). **Age** 4.5 to 6.5 years **Female** 42.7% **Race/ethnicity** Not reported **Socioeconomic status** One third of mothers had postgraduate education and either parent in half of households **Skin type** Not reported **Other** 17% (n=34) overweight/obese 9% suffered from protracted/chronic disease (predominantly asthma, allergies) 95% spent at least one hour outdoors on an ordinary Sunday	between play structures/areas scored 2. Environments with both the above scored 3. The sum of environment scores per site were divided by three and the averages dichotomized to classify sites into high (>2) and low (<2) quality environment. **Intervention** Sites with a high outdoor play environment score **Comparator** Sites with a low outdoor play environment score **Intervention period** May-June 2004 (12 days) **Sample size** n=199 children High quality environment sites: 5 preschools Low quality environment sites: 6 preschools **Baseline comparisons** Global available UVR ranged from 29,368 Jm^2 to 31.832 J/m^2 **Study sufficiently powered?** Not reported	Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Not applicable **Method of analysis** The correlation between several variables and UV exposure and step count were calculated using: t-test (environment category, gender, dichotomized body mass index, being outdoors without adult supervision, leisure time activities involving physical activity, outdoor education); Kendall's tau-b correlation coefficient (surface in- and outdoors, age 4.5-6.5 years by 6 month periods, attendance days/week, time spent outdoors on a usual Sunday, child's health as stated by parent, child's socioeconomic standard by mother's education, and by highest of parents' education); and Pearson's correlation	analysed in the linear mixed model, gender and environment remained statistically significant. A high environment score increased step count by 3.6 steps/minute or 20% from 17.7 to 21.3 steps/minute ($p<0.001$). Translating into 1500-2000 more steps per day in a child staying 7 hours as preschool and spending half of the time outdoors. **Attrition details** 2 children were absent during the whole measurement period and were excluded from the analysis. 90% of children were measured for five days or more. It is unclear how many were measured for the full observation period.	Spatial Planning, and the Swedish Radiation Protection Authority.

			coefficient (body mass index, outdoor stay, inter-site attendance, individual attendance). Statistically significant associations were entered into a linear mixed model analysis and then sequentially removed (p>/= 0.05) based on the highest p value first.		
Author Dobbinson et al. [6] **Year** 2009 **Study aim** To assess the extent to which students use or avoid newly shaded areas created by shade sails in schools. **Study design** Cluster RCT **Internal validity** ++ **External validity** +	**Country** Australia **Setting** Educational setting Temperature at baseline Intervention: mean 19.5ºC (range 9.7-33.7) Control: mean 19.5 ºC (range 9.7-33.7) **Source population** 147 Secondary schools from outer metropolitan areas of Melbourne, Australia. **Eligible population** 127 secondary schools that enrolled 300 or more students with all year levels (7-12) on campus and with two potential shade development areas (a full sun area during spring and summer terms; a sufficiently large space for students to congregate; used regularly by students and located in a main activity area	**Method of allocation** Schools were randomly assigned (without matching or stratification) to intervention or control groups. **Intervention** Construction of shade sail structure at one of two full sun sites at each intervention school for students to use during passive outdoor activities such as eating lunch. The schools preferred area was defined as the primary site and the adjacent or nearby area, the secondary site. The average size of the sail was 74 m^2 (range 46-120 m^2), constructed to provide full shade at noon. **Comparator** Control: no built shade at either full sun site **Intervention period**	**Sun protection practices** (1) Change in the mean number of students using the primary site during lunch-times in Spring and Summer terms (before and after the intervention), (2) Change in the mean number of students using the alternative site (shade avoidance) Sites were observed using a digital video camera. On each observation date, sites were filmed for three periods of two minutes at approximately equal intervals during the main part of lunchtime. Schools were randomly assigned to the day of the week for observation. Participants were informed it was a study of outdoor behaviour. Eight trained coders who had achieved high agreement at training undertook content analysis of	**Sun-protection behaviours** (1) Student use of primary site There was a statistically significant difference in mean change in the use of the primary site (25 intervention schools; 26 control schools) using unpaired t-test and intention to treat analysis: 2.67 students (95% CI: 0.65 to 4.68, p=0.011) Mean use (SD) Baseline: intervention 3.24 (2.83) (range 0-30 students); control 3.49 (2.82) (range 0-59 students) Group difference = -0.25 Post intervention: intervention 5.87 (4.70) (range 0-47); control 3.46 (2.69) (range 0-34) Group difference = 2.41 Mean change from baseline to post intervention: intervention 2.63 (4.26); control -0.03 (2.78) (2) Student use of alternative site (shade avoidance) (24 intervention schools; 26 control schools) did not change significantly. Mean change from baseline to post	**Limitations identified by author** (1) Effects of shade were mainly assessed in seated recreation sites rather than active sites. (2) The most frequently used and attractive areas in school may not have been reflected in the choice of shade sail development area. (3) There was only a very small difference in the average number of students using the shaded compared to unshaded primary sites. (4) Treatment effect may have been underestimated as two of the schools in the intervention group did not receive the shade sail. **Limitations identified by review team** None identified; No significant flaws or sources of bias.

	of the school; avoided existing underground services, major paths, and roadways) and approved as suitable by the school. **Selected population** 51 Secondary schools Enrolment size at baseline Intervention: mean 903 (range 277-1876) Control: mean 859 (range 229-1371) **Age** Adolescents **Female** Not reported **Race/ethnicity** Not reported **Socioeconomic status** Not reported **Skin type** Not reported	2005-2006 **Sample size** Intervention: n=25 schools Control: n=26 schools **Baseline comparisons** Weather conditions (temperature and cloud cover), missing observation data, and school environment size (school enrolments) were similar between intervention and control groups pre- and post-intervention. **Study sufficiently powered** Cohen's power tables suggested that 30 matched pairs were required for 80% power to detect a large intervention effect (g=0.25). The authors state that the unmatched design increased the degrees of freedom from 29 to 58 compared to matched pairs design.	the film. Use of the site was defined as; not having been previously counted and being within the site boundaries playing, standing, sitting, or chatting to others for more than two frames (approximately 20 seconds). **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** School reports of vandalism to the shade sails or injuries resulting from building the sails. **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Yes **Other outcomes** Cost of the shade sails and their construction **Follow-up period** Baseline observation was over 16 weeks (spring and summer terms 2004-5) and post-	intervention: intervention -0.03 (95% CI: -1.09 to 1.02); control 0.87 (95% CI: -0.22 to 1.95) Group difference* = 0.90 (95% CI: -2.03 to 0.23, p=0.119) .(*Excludes one intervention school where observations of the alternative site were not possible). The mean change was greater for the primary sites compared with alternative sites; 2.70 (95% CI: 0.75, 4.64, p=0.007) at intervention schools, but there was no difference at control schools. **Adverse consequences** None of the schools reported any vandalism to the shade sails or injuries resulting from building the sails. **Process and implementation** (1) Two intervention schools did not receive a shade sail, two control schools built shaded areas, and one intervention school used portable shade umbrellas. (2) The authors state that a pilot study to assess the feasibility of shading areas where more active recreation takes place found there were more constraints, such as safety concerns, and the need for larger sails. (3) Although the shade sails were large on average, they were used by only six students at a time. The authors suggest that groups of friends might avoid encroaching on others space, limiting optimal use of the sail shade. **Other outcomes** Average cost per shade: $A11,500 Maximum construction costs: $A22,000	**Evidence gaps and/or recommendations for future research** To examine whether increased shade is beneficial for the prevention of skin cancer in adolescents in settings other than schools. To determine the circumstances that maximise use of shade structures (such as seating arrangements as well as size of sail) and what types of areas in schools would be best for shade sails. **Source of funding** Australian National Health and Medical Research Council; research project grant (ID 265902)

			intervention was over 14 weeks (spring and summer terms 2005-6. **Method of analysis** Dates with two or three lunch time observations were included to calculate the aggregate mean of observations pre- and post-intervention in the intervention and control groups. The mean change in students' use of the primary site (pre- and post-intervention) was then calculated for intervention and control sites using unpaired t test. Differences in the students' use of the alternative sites were also calculated. Fitted generalised estimating equations with robust standard errors were fitted to the date, allowing for an interaction between group and site. Intra-school correlation coefficients were also calculated by fitting linear mixed models to the non-aggregated data. ITT for primary outcome	**Attrition details** None of the schools dropped out, but some observations were missing due to filming difficulties etc: Missing observations (mean)Pre-test: intervention 3.8 (range 2-7); control 3.3 (1-6) Post-test: intervention 1.8 (0-4); control 1.3 (0-4)	

[a] paper did not explicitly state whether the confidence intervals used were at 95% level

Table B: Provision of multi-component interventions at beaches and pools evidence tables

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
Author Dobbinson et al.[15] **Year** 1999 **Study aim** To explore differences in sun protection attitudes and behaviours between lifesavers in Victoria and New South Wales **Study design** Observational study (with a comparison community) **Internal validity** - **External validity** +	**Country** Australia **Setting** Beach **Source population** Lifesaving clubs in Victoria (intervention area: 55 clubs, n= 5500 members) and New South Wales (control area: 120 clubs, n= 9100 members), Australia **Eligible population** A random selection of life saving clubs from the two areas **Selected population** **Age** Intervention: 52% <20 years Control: 37% <20 years **Female**: 33% **Race/ethnicity** Not reported **Socioeconomic status** Not reported **Skin type** (Lifesavers) Susceptible to sunburn: one third Darker skin type: two thirds	**Method of allocation** Sponsorship programme provided in Victoria and compared with a community (New South Wales) where the sponsorship programme had not been implemented. **Intervention** A 10 year sponsorship programme of life-saving associations in Victoria to promote structural change, including: (1) Education for lifesavers on better sun protection practices,; emphasis on the importance of them as role models for the safe use of beaches and pools. (2) Lifesavers were provided with sunscreens, which they could then sell at a profit. (3) Shade structures and protective clothing supplied by sponsor (including broad-brimmed hats and long-sleeved t-shirts). (4) Access to training programmes for youth to raise awareness and education related to skin cancer. **Comparator** (1) Life-savers from New South	**Sun protection practices** Use of sunscreen, shade, and protective clothing or hat (1) change in life-savers behaviours - self report of 'usually or always' protected from the sun (2) comparison with control - self reported behaviour **Sun exposure** Self report relating to being burnt on patrol that summer (rarely/never or sometimes) **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Lifesavers perceptions of themselves as role models and attitudes to sun tans **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** Public perceptions about lifesavers as	**Sun-protection behaviours** (1) Change in Victorian lifesavers' behaviour between 1989 and 1997 (1989 n=207; 1997 n=129) Hats in sun: 1989 76%; 1997 89% Hats when no sun: 1989 47%; 1997 71% Sunscreen in sun: 1989 83%; 1997 97% Sunscreen when no sun: 1989 46%; 1997 76% Shade/shelter in sun: 1989 59%; 1997 77% Shade/shelter when no sun: 1989 32%; 1997 59% (2) Comparison between intervention and comparator areas (regular use). (Other categories, i.e. sometimes use, rarely/never use are available in the paper) Hats in sun: Intervention 89%; comparator 55% (p<0.001) Hats when no sun: Intervention 71%; comparator 22% (p<0.001) Long-sleeved shirts in sun: Intervention 81%; comparator 60% (p<0.05) Long-sleeved shirts when no sun: Intervention 79%; comparator	**Limitations identified by author** (a) Possibility of self-report bias in actual levels of protection. (b) Sampling methods differed for the surveys conducted in 1989 and 1997. (c) Sunburn differential may be due in part to greater UV levels in the control area. **Limitations identified by review team** (1) Limitations with study design - not prospective, (2) differences between the two areas may have influenced the findings, (3) it was unclear whether participants in the intervention and comparator areas were comparable at baseline (limited data provided), (4) it was not possible to establish influence of provision of shade and free clothing, (5) free sunscreen was provided for the lifesavers to sell on at a profit and not provided specifically for personal use. **Evidence gaps and/or recommendations for future research**

	Skin does 'not burn at all': 14%	Wales, where the SunSmart life-savers sponsorship programme had not been implemented. (2) Comparison of 1997 survey with 1989 survey in Victoria (where sponsorship programme was implemented). **Intervention period** 1988-1997 **Sample size** Total n=263 Intervention n=129 (19 clubs) Comparator n=134 (11 clubs) **Baseline comparisons** Comparator area closer to the equator with higher UV levels on clear days, but more rain in summer than intervention area. Since the 1990s, there has been a comparable sized sun-safe programme in New South Wales. **Study sufficiently powered** Not reported	role models for sun protection practices (based on interviews with beachgoers: Victoria n=228; New South Wales n=153) **Follow-up period** Not applicable (retrospective study design) **Method of analysis** Results are presented as proportions. Chi-squared used to compare groups.	65% (not significant) Sunscreen in sun: Intervention 97%; comparator 85% (p<0.001) Sunscreen when no sun: Intervention 76%; comparator 54% (p<0.001) Shade/shelter in sun: Intervention 77%; comparator 62% (p<0.05) Shade/shelter when no sun: Intervention 59%; comparator 42% (p<0.01) Significantly more lifesavers in the intervention area regularly used a shelter or shade on the beach on sunny (p<0.05) and cloudy days (p<0.01) compared with lifesavers in the comparator area (based on 125 (93%) of the sample reporting an available shelter). Significantly more intervention lifesavers regularly used a hat on sunny and cloudy days (both p<0.001) compared with comparator, and used significantly more sunscreen on sunny and cloudy days (both p<0.001). Intervention lifesavers were significantly more likely to regularly wear a long-sleeved shirt on sunny days compared with lifesavers in the comparator area (p<0.05), but there were no differences in their use on cloudy days.	Cost-effectiveness studies of sponsorships **Source of funding** VicHealth

				Sun exposure Sunburnt while on patrol that summer: Intervention 42%; comparator 65% (p<0.001) **Knowledge, attitudes, beliefs** (1) There were no differences in attitudes to wearing hats or long-sleeved shirts, or in attitudes towards sun tans and approaches to sunbathing between lifesavers in the intervention and comparator areas over the summer. (2) Lifesavers as role models for sun protection (very much). (Other categories, ie. little/not at all, somewhat, quite, and very much are reported in the paper) Effectiveness of lifesavers in promoting sun protection: Intervention 42%; comparator 13% (p<0.001) Effect of lifesavers sun protection practices on beachgoers: Intervention 32%; comparator 24% (p<0.01) Lifesavers encouragement of sun protection precautions (always). (Other categories, ie. rarely/never, sometimes, usually, and always, are reported in the paper) Encouragement of beachgoers:	

				Intervention 23%; comparator 19% (p<0.05) Encouragement of friends: Intervention 44%; comparator 37% (p<0.05) There were no differences in lifesavers encouragement of family. **Other outcomes** Beachgoers perceptions: 76% believed that life-savers sun protection modelling provided some encouragement to beachgoers. There were no significant differences between intervention and comparator areas. **Attrition details** Not applicable (not a prospective study)	
Author Glanz et al.[9] Geller 2001[16] **Year** 2002 **Study aim** To evaluate the impact of a multi-component skin cancer prevention programme on sun protection habits	**Country** United States **Setting** Swimming pool **Source population** Thirty two public municipal and suburban pools, private pools, YMCAs, and military pools in Hawaii and Massachusetts, USA. **Eligible population** Children aged 5 to 10 years of	**Method of allocation** Pools from Hawaii and Massachusetts were randomised separately using a blocking procedure to balance pool size and geographic location. **Intervention** Based on Social Cognitive Theory. The sun protection intervention included 1 hour orientation and training session plus leader's guide for pool staff, and educational and environmental components for children and their	**Sun protection practices** Parents (or other caregivers) completed surveys for themselves and their children, and aquatics staff completed surveys for themselves about their use of sunscreen, shade, protective clothing and hats, and sunglasses using a 4-point ordinal scale ranging from 1 (rarely or never) to 4 (always). Pool Cool staff (two independent observers) conducted observations on the availability of sunscreen, shade, and protective clothing and	**Sun-protection behaviours** Child sun protection and sunburns Parents reported statistically significantly greater use of sunscreen (effect size: d=0.17), shade (d=0.23), and the Composite Sun Protection Habits score (d=0.22) in children in the intervention group at follow-up compared with the control. Sun Protection Habits Score (adjusted mean, SE) Intervention: Baseline (n=558)	**Limitations identified by author** (1) short intervention period, (2) lack of longer term follow-up, (3) repeated cross-sectional design, (4) partial reliance on self-report measures and parents' reports on behalf of their children, (5) it is not possible to determine the influence of each intervention component on the outcomes, (6) no questions relating to the frequency of sunscreen reapplication, and

Study design Cluster RCT **Internal validity** + **External validity** – **Related papers** Diffusion trial: Elliot 2008;[17] Escoffery 2008;[18] Escoffery 2009;[19] Glanz 2005;[20] Hall 2009[21] Pool Cool with and without peer component: Hall 2008;[22]	age (primarily those taking swimming lessons), their parents, and aquatics staff (lifeguards and aquatics instructors) at 32 (pools based on size and provision of swimming lessons, no further details provided). **Selected population** 28 of 32 pools (87.5%) (n=1,010 parent-child responses included in the analysis at baseline and 842 at follow-up), n=15 sun protection intervention pools, n=13 injury prevention (control) pools **Mean Age** (SD) Parents: 39.2 (7.74) Children: 6.6 (1.51) Aquatics staff: 20.9 (0.60) **Female** Parents: 83.0% Children: 47.1% Aquatics staff: 68.7% **Race/ethnicity** Parents: 57.2% Caucasian Aquatics staff:62.5% Caucasian **Socioeconomic status** Parents College educated: 86.0% Household income >$50,000: 68.4% Aquatics staff	parents. Educational components: (1) 8 sun-safety lessons taught at the start of swimming lessons, to reinforce the 4 Pool Cool Rules: to remind children to use sunscreen, cover up, protect their faces and eyes, and seek shade and limit exposure to the sun, (2) a 'big book' to make lessons more interactive, (3) on-site interactive activities, (d) incentives to reinforce sun safety messages (eg. sunscreen samples, t-shirts, Pool Cool hats). Environmental components: (1) provision of refillable pump sunscreen container, (2) a portable shade structure or umbrella (of their choosing), (3) sun-safety signs and sunscreen tips poster. Aquatics staff training: guides on skin cancer and sun safety, Pool Cool lessons, other activities and incentives. Pool managers received a booklet (Decision Maker's Guide for Sun Safe Swimming Pools) and informal consultations to guide them toward more sun safe pool environments and policies. **Comparator** Injury prevention control: lessons and activities on bicycle and	hats at three time points (beginning, middle and end of the summer). Composite measure of behaviours A composite score (Sun Protection Habits score) was calculated for the above 5 sun protection practices for parents/children and aquatics staff, ranging from 1 to 4. Calculation of a composite score required responses on at least 3 of the 5 protective behaviours. **Sun exposure** Parents completed surveys on their child's previous sunburn experience and sunburns during the study summer. Aquatic staff were asked about the number of times they had received a sunburn in the previous and current summer.[16] **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Parents completed 8 questions relating to knowledge about skin cancer and sun protection guidelines, scored as 0 (incorrect) or 1 (correct). Scores were combined to calculate a summary knowledge score. Aquatics staff completed 8 knowledge questions relating to	2.29 (0.02); follow-up (n=452) 2.30 (0.02) Control: Baseline (n=446) 2.33 (0.02); follow-up (n=396) 2.24 (0.02) Group x time interaction F=4.69 (df 1, 1789, p<0.05) There was a dose-response effect on Sun Protection Habits for children receiving two or more swimming lessons or activities compared with parents who reported their children received zero or one. Sunscreen use (adjusted mean, SE) Intervention: Baseline (n=558) 3.09 (0.03); follow-up (n=452) 3.15 (0.04) Control: Baseline (n=446) 3.13 (0.04); follow-up (n=396) 3.05(0.04) Group x time interaction F=3.83 (df 1, 1813, p<0.05) Use of shade (adjusted mean, SE) Intervention: Baseline (n=558) 2.12 (0.03); follow-up (n=452) 2.16 (0.03) Control: Baseline (n=446) 2.20 (0.03); follow-up (n=396) 2.07 (0.04) Group x time interaction F=6.82 (df 1, 1804, p<0.05) There were no statistically significant differences between groups in the use of hats, shirts,	thoroughness of application. **Limitations identified by review team** (1) It is unclear how the 32 eligible pools were selected to participate, (2) limited details on the components other than information giving. **Evidence gaps and/or recommendations for future research** There is a need for more rigorous research to examine the longer term impact of skin cancer prevention interventions. There is also a need for further studies to focus on and evaluate intervention targeted at aquatics staff.[16] **Source of funding** Division of Cancer Prevention and Control, US Centres for Disease Control and Prevention Grant U56-CCU 914658

	High school education or less: 52.6% **Skin type** Not reported for parents or children. 67.9% of aquatics staff reported that the colour of their untanned skin was very fair/fair. **Other** Moderate or high skin cancer risk: 64.7% (parents), 67.8% (children), 68.1% (aquatics staff) One or more sunburns in the previous summer: 40.9% (children) Approximately 50% of aquatics staff reported a history of severe sunburn, and almost 80% reported at least one sunburn during the previous summer.	rollerblading safety, fire safety, traffic and walking safety, poisoning and choking prevention, and playground safety. **Intervention period** Summer 1999 **Sample size** 28 pools; 15 intervention, 13 control (n=1,010 parents/children; n=220 aquatics staff) **Baseline comparisons** There were significant differences between the 2 sites in: the proportion of females (parents p<0.01), the proportion of Caucasian participants (parents p<0.01), levels of college education (parents p<0.01), household incomes >$50,000 (parents p<0.01), and proportion at moderate or high skin cancer risk (parents and children p<0.01). There were also baseline differences in the sun protection habits index (parents p<0.01; children p<0.05), pool protection policies (parents p<0.01), and knowledge (p<0.05). Baseline differences were significant between the intervention and control groups for gender, with more male parents responding in the control group (p<0.05).	barriers to sun safety, and questions relating to attitudes and social norms. Scores were combined to calculate a summary score ranging from 0 (low score) to 8 (high score).[16] **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Aquatics staff responded to questions on sun protection policies (ie. encouraging the use of shade, reminding children to wear sunscreen, reminding parents to provide children with sunscreen, and provision of sunscreen for swimmers who had not applied sunscreen beforehand), and a composite score was calculated with possible scores of 0 to 4. At post-test aquatics staff were asked about the frequency with which they taught intervention or control lessons, use of various teaching methods, and received incentives. Teaching encounters were categorised as 0, 1 - 4, 5 - 8, and > 8.[16] Parents completed follow-up questions on participation, incentives received, and their reactions. A composite score was calculated from a 4-item questionnaire on whether the swimming pool sites required or encouraged sun protective practices,	or sunglasses. Use of shirt (adjusted mean, SE) Intervention: Baseline (n=558) 2.45 (0.04); follow-up (n=452) 2.52 (0.04) Control: Baseline (n=446) 2.43 (0.04); follow-up (n=396) 2.48 (0.05) Group x time interaction F=0.04 (df 1, 1814) Use of hat (adjusted mean, SE) Intervention: Baseline (n=558) 2.05 (0.03); follow-up (n=452) 2.05 (0.04) Control: Baseline (n=446) 2.12 (0.04); follow-up (n=396) 2.04 (0.04) Group x time interaction F=1.09 (df 1, 1812) Use of sunglasses (adjusted mean, SE) Intervention: Baseline (n=558) 1.74 (0.03); follow-up (n=452) 1.64 (0.04) Control: Baseline (n=446) 1.79 (0.04); follow-up (n=396) 1.61 (0.04) Group x time interaction F=4.25 (df 1, 1810) Parent Sun Protection Habits and Knowledge scores and pool sun protection policies Parents reported statistically significantly greater use of sunscreen (effect size: d=0.17),	

		For aquatics staff, there were no differences at baseline between the groups in demographics, knowledge, attitudes, social norms, or pool sun protection policies. Control respondents were significantly more likely to report being at moderate to high risk for skin cancer and to have higher sun protection behaviour scores than intervention respondents. **Study sufficiently powered** The authors state that sample size was determined by power calculations based on effect sizes found in a previous randomised skin cancer prevention intervention (Glanz et al, 2000). Add ref. No other details were provided.	scored as 1 (yes) or 0 (no). **Other outcomes** No **Follow-up period** Eight weeks **Method of analysis** All parent-child respondents who completed usable surveys (>50% of questions answered and outcome behaviour measures completed) and had a child attend swimming lessons were included in the analyses (using a repeated cross-sectional design). Bivariate analyses were conducted on composite scores using chi-square and t tests. Multivariate analyses were conducted for each outcome with adjustments for gender, risk group (low, moderate, high), and ethnicity. The model included a time by treatment interaction to determine the intervention effect from pre- to post-intervention between groups. Multivariate analyses were also conducted to take into account the possible effects of clustering by pool site and validate the primary results. A dose response analysis was conducted to explore the impact of number of lessons and activities that the intervention children received. Parallel analyses were conducted to	hats (d=0.17), and the Composite Sun Protection Habits score (d=0.19) at follow-up in the intervention group compared with control. Sun Protection Habits Score (adjusted mean, SE) Intervention: Baseline (n=558) 2.45 (0.03); follow-up (n=452) 2.52 (0.03) Control: Baseline (n=446) 2.53 (0.03); follow-up (n=396) 2.49 (0.03) Group x time interaction F=4.52 (df 1, 1768, p<0.05) Hat use (adjusted mean, SE) Intervention: Baseline (n=558) 2.07 (0.04); follow-up (n=452) 2.15 (0.05) Control: Baseline (n=446) 2.17 (0.05); follow-up (n=396) 2.02(0.05) Group x time interaction F=7.11 (df 1, 1790 p<0.01) Sunscreen use (adjusted mean, SE) Intervention: Baseline (n=558) 2.52 (0.04); follow-up (n=452) 2.56 (0.05) Control: Baseline (n=446) 2.64 (0.05); follow-up (n=396) 2.47(0.05) Group x time interaction F=6.32 (df 1, 1787 p<0.01) There were no statistically significant differences between	

			explore effects by site. Bi-variate analyses were conducted on composites scores for aquatics staff by study group and study site (Hawaii/Massachusetts). Baseline characteristics were compared using chi-squared tests for categorical data and t-tests for continuous data. Changes in outcome variables over time were analysed with adjustments made for ethnicity, gender, and risk group. Analyses were also conducted to take into account the possible effects of clustering by pool site. All aquatics staff were included in the analysis of knowledge, attitudes, sun protection habits, and policies, but in the analysis of sunburns, low-risk staff were excluded.	groups in the use of shirts, shade, or sunglasses. Use of shirt (adjusted mean, SE) Intervention: Baseline (n=558) 2.44 (0.05); follow-up (n=452) 2.56 (0.05) Control: Baseline (n=446) 2.45 (0.05); follow-up (n=396) 2.57 (0.05) Group x time interaction F=0.00 (df 1, 1788) Use of shade (adjusted mean, SE) Intervention: Baseline (n=558) 2.42 (0.04); follow-up (n=452) 2.48 (0.04) Control: Baseline (n=446) 2.50 (0.04); follow-up (n=396) 2.47 (0.04) Group x time interaction F=1.39 (df 1, 1786) Use of sunglasses (adjusted mean, SE) Intervention: Baseline (n=558) 2.81 (0.05); follow-up (n=452) 2.87 (0.05) Control: Baseline (n=446) 2.90 (0.05); follow-up (n=396) 2.91 (0.05) Group x time interaction F=0.29 (df 1, 1794) Using multivariate analyses to account for within-pool clustering, showed virtually no difference in outcomes. Sun safety environment	

				There was a statistically significant change over time in sunscreen availability between groups ($p<0.05$) and use of sun safety signs ($p<0.01$) Sunscreen availability Time 1 (% yes): Intervention 46.7%; control 45.5% Time 2: Intervention 60.0%; control 27.3% Time 3: Intervention 85.7%; control 41.7% Sun safety signs Time 1 (% yes): Intervention 0.0%; control 0.0% Time 2: Intervention 80.0%; control 18.2% Time 3: Intervention 85.7%; control 16.7% There were no statistically significant differences between groups over time on shade structures/shade areas Time 1 (% yes): Intervention 66.7%; control 90.9% Time 2: Intervention 86.7%; control 81.8% Time 3: Intervention 85.7%; control 83.3% Observed lifeguard sun protection There was a statistically significant increase in the proportion of lifeguards using a shirt in intervention compared to control group over time ($p<0.01$), but not in hat use	

				Shirt use Time 1 (% yes): Intervention 93.3%; control 100% Time 2: Intervention 100%; control 54.6% Time 3: Intervention 100%; control 83.3% Hat use Time 1 (% yes): Intervention 71.4%; control 63.6% Time 2: Intervention 64.3%; control 63.6% Time 3: Intervention 78.6%; control 66.7% Aquatics staff [16] There were no statistically significant differences between groups in the use of sunscreen (p=0.94), use of shirt (p=0.06), use of a hat (p=0.54), staying in the shade (p=0.70), use of sunglasses (p=0.55), or the sun protection habits index (p=0.75). Sunscreen use (value range 1=rarely to 4=always) Baseline adjusted mean (SE): Intervention 2.73 (0.08); control 2.93 (0.12) Follow-up: Intervention 2.71 (0.09); control 2.93 (0.12) Shirt use Baseline adjusted mean (SE): Intervention 2.14 (0.08); control 2.33 (0.11) Follow-up: Intervention 2.41 (0.08); control 2.25 (0.11)	

				Hat use Baseline adjusted mean (SE): Intervention 2.15 (0.08); control 2.24 (0.11) Follow-up: Intervention 2.08 (0.09); control 2.28 (0.11) Shade use Baseline adjusted mean (SE): Intervention 2.17 (0.06); control 2.34 (0.09) Follow-up: Intervention 2.31 (0.07); control 2.42 (0.09) Sunglasses use Baseline adjusted mean (SE): Intervention 2.88 (0.08); control 3.07 (0.12) Follow-up: Intervention 2.96 (0.09); control 3.27 (0.12) Composite score Baseline adjusted mean (SE): Intervention 2.41 (0.05); control 2.58 (0.07) Follow-up: Intervention 2.50 (0.05); control 2.63 (0.07) **Sun exposure** There was a statistically significant difference in the number of child sunburns in the intervention group (23% reduction) compared with the control group (1% reduction) (d=0.22). Sunburns (including only children at moderate or high risk; n=622 at	

				baseline, n=602 at follow-up) (adjusted mean, SE) Intervention: Baseline 0.77 (0.05); follow-up 0.54 (0.05) Control: Baseline 0.71 (0.06); follow-up 0.70 (0.05) Group x time interaction F=4.25 (df 1, 1221, p<0.05) Aquatics staff in the intervention group were statistically significantly less likely to report a sunburn during the study summer, (1.42 burns versus 2.07, p<0.05) (n=291 moderate and high-risk respondents).[16] Baseline: Intervention 2.22 (0.18); control 1.42 (0.18) Follow-up: Intervention 2.10 (0.22); control 2.07 (0.23) **Knowledge, attitudes, beliefs** Parents There were no significant differences between groups in the Knowledge score (range 0-8) mean (SD) Intervention: Baseline (n=558) 6.88 (0.05); follow-up (n=452) 6.88 (0.06) Control Baseline (n=446) 6.72 (0.06); follow-up (n=396) 6.73 (0.06) Group x time interaction: F=0.00 (df 1, 1832) Aquatics staff[16] There no statistically significant differences between groups for	

				social norms (p=0.49) or knowledge (p=0.68). Social norms Baseline: Intervention 3.52 (0.07); control 3.42 (0.10) Follow-up: Intervention 3.60 (0.08); control 3.62 (0.10). Knowledge Baseline: Intervention 6.71 (0.09); control 6.81 (0.13) Follow-up: Intervention 6.84 (0.10); control 7.03 (0.13). 87% of intervention staff reported teaching sun protection in swimming lessons, approximately 66% used the Pool Cool Leader's Guide, and 60% used sunscreen provided in a dispenser. By comparison, 83% of control staff reported teaching injury prevention lessons, and 70% used the Pool Cool Leader's Guide. There was a non-statistically significant trend toward higher sun protection behaviour scores with more frequent teaching of lessons/activities. The mean score for no teaching was 2.30, 2.40 for 1 - 4 lessons, 2.60 for 5 - 8 lessons, and 2.59 for more than 8 lessons. **Process and implementation** Parent surveys showed a statistically significantly greater	

				increase in sun protection policies at intervention pools compared with control pools (d=0.54) Pool sun protection policies (range 0-4) Intervention (mean, SE): Baseline (n=558) 1.25 (0.07); follow-up (n=452)_2.59 (0.08) Control: Baseline (n=446) 1.22 (0.08); follow-up (n=396) 1.67 (0.08) Group x time interaction F=34.25 (df 1, 1847, p<0.001) Monitoring data forms (n=615) showed that 76% of aquatics staff reported teaching the lessons, and 61.9% reported teaching the majority of lessons (five or more). About two-thirds of parents reported receiving intervention or control information, and 57% reported that they were taught health topics in swimming lessons, but activity participation was reported at a fairly low level (as per dose-response analysis) Aquatics staff [16] Intervention groups showed statistically significant improvements in sun protection policies compared to controls (p=0.04). Baseline (range 0 to 4): Intervention 2.17 (0.11); control 1.99 (0.15) Follow-up 2.78 (0.12); control	

				2.07 (0.15) **Attrition details** 32 pools were eligible for inclusion, 29 agreed to participate, with one lost to follow-up. Number of completed usable surveys at baseline: 1,010 of 1,172 (13.82% of surveys unusable). Dropout from baseline to follow-up: 842 of 1,010 parents (16.63% dropout). Less than 10% of aquatics staff who attended sessions, were lost to follow-up.[16]	

Studies related to Glanz 2002[9]

Pool Cool diffusion trial[17-21]

The aim of the Pool Cool Diffusion trial was to evaluate the effects of two strategies for diffusion of the Pool Cool skin cancer prevention programme on implementation, maintenance and sustainability; improvements in environmental supports for sun safety in swimming pools and sun protection habits and sunburn among participating children.

The trial used a three level nested experimental design across 3 years (2003-2006) of intervention (the three levels were field coordinators (FC), swimming pools and children (aged 5-10 years) in swimming lessons). Each FC was responsible for a cluster of between 4 and 15 pools in a region and regions were randomly assigned to receive a basic tool kit (description of how to implement the programme, lesson cards, cartoons for interactive use, material for poolside activities, dispenser of sunscreen and sunscreen tips) or an enhanced tool kit (basic kit plus additional sun safety items, sun safety signs, shade structures and incentives including hats, UV sensitive stickers, and water bottles). Pool managers completed surveys at the beginning and end of the summer (pool level data) as did lifeguards and parents; archival information was sourced along with e-mails and activity logs and interviews and site visits took place. A total of 433 pools enrolled; 58 dropped out for various reasons.

Scores on sun safety programmes and policies increased from baseline to follow-up in both groups of pools (19.8% increase in overall programmes; 52.3% increase in policies, environments and programmes). At follow-up 97.7% of pool managers reported that Pool Cool had been conducted (all key components) at their pools during the summer. Statistically significant differences were found between the basic and enhanced conditions in 2 out of 10 comparisons; with pools in the enhanced group teaching Pool Cool lessons less frequently than in the basic condition (mean 2.94, SD 0.98 versus 3.06, 0.94; p=0.04) and pools in the enhanced condition displaying sun safety signs less frequently than pools in the basic condition (71.6% versus 93.4%; p=0.001).

Between 96 and 121 activity logs were submitted each summer. Primary activities logged were communication, management of survey data, and management of Pool Cool materials. Training, site visits with participating staff and administrative tasks were reported less frequently. Over 5000 e-mails were sent to and from FCs over the study period. Surveys revealed that lifeguards reported high implementation of the Cool Pool programme and policies. Site visits and pool observations indicated high implementation levels across pools, with an

implementation score spanning from 68.3% to 73.2% from 2003 to 2006. More than 75% of pools posted sun safety signs and more than 90% used the bottle of sunscreen. There were few significant differences between pools in the basic and enhanced conditions across all years.

Objective assessment of sunscreen use, via skin swabs, was carried out at 16 pools on one weekday morning and one weekend morning. Lifeguards, parents and children were swabbed 4 times (twice during each morning). 993 eligible participants were approached across the 16 pools; 631 consented to participate (64%; 223 parent/child pairs and 185 lifeguards and 564 completed the study (89%; 201 parent/child pairs and 162 lifeguards).

Three pools demonstrated much higher sunscreen use (>95%) than the others (47.1%). At these three pools 67% of participants wore shirts with sleeves, 43% wore sunglasses and 10% hats. Observations of sun-safety behaviour revealed statistically significant differences between the 3 high sunscreen use pools and the other 13 pools on use of sunglasses (45% versus 24%; $p<0.001$) but not on any other sun safety behaviours.

In the 3 pools with high sunscreen use, sunscreen was available and conveniently located, highly visible, easy to access and usually located near to the pool and/or entrance to an office or break room. (No information reported with regard to the other 13 pools).

Targeted, peer-driven skin cancer prevention programme[22]
Pools from 2 regions that had previously participated in the Cool Pool Program between 2003 and 2006 were randomised to receive standard Pool Cool program or Pool Cool Plus in the summer of 2007. Pools in a third region that had not participated previously received the Pool Cool Plus program. Lifeguards were trained or retrained on sun safety and use of Pool Cool materials according to the previous protocol; plus educational materials, incentive items and sunscreen and dispenser. Lifeguards in the Cool Pool Plus program received the same, plus specific strategies targeting lifeguards such as motivational appeals, a peer-driven approach and extra policy and environmental supports including a free shade structure for each pool. (This study builds on the diffusion trial and includes implementation strategies specifically targeted to lifeguards.)

Process evaluation was carried out through site visits (Pool Cool Plus pools only) and in-person and telephone interviews and outcome evaluation by surveys at baseline and follow-up. Sun protection habits were assessed by measuring five behaviours (use of sunscreen, wearing a shirt, a hat, sunglasses and seeking shade on a 4-point scale (rarely to always). Sunburn was assessed by asking how many times participants experienced sunburn last summer (baseline) and this summer (follow-up).

Linear regression was sued to regress each outcome variable onto intervention group, controlling for previous participation in the program and for differences between groups at baseline. Multivariate analysis of covariance was used to assess changes from baseline to follow-up by group, with previous participation included as a covariate. (I have only reported the MANCOVA results.)

17 pools were included at baseline, 3 pools from the Pool Cool Plus intervention were lost to follow-up. Baseline surveys were completed by 260 lifeguards and follow-up by 195.

Change in sun protection habits over the summer by intervention group showed a statistically significant increase from baseline to follow-up in both the standard and 'Plus' groups ($F(1, 86) =4.38$, $p=0.04$). Sun protection habits at work by intervention group showed a statistically significant increase from baseline to follow-up in the standard group only ($F(1, 99) =5.44$, $p=0.02$). A statistically significant decrease in sunburn was found over the summer in the 'Plus' group only ($F(1, 87) =16.97$, $p <0.001$).

All pools that were observed ('Plus' pools only) had shade in the pool area and free sunscreen available for staff. 69.2% of staff observed were wearing hats, 30.8% were seen applying sunscreen, 30.8% wearing a shirt with sleeves and 46.2% wearing pool Cool items. Telephone interviews with staff indicated a high rate of program implementation with 92.9% reporting that sun safety lessons were taught.

Limitations – Three elements (motivational appeals, peer driven approach and environmental supports) were combined in Pool Cool Plus and therefore it is not possible to separate out the

effects of different elements of the program. All pools received Cool Pool, so no real control group. 3 pools in Pool Cool Plus were lost to follow-up.					
Author Lombard et al.[14] **Year** 1991 **Study aim** To assess the effect of an intervention package combining commitment, posted prompting and feedback strategies on skin cancer risk behaviours at community swimming pools. **Study design** Before and after comparison at two swimming pools **Internal validity** - **External validity** -	**Country** United States **Setting** Swimming pool **Source population** Two private swimming pools in two south-west Virginia towns **Eligible population** All pool patrons at the two swimming pools **Selected population** Pool A had 325 members and the shaded area was approximately 560 square feet and Pool B 293 participants and the shaded area was approximately 477 square feet. The authors state that daily temperature and weather conditions did not differ significantly. **Age** Not reported **Female** Not reported **Race/ethnicity** Not reported	**Method of allocation** Both pools received the same intervention but implementation of the intervention was scheduled differently. It is unclear how the pool was chosen for the delayed implementation. **Intervention** (1) Two 19x24 inch informational posters about sun protective practices, (2) separate information fliers for adults and children on skin cancer and protection were placed at the front desk, (3) feedback on the proportion of patrons performing two or more sun protective practices on a 19x24inch poster, (4) 3-hour training session for lifeguards encouraging modelling of sun protective behaviours. To facilitate this they were provided with a supply of sunscreen, zinc oxide and logo t-shirts. The proportion of lifeguards using sun protective practices was also displayed on a poster, (5) lottery to win logo hats and t-shirts for patrons when children reached their goal of 40% sun protective behaviours for three consecutive days. Free SP15 sunscreen in a 32 ounce dispenser was available at the front desk of each pool at baseline and during the intervention	**Sun protection practices** The behaviour of pool users was observed between 2 and 2.30 pm seven days per week at baseline and during implementation of the intervention. Three trained observers walked a specified route covering the entire pool area and recorded each pool users behaviour (1 to 17 year olds and over 18 year olds separately) and lifeguard behaviour on the variables of interest: (a) Wearing of any type of shirt covering large areas of the upper body, (b) being in any area where the entire body was shaded from the sun, (c) wearing any type of hat that covered part of the head and shaded the face, (d) wearing a pair of tinted sunglasses covering the eyes, (e) wearing zinc oxide of any colour on the face, (f) displaying any type of sunscreen bottle with at least SPF 2. Inter-observer reliability was based on a comparison of the total number of behaviours observed for behaviour category before the study started (not a comparison of how observers coded the behaviour of the same individual). Reliability was 97.8% for shirts; 87.1% for sunglasses; 100% for being in the shade; 93.1% for wearing hats; and 100% for zinc oxide. The ratio of sunscreen used to number of patrons attending the	**Sun protection practices** Lifeguards Pool A: lifeguards increased their use of all the protective behaviours from a baseline mean of 25% to 64.5% during the intervention; Pool B increased from 8.3% to 62.4%. The proportion of protective behaviours ranged from 50% to 80% at Pool A and at pool B ranged from 100% during the first 4 days to 40% during the last week of the intervention. Children Pool A: children increased their use of at least two protective behaviours from a baseline mean of 6.3% to 24.7% during the intervention; Pool B increased from 6.6% to 29.1% Pool A: children increased their use of at least one protective behaviour from a baseline mean of 37.1% to 61.6% during the intervention; Pool B increased from 38.3% to 58.7% Individual behaviours Shade: Pool A 10% to 45.3%; Pool B 15.6% to 41.2% Shirts: Pool A 21% to 31.6%; Pool B 22.6% to 36.3%	**Limitations identified by the authors** (1) The study did not use a true multiple baseline design as one pool had the intervention introduced in phases but the other did not; the sequential introduction of the intervention at Pool A may have maintained the interest of adults at that pool, resulting in higher rates of protection at that pool, (2) reliability measures were not undertaken during the study which brings into question the accuracy of the observed behaviours, (3) the presence of the researchers observing behaviours may have led to an increase in sun protective behaviours, (4) dividing children into small age bands may have been more informative **Limitations identified by the review team** (1) the study does not have an appropriate control group to assess the effectiveness of the multi-component intervention, (2) it is not possible to assess the contribution of the individual components to outcome (3) It is unclear how many pool users and lifeguards participated in the study, (4) few details were provided

	Socioeconomic status The authors state primarily middle to upper class. **Skin type** Not reported	period. **Comparator** Pool A: from day 16 the lifeguards modelled the sun protective behaviours and the posters were displayed; from day 24 the information fliers were placed at the front desk; and on day 31 the commitment lottery was announced. Pool B: all five components were delivered simultaneously. **Intervention period** Dates not provided **Sample size** 2 pools; number of pool users observed is unclear **Baseline comparisons** The authors state the pools were similar for membership, demographic characteristics (primarily middle to upper class) and size of shaded areas. **Study sufficiently powered** Not reported	pool was assessed: The sunscreen dispenser was weighed each day to determine the daily amount of sunscreen used and this was divided by the number of people attending the pool that day based on the sign-in sheet. **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** During the intervention period 41 observation days for Pool A and 21 observation days for Pool B Method of analysis The proportion of participants (children, adults and lifeguards) engaging in each of the sun	Hats: Pool A 3% to 4.8%; 3.7% to 7.1% Sunglasses: Pool A 2% to 5.4%; Pool B 4.3% to 1.8% Zinc oxide: Pool A 1.1% to 3.3%; Pool B 0.4% to 3.2% Adults Pool A: adults increased their use of at least 2 sun protective behaviours from a baseline mean of 23.3% to 46% during the intervention; Pool B increased from 20.7% to 29.7%. Pool A: adults increased their use of at least 1 sun protective behaviour from a baseline mean of 62.6% to 81.1% during the intervention; Pool B increased from 59.8% to 65.2%. Individual behaviours Shade: Pool A baseline 10.7%, follow-up 30.8%; Pool B 6.1%, 9.9% Shirts: Pool A baseline 19.6%, follow-up 22.3%; Pool B 15.1%, 16.9% Hats: Pool A baseline 13.6%, follow-up 23.1%; Pool B 13.1%, 14.4% Sunglasses: Pool A baseline 48.1%, follow-up 49.4%; Pool B 47.6%, 56.1%	about the pools and the participants, (5) at Pool B lifeguards were informed by the manager that they had to perform the sun protective behaviours or they would be sacked which is likely to have affected behaviour. **Evidence gaps and/or recommendations for future research** (1) Systematic replications of the study are required, (2) future assessments of sun protective behaviours that give weight to the different value of each of the behaviours should be considered.

			protective behaviours was calculated for each pool.	Zinc oxide: Pool A baseline 1.1%, follow-up 1%; Pool B 1.6% to 0% The use of free sunscreen did not change at either pool: Pool A 0.011 oz per pool user at baseline and 0.011 during the intervention; Pool B 0.01 oz at baseline and 0.012 during the intervention The proportion of pool users with a visible bottle of sunscreen increased slightly from baseline to follow-up: Pool A 14.6% to 19.1%; Pool B 11.4% to 17.3% The lottery did not take place as the goal for sun protective behaviours was not reached on any 3 consecutive days. **Attrition details** None of the pools dropped out. Not relevant for participants as cross-sectional samples were used.	
Author Mayer et al.[10] **Year** 1997 **Study aim** To evaluate the effectiveness of a multi-component intervention in	**Country** United States **Setting** Swimming pool **Source population** Children's aquatics classes **Eligible population** Children aged 6-9 years of age	**Method of allocation** Within pairs of aquatic classes of adjacent timeslots in the morning (e.g. 10.00-10.30 and 10.30 - 11.00am) or in the afternoon (e.g. 1.30-2.00 and 2.00-2.30pm), within each YMCA one timeslot was randomly assigned to the intervention and the other to control. Randomisation was performed for each new set of	**Sun protection practices** (a) Child's specific use of sunscreen. Reported by parents, while the child was available to assist with answers, using a telephone parental report survey version of the Solar Protection Behaviour Diary. Parents were phoned between 3.00pm and 9.00pm and asked whether the child wore sunscreen that day between 10.00am and 3.00pm on each of the	**Sun-protection behaviours** (1) Composite solar protection score Post intervention there was no statistically significant difference in mean composite solar protection score between the intervention (n=64 children) and control group. (n=68 children).	**Limitations identified by author** (1) Time interval between colorimeter readings was short (mean 2.5 weeks). (2) Participation bias may have weakened potential between-group differences if participants had high levels of solar protection relative to

reducing children's UVR exposure. **Study design** Cluster RCT **Internal validity** + **External validity** +	enrolled in aquatics classes. **Selected population** 48 aquatics classes in 4 YMCAs in San Diego, California, USA. Classes contained 2-7 children. 169 of 280 children enrolled in the classes participated. **Mean age**: 7.6 years (range 4-11 years) **Female**: 49.7% **Race/ethnicity** White 79.8% Hispanic 6.5% Asian/Pacific Islander 7.7% African American 5.3% Native American 0.6% **Socioeconomic status** Family income (%) <$30,000 15% $30,000-$49,000 18% $50,000-$69,000 27% $70,000-$89,000 19% ≥$90,000 21% **Skin type** Always burns 5% Usually burns 21% Sometimes burns 41% Rarely burns 33% **Other** Family history of skin cancer 28.3%	classes. In the intervention group all children received the intervention but outcomes were assessed for a subset of some classes. **Intervention** The intervention targeted 4 different sun protection behaviours: sunscreen, protective clothing, shade and peak sunlight hours. Duration was approximately 6 weeks: (1) Aquatics curricula including 4 five minute lessons Each lesson covered a sun protection behaviour, which was covered again in subsequent lessons. Aquatics instructors used photographs of animals to depict sun protection behaviour and engaged children in discussing sun protection behaviours; modelled sun protection behaviour e.g. wearing a hat; and rewarded children's sun protection use verbally and with stickers. Sunscreen and hats were available at each lesson. (2) home-based curricula, including several activities for children At the beginning of the intervention, parents received a manual containing information about skin cancer prevention,	following body parts: face, neck, shoulders, upper arms, lower arms, torso, legs and feet. Parents were also asked for the SPF of the sunscreen used. Four interviews were attempted: two 1-14 days before the first aquatics class and two 7 to 30 days following the end of the intervention. (b) Child's general use of sunscreen At one pre-test and one post-test interview parents were asked to rate their child's general use of sunscreen ≥SPF 15 on a 5 point scale, with 1=never to 5=always. Use of protective clothing or hat (a) Child's specific use of protective clothing Using a telephone parental report survey (see above), parents were asked what clothing the child wore that day between 10.00am and 3.00pm on the following body parts: face, neck, shoulders, upper arms, lower arms, torso, legs and feet. (b) How often child wears a hat At one pre-test and one post-test interview parents were asked to rate how often their child wore a hat on a 5 point scale, with 1=never to 5=always. Composite solar protection score Based on parental response to telephone survey. Each child's body part protected by sunscreen or	Mean composite solar protection score (SD) Baseline: intervention 11.30 (3.19); control 10.73 (2.90) Post-test: intervention 12.32 (2.18); control 11.36 (2.93) Adjusted-post test: intervention 12.11; control 11.38; regression estimate 0.730(SE 0.505); p=0.15 (2) How often child wears SPF ≥ 15 Post intervention there was no statistically significant mean difference in how often children wore SPF ≥ 15 between the intervention (n=76 children) and the control group (n=76 children. Mean Likert scale value (SD) Baseline: intervention 3.41 (1.13); control 3.33 (1.01) Post-test: intervention 3.55 (0.96); control 3.39 (1.03). Adjusted post-test: intervention 3.52; control 3.41; p=0.44 (results remained the same when controlling for age and gender). (3) How often child wears a hat Post intervention children in the intervention group (n=76 children) were statistically significantly more likely to wear a hat than those in the control group (n=76 children). Mean Likert scale value (SD) Baseline: intervention 2.21 (0.94);	non-participants. (3) SUNWISE section of 3-5 minutes during aquatics lesson may have been too short to produce a strong effect. **Limitations identified by review team** (1) Sunscreen and hats were made available at each session but no details were provided about how participants were encouraged to use these, how they were made available, or uptake. (2) Sunscreen and hats were a minor component of the intervention and it is not possible to determine their influence on outcome. (3) All measures, except change in tan-associated skin colour, were self reported by parents and subject to responder and social desirability biases. (4) There was no comparison of responders and non-responders. (5) Target age range of children was stated to be 6-9 years; actual age range of included children was 4-11 years. **Evidence gaps and/or recommendations for future**

		Project SUNWISE, and instructions and materials for child and family activities. Activities were age appropriate. Family activities included calendars with reward stickers for days sunscreen was used; selecting sun protective clothing for different outdoor activities; making a map of the garden and with areas of shade highlighted; and reducing time outdoors during peak sunlight hours. (3) SUNWISE board game and UV meter. After the fourth lesson, additional child and family activities including a SUNWISE board game and UB meter were mailed to participants. **Comparator** No intervention **Intervention period** 6 weeks: Summer 1995 **Sample size** Intervention: 84 children Control: 85 children **Baseline comparisons** No statistically significant differences between the groups in terms of demographic characteristics, skin cancer risk factors and outcome variables. **Study sufficiently powered** Not reported	protective clothing was given a sub-score. The possible total score ranged from 0-16, with scores of 12 or more indicating adequate level of sun protection as at least 75% of the body is protected. **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** Change in tan-associated skin colour: 6 body sites (5 exposed sites (forehead, upper arms, lower arms, upper leg, and lower leg) and 1 unexposed site (underarm), were measured at the first and last aquatics classes. This interval ranged from 1.5 to 4 weeks (mean 2.5 weeks). A portable colorimeter was used. Two colour dimensions L* and b*,	control 2.59 (1.10) Post-test: intervention 2.74 (1.00); control 2.62 (1.08) Adjusted post-test: intervention 2.84; control 2.52; p=0.029 (results remained the same when controlling for age and gender) **Other outcomes** (1) Change in tan-associated colour (a) Change in L* value Post intervention there was no statistically significant difference in mean L* values between the intervention (n=73 children) and control group (n=65 children). Mean change in L* value (SD) Baseline: intervention 55.40 (5.67); control 56.46 (5.39) Post-test: intervention 54.98 (5.63); control 55.58 (5.40) Adjusted post-test: intervention 55.46; control 55.05; regression estimate 0.410 (SE 0.312); p=0.19. (b) Change in b* value Post intervention there was no statistically significant difference in mean b* values between the intervention (n=73 children) and control group (n=65 children). Mean change in b* value (SD) Baseline: intervention 16.13 (1.85); control 15.51 (1.91) Post-test: intervention 16.04 (1.77); control 15.94 (1.88)	**research** Further research (1) Addition of environmental/ structural components to intervention e.g. addition of large free or low cost containers of sunscreen at the poolside. (2) Encouraging all aquatics staff to wear hats. (3) Intensifying and lengthening the intervention. (4) Lengthening the pre- to post-colorimeter interval. **Source of funding** Funded by the National Institute of Arthritis and Musculoskeletal and Skin Diseases.

			were measured. L* indicates the colours lightness from black to white, with the value increasing as the colour lightens (i.e. becomes less tanned). b* assesses blue to yellow, with the value increasing as the colour becomes more yellow (i.e. more tanned). Two consecutive readings were obtained on each body site and the mean used. **Follow-up period** Last parental telephone interview occurred 7-30 days after the intervention ended. Colorimeter measures were recorded at the last aquatics class. **Method of analysis** Intra-cluster correlations for colorimeter L*, colorimeter b*, and solar protection score were calculated for the intervention and control groups separately at class and time slot levels to measure degree of dependence within clusters. Differences between intervention and control groups for colorimeter L*, colorimeter b*, solar protection score, how often the child wears a hat, and how often the child wears SPF≥15, were tested using generalised estimating equations, which took into account class clustering. Results were adjusted for baseline score and age and gender (adjusted results are reported).	Adjusted post-test: intervention 15.75; control 16.16; regression estimate -0.405 (SE 0.234); p=0.084 **Attrition details** Percentage attrition L* and b* measurements: intervention 13.1%; control 23.6% Composite solar protection scale: intervention 23.8%; control 20% How often child wears a hat: intervention 9.5%; control 10.6% How often child wears SPF≥ 15: intervention 9.5%; control 10.6%	

			Adding age and gender as covariates did not alter the results.		
Author Pagoto et al.[13] **Year** 2003 **Study aim** To assess the efficacy of a multi-component intervention that aimed to increase the saliency of skin cancer risk while promoting the use of sun protection **Study design** Non-randomised controlled trial **Internal validity** - **External validity**-	**Country** United States **Setting** Beach **Source population** Beachgoers in a mid-western city, USA, visiting public access, sand-covered beaches. Beaches were predominantly populated by Caucasians of all ages. **Eligible population** Participants at least 18 years of age and English speaking. **Selected population** 100 of 257 beachgoers who provided complete data (population characteristics based on n=100) **Age** Intervention: mean age 27.96 (SD 6.17) Control: mean age 24.49 (SD 3.21). There was a significant difference in mean age between the two groups (p<0.01). **Female** Intervention: 55% Control: 75% **Race/ethnicity**	**Method of allocation** Non-randomised groups - two locations were chosen one mile apart on the same beach, the intervention was implemented in one area and the other location acted as a control (no further details provided). **Intervention** A multi-component intervention to provide education and enhance the personal relevance of sun-related risks, through the provision of: (1) sun protection recommendations, based on individuals skin sensitivity levels to solar radiation, (2) American Cancer Society's (1999) safe sun recommendations pamphlet, (3) assessment of sun damage to skin using UV photographs, (4) commitment cards, signed by participant and a friend, to prompt use of sun protection, (5) provision of a selection of free sunscreens and instructions on their correct use, (6) modelling of proper sun behaviour by research assistants. **Comparator** The control location participated in the sun protection questionnaire. **Intervention period** Summer 2000	**Sun protection practices** Composite measure of behaviours Items including: (1) frequency of sunscreen use (SPF 15 or higher), and (2) frequency of protective clothing use during sun exposure, measured on a 4-point Likert-type scale ranging from "very seldom" to "always", (3) the number of body parts protected from the sun, rated from 0 (no body parts covered) to 3 (all body parts covered). Possible score range was 1 to 7. **Sun exposure** Composite score of self-reported number of hours spent sunbathing per week and engaging in outdoor recreational-occupational activities. **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes**	**Sun-protection behaviours** When baseline rates were held constant, reports of sun protection behaviours were significantly higher in the intervention group compared to control at follow-up: ANCOVA F(5,96)=7.15, p<0.01. Intervention (n=53): baseline mean 5.52 (SD 1.84); follow-up 6.44 (1.80) Control (n=47): baseline mean 5.55 (1.85); follow-up 5.19 (1.84 (p<0.05) **Sun exposure** No significant differences between intervention and control groups: Intervention (n=53): baseline 14.90 (SD 16.90); follow-up 8.96 (9.0) Control (n=47): baseline 7.53 (7.01); follow-up 6.85 (5.09) **Other outcomes** A greater number of participants in the intervention group advanced at least one stage across time compared with controls: intervention: 49%; control 25% (X=5.742, p<0.02) There were no significant differences in stage regression between the intervention (12%)	**Limitations identified by author** (1) High non-response to follow-up, (2) short-term follow-up, (3) use of nonrandomised groups, and (4) non-standardised measures of sun protection and exposure, and (5) the increase in the average score of sun protection behaviour in the intervention group was small (0.81) in a possible score range of 1-7. **Limitations identified by review team** (1) little detail is provided about allocation to intervention and control (2) loss to follow-up was high (3) provision of free sunscreen was a small component of the intervention and no data are reported on uptake or use. **Evidence gaps and/or recommendations for future research** Further research i to evaluate interventions that both reduce sun exposure and increase sun protection behaviours. **Source of funding** Blue Cross Blue Shield Foundation of Michigan Award and National Institutes of Health Grant. Canfield

	Predominantly Caucasian. **Socioeconomic status** Intervention: 83% college educated, 17% educated to high school. Control: 83% college educated, 15% educated to high school. 2% unknown level of education. **Skin type** Intervention: Skin type I (a painful burn the next day after 1 hr of unprotected sun exposure): 11% Skin type II (a painful burn the next day and a light tan 1 week later): 28% Skin type III (a slightly tender burn the next day and a moderate tan 1 week later): 36% Skin type IV (no burn the next day and a moderate tan 1 week later: 25% Control: Skin type I: 9% Skin type II: 15% Skin type III: 49% Skin type IV: 27% **Other** Stage of change Pre-contemplation:	**Sample size** Intervention n=53 Control n=47 **Baseline comparisons** The intervention group was significantly older than the control group: mean 27.96 years (intervention), 24.49 years (control) ($p<0.01$). Sun exposure was higher in the intervention group (mean 14.90 hours per week) compared with controls (mean 7.53 hours per week) ($p<0.01$). **Study sufficiently powered** Not reported	Sun stage of change **Follow-up period** 2-months **Method of analysis** Two way analyses of covariance (ANCOVAs) used to compare group differences on sun protection and sun exposure with baseline values, age, and gender entered as covariates.	and control group (15%) **Attrition details** Non responders at follow-up: email 44%; mail 48%; phone 93%	Scientific, Inc provided photographic equipment.

	intervention 34%; control 53% Contemplation: intervention 0%; control 2% Preparation: intervention 39%; control 23% Action: intervention 8%; control 11% Maintenance: intervention 18%; control 11%				
Author Weinstock et al.[11] **Year** 2002 **Related papers** Weinstock 2000[23] **Study aim** To assess the effectiveness of a multi-component intervention to increase sun protection in at-risk beach goers. **Study design** RCT **Internal validity** - **External validity**-	**Country** United States **Setting** Beach **Source population** Sunbathers on beaches in or near Rhode Island, USA **Eligible population** Forty public coastal salt water beaches in Southern Rhode Island **Selected population** Seven of the largest coast salt water beaches appealing to teens, families, and locals/communities (n=2,324 of 2,800 sunbathers approached aged 16 to 65). **Mean age**: 33 years (range 16 to 65) 16 to 24 years: n=821 (35%) 25 to 39: n=822 (35%) 40 to 65: n=678 (29%) **Female**: n=1,406 (60%)	**Method of allocation** Participants were randomly allocated using a pre-assigned sequence, by interviewers as part of the baseline survey on the beach. **Intervention** Between 10am and 4pm between one and five teams (per beach) of four interviewers and one camera person conducted interviews, which lasted between 15 to 25 minutes Based on the five states of change, specified by the Transtheoretical Model. On the beach participants received: (1) educational pamphlet, (2) personalised/tailored sun sensitivity assessment and feedback (written and verbal), (3) SPF 15 sunscreen, (4) instant sun damage photographs. Based on data provided by baseline, a feedback report matched to the individual's stage of change was mailed two to three weeks later. A second report was delivered after the 12 month assessment. In	**Sun protection practices** Participants completed a question on sunscreen use and protective clothing or hat use based on a five-point Likert scale of frequency (never, rarely, sometimes, often, and always) "when in the sun for more than about 15 minutes". Composite measure of behaviours Participants completed a nine-item Sun Protection Behaviour Scale to measure sunscreen use, hat use, and sun avoidance, based on a five-point Likert scale of frequency (never, rarely, sometimes, often, and always) "when in the sun for more than about 15 minutes". **Sun exposure** Participants completed a question on sun avoidance based on a five-point Likert scale of frequency (never, rarely, sometimes, often, and always) "when in the sun for more than about 15 minutes". **Long-term outcomes** Outcome not assessed **Adverse consequences**	**Sun-protection behaviours** Sun Protection Behaviour Scale There was a statistically significant group by time interaction F=9.95 (df 1, 1,287) p<0.001 Baseline: Intervention 2.82 (0.87); control 2.78 (0.88) 12 months: Intervention 3.04 (0.82); control 2.96 (0.85) 24 months: Intervention 3.18 (0.86); control 3.02 (0.85) There was a statistically significant group by time interaction for sunscreen use (p=0.001) and hat use (0.047) Sunscreen use Baseline mean (SD): Intervention 2.98 (1.28); control 2.96 (1.26) 12 months: Intervention 3.18 (1.23); control 3.07 (1.23) 24 months: Intervention 3.36 (1.24); control 3.15 (1.24) Hat use Baseline: Intervention 2.13 (1.14); control 2.23(1.18) 12 months: Intervention 2.17 (1.10); control 2.24 (1.15)	**Limitations identified by author** (1) self-report outcomes which introduces the possibility of social desirability bias, (2) it was not possible to identify the influence of each intervention component on the outcomes, (3) outcomes in participants who withdrew were not assessed, intention-to-treat analysis may have found smaller treatment effects. **Limitations identified by review team** (1) Provision of sunscreen is a very small component of the intervention, (2) no information on quantity of sunscreen provided, (3) there is a risk of spurious statistically significant findings due to the multiple statistical tests undertaken, (4) a statistically significant difference between groups over time was reported, but it is unclear at which time point(s), (5) the analyses are poor in relation to subgroups, (6) method of randomisation is

	Race/ethnicity White (not Hispanic): n=2,184 (94%) Black (not Hispanic): n=15 (<1%) Hispanic: n=42 (2%) American Indian: n=16 (<1%) Asian: n=17 (<1%) Other: n=50 (2%) **Socioeconomic status** Annual household income Less than $15,000: n=186 (9%) $15,001-$25,000: n=225 (10%) $25,001-$45,000: n=558 (26%) $45,001-$65,000: n=611 (28%) More than $65,000: n=589 (27%) Highest grade completed Less than high school: n=275 (12%) High school graduate: n=617 (27%) Some college: n=737 (32%) Bachelors degree: n=440 (19%) Postgraduate education: n=252 (11%) **Skin type** Sun sensitivity based on natural hair colour, skin colour, and tendency to burn when in the sun (possible score 0 to 10): mean 4.5 (SD 2.4) Good natural protection: n=615 (26%) Moderate sensitivity: n=1,271	addition, a 'Being Sun Smart' manual containing stage-tailored information on sun protection, and a second educational pamphlet were distributed as a booster/reminder eight months post baseline. Participants were eligible for a lottery prize of $1,000 for completing each assessment. **Comparator** No intervention **Intervention period** June to November 1995 **Sample size** n=7 beaches, n=2,324 sunbathers **Baseline comparisons** Assessment of baseline differences by treatment group in participants completing the 24-month assessment (n=1,450) showed no significant differences for age, gender, sun sensitivity, sun protection, or stage of change for sun protection. There were significant differences in stage of change of sunscreen, with control participants more likely to be in pre-contemplation (56.0%) compared with intervention (52.6%) and maintenance (control: 28.9%; intervention 25.5%), and less likely to be in action (control	Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** Two algorithms were used to measure stage of change for: (1) sun protection (avoiding sun exposure; covering up with clothing/hats, and using SPF 15 sunscreens) and (2) consistently using SP15 sunscreens, based on a short series of questions designed to assess intentions and behaviours for reducing sun exposure. Participants were categorised into one of the five stages of change: pre-contemplation (inconsistent protection from the sun and did not intend to start doing so within the next 12 months), contemplation (inconsistent protection from the sun, but seriously thinking about starting to do so within the next 12 months), preparation (not currently protecting from the sun, but were planning to do so within the next 30 days), action (consistently protecting from the sun and had been doing so for fewer than 12 months), or maintenance (protecting from the sun for 12	24 months: Intervention 2.28 (1.19); control 2.24 (1.15), ` General stage of change Baseline: Intervention 2.97 (1.78); control 2.96 (1.80) 12 months: Intervention 2.93 (1.78); control 2.88 (1.82) 24 months: Intervention 3.18 (1.81); control 2.87 (1.84) p=0.004 Sunscreen stage of change Baseline: Intervention 2.54 (1.76); control 2.68 (1.81) 12 months: Intervention 2.73 (1.78); control 2.61 (1.80) 24 months: Intervention 2.87 (1.85); control 2.67 (1.85) p=0.001 Age, gender, sun sensitivity, use of tanning booths in the past year, knowing someone with skin cancer, and socioeconomic status were shown to be significant predictors of sun protection at baseline. The authors state that repeated measures analysis of covariance suggests that the intervention was most effective for younger individuals, people who had low sun sensitivity and people with income <$25,000 (results are not reported). **Sun exposure** The intervention group showed statistically significantly greater improvement in sun avoidance	unclear. **Evidence gaps and/or recommendations for future research** The authors suggest that further research is needed to assess whether the increases in sun protection practices in the control group reflects repeated assessment. They also suggest further research to assess the effects of each intervention component. **Source of funding** National Institute of Arthritis, Musculoskeletal and Skin Disorders (#RO1 AR43051).

	(55%) Very vulnerable: n=438 (19%) **Other** Stages of change for general sun protection Pre-contemplation: n=1,040 (45%) Contemplation: n=68 (3%) Preparation: n=333 (14%) Action: n=93 (4%) Maintenance: n=779 (34%) Stages of change for sunscreen use Pre-contemplation: n=1,295 (56%) Contemplation: n=67 (3%) Preparation: n=242 (10%) Action: n=105 (5%) Maintenance: n=605 (26%)	2.9%; intervention 6.0%) and preparation (control 6.5%; intervention 10.3%), X2=15.3, p<0.01. **Study sufficiently powered** A sample size of 2,400 was required based on a minimum power of 0.90 and expected intervention effect sizes of d=0.20 to 0.25.	months or more). **Follow-up period** Two, 12 and 24 months after baseline assessment (only results for 12 and 24 months reported). **Method of analysis** Analysis of variance, repeated-measures analysis of variance, and analysis of covariance (ANCOVA). ANCOVA for the Sun Protection Behaviour Scale by group was adjusted for age, gender, sun sensitivity, use of tanning booths in the past year, knowing someone with skin cancer, and socioeconomic status (only participants with data at all three time points were included).	over time compared with controls. Baseline: Intervention 2.71 (0.86); control 2.72(0.86) 12 months: Intervention 2.94 (0.82); control 2.87 (0.84) 24 months: Intervention 3.04 (0.87); control 2.92 (0.85), p=0.008 **Other outcomes** Participants in the intervention group were more likely than controls to have progressed from pre-action stages at baseline to the action or maintenance stages to increase sun protection at 12 (p=0.049) and 24 months (0.054), and sunscreen use at 12 (p=0.001) and 24 months (p=0.001). Percentage in action/maintenance stage of change (only participants in pre-action stage at baseline included) Sun protection stage of change 12 months All (n=973): Intervention 25.9; control 20.5, p=0.049 Ages 16-24 (n=317): Intervention 23.3; control 15.8, p=0.095 25-39 (n=410): Intervention 24.5; control 24.8, p=0.951 40-65 (n=246): Intervention 31.1; control 19.3, p=0.035 Females (n=589): Intervention 27.9; control 20.0, p=0.025 Males (n=384): Intervention 22.8;	

				control 21.4, p=0.732 24 months All (n=845): Intervention 31.5; control 25.5, p=0.054 Ages 16-24 (n=261): Intervention 32.3; control 23.4, p=0.071 25-39 (n=357): Intervention 26.3; control 25.8, p=0.921 40-65 (n=227): Intervention 38.2; control 27.9, p=0.100 Females (n=503): Intervention 30.9; control 26.0, p=0.219 Males (n=342): Intervention 32.4; control 24.9, p=0.124 Sunscreen use stage of change 12 months All (n=1,092): Intervention 22.3; control 13.5, p=0.001 Ages 16-24 (n=332): Intervention 20.5; control 11.7, p=0.029 25-39 (n=450): Intervention 19.9; control 14.7, p=0.147 40-65(n=310): Intervention 27.1; control 13.6, p=0.004 Females (n=647): Intervention 25.0; control 14.4, p=0.001 Males (n=445): Intervention 18.3; control 12.0, p=0.065 24 months All (n=948): Intervention 27.1; control 17.0, p=0.001 Ages 16-24 (n=278): Intervention 20.9; control 15.3, p=0.223 25-39 (n=393): Intervention 26.1; control 18.9, p=0.090 40-65 (n=277): Intervention 33.5; control 16.0, p=0.001	

				Females (n=551): Intervention 31.7; control 20.5, p=0.003 Males (n=397): Intervention 20.7; control 12.2, p=0.023 Group difference in advancement to any stage (stage progression) (only participants in pre-action stage at baseline included) Sun protection stage of change 12 months All (n=973): Intervention 35.8; control 29.7, p=0.040 Ages 16-24 (n=317): Intervention 34.6; control 25.3, p=0.072 25-39 (n=410): Intervention 34.5; control 34.8, p=0.956 40-65(n=246): Intervention 39.4; control 26.3, p=0.030 Females (n=589): Intervention 37.8; control 29.2, p=0.027 Males (n=384): Intervention 33.0; control 30.5, p=0.597 24 months All (n=845): Intervention 42.4; control 32.2, p=0.002 Ages 16-24 (n=261): Intervention 43.5; control 32.1, p=0.057 25-39 (n=357): Intervention 37.1; control 31.9, p=0.294 40-65 (n=227): Intervention 48.8; control 32.7, p=0.014 Females (n=503): Intervention 41.0; control 35.0, p=0.171 Males (n=342): Intervention 44.5; control 27.8, p=0.001 Sunscreen use stage of change	

				12 months All (n=1,092): Intervention 31.8; control 22.1, p=0.001 Ages 16-24 (n=332): Intervention 29.8; control 22.8, p=0.147 25-39 (n=450): Intervention 30.1; control 21.9, p=0.047 40-65(n=310): Intervention 35.9; control 21.4, p=0.005 Females (n=647): Intervention 35.7; control 22.9, p=0.001 Males (n=445): Intervention 26.2; control 20.8, p=0.183 24 months All (n=948): Intervention 35.8; control 23.4, p=0.001 Ages 16-24 (n=278): Intervention 33.6; control 26.4, p=0.190 25-39 (n=393): Intervention 33.0; control 21.6, p=0.011 40-65 (n=277): Intervention 41.1; control 22.7, p=0.001 Females (n=551): Intervention 39.7; control 26.9, p=0.001 Males (n=397): Intervention 30.3; control 18.5, p=0.007 No significant differences were found between groups in relapse rates (participants in action or maintenance at baseline who regressed to a pre-action stage at follow-up) for reducing unprotected sun exposure (intervention 34.6% versus control 30.0% at 12 months; 20.7 versus 21.2% respectively at 24 months) or for sunscreen use (intervention 29.4% versus	

				control 28.8% at 12 months; 26.6% versus 27.3% respectively at 24 months). **Attrition details** 12 months (n=1,629): 70% of baseline 24 months (n=1,450): 62% of baseline Dropout rates were similar between groups	
Author Winett et al.[12] **Year** 1997 **Study aim** To assess the effect of a Safe-sun intervention on lifeguards' and the publics' skin protective behaviours at swimming pools. **Study design** Study 1: Cluster RCT Study 2: Before and after comparisons in a sub-set of swimming pools **Internal validity** - **External validity** -	**Country** United States **Setting** Swimming pool **Source population** Swimming pools in south-western Virginia, USA. **Eligible population** Study 1: 33 swimming pools located within a 50-mile radius of the research centre, south-western Virginia, serving at least 50-75 members of the public on warm summer days, had a pool manager and at least 2 lifeguards, provided ready access for research staff to the pool, and were willing to follow the study's methods, including random allocation to intervention group. Study 2: Five swimming pools that participated in Study 1	**Method of allocation** Pools were randomly assigned after baseline measurement; no further details are provided. **Intervention** Study 1: (1) two 3x5 foot informational posters regarding skin cancer and sun protection, and one 3x5 foot poster providing feedback for the public and lifeguards on the percent protected, (2) approximately once weekly lottery to win Safe Sun hat or shirt for those engaging in Sun Safe practices (in the shade or wearing a shirt and a hat or sunglasses), (3) lifeguards received a Safe Sun hat and two logo Safe Sun shirts for voluntary use on and off duty, (4) free sunscreen available in two large self-serve containers at each pool. Study 2: In addition to the above: (1) explanation of the Safe Sun programme, including step-by-step explanation of all elements of	**Sun protection practices** Use of sunscreen Study 1: Questionnaires were completed by a convenience sample of 100 adults to assess knowledge and use of sunscreen, and 15 adults were observed to assess sunscreen use after leaving the water but remaining at the pool. Study 2: Not specifically assessed: composite measure of behaviours Study 1 and 2: 15 observers were rotated through different pools to record the number of protective behaviours of each pool user and lifeguard. Protection behaviours included being completely in the shade, or wearing a shirt plus a hat or sunglasses. Observations were conducted every day between 1pm and 4pm at each pool during a 60-day summer period, with times of observations varying at each pool. **Sun exposure**	**Sun-protection behaviours** **Study 1** Children/adolescents mean (SD) % engaging in sun protective behaviours There was a statistically significant group by time interaction (F=4.69 (df 1, 21), p<0.05) Full programme: Baseline 37.7 (14.8); post-intervention 50.3 (15.3) Posters only: Baseline 34.1 (13.3); post-intervention 38.1 (12.5) Adults There was no statistically significant differences between groups over time. Full programme: Baseline 27.3 (10.7); post-intervention 32.5 (12.9) Posters only: Baseline 23.1 (9.9); post-intervention 28.4 (9.8) None of 15 pool-users observed leaving the water but remaining	**Limitations identified by author** (1) No attempt to conduct formative research to ascertain current beliefs about the causes of skin cancer and its prevention or to use data with theoretical guidance to tailor the intervention, (2) incentives and promotional tactics to offer the intervention as an attractive product were limited. **Limitations identified by review team** Study 1: (1) The free sunscreen was provided at both intervention and comparator pools and appeared not to be part of the actual intervention being evaluated and sunscreen use was not reported by group, (2) limited data reported in study 1 on the intervention components of interest, (3) it was not possible to draw conclusions about the influence

	Selected population Study 1: 23/33 pools (70%); six public, 17 private Study 2: 4/5 pools (80%). **Age** Not reported **Female** Not reported **Race/ethnicity** Not reported **Socioeconomic status** The authors state that there was a wide cross-section of individuals in terms of socioeconomic status at the public pools, with private pools having mainly middle-class users. **Skin type** Not reported	the programme at a 'kick off day' involving music, food and entertainment, (2) larger posters (1.2 x 1.8m) with more information, (3) more frequent lotteries (three times per week during the first two weeks, then twice per week each successive week), (4) upgraded lifeguard component where lifeguards could choose the hats and better quality shirts, (5) one hour meetings with lifeguard prior to the start of the intervention, (6) meeting with pool manager to agree requirement for lifeguards to follow Sun Safe guidelines, (7) a competition, (8) provision of shaded area (9 x 9m) at two pools midway through the intervention. The 4 pools in study 2 received slightly different interventions. Pool A (public): Two week baseline followed by intervention, except shade which was introduced after week 6. Pool B (private): Two week baseline followed by intervention, but not shade as pool already had a shaded area. Pool C (private): Four week baseline followed by intervention including shade, which was introduced after week 6. Only management at Pool C agreed to require lifeguards to wear their shirt and hat or sit under an umbrella while on duty, at other pools this was voluntary.	Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Knowledge Study 1: Knowledge was assessed but the data were not reported Study 2: Pool users answered questions relating to knowledge of sunscreen (eg. how often to apply) and it's appropriate use (eg. applied once at home). **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Study 1: Sunscreen containers were weighed every week to calculate the amount of sunscreen used and provide an estimate of the number of applications per day per pool. Study 2: Not assessed **Other outcomes** No **Follow-up period** Study 1: during 32 day intervention period Study 2: during eight week intervention period	in the pool area applied sunscreen. Questionnaire data on sunscreen use were not reported. The authors state that “most patrons reported using no sunscreen or applying sunscreen once at home before leaving for the pool”. Lifeguards There was a statistically significant group by time interaction (F=15.46 (1, 21), p<0.001) Full programme: Baseline 45.6 (22.2); post-intervention 75.0 (16.1) Posters only: Baseline 43.2 (21.3); post-intervention 49.3 (20.4) Out of 32 days of the intervention, the full programme pools showed higher levels of protective behaviours over 29 days compared with poster only pools. **Study 2** Children/adolescents mean (SD) % engaging in sun protective behaviours Age 0-7: Pool A: Baseline 6.5 (6.0); intervention 12.6 (15.8) Pool B: Baseline 31.5 (24.4); intervention 34.3 (23.8) Pool C: Baseline 21.5 (11.7); intervention 46.3 (5.4) Pool D: Baseline 18.2 (8.9);	of the individual components. Study 2: (1) The intervention was implemented slightly differently at each pool making the comparison data difficult to interpret, (2) participation at two intervention pools was voluntary, (3) limited data reported on the shade component and it is not possible to determine the effect of this element. Study 1 and 2: (1) It is unclear how pools were selected and allocated to intervention groups, (2) it is unclear how many pool users and lifeguards participated in the study, (3) some reliance on self-report, (4) some of the outcomes were summarised, but data were not reported. **Evidence gaps and/or recommendations for future research** None stated **Source of funding** American Cancer Society (Grant #PBR-75)

		Comparator Study 1: Informational posters plus provision of sunscreen in 2 large self-serve containers. Study 2: Pool D (public) received only educational material after week 4. **Intervention period** Study 1: June to July 1993 Study 2: summer 1994 **Sample size** Study 1: n=12 pools in the full programme condition; n=11 in the education only condition Study 2: n=4 pools; pool A and B received the full programme intervention The number of participants observed at each pool was not reported. **Baseline comparisons** Not reported **Study sufficiently powered** Not reported	**Method of analysis** Study 1: The percent of members of the public and lifeguards engaging in protective behaviours were calculated. Repeated measures analyses of variance were used to calculate group by time interaction for children, adolescents, lifeguards, and adults, using pools as the unit of analysis and mean percent protected during each phase as the dependent measure. Study 2: As above, but participants were categorised by age to examine effects across age groups: 0-7, 8-12, 13-17, 18-29 and over 30 years.	intervention 13.9 (5.2) Age 8-12 Pool A: Baseline 16.3 (18.7); intervention 19.8 (6.7) Pool B: Baseline 40.2 (7.4); intervention 40.0 (21.7) Pool C: Baseline 33.3 (3.9); intervention 60.7 (9.8) Pool D: Baseline 12.9 (7.9); intervention 10.7 (7.5) Age 13-17 Pool A: Baseline 6.7 (9.4); intervention 7.9 (11.4) Pool B: Baseline 22.2 (2.2); intervention 29.5 (20.5) Pool C: Baseline 52.7 (4.7); intervention 64.1 (23.6) Pool D: Baseline 16.4 (8.7); intervention 8.9 (8.4) Adults Age 18-29 Pool A: Baseline 11.6 (16.4); intervention 14.6 (7.9) Pool B: Baseline 24.4 (10.9); intervention 30.6 (37.4) Pool C: Baseline 20.4 (14.7); intervention 42.8 (29.4) Pool D: Baseline 7.2 (1.1); intervention 7.6 (9.2) >30 Pool A: Baseline 19.9 (3.3); intervention 23.0 (10.5) Pool B: Baseline 39.9 (1.2); intervention 38.7 (8.1) Pool C: Baseline 25.5 (3.4); intervention 45.9 (6.0)	

				Pool D: Baseline 17.5 (4.8); intervention 18.8 (4.9) Lifeguards Pool A: Baseline 40.1 (7.5); intervention 68.6 (13.8) Pool B: Baseline 62.2 (4.3); intervention 75.2 (11.1) Pool C: Baseline 40.8 (6.6); intervention 95.7 (3.2) Pool D: Baseline 27.0 (13.4); intervention 38.4 (5.5) Differences of around 20% reported in protective behaviours at public compared to private pools. **Knowledge, attitudes, beliefs** Study 1: Not reported Study 2: Pool users across pools and age groups indicated minimal knowledge or appropriate use of sunscreens. **Process and implementation** Study 1: Weighing of sunscreen containers indicated a mean of approximately 10 applications per day per pool. The authors state that the questionnaire data indicated minimal knowledge of appropriate amount and frequency of sunscreen use, with most participants reporting no use of sunscreen or applying sunscreen once at home prior to arriving at the pool (data not reported). None of the 15 participants observed leaving the	

				water but remaining at the pool applied sunscreen. Study 2: Not assessed **Attrition details** None of the pools dropped out. Not relevant for participants as cross-sectional samples were used.	

Table C: Provision of multi-component interventions in the community evidence tables

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
Author Dietrich et al.[24] **Year** 2000 **Related papers** Dietrich 1998[30] **Study aim** To evaluate the impact of an intervention promoting sun protection behaviour among 2 to 11 year olds through schools and day care centres, primary care practices, and	**Country** United States **Settings** School/day care Beach: Mean temperature at baseline was 84°F, and 81°F for control and 80°F for intervention at first follow up. Primary care setting **Source population** All New Hampshire towns with populations of 4,000 to 15,000 that included at least 500 children 2 to 9 years of age; at least 20% of households with 1990 incomes below the federal poverty level, and at	**Method of allocation** Towns were matched into pairs based on demographics and weather patterns, and randomly assigned to control or intervention using **Intervention** All components promoted avoidance of sun between 11am to 3pm, cover up, use of sunscreen with SPF≥15, encouragement of sun protection amongst family and friends. The school/day care intervention included an age- and grade-specific curriculum (including activities modelled on the 'Slip, Slop, Slap' and SunSmart programmes), and 'free materials' (used for a	**Sun protection practices** A composite measure of behaviours was calculated using the change in mean proportion of children protected on one or more body areas (on the head and neck; on the torso and arms; and on the legs) by (a) sunscreen, clothes, and/or shade; and (b) the proportion protected on all three body areas by any means. (c) The change in mean proportion of children using the individual components from baseline (collected in June to late August 1995) to follow-up were calculated from data collected by field observers visiting beaches on clear days with temperatures predicted to exceed 72°F (22°C) All willing	**Sun-protection behaviours (children)** The composite measure showed a statistically significantly greater mean change in the number of children in the intervention group compared to control group who were protected on one or more body area by sunscreen, clothes, and/or shade (mean difference from baseline to follow-up 1: 0.13, p=0.029; and from baseline to follow-up 2: 0.12, p=0.033) Baseline: intervention 0.78 (n=456); control 0.85 (n=409) Follow up 1: intervention 0.87 (n=561); control 0.80 (n=504) Baseline: intervention 0.58 (n=446); control 0.67 (n=408)	**Limitations identified by author** Small sample size, and that it was not possible to assess the relative contributions of the different setting intervention components or determine the intensity with which the intervention was applied by each setting in 1997. It was not possible to distinguish the effects of the 1996 intervention and the 1997 intervention. Furthermore, there was no assessment of sun avoidance by staying away from the beach, which means that the true impact of the intervention may have been

recreation areas. **Study design** Cluster RCT **Internal validity** + **External validity** +	least one of each relevant setting. **Eligible population** Ten towns with the highest proportion of low-income families. **Selected population** Children aged 2 to 9 years (1995 - baseline) Children aged 2 to 11 years (1996 and 1997 - follow up 1 and follow up 2) **Female** 1996: 48% 1997: 50% **Race/ethnicity** Not reported **Socioeconomic status** At least 20% of households with 1990 incomes below the federal poverty level. **Skin type** 54% (at baseline) described as burning easily. **Other** All children lived in the town or within 8 miles of its borders.	minimum of two class periods). Researchers performed 3 visits of 40 minutes to schools and one visit of 40 minutes to day care centres in Spring 1996, and one visit of 20 minutes to each setting in Spring 1997. The beach intervention provided a sun protection poster with daily updates on predicted UV index for the day, sunscreen samples and educational pamphlets, available to beachgoers through lifeguards. Researchers performed two visits of 40 minutes in Spring 1996 and one visit of 20 minutes in Spring 1997. The primary care intervention included an office system manual to promote sun protection advice during patient visits, practice meeting for project staff to present information on preventing skin cancer, a sun protection manual, patient education materials (eg. pamphlets, posters, stickers), sunscreen samples. Researchers performed one visit of 40 minutes in Spring 1996 and one visit of 20 minutes in Spring 1997. **Comparator** Controls received no intervention. **Intervention period** Between March and May 1996 and March and May 1997	adults caring for children meeting the eligibility criteria were interviewed at baseline and follow up 1 on the use of sunscreen and the SPF from the sunscreen container was recorded. At follow up 2, to be considered protected by sunscreen, an area had to be protected by sunscreen of no less than SPF 15, which had been applied within the past 2 hours. Again, the sunscreen container was observed and the SPF recorded. Direct observations were also made of the children's use of shade, and use of protective clothing (including a hat with at least a 2 inch forward brim; a shirt with sleeves at least halfway to the elbow; trousers or a swimsuit that extended to just above the knee or longer) at baseline and follow-up. **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation**	Follow up 2: intervention 0.73 (n=746); control 0.70 (n=744) There was no statistically significant difference between groups for protection on all three body areas, from baseline to follow up 1 (mean difference 0.15, p=0.18). Baseline: intervention 0.53 (n=456); control 0.66 (n=409) Follow up 1: intervention 0.74 (n=561); control 0.72 (n=504) No data were provided for follow up 2. Data on the percentage of children with various levels of solar protection were available in graphical form. Details of statistical significance were not provided. Percentages are means of town means. Data were only presented for baseline and follow up 2. Fully protected (all three body areas) Baseline: intervention 31%; control 46% Follow up 2: intervention 50%; control 46% Partially protected (one or two areas) Baseline: intervention 27%; control 21% Follow up 2: intervention 23%; control 24%	underestimated. The study findings may not be generalisable given the distinct nature of the region and participant population. **Limitations identified by review team** (1) The provision of samples was a very minor component of a predominately information intervention. No information was provided about the quantity of sunscreen samples and none of the outcomes refer directly to their use. (2) The intensity of the intervention may have varied between towns in the intervention group. (3) It was unclear why the number of children at baseline differed between the main paper and the related paper. **Evidence gaps and/or recommendations for future research** Further research is required to test SunSafe in settings other than those used in this study and to include preteens and adolescents. The authors recommend

		Sample size Intervention: n=5 towns Control: n=5 towns **Baseline comparisons** The age of children (<5years or ≥5 years), gender, and percentage of children with their own parent were similar between intervention and control groups at baseline and both follow up periods. The percentage of children that burnt easily, and caregivers with one child were similar between groups at baseline and follow up 1 (data not reported for follow up 2). **Study sufficiently powered** Not reported	**outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Between June and August 1996 and June and August 1997. **Method of analysis** A logistic regression model for clustered binary data was fit to protection data for individual children in each community and each summer (to compensate for clustering by caregiver). The variables included in the model were: town of residence in each year; interview -specific time of day; temperature; degree of cloud cover and wind; observer performing the interview; child's age and gender; and caregiver's perception of tendency to burn. Squared terms for temperature and time of day were included to capture the non-linear effect of these variables. The effect of the intervention was then determined using the adjusted year and town specific proportion of protected children from the regression models. Change from baseline to follow-up in each group and the difference in change between groups was calculated. A variance weighted t test was performed on the pair adjusted changes in the control and intervention towns.	No protection Baseline: intervention 42%; control 33% Follow up 2: intervention 27%; control 30% (1) Sunscreen use a) Proportion of children wearing sunscreen on at least one body area There was a statistically significant greater mean change in the intervention group from baseline to follow up 1, compared with controls (mean difference 0.17, p=0.011), but not from baseline to follow-up 2 (mean difference 0.21, p=0.056). Baseline: intervention 0.57 (n=456); control 0.65 (n=409) Follow up 1: intervention 0.75 (n=561; control 0.66 (n=504) Baseline: intervention 0.44 (n=446); control 0.55 (n=408) Follow up 2: intervention 0.63 (n=746); control 0.53 (n=744) b) Sunscreen used on face There was a statistically significant greater mean change in the intervention group from baseline to follow up 1, (mean difference 0.15, p=0.031). Baseline: intervention 0.56 (n=456); control 0.64 (n=409) Follow up 1: intervention 0.70	exploring how long external support needs to be maintained to achieve lasting change. **Source of funding** National Cancer Institute Grant CA 63029. Donations of sunscreen from: Schering-Plough Healthcare Products, Inc.; Hawaiian Tropic; Pfizer, Inc.; and Johnson and Johnson Consumer Products, Inc.

				(n=561); control 0.63 (n=504) There was no statistically significant difference between groups from baseline to follow up 2 (mean difference 0.17, p=0.065). Baseline: intervention 0.40 (n=446); control 0.50 (n=408) Follow up 2: intervention 0.55 (n=746); control 0.47 (n=744) c) Sunscreen used on torso/back There was a statistically significant greater mean change in the intervention group between baseline and follow up 1 and baseline and follow up 2, compared with control (mean difference 0.17, p=0.008; 0.20, p=0.041 respectively). Baseline: intervention 0.51 (n=456); control 0.61 (n=409) Follow up 1: intervention 0.77 (n=561); control 0.70 (n=504) Baseline: intervention 0.35 (n=446); control 0.46 (n=408) Follow up 2: intervention 0.59 (n=746); control 0.49 (n=744) d) Sunscreen used on legs There was no statistically significant difference between groups from baseline to follow up 1, or from baseline to follow up 2 (mean difference 0.11, p=0.14; and 0.14, p=0.12 respectively). Baseline: intervention 0.49 (n=456); control 0.52 (n=409) Follow up 1: intervention 0.68 (n=561); control 0.60 (n=504)	

				Baseline: intervention 0.36 (n=446); control 0.40 (n=408) Follow up 2: intervention 0.51 (n=746); control 0.42 (n=744) (2) Protective clothing a) Any protective clothing There was no statistically significant difference between groups from baseline to follow up 1, or from baseline to follow up 2 (mean difference 0.02, p=0.78; and -0.03, p=0.56. respectively). Baseline: intervention 0.30 (n=456); control 0.26 (n=409) Follow up 1: intervention 0.24 (n=561); control 0.18 (n=504) Baseline: intervention 0.18 (n=446); control 0.17 (n=408) Follow up 2: intervention 0.27 (n=746); control 0.28 (n=744) b) Hat There was no statistically significant difference between groups from baseline to follow up 1 (mean difference 0.01, p=0.18). Baseline: intervention 0.03 (n=456); control 0.02 (n=409) Follow up 1: intervention 0.03 (n=561); control 0.01 (n=504) c) Shirt There was no statistically significant difference between groups from baseline to follow up 1 (mean difference -0.01, p=0.97). Baseline: intervention 0.11 (n=456); control 0.10 (n=409) Follow up 1: intervention 0.09	

				(n=561); control 0.09 (n=504) d) Trousers/swimsuit There was no statistically significant difference between groups in mean change from baseline to follow up 1 (mean difference -0.01, p=0.78). Baseline: intervention 0.21(n=456 children); control 0.15 (n=409 children) Follow up 1: intervention 0.15 (n=561 children); control 0.10 (n=504 children) No data were provided for use of hats, shirts, or trousers/swimsuit at follow-up 2. (3) Protection by shade There was no statistically significant difference between groups from baseline to follow up 1, or from baseline to follow up 2 (mean difference -0.06, p=0.38; and -0.01, p=0.68 respectively). Baseline: intervention 0.14 (n=456); control 0.18 (n=409) Follow up 1: intervention 0.14 (n=561); control 0.24 (n=504) Baseline: intervention 0.08 (n=446); control 0.13 (n=408) Follow up 2: intervention 0.09 (n=746); control 0.14 (n=744) **Other outcomes** Subgroup analyses were performed for the outcome 'sunscreen used on at least one body area'.	

				From baseline to follow up 1: (a) For boys, there was a statistically significant greater mean change in the intervention compared with the control group (mean difference 0.16, p=0.044). Girls showed no statistically significant difference between groups (0.18, p=0.12). (b) For children aged less than five, and children aged five and over, there was a statistically significant greater mean change in the intervention compared with the control group (mean difference 0.07, p=0.006; and 0.19, p=0.029 respectively). (c) For children who were perceived to burn easily there was no significant difference between groups (mean difference 0.07, p=0.17). For children who were perceived 'not to burn easily', there was a statistically significant greater mean change in the intervention group (mean difference 0.23, p=0.006). **Attrition details** Not relevant as cross-sectional samples were used	
Author Glanz et al.[28] **Year**	**Country** United States **Setting**	**Method of allocation** Not applicable **Intervention**	**Sun protection practices** Use of sunscreen, shade, protective clothing or hat, and sunglasses measured on a 4-point scale ranging	**Sun-protection behaviours** Parents use of sunscreen increased by 2.5% (60.9% to 63.4%), and children's use	**Limitations identified by author** Limitations with this study included (1) small sample size,

1998 **Study aim** To evaluate the SunSmart programme for 6 to 8 year old children, their parents, and outdoor recreation staff. **Study design** Before and after **Internal validity** - **External validity** -	Summer Fun sites **Source population** Five public and privately sponsored outdoor recreation sites in Hawaii **Eligible population** All 6-8 year old children, their parents and staff at field test sites for SunSmart, including three YMCAs, one city park Summer Fun site, and one public swimming pool in Hawaii. **Selected population** 156 parents (113 provided follow-up data) and 45 staff members (41 provided follow-up data) **Age** Children were aged 6 to 8 years and the average age of staff was 20 years. The age of parents was not reported. **Female** Parents were predominantly female and two thirds of the staff female **Race/ethnicity** The majority of parents were reported to be white or Asian/Pacific islanders. 4.4% of staff were white, 42.2% Hawaiian, 26.7% Asian/Pacific islanders, and 26.7% were of	A four week education intervention to increase awareness, intentions, skills, and practices for skin cancer prevention, including: (1) staff training (orientation session to enable the implementation of the programme), (2) group activities for children, (3) take-home booklets/guides for children and parents, including interactive activities, (4) incentives for children and staff (including sunscreen samples, magnets, note boards, school pencil packs, t-shirts, insulated lunch sacks, and SunSmart hats), (5) promotion of sun safe environments and policies, including behaviour monitoring scoreboards for children, (6) a sunscreen dispenser and sun safety posters were provided at each site. **Comparator** Comparison between baseline and follow-up **Intervention period** Summer 1995 **Sample size** Parents/children n=156 Staff n=45 **Baseline comparisons** Not applicable	from one to four ("rarely or never" to "always") were reported individually (parents completed for themselves and their children) and as part of a composite measure of sun-protection norms. **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Knowledge about skin cancer and sun protection, and attitudes of parents and staff were included as part of the survey - no other details were provided. **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Recreation staff completed weekly monitoring forms to record children's reactions, and a 4-point index of SunSmart implementation was created from the staff follow-up survey responses. **Other outcomes** Four stages of change relating to sun protection habits, how long the habits had been practiced, and	increased by 6.7% (68.3% to 75%). Seeking shade increased by 12% (45.6% to 57.6%) in parents, and by 14.6% (22.9% to 37.5%) in children. Sunscreen use norms increased by 19% (51% to 70%), hat wearing norms by 21% (29% to 50%), and covering up when outside increased by 24.5% (33% to 57.5%) in staff. (a) Cross-sectional analysis (n=156 parents, n=45 staff baseline; n=113 parents, n=41 staff follow-up) There were significant changes in sun protection practices among children: baseline mean (SD) 10.5 (2.7); follow-up (SD) 11.8 (2.6)($p<0.01$), and sun protection norms among staff: baseline 9.2 (3.1); follow-up 10.7 (2.2)($p<0.05$). There were no significant changes in parental sun protection habits: baseline mean 12.6 (3.2); follow-up 13.2 (2.9), or staff sun protection habits: baseline mean 11.8 (2.2); follow-up 11.9 (2.3). (b) Longitudinal analysis (n=94 parents/children; 30 staff) There were significant changes in sun protection practices among	(2) lack of experimental design, (3) some survey non-response, (4) and potential bias with staff at participating sites being motivated and eager to participate in the new programme. **Limitations identified by review team** (1) High attrition rate, (2) unclear reliability of survey and observational methods, and the lack of information on some of the outcome measures, (3) limited details on participant characteristics and study methods, (4) limited information about the population and sites chosen **Evidence gaps and/or recommendations for future research** None specified **Source of funding** Not stated

	mixed ethnicity. **Socioeconomic status** Parents were predominantly well educated and middle or upper income. 56% of staff attended or graduated from college. **Skin type** Not reported **Other** Parents and staff who answered only the pre-test and those who completed both surveys did not differ in background characteristics or on most measures of risk, beliefs, practices, or programme policy.	**Study sufficiently powered** Not reported	whether the respondent was thinking about or planning to take further steps towards sun protection were measured. **Follow-up period** End of intervention (four weeks) **Method of analysis** Results are presented as (1) differences between the cross-sectional respondent samples at baseline and follow-up using two-tailed t tests (for index variables) and Mann-Whitney U tests (for single item variables, eg. stage of change), and (2) changes in response of participants returning both the baseline and follow-up surveys using McNemar t tests and Wilcoxon z tests.	parents: baseline (SD) 12.7 (3.3); follow-up (SD) 13.4 (2.9) ($p<0.05$) and children: baseline 10.4 (2.8); follow-up 12.0 (2.6) ($p<0.01$). And significant changes in stage of change among parents: baseline 3.3 (1.0); follow-up 3.6 (0.7)($p<0.05$) and children: baseline 3.6 (0.7); follow-up 3.8 (0.5) ($p<0.01$). There were no significant changes in sun protection practices among staff: baseline 11.9 (1.9); follow-up 12.1 (2.5), or sun protection norms among staff: baseline 9.8 (3.0); follow-up 10.3 (2.2). **Knowledge, attitudes, beliefs** There were no significant changes in knowledge for parents or staff using longitudinal analysis (n=94 parents, n=30 staff) Parents: baseline (SD): 4.9 (1.1); follow-up 5.1 (1.0) Staff: baseline 4.0 (1.0); follow-up 4.3 (1.1) **Process and implementation** (a) Cross-sectional analysis (n=156 parents at baseline; n=113 at follow-up) Parents indicated significant changes in sun protection policies: baseline (SD) 0.9 (1.1); follow-up 1.7 (1.2) ($p<0.01$) (b) Longitudinal analysis (n=94	

				parents) Parents indicated significant changes in sun protection policies: baseline (SD) 0.8 (1.0); follow-up 1.6 (1.1) (p<0.01) Process evaluation 92.3% of staff reported presenting the sun safety messages using the stickers and SunSmart scoreboards (94.9%), 92.3% reviewed the ABCs of sun safety, and 89.7% encouraged children to be sun smart at home. Activities were rated favourably, and observations indicated that SunSmart activities were conducted often and were well received by children. **Other outcomes** (a) Longitudinal analysis (n=94 parents/children, n=30 staff) There were no significant changes in parental stages of change: baseline (SD) 3.3 (1.0); follow-up 3.6 (0.7), or in children: baseline 3.6 (0.7); follow-up 3.8 (0.5), or staff: baseline 3.3 (0.9); follow-up 3.6 (0.6) (b) Cross-sectional analysis also showed no significant changes **Attrition details** Parents: 62 non responders Staff: 15 non responders	

Author Glanz et al.[25] **Year** 2000 **Related papers** Glanz 2001[31] **Study aim** To assess the effects of a skin cancer prevention programme at outdoor recreation sites on children's sun protection behaviours and site sun protection policies. **Study design** Cluster RCT **Internal validity** - **External validity** -	**Country** United States **Setting** City-managed community park sites and YMCAs that provided summer day camp programmes. **Source population** Twenty outdoor recreation sites (Summer Fun sites) on the island of Oahu, Hawaii **Eligible population** Children aged 6 to 8 years and their parents (n=488), and recreation leaders (n=258) at 14 outdoor recreation sites **Selected population** n=756 parents and children using Summer Fun Programme and n=176 recreation leaders. Recreation sites: public (eight city parks and community centres); private (six YMCA-based sites). **Age** The mean age of staff in all three arms was 20.9 (SD 7.7) The mean age of parents in each arm was: Education/environment 37 years; Education 40 years; control 38 years	**Method of allocation** Sites were grouped into 12 clusters (two clusters had two small sites) and randomly assigned to study group using a blocking strategy to balance size and geographic location. **Intervention** The intervention was based on the social cognitive theory and stages of change. The education/environment intervention provided: (1) Training for recreation staff (60 to 90 minute session), including a leader's guide containing on-site activities for children, (2) on-site activities for children, including behaviour monitoring SunSmart scoreboards used to monitor activities completed by each child, (3) take-home interactive educational activities, including two family fun guides with stories, games, and puzzles for children and parents to complete, newsletters and brochures, (4) incentives (sunscreen samples, magnets, note boards, school pencil packs, SunSmart logo t-shirts, insulated logo lunch sacks, and logo hats newsletters and brochures, (5) sunscreen in large dispensers, sun safety posters, portable shade tents, and policy consultation with SunSmart staff. **Comparator**	**Sun protection practices** Self-report surveys were completed by parents and recreation staff on the use of sunscreen, shade, shirts with sleeves or hats, and sunglasses at baseline and post-test (six weeks later for parents, and eight weeks post-test for staff) and at 3 month follow-up. Responses were categorised on a scale of 1 to 4 as usually, sometimes, or rarely/never. A composite measure of behaviours score was calculated for the five protective behaviours. **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Staff completed a survey (56 items at baseline; 39 at post-test on (1) knowledge about skin cancer prevention (score 0 to 6), (2) sun protection habits (1 to 4), (3) sunscreen use (1 to 4); (4) perceived norms (1 to 5). **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes**	**Sun-protection behaviours** Data on sunscreen use were reported and extracted, but data on the remaining four individual components of the index completed by parents were only available in graphs and it was not possible to extract data from them. Children Sunscreen use increased significantly among in the education group compared with control group (adjusted analysis 0.16 +/- 0.08, p<0.05), but there were no significant differences between the education/environment and control groups. The composite score showed significant baseline to post-test changes in the education/environment group compared to controls (adjusted analysis 0.19 +/- 0.06, p<0.01), and education compared to control group (0.20 +/- 0.06, p<0.001). There were no statistically significant differences between the education/environment and education only groups. Staff Staff in the education/environment group significantly increased their use of sunscreen compared with controls between baseline and post-test;	**Limitations identified by author** (1) Reliance on self-reported behaviour, (2) differences in baseline characteristics, (3) attrition rates, especially at follow-up, (4) the findings may not be generalisable to non-tropical settings or areas with predominantly white children, (5) data collection procedures were limited by the lack of definitive lists of children, parents, and staff and the need to rely on young children to collect data from their parents, (6) the intervention was limited to the outdoor recreation programme summer season, when outdoor activity occurs all year round in Hawaii, (7) the time frame was limited for both the intervention and evaluation during a single summer season. **Limitations identified by review team** The main limitation with this study was that sunscreen samples, t-shirts, and hats were only incentives and were received by both intervention groups, so it is not possible to assess their influence. Details about the environment component of the intervention were very sparse.

	The mean age of children in each arm was: Education/environment 7 years; Education 7 years; control 7 years **Female** Staff (all three arms): 106 (60.9%) Parents: Education/environment 83%; education 85%; control 90% Children: Education/environment 44%; education 52%; control 52% **Race/ethnicity** Staff (all three arms): White 9 (5.3%); Hawaiian/part-Hawaiian 39 (22.8%); Japanese 53 (31.0%); Filipino 16 (9.4%); Chinese 10 (5.8%); other/other mixed 44 (25.7%) Parents: Education/environment 17% white; education 21% white; control 22% white **Socioeconomic status** Not reported **Level of education** Staff (all three arms): High school or less n=72 (42.1%); some college n=79 (46.2%); at least college graduate n=20 (11.7%)	Education arm: As above for the education/environment arm, but without the additional component (5). Control: Received a condensed educational programme pack after the post-test survey **Intervention period** Summer 1996 (six weeks) **Sample size** Staff: n=127 Children: Baseline to post-test cohort n=383; post-test to follow-up n=285 **Baseline comparisons** Staff: 11 variables were compared at baseline (demographics, sun protection habits, knowledge, policies, and norms) with two variables (gender and age) indicating significant differences between the three study arms. Parents: There was a significant difference in mean age, control (38); education (40); education/environment (37), p<0.001. Children: There was a significant difference in skin cancer risk index: control (1.38); education (1.39); education/environment (1.21%), p<0.05. **Study sufficiently powered**	Staff completed surveys and monitoring forms on programme policies and norms for sun protection (score range 0 to 5)[31] to measure the effects of the intervention on the site sun-protection policies; the extent of programme implementation and reactions to SunSmart; and observations to assess programme implementation. An overall sun protection policy score was calculated by adding up five responses relating to whether recreation sites required or encouraged sun protection behaviours. **Other outcomes** No **Follow-up period** Three months post intervention (outcome assessed at six weeks) **Method of analysis** Changes from baseline to post-test surveys and maintenance of change from post-test to follow-up were analysed using mixed model analysis of variance. Staff or parent age, education, ethnicity, income, child's skin cancer risk, recreation site, type of staff position, and baseline level of the dependent variable of concern were controlled for. The different multivariate models were run with different sets of assumptions. Multivariate adjustment had little effect and	0.43 (SE 0.22), p<0.05. There were no statistically significant differences between the education and control groups. Differences between the education/environment and environment groups were not reported. Baseline (mean) (n=176): Education/environment 2.09; education 2.18; control 2.08 Post-test (n=144): Education/environment 2.37; education 2.46; control 2.44 Follow-up (n=66): Education/environment 2.46; education 2.40; control 2.39 There were no significant differences in staff sun protection habits between the education/environment and control groups 0.17 (SE 0.12), but there was a significant difference between the education and control groups 0.37 (SE 0.12), p<0.05. Differences between the education/environment and control groups were not reported. Baseline: Education/environment 2.25; education 2.39; control 2.33 Post-test: Education/environment 2.27; education 2.49; control 2.33 Follow-up: Education/environment 2.30; education 2.30; control 2.25 **Knowledge, attitudes, beliefs**	**Evidence gaps and/or recommendations for future research** There is a need for both sustained programme activity and longer-term evaluation of preventive programmes. The authors also recommend that changing policy and environment should be a goal of future skin cancer prevention efforts in the US. **Source of funding** Co-operative agreement with the Health Promotion and Education Branch, Department of Health, State of Hawaii, and the Chronic Disease Prevention Control Programme of the Centres for Disease Control and Prevention, US Public Health Service.

	The authors state that most parents were married, had at least some college education, and had household incomes over $20,000 per year. **Skin type** Not reported for staff or parents. Children (skin cancer risk index, 0 to 4): Education/environment 1.21; education 1.39; control 1.38 **Other** Marital status of staff (n=157): 148 (94.6%) were not married	Not reported	results are reported as unadjusted means, except where results for recreation staff are reported for the cohort who completed multiple both the baseline and post-test surveys (n=127). Results reported by parents are based on the cohort of 383 children completing surveys at baseline and post-test. Post-test to follow-up results are based on a cohort of 285 children.	More positive changes between baseline and post-test were reported in the education/environment arm compared to control arm. Significant intervention effects were found for knowledge and perceived norms. Staff (adjusted analysis) Knowledge (0-6) (difference (SE)): Education/environment versus control 0.67 (0.26), p<0.05; education versus control 0.79 (0.27), p<0.01. Differences between the education/environment and education groups were not reported, but the authors state that there were no differences. Baseline (n=176): Education/environment 4.29; education 4.46; control 4.67 Post-test (n=144): Education/environment 4.85; education 5.02; control 4.57 Follow-up (n=66): Education/environment 4.67; education 4.98; control 4.55 Perceived norms (1-5): Education/environment versus control 0.69 (0.25), p<0.01; education versus control 0.51 (0.25), p<0.05. Differences between the education/environment and education groups were not reported, but the authors state	

				that there were no differences. Baseline: Education/environment 3.13; education 3.01; control 3.11 Post-test: Education/environment 3.56; education 3.43; control 2.99 No data reported for follow-up **Process and implementation** There was a significant improvement in sun protection policies in the education/environment arm compared with controls; difference (SE) 0.95 (0.39), p<0.05; there were no statistically significant differences between the education and control groups 0.68 (0.39). Baseline (n=176): Education/environment 2.29; education 1.72; control 1.44 Post-test (n=144): Education/environment (not reported); education 2.12; control 1.68 Follow-up (n=66): not reported 85.6% of staff in the intervention arms reported giving sun safety messages to children; 88.9% encouraged children to be sun smart at home; and 76.7% went over the ABCs of sun protection. There were no statistically significant differences between the education/environment and education only arms.	

				Attrition details Staff: baseline 176 (68.2% response rate); post-test 144 (71.9%); follow-up 66 (61.4%). Seventeen respondents to the post-test survey were not included in the main analysis as they did not complete the baseline survey. Parents Education/environment: 281 parents completed the baseline survey (72% response rate); education: n=268 (58% response rate); control: n=207 (63% response rate) Baseline and post-test surveys: Education/environment (n=102); education (n=143); control (n=138) Post-test and follow-up surveys: Education/environment (n=53); education (n=122); control (n=110)	
Author Mayer et al.[27] **Year** 2001 **Study aim** To evaluate the effects of a multi-component intervention on hat wearing by children and the purchasing of sunscreen and select hats in gift shops.	**Country** United States **Setting** Zoo **Source population** Visitors to the San Diego Zoo and to the San Diego Wild Animal Park, California, USA. **Eligible population** Visitors to the San Diego Zoo and Wild Animal Park. Leaflets and coupons were given to visitors with the map received on entry.	**Method of allocation** This was a non-randomised trial. It is unclear how the two sites were allocated to receive/not receive the intervention. **Intervention** The intervention included (1) a sun safety tip sheet for parents, (2) a stamping activity sheet for children, and other relevant children's activities, (3) coupons for discounted children's hats (11-17% discount in the form of $1.00 off hats ranging from $5.99 to $8.99) and sunscreen (10% discount in the form of $0.25 off $2.49 sunscreen) in zoo gift shops,	**Sun protection practices** Average sales rate of sunscreen and hats per 1000 visitors The daily number of units of sunscreen and discounted hats sold each day were obtained from the merchandising buyer. Data on daily number of visitors was obtained from the marketing department. Use of protective clothing or hat (1) Hat use by children who appeared 12 years or younger was recorded by trained observers on a portion (range 32-45%) of baseline and intervention days as children exited the intervention/comparator	**Sun-protection behaviours** Sunscreen sales (per 1000 visitors) There was a statistically significant increase in sunscreen sales from baseline to intervention phase at the intervention site compared to the comparator site during the winter and summer. Baseline (Winter): intervention 0.57; control 0.73. Change in rate: intervention 2.94; comparator 0.82; p=0.011 Baseline (Summer): intervention 3.27; comparator 4.15. Change in rate: intervention 2.04; comparator -0.50; p<0.001	**Limitations identified by author** The main limitations with this study were the small amount of time for sun safety education, limited exposure to the intervention components and follow-up measures, and the effects of the individual intervention components cannot be identified. The authors also suggest that because of the non-equivalent comparison group design, caution should be used in interpreting the

Study design Non-randomised controlled trial **Internal validity** - **External validity** -	**Selected population** No population details were provided.	(4) point of purchase signs for hats and sunscreens in gift shops, (5) signs about sun safety adaptations in animals, (6) incorporation by bus tour narrators of animal adaptations for skin protection, (7) sunscreen and sun safety reminder signs. **Comparator** Park: evaluation only **Intervention period** Winter study: Began January 1999. Four week baseline evaluation followed by six week intervention (at the zoo) and continued evaluation at both the intervention and comparator sites. Summer study: Began July 1999. Four week baseline evaluation followed by four week intervention period (at the zoo) and continued evaluation at both the intervention and comparator sites. **Sample size** Winter n=8721 (zoo n=5418, park n=3303) Summer n=8524 (zoo n=6011, park n=2513) **Baseline comparisons** The zoo was in a downtown area whilst the comparator site was in a relatively rural area 29 miles away. Both sites were operated by the same zoological society and sold similar items in the gift stores.	site. Observations were conducted from 2.00pm to 4.00pm in winter and 3.00pm to 5.00pm in summer. Observers recorded: the child's estimated age (0-3, 4-9, or 10-12 years), gender, and hat use (none, visor, cap/bonnet, flap hat, 2-inch brim, 3-inch brim, stroller/umbrella cover or hood/backward cap). In order to obtain observer reliability estimates, on 51% (winter study) and 60% (summer study) of observation days, a second observer also recorded data. **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Data were collected on the redemption of coupons, stamping booth use, satisfaction with stamping activity, compliance of delivery of information by tour bus	Hat use The odds of ideal hat use (i.e. flap, 2 or 3 inch brim, stroller/umbrella) during intervention versus baseline phase were statistically significantly greater during the Winter for the intervention versus the comparator site (OR: 1.84, 95% CI 1.13 to 2.98; p=0.01). There was no statistically significant difference between sites during the Summer (OR: 0.90; 95% CI 0.67 to 1.20; p=0.46). Percentage ideal hat use Winter Baseline: intervention 2.2% (n= 2069 children); comparator 5.5% (n=1024 children) During intervention: intervention 3.8% (n=3349 children); comparator 6.3% (n=2279 children) Difference between baseline and intervention phase: intervention 1.6%; comparator 0.8% Summer Baseline: intervention 11.4% (n=1189 children); comparator 12.3% (n=1024 children) During intervention: intervention 13.3%(n= 3349 children); comparator 15.9% (n=1324 children) Difference between baseline and intervention phase: intervention 1.9%; comparator 3.6%	internal validity of the study. They also highlighted that although the sites were well matched in respect to visitor demographics, base rates of hat use, and inventory of gift shop items, there may have been other confounding factors (eg. the intervention site was closer to the coast than the comparison site and had somewhat cooler temperatures). Other limitations included (1) the reliability of the outcome measures which were based on sales data (ie. indirect measure), (2) measuring hat use based on visitors exiting the site may not have reflected hat use during most of the visit, (3) visitors who purchased sunscreen or hats may not have used them during their visit, (4) only hat use rather than protective clothing for whole body were measured, **Limitations identified by review team** (1) The target population of the intervention were not clearly defined. The authors state that the intervention was "generally aimed at children who were uncovered by sunscreen or protective clothing".

		Study sufficiently powered A sample size calculation was not reported.	narrators, participant exit interviews. **Other outcomes** No **Follow-up period** Implementation and evaluation of the intervention occurred simultaneously. **Method of analysis** (1) Sales of sunscreen/ hats A poisson regression model was fitted to each dependent variables (number of sunscreen bottle sold or number of hats sold). Independent variables consisted of phase (baseline, intervention), site (zoo, park), time in days, and phase-by-site interaction. A set of models with a quadratic term for time were created in order to assess whether there was a nonlinear component to the time series effect. The results did not change. (2) Observational measure of hat use Two dichotomous variables were created. "Ideal hat use" (flap, 2-inch or 2-inch brim, and stroller/umbrella versus all other categories) and "any hat use" (no hat use versus all other categories). To assess change in use (from baseline to intervention phase) between the two sites, logistic	Hat sales (per 1000 visitors) There was a statistically significant difference in the rate of hat sales from baseline to intervention phase at the intervention compared to the comparator site during the Summer, but not during the Winter. Baseline (Summer): intervention 5.34; comparator 3.87. Change in rate: intervention 1.92; comparator -0.18; p=0.007 Baseline (Winter): intervention 1.95; comparator 1.19. Change in rate: intervention 3.01, comparator 1.32; p=0.41 **Process and implementation** During the Winter 1,128 tubes of sunscreen were sold (67% purchased with discount coupons). During the Summer 2,283 tubes were sold (68% purchased with discount coupons). During the Winter 1,518 hats were sold (48% purchased with discount coupons).During the Summer 3,162 hats were sold (47% purchased with discount coupons). The percentage of visitors exposed to the individual intervention components were based on exit interview data. During the Winter (n=526 visitors) 50% were exposed	(2)Observations were only recorded on children who appeared to be over the age of 12, which means that some children included in observations may have actually been aged over 12 years, and some children aged 12 or younger may not have been recorded as they looked older than 12 years old. (3) Only a fraction of observation days had two observers, therefore the reliability of the data is unclear. (4) It was unclear whether observations were made at the intervention and control sites on the same day. (5) There is no information on how days were selected for observation. (6) There is no information on weather conditions on observation days. (7) Indirect measures of sunscreen use based on sunscreen sales are unreliable in that sunscreen could have been used by adults or children aged over 12.

			regression models were fitted. The independent variables were: site, phase, and the site by phase interaction. To assess the impact of clustering by day of observation, generalised estimating equations were fitted with a logit link and a binomial error. The effect of day of observation was negligible and therefore logistic models with no adjustment for clustering due to day of observation were reported.	to the tip sheet, 41% to coupons and 41% to the stamping activity. During the Summer: (n=540 visitors), 62% were exposed to the tip sheet, 58% to the coupons, and 52% to the stamping activity. **Other outcomes** Subgroup analysis was performed for the outcome of ideal hat use. Age In both winter and summer, children aged 0-3 wore ideal hats statistically significantly more than children aged 4-9 (OR 0.35, 95% CI 0.27 to 0.45, p<0.001; and OR 0.22, 95% CI 0.19 to 0.26, p<0.001 respectively) and children aged 10-12 (OR 0.44, 95% CI 0.30 to 0.65, p<0.001; and OR 0.24, 95% CI 0.19 to 0.30, p<0.001 respectively). Gender In both winter and summer, females wore ideal hats statistically significantly more than males (OR 1.32, 95% CI 1.04 to 1.66, p=0.002; and OR 1.39, 95% CI 1.21 to 1.60, p<0.001 respectively). **Attrition details** Neither the intervention or control site dropped out.	(8) The intervention was not free provision; it assessed discounting in conjunction with provision of information. **Evidence gaps and/or recommendations for future research** The intervention should be tested in multiple zoos using a randomised controlled design. There is a need for interventions in multiple environments that in combination will influence parent and child sun safety before, during and after a zoo visit. In addition, interventions should be assessed in a specific environment so that it can be tailored and its independent effects on behaviour may be assessed. Conducting follow-up assessments with a cohort of zoo visitors after their visit would provide data on whether behaviours were maintained and in which other environments they were performed. **Source of funding** Cooperative Agreement No. U56/CCU914634, Centre for Disease Control and

					Prevention (CDC)
Author Olson et al.[26] **Year** 2007 **Study aim** To assess the impact of a multi-component community-wide intervention on sun protection practices of early adolescents. **Study design** Cluster RCT **Internal validity** - **External validity** -	**Country** United States **Setting** School Athletic and recreation facilities, primary care practices, and other community venues. Temperatures and the UV index were recorded every hour during the observation period: Temperatures at baseline Cool (<70°F): Intervention 97 (27.7%); control 19 (4.3%) Warm (70-79°F): Intervention 99 (28.3%); control 357 (81.1%) Hot (>79°F): Intervention 154 (44.0%); control 64 (14.5%) 1-year follow-up Cool (<70°F): Intervention 0 (0.0%); control 11 (4.7%) Warm (70-79°F): Intervention 221 (56.7%); control 112 (48.3%) Hot (>79°F): Intervention 169 (43.3%); control 109 (47.0%) 2-year follow-up Cool (<70°F): Intervention 0 (0.0%); control 0 (0.0%) Warm (70-79°F): Intervention 197 (56.4%); control 84 (60.0%) Hot (>79°F): Intervention 152 (43,6%); control 56(40.0%)	**Method of allocation** Random allocation by computer-generated numbers **Intervention** The intervention used a socio-ecologic approach based on Bandura's social cognitive theory, and the education sessions were based on Roger's protection motivation theory. Adult materials and training included (1) provision of a 30 minute educational session to increase awareness of adolescent sun protection in the region and the risks of skin cancer from UV exposure, to dispel myths, provide key messages, and discuss the importance of their role as role models, (2) viewing skin damage under UV-filtered light, (3) and provision of specific aids to remind them of sun protection and to assist in counselling (clinicians received posters, brochures, seasonal counselling cue cards, and temporary tattoos; teachers received water bottles, pencils, tote bags, UV meters for class activities, and UV-exposure cards; and coaches and lifeguards received lanyards, tote bags, sunscreen samples, and refrigerator magnets with sports-family home information), (4) annual presentations to provide new messages and materials, and supplies of sun screen were	**Sun protection practices** A composite measure of behaviours was measured using the proportion of individual adolescents' body surface are (BSA) protected from the sun by clothing, sunscreen or shade. Adolescent's self-reported use of sunscreen on 4 body areas (face/neck, arms, legs, trunk) and the sun-protection factor of any sunscreen used. Corroborated by observations of the sunscreen bottle used. Trained observers visited pools/beaches between 11am and 3pm (June to August) on days when weather reports did not predict rain or heavily overcast skies (an average of 30 observational days per year), to record sunscreen use, clothing coverage and shade protection (six levels of upper body clothing, four levels of lower body clothing, and three levels of hats, sunglasses, and use of shade). The total percent of body surface protected was calculated using algorithms based on BSA. Participants in the shade were classed as 100% protected. The face was classed as protected if a hat with a forward brim was worn, and the head and neck were considered protected if a hat with a 2-inch brim	**Sun-protection behaviours** Composite score There was a statistically significant effect for the factors time, group, and group x time interaction. The group x time interaction was statistically significant at 2-year follow-up: coefficient 11.31, 95% CI: 4.5 to 18.13, p=0.001, but not at year 1 coefficient -3.00 (95% CI: -9.26 to 3.26, p=0.35. For individual component scores, there were no significant changes over time in use of clothing (data were not presented in the report). There was a statistically significant increase in the intervention group for use of any sunscreen and the number of body areas where sunscreen was applied. Any sunscreen use Baseline: Intervention 199 (58.0%); control 285 (65.8%), p<0.05 1-year follow-up: Intervention 178 (47.0%); control 134 (59.6%), p<0.01 2-year follow-up: Intervention 164 (47.0%); control 19 (13.8%), p<0.001 Number of body areas where sunscreen applied: baseline (p<0.05); 1-year follow-up (p<0.001); 2-year follow-up (p<0.001)	**Limitations identified by author** It was not possible to determine the contribution of each intervention component. Other limitations included (1) the use of repeated cross-sectional analysis rather than longitudinal analysis, (2) fewer adolescents used the beach as they got older, making it difficult to determine whether the adolescents who continued to attend the beach or pool after 8th grade were teens with more tan-seeking behaviours than their peers who no longer attended, (3) cancelled school events over the two years meant that a sufficiently large adolescent population could not be recruited to determine sun protection at other outdoor activities, (4) parents were not directly targeted as part of the intervention. **Limitations identified by review team** The sunscreen component included a sunscreen sample offered to coaches and lifeguards and it is not possible to determine uptake of the samples, or how this component affected

	UV rating at baseline 0 to 6: Intervention 95 (26.6%); control 219 (49.8%) 7 to 10 or more: Intervention 262 (73.4%); control 221 (50.2%) 1-year follow-up 0 to 6: Intervention 109 (27.0%); control 81 (34.8%) 7 to 10 or more: Intervention 295 (73.0%); control 152 (65.2%) 2-year follow-up 0 to 6: Intervention 125 (35.5%); control 67 (47.5%) 7 to 10 or more: Intervention 227 (64.5%); control 74 (52.5%) **Source population** Communities in New Hampshire and Vermont, USA **Eligible population** Ten geographically distinct communities (20 miles apart) that had not previously participated in the SunSafe project, and had a middle school with grades six to eight within the same building, at least one community primary care practice and a freshwater beach or town swimming pool used primarily by locals. **Selected population** Town populations ranged from 6,300 to 34,000	replenished. SunSafe bookmarks were distributed throughout libraries in the summer of each intervention year, and sun protection posters were displayed in local stores in years two and three. Student materials emphasised protection against the sun while having fun outdoors. Students (1) received a 45-minute activity (including a slide show on UVR and skin cancer and sun protection strategies, and viewing skin damage under UV-filtered light), (2) peer education activities (including poster contests), (3) incorporation of sun safety into school health fairs and inclusion of sun protection on school outdoor trip permission forms. **Comparator** Appeared to be no intervention (no details provided) **Intervention period** 2001 to 2004 **Sample size** n=1,927 **Baseline comparisons** There were differences between groups in temperature at baseline and one year follow-up and differences in UV rating at all three assessment periods.	was worn. **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Two years **Method of analysis** Change in the mean percent of BSA protected (primary outcome) at each follow-up period was calculated using a multiple linear regression model (random effects). For the main analysis the model was adjusted for gender, skin reaction to sun, UV level, year of observation and temperature. The adjusted mean protection level for adolescents in both groups was	None Baseline: Intervention 144 (42.0%); control 148 (34.2%) 1-year follow-up: Intervention 201 (53.0%); control 91 (40.4%) 2-year follow-up: Intervention 185 (53.0%); control 119 (86.2%) One Baseline: Intervention 18 (5.2%); control 41 (9.5%) 1-year follow-up: Intervention 20 (5.3%); control 12 (5.3%) 2-year follow-up: Intervention 31 (8.9%); control 1 (0.7%) Two Baseline: Intervention 28 (8.2%); control 36 (8.3%) 1-year follow-up: Intervention 33 (8.7%); control 11 (4.9%) 2-year follow-up: Intervention 20 (5.7%); control 3 (2.2%) Three Baseline: Intervention 23 (6.7%); control 46 (10.6%) 1-year follow-up: Intervention 31 (8.2%); control 43 (19.1%) 2-year follow-up: Intervention 13 (3.7%); control 2 (1.4%) Four Baseline: Intervention 130 (37.9%); control 162 (37.4%) 1-year follow-up: Intervention 94 (24.8%); control 68 (30.2%) 2-year follow-up: Intervention 100 (28.7%); control 13 (9.4%)	outcomes. Adolescents were not provided with free sunscreen. **Evidence gaps and/or recommendations for future research** The authors suggest that (1) the role of parents in future studies is expanded as they are important role models for their adolescent children, (2) future research should address both intentional and incidental sun tanning in adolescents, with interventions and messages tailored for boys and girls, and high schools, (3) interventions should be developed to be responsive to adolescent activities, motivations, and developmental stage. **Source of funding** Not stated

	All athletic and recreation programmes in the intervention communities agreed to participate; 10 of 13 schools agreed to participate, and 11 of 14 primary care practices agreed to participate **Age** School grade at baseline 6: Intervention 347 (97.2%); control 432 (98.2%) 7: Intervention 6 (1.7%); control 3 (0.7%) 8: Intervention 4 (1.1%); control 5 (1.1%) **Female** Intervention: 201 (56.3%) female Control: 252 (57.7%) female Race/ethnicity 94% white **Socioeconomic status** Not reported **Skin type** Skin reaction after first exposure without sunscreen: Always burn, never tan: Intervention 26 (7.4%); control 40 (9.2%) Usually burn, sometimes tan: Intervention 72 (20.6%); control 83 (19.0%) Occasionally burn, often tan: Intervention 106 (30.3%); control 138 (31.7%)	**Study sufficiently powered** Not reported	computed according to follow-up time point.	There was no statistically significant difference in the adjusted mean % BSA covered at baseline: Intervention (n=343) 71.8 (SE 1.6); control (n=433) 73.7 (SE 1.4), p=ns. At second follow-up, the difference was statistically significant: Intervention (n=349) 66.1 (1.5); control (n=138) 56.8 (2.3), p<0.01. The % change from baseline to year 2 was -23% in the control group and -8% in the intervention group. The intervention compared to control was more effective in improving sun protection in girls compared to boys (coefficient 5.88, 95% CI: 0.84 to 10.92, p=0.022) and when the UV index was high (coefficient 7.04, 95% CI: 1.72 to 12.35, p=0.010). **Attrition details** A cross-sectional sample was used for observations each year. Baseline: n=794 1-year follow-up: n=637 2-year follow-up: n=492	

	Rarely burn, always tan: Intervention 146 (41.7%); control 175 (40.1%)				

Table D: Provision of multi-component interventions in education settings evidence tables

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
Author Barankin et al.[35] **Year** 2001 **Study aim** To assess the impact of including parental involvement at home in the sun protection programme received by children in school. **Study design** Non-randomised controlled trial (cluster) **Internal validity** -	**Country** Canada **Setting** School **Source population** Public schools in the Thames Valley District School Board in London, Ontario, Canada. **Eligible population** Grade 4 classes at public schools in the Thames Valley District School Board, London, Ontario, Canada, whose teachers responded. **Selected population** Twenty three classes in 16 schools	**Method of allocation** The first 16 classes were randomised (details not provided) to the enhanced or standard groups and the remaining 8 classes allocated to the control group. **Intervention** Enhanced group: (1) children and teachers received a 'Sun and the Skin' presentation discussing UV light, the harmful effects of the sun, and skin cancer risks and prevention (a one hour presentation by medical students), (2) an activity book was provided, (3) sunscreen was provided prior to the summer holiday, (4) a letter informing parents of presentations, relevance of sun protection	**Sun protection practices** Use of sunscreen Use of protective clothing or hat Use of sunglasses Parents and teachers were asked to estimate the % of their students engaged in these behaviours. **Sun exposure** Absence of sunburns and multiple sunburns based on survey of parents and children. **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Teachers were asked to	**Sun-protection behaviours** Sunscreen use Teachers (n=7): reported that in May and June less than 25% of students in the enhanced group used sunscreen at least once a day; no significant differences between groups. Parents (n=137): 90%-95% reported that their children 'sometimes' to 'usually' applied sunscreen 15-30 minutes before going out in the sun, reapplied sunscreen after swimming or sweating, and avoided activities during the midday sun. 75% in the enhanced group used SPF 30+ in September compared to 75-78.6% (across all groups) in May. This data is from the enhanced group parents - the authors state there	**Limitations identified by author** There may be some bias in the June and September surveys due to a lower response rate compared to May. **Limitations identified by review team** Limitations identified were: (1) the groups were not randomised, (2) outcomes were measured using self-report methods and data were not presented for all time periods and groups, (3) dropout was higher in the enhanced and standard groups compared with the control group, (4) details on participants and study methods were limited, (5) provision of sunscreen seemed to be a minor component with no information

External validity -	**Age** Grade 4 (age 9-10 years approximately) **Female** Not reported **Race/ethnicity** Not reported **Socioeconomic status** Not reported **Skin type** Not reported	behaviours, and encouraging them to ensure that children had appropriate sun protection plus sun protection factsheets were sent to parents. **Comparator** Standard group: (1) children and teachers received a 'Sun and the Skin' presentation discussing UV light, the harmful effects of the sun, and skin cancer risks and prevention (a one hour presentation by medical students), (2) an activity book was provided. Control group: received an activity book. **Intervention period** May/June 1999 **Sample size** Enhanced 8 classes (7 teachers, 137 parents, 170 children) Standard 8 classes (7 teachers, 163 parents, 191 children) Control 7 classes (5 teachers, 130 parents, 148 children) **Baseline comparisons** Not reported **Study sufficiently powered** Not reported	characterise the attitudes of their students and students were asked their views about having a tan. **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Four months (baseline May, follow-up June and September) **Method of analysis** Results were reported as percentages of students practicing sun protection behaviours at each survey period.	were similar trends with the other groups. Children (n=509): in May, June and September, a large proportion of all children reported using sunscreen with SPF 30 or greater, and more than 90% used sunscreen with SPF 15 or greater. There were no significant differences between groups or time periods. Protective clothing Teachers: during May and June 0%-24% of students wore long trousers and long-sleeved shirts in the warm weather. With the exception of one teacher, the remainder reported that <50% usually wore a hat outdoors, <25% of students were reported to wear sunglasses outdoors. The authors state there were no significant differences between groups. Parents: most reported that children either 'never' or 'sometimes' wore long trousers and long-sleeved shirts in May and September. There were no significant differences between groups. **Sun exposure** Teachers (n=7): two teachers reported that 25%-50% of students had a sunburn during the year, with the remaining teachers reporting 0%-25% of students	provided on uptake or use, and (6) the enhanced intervention differed from the standard intervention in two components so it was not possible to assess the effect of sunscreen. **Evidence gaps and/or recommendations for future research** Well-conducted, higher quality studies, preferably RCTs, would be beneficial. **Source of funding** The Canadian Dermatology Association (Sun Facts information sheets and stickers); the Canadian Cancer Society (Rayguard activity books and t-shirts); and Cosmair, La Roche-Posay and Westwood-Squibb (sunscreen).

				with a sunburn during the year. It is not stated whether there were between group differences. Parents: reported an increase in the absence of sunburns; 40.2% in May to 50.9% in September in the enhanced group (n=137). The standard group increased from 43.6% to 54.2% (n=163), and the control group showed little change (43.1% versus 42.7%) (n=130).The authors state that there was no statistically significant difference. Children (n=170): increased absence of sunburns; 37.1% (May) versus 43.6% (September) in the enhanced group. Standard group (n=191):39.9% (May) versus 47.2% (September) Control group (n=148): 36.5% (May) versus 36.8% (September) **Knowledge, attitudes, beliefs** Teachers: 50% (2 of 4) reported that students in the enhanced group were very aware of the consequences of too much sun. Standard: 100% (4/4) Control: 75% (3/4) Across groups none of the teachers reported that their students thought a tan was 'cool'. There was a significant reduction in the number of students wanting a tan in the enhanced group; 32.9% (May) versus 3.7%	

				(September) (p<0.05). Standard: a small reduction from May (31.4%) to September (15.5%) Control: no improvement from May (23.3%) to September (21.1%) **Attrition details** Enhanced group Teacher: 7 (May); 4 (June) Parent: 137 (May); 23 (June); 57 (September) Child: 170 (May); 108 (June); 55 (September) Standard group Teacher: 7 (May); 4 (June) Parent: 163 (May); 48 (June); 72 (September) Child: 191 (May); 107 (June); 107 (September) Control group Teacher: 5 (May); 4 (June) Parent: 130 (May); 81 (June); 103 (September) Child: 148 (May); 151 (June); 97 (September)	
Author Bauer et al.[5] **Year** 2005 **Study aim** To determine whether receiving education or education and free	**Country** Germany **Setting** Nursery schools **Source population** 242 public nursery schools in Stuttgart and 169 in Bochum, Germany in different suburbs of both cities.	**Method of allocation** Day care centres were randomly allocated to groups (all children within centres were invited to participate) **Intervention** Education and sunscreen: 1) Initial educational session, 2) educational material (both same as educational group) and 3)	**Sun protection practices** Use of sunscreen % using sunscreen since 1998 % "almost always" using sunscreen since 1998 Use of protective clothing or hat Changes in use of sun protective clothing at beach or swimming pool between 1998 and 2001: % change in use of T-shirts;	**Sun-protection behaviours** There was a statistically significant difference in the % using sunscreen since 1998 (p=0.033) Education and sunscreen: 99.4% Education: 99.7% Control: 98% (There was no statistically significant difference between the two intervention groups or between the education and	**Limitations identified by author** The high prevalence of sunscreen use at baseline and the single educational session received by the control group may have reduced the possibility of identifying a positive benefit of the interventions. Conflicting results have previously been reported on the impact of sunscreens on MN counts in

sunscreen would significantly reduce the incidence of melanocytic nevi in children over a 3 year period compared to controls **Study design** Cluster RCT **Internal validity** + **External validity** +	**Eligible population** 2,440 children aged between 2 and 7 years with Type I-IV Fitzpatrick skin type from 81 randomly selected public nursery schools: 3 schools (n=81) declined to participate; 49 participated in Stuttgart, and 29 in Bochum, Germany) **Selected population** 1887 children whose parents had given consent (no parental consent n=436) **Age** 2-7 years old **Female** 48.6% (of children with a complete follow-up) **Race/ethnicity** 100% Caucasian **Socioeconomic status** Not reported. 21.4% of mothers and 39.5% of fathers had a university degree (of those with complete follow-up). **Skin type** 11.6% with complete follow-up had Fitzpatrick Skin Type 1 **Other** 74.4% had a history of holidays in sunny climates (median 4 weeks; IQR 0 to 8); median	provision of 800ml SPF 25 sunscreen yearly. Parents were asked to buy more sunscreen if they had used up their free sunscreen. They were instructed to apply sunscreen from Spring to Autumn on sun exposed body parts several times a day **Comparator** Education: 1) received an initial educational session (3 hours including comprehensive information on the risks of sun exposure and sunburn, sun protective measures and proper application and reapplication of sunscreen), then 2) an educational letter 3 times a year (Easter, Pentecost and summer holidays) with detailed information on proper sunscreen use and sun protection, and information brochures from public melanoma prevention campaigns with detailed information. Control group: (1) an initial educational session **Intervention period** 1998 to 2001 **Sample size** Education and sunscreen: 25 centres (626 children); Education: 26 centres (624 children) Control: 27 centres; 637 children	shorts; trunks, t-shirts and shorts; use of hat All based on a parental questionnaire **Sun exposure** Median (IQR) melanocytic nevi (MN) developed between 1998 and 2001 (primary outcome) (Two dermatologists conducted a physical examination, in a well lit room, of children who were wearing only underpants at baseline (1998) and follow-up (2001). MN were defined and counted using a standard protocol and the dermatologists were blinded to intervention group at follow-up. Median weeks (IQR) on holiday in sunny climates: (Median (IQR) score of country of holiday (0 no holiday; 1 Northern Europe or USA; 2 Northern Mediterranean; 3 Northern Africa; 4 Tropics; the scores were added for each of the 4 years 1998 to 2001, possible score range 0 to 16). Median difference (IQR) in hours/day in sun during holidays in sunny climates 1998 to 2001 Median difference in home activity score (playing ball, sunbathing, swimming outdoors, playing outdoors, walking, bike-	sunscreen group and control) There was no statistically significant difference in the % 'almost always' using sunscreen since 1998 (p=0.079) Education and sunscreen: 88.4% Education: 84.8% Control: 83.1% There was no statistically significant difference in % change to use of protective clothing between 1998 and 2001: T-shirts (p=0.53) Education and sunscreen: 13.4%; Education: 10.1%; Control: 13.1% Shorts (p=0.99) Education and sunscreen: 12.3%; Education: 13.0%; Control: 11.8% Trunks, t-shirts and shorts (p=0.98) Education and sunscreen: 11.9%; Education: 12.0%; Control: 10.8% Hat (p=0.63) Education and sunscreen: 8.7% Education: 7.3%; Control 7.0% There was a statistically significant difference between groups in the median weeks on holiday in sunny climates (p=0.021) Education and sunscreen: Median	children. All of the outcomes except MN count were based on parental reports and may have been influenced by social desirability. In addition the method used to measure holiday sun exposure had limitations. Children most at risk completed the study which may reflect their parent's higher awareness of the risks of sun exposure leading to the groups being homogenous in relation to their sun protection practices. Inadequate application of sunscreen over the long intervention period. **Limitations identified by review team** 1) Fairly high proportion lost to follow-up and not included in the analysis, 2) No data are provided on parents use of the sunscreen provided or whether they bought additional sunscreen. **Evidence gaps and/or recommendations for future research** More objective data on sunscreen use required in future studies such as weighing used sunscreen bottles **Source of funding** Not reported

	number of previous sunburns 0 (IQR 0 to 2); 97.5% of parents stated that they had previously used sunscreen on their children; median number of melanocytic nevi 8 (IQR 5, 14)	**Baseline comparisons** There were no statistically significant differences between groups at baseline **Study sufficiently powered** Power calculation not reported	riding, and being outdoors in general were each scored '0' for less than once per week and '1' for at least once per week and scores were added to obtain overall activity score, possible score range 0 to 7) Mean (SD) difference of hrs/day outside at home % with sunburn experience between 1998 and 2001; median (IQR) number of newly experienced sunburns All of above based on parental questionnaire **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period**	4 weeks (IQR 2, 7.5) Education: 6 (2, 8) Control: 5 (2, 8) (There was a statistically significant difference between both intervention groups and control) There was a statistically significant difference between groups in the median score of country of holiday (p=0.009). Education and sunscreen: Median 4 (IQR 3, 6) Education: 4 (3, 6) Control: 4 (3, 6) (There was a statistically significant difference between the education sunscreen group and the education group as well as the control group; the education and sunscreen group was more likely to holiday in countries away from the equator) There was no statistically significant difference in the change in the hours per day in the sun while on holiday between 1998 and 2001 (p=0.061) Education and sunscreen: Median 0 hrs (IQR -1, 1) Education: 0 (-1, 1) Control: 0 (-1, 1) There was no statistically significant difference in the home activity score between 1998 and 2001 (p=0.836). Education and sunscreen: Median	

			3 years (at end of 3 year intervention period) **Method of analysis** The groups were compared using X^2, analysis of variance or Kruskal-Wallis test as appropriate. For two-arm comparisons Wilcoxon test, X^2 test or Fisher's exact test were used. A multivariate linear regression model was used to explore the influence of possible confounding variables on the primary outcome for the whole cohort (age, gender, Fitzpatrick skin type, hair colour, freckling on face, parental education, parent ethnicity, number of moles on mothers' arms, fathers' arms, score of country of holiday 1998 to 2001, activity score at home, history of sunburn, extent and severity of sunburn).	0 hrs (IQR -1, 1) Education: 0 (-1, 1) Control: 0 (-1, 1) There was no statistically significant difference in the number of hours/day outside (p=0.353). Education and sunscreen: Mean 0.15 hrs (SD 1.12) Education: 0.14 (1.13) Control: 0.24 (1.09) **Sun exposure** There was no statistically significant difference between the three comparison groups in the number of new MN (p=0.779). Total sample: median 26 new MN (IQR 17, 40) Education and sunscreen (n=465): Median 27 (18, 40) Education (n=369): Median 26 (16, 41) Control (n=398): Median 27 (17, 40) There was no statistically significant difference between groups in the proportion of children with sunburn experience 1998-2001 (p=0.844) (n as for primary outcome) Education and sunscreen: 22% Education: 21.5% Control: 23.2% There was no statistically significant difference between groups in the median number of	

				newly experienced sunburns 1998-2001 (p=0.604) Education and sunscreen: Median 0 (IQR 0, 1) Education: Median 0 (0, 1) Control: Median 0 (0, 1) **Attrition details** In total 32% of eligible participants were lost to follow-up (n=580 of 1812) Education and sunscreen: n=626 randomised; n=24 excluded; n=137 lost to follow-up Education: n=624 randomised; n=31 excluded; n=224 lost to follow-up Control: n=637 randomised; n=20 excluded; n=219 lost to follow-up There was a statistically significant difference between groups in loss to follow-up (p=0.0001) Education and sunscreen 22.8% ; education 37.7%; control 35.5% The authors state that children lost to follow-up tended to be at low risk for developing MN compared to children who completed the study: children lost to follow-up were (at baseline) less likely to have fair skin, had fewer MN, their parents were less educated, less likely to be both German descent and had fewer MN on their arms; spent fewer holidays in sunny climates, had previously experienced less sunburns, previously used	

				sunscreen less often, and were less likely to wear at least two pieces of protective clothing at the beach or swimming pool.	
Author Buller et al.[32] **Year** 1997 **Study aim** To evaluate the effectiveness of a school-based skin cancer prevention programme (Sun Smart Day) to improve fourth graders' and their parents' knowledge, attitudes, and behaviour related to skin cancer prevention. **Study design** Cluster RCT **Internal validity** - **External validity** -	**Country** United States **Setting** Public elementary schools **Source population** Elementary schools in Tucson, Arizona, US **Eligible population** Fourth-grade classes, their teachers, and parents at three public elementary schools in Tucson, Arizona. **Selected population** 16 fourth-grade classes in three public elementary schools (parental consent received from 318 fourth-grade students, 60% of all fourth graders). The authors reported that three quarters of children enrolled in school in Southern Arizona are white or Caucasian and have the skin phototype at highest risk for skin cancer. **Age** Fourth-graders **Female** Follow-up 1: 56% Follow-up 2: 58%	**Method of allocation** Randomly assigned at the school level **Intervention** Teachers attended a 2-hour training and orientation session before implementing the one lesson classroom based intervention (lasting approximately one hour): (1) teacher-driven programme material and in-class activities from the 'Sunny Days, Healthy Ways' programme, which includes material on (a) the sun's energy: it can help us and hurt us, (b) latitude, elevation, and sun intensity, (c) geographic origins and skin types, (d) what is skin cancer?, and (e) physical and chemical sunblocks; (2) At the end of the lesson, students received certificates of accomplishment and bags with information for parents, sunscreen samples, and other solar protection literature. **Comparator** Sun safety fair: health educator-implemented activities based on lessons from the 'Sunny Days, Healthy Ways' prevention curriculum. Students received a certificate of accomplishment.	**Sun protection practices** Use of sunscreen Children reported on the SPF of last sunscreen used (1=0, 2=1 to 14, 3=15 or more), and the extent of sunscreen application (1=none, 2=some of the body, 3=all of the body) Use of protective clothing or hat Children reported on hat use (range=2 to 6) Other (specify) Children reported on parental preventive behaviours using an 8-item scale, and performance of skin exams on their children (0=never, 1=once every few years, 2=once each year, 3=once each month). Children also reported on their use of lip balm (range=2 to 6). **Sun exposure** Outcome not assessed **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** The Sunshine and Your Skin	**Sun-protection behaviours** There were no statistically significant differences immediately after the intervention: SPF of last sunscreen used: Curriculum 2.95; health fair 2.92; control 2.89 Extent of sunscreen application: Curriculum 2.67; health fair 2.67; control 2.63 At 3-month follow-up the effects remained non-significant. SPF of last sunscreen used: Curriculum 2.95; health fair 3.07; control 2.86 Extent of sunscreen application: Curriculum 2.68; health fair 2.56; control 2.64 There was no statistically significant difference between groups in lip balm use immediately after the intervention: Curriculum 3.96; health fair 3.98; control 3.82, and there were no differences in children's hat use (range = 2 to 6): Curriculum 4.13; health fair 4.19; control 4.04. At 3-month follow-up there was no statistically significant difference between the groups in lip balm use: Curriculum 4.09; health fair 3.98; control 3.76; or	**Limitations identified by author** None identified **Limitations identified by review team** (1) This was a predominantly education/provision of information intervention and only sunscreen samples were provided, (2) it was unclear how the three elementary schools were chosen or how they were randomised, (3) exposure to the classroom curriculum lasted only an hour, and it was unclear how much exposure children had to the sunscreen samples, (4) the main outcomes were based on self-report knowledge and attitudes rather than actual behaviours, (5) limited statistical analysis due to the small number of schools and classes in each condition, (6) short term follow-up, (7) high attrition rates. **Evidence gaps and/or recommendations for future research** The authors state that Sun Smart Day interventions could be targeted at several grade levels and need to be supplemented with additional skin cancer prevention activities, such as comprehensive school-based

	Race/ethnicity Based on follow-up 1 cohort (group at second follow-up was similar) White: 75% Asian or Oriental: 4% Black: 2% Hispanic: 4% Native American: 2% Indian (eg. from India or Pakistan): 3% Other: 10% **Socioeconomic status** Not reported **Skin type** Colour of skin Based on follow-up 1 cohort (group at second follow-up was similar) Very fair, with many freckles: 11% Fair, with no freckles or few freckles: 54% Light brown: 29% Dark brown: 5% Black: <1% Reaction of skin to sun exposure Based on follow-up 1 cohort (group at second follow-up was similar) Never burns, but always tans: 36% Burns, and then tans: 47% Always burns, and never tans: 17%	(This intervention arm was included in the phase I report) Controls: no intervention **Intervention period** June 1993 (one day) **Sample size** Curriculum intervention: n=109 Health fair: n=105 Control: n=104 **Baseline comparisons** Not reported **Study sufficiently powered** Not reported	Questionnaire included a 10-item term recognition scale; a 35-item true/false knowledge scale addressing environmental factors (eg. UVR, latitude, sun intensity, tanning booths), skin (type, layers, moles), and skin cancer (screening, treatment, and prevention strategies); and 11 items that measured attitudes toward tanning, barriers to sunscreen use, and stylishness of tans. **Intention to engage in sun protection practices** Behavioural intentions The Sunshine and Your Skin Questionnaire included 13 questions measuring participants' intentions to reduce sun exposure through sunscreen use, lip balm use, and hat use. **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Immediate post intervention and three month follow-up at the end of the summer break **Method of analysis** Immediate and 3-month follow-up responses were analysed	hat use: Curriculum 4.02; health fair 4.06; control 4.09. Children receiving the curriculum and health fair interventions reported that their parents did more to protect them from the sun than controls at immediate follow-up (p<0.05): Parental protection behaviour (range=8 to 24): Curriculum 16.26; health fair 16.36; control 15.51 Parents perform skin exam on child: Curriculum 1.21; health fair 1.31; control 0.92 3-month follow-up (not statistically significant): Curriculum 16.12; health fair 16.72; control 16.16 Parents perform skin exam on child: Curriculum 1.26; health fair 1.46; control 1.11 **Knowledge, attitudes, beliefs** Recognition of terms (range=0 to 10) immediately post intervention: Curriculum 9.78; health fair 9.02; control 8.09 (p<0.05) Skin cancer knowledge (range=0 to 35) immediately post intervention: Curriculum 28.29; health fair 26.04; control 21.63 (p<0.05) Recognition of terms at three month follow-up: Curriculum 9.61; health fair 9.32; control 8.54 (p<0.05)	programmes that teach skin cancer prevention skills and supportive structural and policy changes at schools (e.g. shaded play areas, scheduling outdoor activities early in the day). In addition, they should include activities and take-home materials that could increase parent participation. **Source of funding** Skin Phototrauma Foundation and the National Cancer Institute (CA23074)

			separately, with the individual student as the unit of analysis. A one-way analysis of covariance comparing the intervention and control group, with the baseline test serving as a covariate to adjust for baseline differences was used for immediate follow-up. A a 3 (curriculum, health fair, and control groups) x 2 (immediate posttest, delayed posttest) mixed model repeated measures analysis of covariance, with baseline response as a covariate was used for second follow-up.	Skin cancer knowledge at three month follow-up: Curriculum 27.88; health fair 26.96; control 23.79 ($p<0.05$) Attitude toward tanning (range=4 to 8) immediately post intervention: Curriculum 5.22; health fair 5.01; control 5.36 ($p<0.05$) There were no other significant differences immediately post intervention: Barriers to sunscreen use (range=3 to 6): Curriculum 3.26; health fair 3.21; control 3.28 Tan is in style (range=2 to 4): Curriculum 3.53; health fair 3.47; control 3.53 At 3-month follow-up, there were no statistically significant differences Attitude toward tanning: Curriculum 5.28; health fair 5.11; control 5.44 Barriers to sunscreen use: Curriculum 3.22; health fair 3.10; control 3.12 Tan is in style: Curriculum 3.53; health fair 3.63; control 3.55 **Intention to engage in sun protection behaviours** There was no statistically	

				significant difference between groups immediately post intervention. "If I'm going to be outside for more than half an hour in the summer, I wear clothing to protect my skin from the sun": Curriculum 1.71; health fair 1.59; control 1.56 "If I'm going to be outside for more than half an hour in the winter, I wear clothing to protect my skin from the sun": Curriculum 2.06; health fair 2.21; control 2.07 "On sunny days, I wear sunglasses": Curriculum 2.03; health fair 2.01; control 2.04 "When I go out in the sun in the winter I put sunscreen on": Curriculum 1.76; health fair 1.73; control 1.72 "I try to play outside early in the morning or late in the afternoon": Curriculum 2.07; health fair 2.10; control 1.90 "I try not to get sunburned": Curriculum 2.81; intervention 2.78; control 2.72 "In the summer, I lay out in the sun to get a tan": Curriculum 1.47; health fair 1.45; control 1.43 At 3-month follow-up there was a	

				statistically significant difference for two items. Tried to play outside early in the morning or late in the afternoon: Curriculum 2.12; health fair 2.28; control 1.88 ($p<0.05$). "In the summer, I lay out in the sun to get a tan": Curriculum 1.39; health fair 1.58; control 1.33 ($p<0.05$). "If I'm going to be outside for more than half an hour in the summer, I wear clothing to protect my skin from the sun": Curriculum 1.60; health fair 1.66; control 1.47 "If I'm going to be outside for more than half an hour in the winter, I wear clothing to protect my skin from the sun": Curriculum 2.10; health fair 2.23; control 1.98 "On sunny days, I wear sunglasses": Curriculum 1.83; health fair 1.99; control 1.85 "When I go out in the sun in the winter I put sunscreen on": Curriculum 1.83; health fair 1.73; control 1.67 "I try not to get sunburned": Curriculum 2.82; health fair 2.93; control 2.78 **Attrition details** It is unclear how many children	

				dropped out from the individual groups. Parental consent was received from 109 children in the curriculum school, 105 in the health fair school, and 104 children in the control school. Attrition rates were reported at each stage of the study for the three schools combined: Baseline n=86/318 (27%); Immediate n=120/318 (32.1%); 3-month follow-up n=159/318 (50%)	
Author Crane et al.[33] **Year** 1999 **Study aim** To evaluate a skin cancer prevention programme directed at caregivers (primary goal) and parents (secondary goal) associated with childcare centres **Study design** RCT **Internal validity** - **External validity** +	**Country** United States **Setting** Pre-schools and daycare centres. **Source population** State Licensed preschools and daycare centres in Colorado US that had responded to a mail survey in 1992. **Eligible population** Centres responding to an earlier survey (159 centres) that were identified as not practicing ideal sun protection in their daily care of children (44%; 70 centres) and cared for more than 20 children. Parents of children who attended the included centres were also invited to take part in a telephone survey after the intervention had been implemented.	**Method of allocation** Centres were randomly assigned having first been stratified by number of students and paired according to the estimated proportion of minority students. **Intervention** The intervention was based on the Health Belief Model and the primary focus was to improve sun protection of children while at childcare centres. The two main components were: (1) Staff members attended a 3 hour workshop (included presentation by dermatologist, and Licensing Administrator of Colorado Department of Social Services; a working session to develop skin cancer prevention plans for participating centres; and participation in children's activities promoting sun protection) (2) parents received a reusable tote bag containing	**Sun protection practices** Use of sunscreen Use of shade Use of protective clothing or hat A telephone survey of parents was conducted at follow-up. This included questions about sun protection practices used by the family as well as at the centre. Parents were asked "what did you do to try to protect your child from the sun over the last summer?" The number of protective practices mentioned without prompting was counted for each respondent. They were also asked how often they used five protective practices for their child (stay in shade, wear hat, wear clothing to cover most of their body, use sunscreen and stay inside) on a 5-point scale from "rarely or never" to "almost always". Directors of the centres were interviewed and completed a	Only the parents received a multi-component intervention of relevance to the review and only results related to this group are reported here. Directors/centre staff received only an information component. **Sun-protection behaviours** There was no difference between the two groups of parents in the use of sun protection practices for their children (data not reported) **Sun exposure** There was no statistically significant difference in parental reports of children being sunburned the previous summer (intervention 55%, Control 64%, p=0.40) **Knowledge, attitudes, beliefs** There was no difference between the two groups of parents in sun protection knowledge/attitudes: mean scores of 33-34 points out	**Limitations identified by author** None related to the parental component **Limitations identified by review team** 1. Parents were provided with a sunscreen sample only; they were not provided with free sunscreen. In addition none of the outcomes related to parents response to the provision of a sunscreen sample. 2. Only a summary of findings from the parental survey were reported (raw data were not reported for all outcomes). 3. It is unclear what proportion of eligible parents were approached to take part in the survey or how respondents differed from non-respondents **Evidence gaps and/or recommendations for future research** None specified

	Selected population Twenty-seven centres were recruited. 226 parents agreed to participate in the survey and interviews were completed with 201. **Age** Preschool children 65% of parents were between 30 and 39 years old **Female** 93% of parents were female **Race/ethnicity** 69% of centres reported that at least 80% of their children were non-Hispanic white 87% of parents were white **Socioeconomic status** Parents who took part in the survey - 71% had income > $40,000 per year; 30% had attended graduate school; and 34% had a college degree **Skin type** Not stated **Other** At baseline 79% of centres reported that children spent one to three hours outside each day; staff at 93% of centres 'at least sometimes' applied sunscreen to children; 59% reported sunscreen was applied	brochures on sun protection produced by The Skin Cancer Foundation, learning activities to complete with child, a "Block the Sun, Not the Fun" kitchen magnet, and sunscreen samples. Behaviours promoted included: (1) application of SPF 15+ sunscreen once in the morning and afternoon (2) schedule outdoor activities before 10am and after 3pm where possible (3) increase shade in play areas and encourage play in shade areas (4) encourage use of sun protection clothing (long sleeves, long pants and hats). **Comparator** "Wait-list" control (received intervention one year later than the intervention group). **Intervention period** Spring 1994 **Sample size** Intervention: 13 centres (104 parents) Control: 14 centres (97 parents) **Baseline comparisons** Based on the directors' survey there seemed to be differences in the proportion of centres engaging in some sun protection practices but they did not appear to be in a single direction. Parents were not assessed at baseline	survey at baseline and follow-up reporting on sun protection practices at their centres. Observations were also made of sun protection practices at the centres (observation at 5 minute intervals for 30 minutes of 6 randomly chosen children in the outdoor play area using a three-point scale to assess head, arm, leg and foot protection and whether they were playing in sun or shade). **Sun exposure** Sunburn (Parental report) **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Parents responded to a 12 item knowledge/attitude questionnaire (three response options scoring 3 (agree); 2 (don't know); 1 (disagree) with a maximum possible score of 36). Directors completed a self administered 12 item questionnaire assessing knowledge and attitudes each answered using a 5-point scale (strongly agree to strongly disagree.	of a maximum 36 **Attrition details** Interviews were conducted with 201 of 226 parents who gave consent	**Source of funding** National Cancer Institute (R03-CA59202). Schering-Plough Health Care Products provided over 2000 sunscreen samples

	at least twice per day; 43% that over 90% of their children wore sunscreen on sunny days. Staff turnover ranged from 5% to 100% during the study; 22 of 27 directors did not change	**Study sufficiently powered** Not stated	**Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Barriers to sun protection were discussed at the directors work shop. These are not reported as they do not relate to the multi-component intervention **Other outcomes** Proportion of centres a with written sunscreen policy, request doctor's permission for sunscreen use, a policy that only parents can administer sunscreen, and policy to encourage parents to provide protective clothing. Based on responses to directors' survey. **Follow-up period** Approximately 3 to 4 months after the intervention **Method of analysis** For centre level data, groups were compared using Fisher's exact test (categorical variables) or t-test (continuous variables). For parent level data mixed model analysis of variance was used (school as random effect, study group as fixed effect) for continuous variables; for dichotomous variables rates were computed for each centre		

			and t-tests were used		
Author Gritz et al.[34] **Year** 2007 **Related papers** Gritz 2005[38] **Study aim** To evaluate the effects of Sun Protection is Fun! (SPF) on preschool staff and parents' behavioural (sunscreen use and sun-avoidance) and psychosocial outcomes related to protecting preschool aged children from sun exposure. **Study design** Cluster RCT **Internal validity** - **External validity** -	**Country** United States **Setting** Pre-schools **Source population** 25 preschools. **Eligible population** Preschools located in the greater Houston area, which maintained summer programmes and were open full time. **Selected population** Staff and parents of 20 preschools of 22 that were eligible. **Age** (at baseline) Staff: mean age (SD): 31.3 (11.2) Parents: mean age (SD): 32.0 (6.2) **Female** (at baseline) Staff: 97% Parents: 91.2% **Race/ethnicity** (at baseline) Staff African American 41% Asian 1.7% Hispanic 20.1%	**Method of allocation** Preschools with similar ethnic distributions of enrolled children were grouped in pairs and randomly assigned (method of randomisation not specified) to intervention and comparison group. **Intervention** The intervention was based on social cognitive theory and incorporated observational learning methods, such as skills training and behavioural modelling (Bandura 1986). 1. Staff intervention (a) Staff training Two hour training session (end of summer 1996) on how to protect children from sun exposure and teach the SPF curriculum and a 2.5 hour training session in Spring 1997, which covered sun protection for children, the SPF curriculum and suggested strategies for supporting sun protection at preschools, such as policy development and adding shade structure. (b) Video In Spring 1998 research staff conducted a 1 hour training session consisting of a video, worksheet and answer pages. Topics included sun protection for children, the SPF curriculum, and environmental strategies such as	**Sun protection practices** Use of sunscreen 1. Staff A cross sectional sample of preschool staff completed anonymised surveys regarding sunscreen use at baseline, 12 months and 24 months. (a) Sunscreen use scale (aggregate score of 5-25 based on responses to sunscreen use items b, c, d, e and f below, which were all on a scale of 1-5, 1=never and 5=always) (b) Apply sunscreen 30 minutes before going outside (c) Reapply sunscreen every 1.5-2 hours (d) Take sunscreen on field trips (e) Use SPF 15+ sunscreen (f) Put sunscreen on when get outside 2. Parents (a) Parent sunscreen use on children (aggregate score of 6-30 based on responses to items b, c, d, e, f and g, which were all on a scale of 1-5, 1=never and 5=always) (b) Apply sunscreen 30 minutes before going outside (c) Reapply sunscreen every 1.5-2 hours (d) Use SPF 15+ sunscreen (e) Put sunscreen on when outside (f) Apply sunscreen in morning	**Sun-protection behaviours** Use of sunscreen 1. Staff There was a statistically significant difference between groups at 12 and 24 months in favour if the intervention group (a) Sunscreen use scale n= 154, effect size 5.73, standard error (SE) 1.18, p<0.001; n=174, effect size 7.41, SE 1.15, p<0.001 (12 and 24 months respectively). (b) Apply sunscreen 30 minutes before going outside n=187, effect size 1.06, SE 0.30, p0.001; n=216, effect size 1.58. SE 0.29, p<0.001. (c) Reapply sunscreen every 1.5-2 hours n=179, effect size 1.16, SE 0.20, p<0.001; n=205, effect size 1.58, SE 0.29, p<0.001. (d) Take sunscreen on field trips n=162, effect size 1.02, SE 0.33, p<0.002; n=186, effect size 1.25, SE 0.33, p<0.001. (e) Use sun protection factor 15+ sunscreen n= 184, effect size 1.13, SE 0.26, p<0.001; n= 208, effect size 1.33, SE 0.31, p<0.001. (f) Put sunscreen on before going outside n= 185, effect size 1.03. SE 0.28 p<	**Limitations identified by author** Preschool staff intervention: (1) Possible contamination by discussing the intervention with/in the presence of staff from control preschools. (2) Self reported outcome measures, which can be subject to social desirability and recall bias, were used. (3) There was no statistical correction for multiple testing. (4) High preschool staff turnover and low response rate to all three surveys (67 staff responded to all 3 surveys) (5) The phenotype of students and sun protection behaviours based on student phenotype were not recorded. Parental intervention: (1) Parental exposure to the intervention was less than desired due to high parental turnover (70 parents completed the 2 year study period). (2) Low response rates (53-71%) effect generalisability (3) Self reported outcome measures, which can be subject to social desirability and recall bias, were used. **Limitations identified by review team** Staff intervention: (1) The provision of free sunscreen was a small

	White 36.2% Other 0.9% Parents African American 21.6% Asian 1.1% Hispanic 14.4% White 62.1% Other 0.8% **Socioeconomic status** Staff education level Less than high school 1.7% High school 23.7% More than high school 74.6% Parent education level: Less than high school 2.7% High school 15.7% More than high school 81.6% **Skin type** Not reported **Other** 4 preschools were privately owned and 16 preschools were owned and operated by public, not-for-profit organisations.	policy development and adding shade structures. (c) Newsletter Four issues (June 1997, December 1997, June 1998, and July 1998). The newsletters contained sun safe facts, a physician's column that addressed issues such as what types of sunscreen to use and the importance of year round sun protection, and role-modelling stories developed from interviews with preschool staff using the intervention. (d) SPF Curriculum - 7 units, 5 activities per unit. Curriculum was designed to educate preschool children about sun protection, increase children's cooperation with staff sun protection behaviours, and reinforce staff compliance with sun protection. Activities used art, science, dramatic play, music, language, and maths to emphasise all sun protection strategies. Activities included opportunities for children to model sun protection practices for their classmates and parents and encouraged children to remind parents and teachers to provide sun protection. (e) Sunscreen With parental written consent, preschool staff applied commercial brand sunscreen that was provided as part of the	before preschool (g) Take sunscreen to the park or zoo Sun avoidance Staff and parents (a) Sun Avoidance Scale (aggregate score of 5-25 based on responses to use of protective clothing items a, b, c and d, and setting up shaded areas all on a scale of 1-5, 1=never and 5=always) (a) Students wear hats or caps (b) Students wear shirts with sleeves (c) Students do not wear tank tops (d) Students wear long shorts (e)setting up shaded areas **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Staff and parents Composite score of 0-5 based on knowledge about sunscreen use, limiting sun exposure during midday, and sun reflective surfaces. **Intention to engage in sun** protection practices Outcome not assessed	0.001; n=218, effect size 1.24, SE 0.23, p<0.001 respectively. 2. Parent sunscreen use At 12 months there was no statistically significant difference between groups (n=589, effect size 0.92, SE 0.55, p<0.093). At 24 months the intervention group scored statistically significantly higher than the control group (n=643, effect size 0.96, SE 0.44, p=0.030). (b) Apply sunscreen 30 minutes before going outside At 12 months there was no statistically significant difference between the two groups (n=605, effect size 0.18, SE 0.10, p<0.058). At 24 months the intervention group were statistically significantly more likely to apply sunscreen to children before going out than the control group (n=656, effect size 0.34, SE 0.09, p<0.001). (c) Reapply sunscreen every 1.5 to 2 hours At 12 and 24 months the intervention group were significantly more likely to reapply sunscreen every 1.5 to 2 hours to children than the control group. (n=599, effect size 0.22, SE 0.10, p<0.026; n=650, effect size 0.20, SE 0.10, p0.038). (d) Use SPF 15+ sunscreen	component of the intervention and it is not possible to determine its influence on outcome. (2)The extent of use of free sunscreen was not reported. (3) There was a low rate of staff (57%) implementing at least half of the curriculum. (4) Three cross-sectional surveys, rather than longitudinal surveys, were used (67 members of staff responded to all 3 surveys; out of 245 who completed the baseline survey). Although the analysis was adjusted for some potential confounders, unknown differences between the cohorts may have introduced confounding. Parent intervention: (1) Parents did not receive free sunscreen. (2) Parents intervention material was given to parents by their child's teacher. There could therefore have been differences in the manner and time that these materials were given to parents. (3) Two cross-sectional surveys, rather than longitudinal surveys, were used. Although the analysis was adjusted for some potential confounders, unknown differences between the cohorts may have introduced confounding.

		intervention. Staff also applied sunscreen if it was provided by parents. 2. Parent intervention (Gritz [38] (a) "Be Sun Safe From Head to Toe" video Provided instruction and modelling of parental sun protection practices for children of different ages in various settings. (b) Newsletter As received by teachers (c) Handbooks One 11 page sun safety handbook containing detailed information on sun protection behaviours with role modelling photographs; one 17 page "Skin Cancer Guide for Parents" containing information on different types of skin cancer, risk factors and skin cancer detection. **Comparator** Received standard education available to the general public and the 'Under Cover' brochure. Staff were asked to maintain their usual routine, including applying sunscreen provided by parents. **Intervention period** 24 months (from end of summer 1996 to end of summer 1998). **Sample size** Intervention: n=10 preschools	**Other outcomes** Development of policies, modifying outdoor playground schedules and adding shaded areas (staff only). Psychosocial outcomes: (a) awareness concerns interest, which was applicable to staff only, and (b) sunscreen-use self-efficacy, (c) teacher sunscreen norms, (d) impediments to sunscreen use, (e) sunscreen-use expectancies, (f) sun-avoidance self-efficacy, and (g) tanning expectancies, which were applicable to staff and to parents. **Follow-up period** Both staff and parents received the last newsletter in July 1998 and the last assessment at end of summer 1998. **Method of analysis** Effect size of the intervention at 12 and 24 months was calculated using a multilevel model that adjusted for intraclass correlation (correlation between survey responses within preschool), group assignment (intervention or comparison), baseline preschool-level means of the outcome variable, and age, gender, ethnicity, education and skin's reaction to the sun.	At 12 months there was no statistically significant difference between the two groups. At 24 months the intervention group were significantly more likely to use SPF 15+ sunscreen on children than those in the control group (n=652, effect size 0.23, SE 0.11, p=0.041). (e-g) There was no statistically significant difference between groups at either time for putting sunscreen on when going outside; applying sunscreen in the morning before preschool; and taking sunscreen to the park and zoo. Sun avoidance 1. Staff Sun Avoidance scale (range 5-25) At 12 and 24 months the intervention group scored statistically significantly higher than the control group (n=161 staff, effect size 2.18, SE 0.65, p=0.001; n=192 staff, effect size 3.85, SE 0.85, p<0.001) (a) Students wear hats or caps At 12 months there was no statistically significant difference between the two groups. At 24 months teachers in the intervention group were statistically significantly more likely to state that students wore hats or caps than the control group (n=217 teachers, effect size 0.67, SE 0.22, p=0.002)	**Evidence gaps and/or recommendations for future research** To determine how to disseminate and maintain skin cancer prevention intervention in preschools. To investigate methods for unobtrusively measuring parents' child protective behaviour and validating self-report of these behaviours. To determine the most effective methods for disseminating sun-protection interventions to parents of pre-school children. **Source of funding** National Cancer Institute (R01 CA 62918)

		Control: n=10 preschools **Baseline comparisons** 1. Staff There were more males in the comparison group than intervention group (6 versus 0) and the comparison group had a higher mean score than the intervention group. The groups were similar on other characteristics. 2. Parents The groups were similar **Study sufficiently powered** Not stated		(b) Students wear shirts with sleeves At 12 months there was no statistically significant difference between the two groups. At 24 months teachers in the intervention group were statistically significantly more likely to state that students wore shirts with sleeves than the control group (n=218 teachers, effect size 0.82, SE0.21, p<0.001). (c) Students do not wear tank tops At 12 months there was no statistically significant difference between the two groups. At 24 months teachers in the intervention group were statistically significantly more likely to state that students were not wearing a tank top than the control group (n=220 teachers, effect size 0.54, SE 0.16, p=0.001). (d) Students wear long shorts At 12 and 24 months teachers in the intervention group were statistically significantly more likely to state that students wore long shorts than the control group (n=186 teachers, effect size 0.38, SE 0.15, p=0.013; n=219 teachers, effect size 0.59, SE 0.18, p=0.001) (e) Setting up shaded areas At 12 and 24 months the intervention group were statistically significantly more	

				likely to set up shaded areas than the control group (n=167 staff, effect size 0.60, SE 0.24, p=0.012; n=190 staff, effect size 1.26, SE 0.26, p<0.001) 2. Parents Sun avoidance scale (range 5-25) At 12 months the intervention groups scored statistically significantly higher than the control group (n=596 parents, effect size 0.54, SE 0.26, p=0.039). At 24 months there was no statistically significant difference between groups. (a) Children wear hats or caps At 12 months, parents in the intervention group were significantly more likely to state that their child wore hats or caps than parents in the control group (n=611 parents, effect size 0.29, SE 0.09, p=0.001). At 24 months there was no statistically significant difference between groups. (b-d) There was no statistically significant difference between groups at either time period in children wearing shirts with sleeves; not wearing tank tops; and wearing long shorts. (e) Setting up shaded areas At 12 months there was no statistically significant difference between groups. At 24 months	

				the intervention group were statistically significantly more likely to set up shaded areas than the control group (n=648 parents, effect size 0.25, SE 0.10, p=0.014). **Knowledge, attitudes, beliefs** 1. Staff (a) Sun protection knowledge scale (range 0-5) At 12 and 24 months the intervention group scored statistically significantly higher than the control group (n=177 staff, effect size 1.00, SE 0.21, p<0.001; n=218 staff, effect size 0.63, SE 0.25, p=0.011 respectively) 2. Parents (a) Sun protection knowledge scale (range 0-5) At 12 months the intervention group scored statistically significantly higher than the control group (n=590 parents, effect size 0.42, SE 0.10, p<0.001). At 24 months there was no statistically significant difference between groups. **Process and implementation** At 12 months 79% of teachers in the intervention group recalled receiving SPF training, 88% receiving and reading the SPF newsletter, 90% reading the curriculum and guide and 56% teaching at least half of the	

				curriculum activities. At 24 months 84% recalled receiving SPF training, 94% receiving and reading the SPF newsletter, 88% reading the curriculum guide and teachers guide and 57% teaching at least half the curriculum. At 12 months 57% of parents in the intervention group reported watching the video, 74% reported reading the Sun Safety Handbook, and 67% reported reading the Sun Safety newsletter. At 24 months 64% reported watching the video, 74% reading the handbook and 75% reading the newsletter. **Other outcomes** 1. Staff (a) Awareness Concerns Interest (ACI) (scale range 9-36) At 12 months there was no difference between the two groups. At 24 months the intervention group scored statistically significantly higher than the control group (n=191 staff, effect size 2.53, SE 0.61, p<0.001). (b) Sunscreen-use self-efficacy (scale range 5-25) At 12 and 24 months the intervention group scored statistically significantly higher than the control group (n=176 staff, effect size 2.78, SE 0.73, p<0.001; n=195 staff, effect size 4.60, SE 0.79, p<0.001	

				respectively). (c) Teacher sunscreen norms (scale range 3-15) At 12 and 24 months the intervention group scored statistically significantly higher than the control group (n=184 staff, effect size 1.08, SE 0.37, p=0.003; n=215 staff, effect size 1.70, SE 0.33, p<0.001 respectively). (d) Impediments to sunscreen use (scale range 3-15) At 12 and 24 months the intervention group scored statistically significantly higher than the control group (n=186 staff, effect size 1.15, SE 0.40, p=0.004; n=207 staff, effect size 0.89, SE 0.37, p=0.017 respectively) (e) Sunscreen-use expectancies (scale range 4-20) At 12 months there was no statistically significant difference between groups. At 24 months the intervention group scored statistically significantly higher than the control group (n=207 staff, effect size 1.84, SE 0.34, p<0.001) (f) Sun-avoidance self-efficacy (scale range 5-25) At 12 and 24 months the intervention group scored statistically significantly higher	

				than the control group (n=178 staff, effect size 2.29, SE 0.80, p=0.004; n=200 staff, effect size 3.17, SE 0.61, p<0.001 respectively). (g) Tanning expectancies (scale range 4-20) At 12 months there was no statistically significant difference between groups. At 24 months the intervention group scored statistically significantly higher than the control group (n=202 staff, effect size 0.95, SE 0.47, p=0.043) 2. Parents (a) Awareness Concerns Interest (ACI)(scale range 9-36) N/A (b) Sunscreen-use self-efficacy (scale range 5-25) At 12 and 24 months there was no statistically significant difference between groups. (c) Teacher sunscreen norms (scale range 3-15) At 12 and 24 months the intervention groups scored statistically significantly higher than the control group (n=574 parents, effect size 1.41, SE 0.26, p<0.001; n=633 parents, effect size 1.76, SE 0.37, p<0.001 respectively). (d) Impediments to sunscreen use	

				(scale range 3-15) At 12 months the intervention group scored statistically significantly higher than the control group (n=615 parents, effect size 0.50, SE 0.25, p=0.044). At 24 months there was no statistically significant difference between groups. (e) Sunscreen-use expectancies (scale range 4-20) At 12 months the intervention group scored statistically significantly higher than the control group (n=578 parents, effect size 0.77, SE 0.23, p<0.001). At 24 months there was no statistically significant difference between groups. (f) Sun-avoidance self-efficacy (scale range 5-25) At 12 and 24 months there was no statistically significant difference between groups. (g) Tanning expectancies (scale range 4-20) At 12 and 24 months there was no statistically significant difference between groups. **Attrition details** Two preschools in the intervention group dropped out after the 12 month assessment. Of 245 teacher who completed the baseline survey, 111 (45%)	

				completed the 12 month intervention assessment and 76 (31%) completed the 24 month assessment. 67 teachers (27%) completed all 3 assessments. Of parents whose data were included in the evaluation, 1054 (78%) completed 1 assessment, 227 (17%) completed 2 assessments, and 70 (5%) completed all three assessments.	
Author Milne et al.[36] **Year** 2006 **Related papers** English 2005;[39] Milne 1999;[43] Milne 2001;[41] Milne 2000;[42] Milne 2002[40] **Study aim** To assess the impact of a sun-safety school-based intervention on sun exposure in children **Study design** Non-randomised controlled trial Geographic cluster **Internal validity** + **External validity** -	**Country** Australia **Setting** School **Source population** Schools within 30km of Perth centre, Western Australia, and with 50 or more first year children (n=97 schools). **Eligible population** n=2,529 children who commenced school in 1995 aged 5 or 6 years from selected schools. Schools were grouped into 15 geographic clusters based on proximity and schools were then randomly selected from these. **Selected population** 14 control schools, 11 moderate intervention schools, 8 high intervention schools. n=1,776 (of 2,529) consented to	**Method of allocation** Non-randomised. Schools closest to Perth centre were designated as high intervention and those furthest away as controls. **Intervention** High intervention group: specifically designed sun protection curriculum, including classroom- and home-based activities encouraging children to reduce sun exposure by staying indoors during the middle of the day and protect themselves when outdoors by using shade, clothing, hats and sunscreen. Plus programme materials provided during the summer vacation from the 'Totally Cool Summer Club", and offered low-cost sun protective swimwear that covers the trunk, upper arms, and thighs. **Comparator** Moderate intervention group:	**Sun protection practices** Use of sunscreen Use of shade Use of protective clothing or hat Parents completed a questionnaire regarding their child's sun-related activities over the summer vacation, including the proportion of time their child used sunscreen at the beach or outside swimming pool, and outside around the home or neighbourhood; the proportion of time spent in the shade at each setting; the proportion of time their child wore a hat or had their back covered by clothing at each setting, and also what type of clothing, swimwear and hats their child wore. **Sun exposure** As above including questions about the number of days their child went to the beach or to an	**Sun-protection behaviours** Sunscreen There were no statistically significant differences in prevalence of sunscreen use at any time between moderate intervention versus control groups, and high intervention versus control groups at baseline, in 1997 or 1999. Data for the high intervention versus control comparisons only: 1995 (n=1,465): Moderate 25%; High 20% (adjusted %) 1997 (n=1,223): OR 1.26 (95 %CI: 0.85 to 1.88), p=0.4 1999 Face (n=1,176): OR 1.06 (95% CI:0.70 to 1.60), p=0.8 Arms (n=1,176): OR 1.02 (95% CI: 0.65 to 1.60), p=1.0 Back (n=657 - only applied to children who did not have their	**Limitations identified by author** (1) Non-randomised and baseline differences between groups, (2) potential over-reporting of favourable behaviours due to use of questionnaire, (3) loss to follow-up may have compromised validity, (4) nevi may not be a sensitive indicator of sun exposure within populations. **Limitations identified by review team** (1) non-randomised design and there were some baseline differences, the high intervention was selected from schools closest to Perth centre, (2) it is not possible to determine the impact of the component of interest (low cost swimwear) on the outcomes, (3) very limited details were provided about the low cost swimwear component and uptake of this component is unclear.

	participate, of whom 1,623 were of European ethnicity and included in the analysis.[39] **Age** Children aged 5 to 6 years **Female** 47.6% **Race/ethnicity** Southern European High: 14.7 Moderate 10.6% Control: 5.4% **Socioeconomic status** Parental education (tertiary) High 48.7% Moderate: 45.2% Control: 25.2% **Skin type** Propensity to burn (severe with blisters or painful burn) High: 53.5% Moderate: 58.6% Control: 54.1% Details from Milne 2002[40] which provides baseline details of children included in analysis of nevi on the back and by group (n=1398)	specifically designed sun protection curriculum, including classroom- and home-based activities encouraging children to reduce sun exposure by staying indoors during the middle of the day and protect themselves when outdoors by using shade, clothing, hats and sunscreen. Controls: received standard Western Australian health education curriculum. **Intervention period** 1995 to 1998 (4 years) **Baseline comparisons** Groups were similar for skin colour, ability to tan, and number of nevi. Southern European ethnicity was more prevalent in the high intervention group compared to control and fewer parents in the control group had tertiary education. **Study sufficiently powered** Designed to have 85% power (alpha 0.05, two sided test) to detect a 25% reduction in exposure when controls compared with high intervention group. However, loss to follow-up may have resulted in loss of power.	outdoor public swimming pool and the number of hours spent there. They were also asked about days and times their child played outside around the home or neighbourhood. Nevi Photographs were taken of the trunk (chest, abdomen, and back for boys, and back only for girls) and the number of nevi were counted in winter by a single trained observer. The number of nevi on the face and arms (inner and outer surfaces) were counted directly, and freckling on the face and arms was directly assessed. The amount of suntan on the back and forearm was measured at the end of the summer vacation using reflectance spectrophometry; a Diffusion Systems Model 99 in 1997, and a Minolta CM 500d spectrophotometer in 1999 and 2001. Melanin density was calculated for 1999 and 2001. Skin colour was assessed by measuring reflectance on the inner surface of the child's arm during the winters of 1995 and 1999. **Long-term outcomes** Outcome not assessed	back covered all the time) OR 1.26 (95% CI: 0.87 to 1.82), p=0.5 There was a significant difference between groups sunscreen use to the back in 2001, but not for other body areas (Data for high intervention versus control comparison only where results are non-significant). Back (n=559 - only applied to children who did not have their back covered all the time) Moderate versus control OR 1.64 (95% CI: 1.02 to 2.62); High versus control OR 1.85 (95% CI: 1.02 to 3.34), p=0.04 Face (n=917): OR 1.36 (95% CI: 0.82 to 2.23), p=0.3 Arms (n=917): OR 1.41 (95% CI: 0.89 to 2.23), p=0.3 Back covered at all times There were significant differences in 1997 and 1999. 1997 (n=1,225): Moderate versus control OR 1.62 (95% CI: 1.17 to 2.25); High versus control OR 1.92 (95% CI: 1.36 to 2.70), p=0.0002 1999 (n=1,176): Moderate versus control OR 1.51 (95% CI: 1.13 to 2.03); High versus control OR 1.56 (95% CI: 1.13 to 2.14), p=0.005 2001 (n=916): Moderate versus	**Evidence gaps and/or recommendations for future research** Further research is required to determine the optimal length of time and dose interventions such as Kidskin require. Future multi-level sun safety interventions should incorporate detailed evaluation of the long-term effectiveness of individual intervention components and the value of providing developmentally appropriate boosters. **Source of funding** National health and Medical Research Council (954601, 110221, 209057) and the Cancer Foundation of Western Australia.

			Adverse consequences Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Two and four year follow-up (1999 and 2001) for sun protection practices and four and six for development of nevi. **Method of analysis** Each outcome was analysed separately for each year with adjustments made for parental education, southern European ancestry, gender and propensity to sunburn, and where possible the baseline value of the outcome measure. Mixed effects regression was used to analyse the degree of suntan, with a random intercept for school and fixed effects for study group, spectrophotometer used, observer and week of observation, inner arm	control OR 1.21 (95% CI: 0.87 to 1.69); High versus control OR 1.26 (95% CI: 0.88 to 1.82), p=0.4 Swimsuit that covered the back and arms There were significant differences in 1997 and 1999 1997 (n=1,292): Moderate versus control OR 1.46 (95% CI: 1.08 to 1.97); High versus control OR 3.41 (95% CI: 2.14 to 5.45), p<0.001 1999 (n=1,235): Moderate versus control OR 1.24 (95% CI: 0.93 to 1.65); High versus control OR 1.53 (95% CI: 1.11 to 2.12), p=0.03 2001 (n=924): Moderate versus control 1.06 (95% CI: 0.70 to 1.61); High versus control OR 0.75 (95% CI: 0.53 to 1.05), p=0.06 Hat use at all times There were no significant differences at any time point 1997 (n=1,213): OR 1.05 (95% CI: 0.62 to 1.79), p=0.7 1999 (n=1,171): OR 1.34 (95% CI: 0.89 to 2.02), p=0.3 2001 (n=912): OR 0.53 (95% CI: 0.29 to 0.98), p=0.08 Shade use more than half the time There were no significant differences at any time point 1997 (n=1,168): OR 1.51 (95% CI: 1.06 to 2.15), p=0.07 1999 (n=1,094): OR 1.55 (95% CI: 0.88 to 2.71), p=0.3	

			reflectance and confounding variables (as above). For the analysis of nevi, month of observation, observer, parental education, tendency to suntan, ethnicity, hair colour and inner arm skin reflectance were considered as potentially confounding variables. The overall proportion of time that children used hats, sunscreen, shade and clothing to cover the back at each setting were averaged after weighting by the proportion of the total time outdoors spent at each setting. These were then collapsed into binary variables. Children with missing data were not included in the analysis. The total number of hours that children spent outside between 11am and 2pm over the summer vacation was calculated. Questions on time outdoors differed slightly at baseline and subsequent years, and comparisons were therefore made among groups within years.	2001 (n=891): OR 1.27 (95% CI: 0.87 to 1.86), p=0.1 There were no significant differences by gender for any comparisons (p>0.05). **Sun exposure** Number of nevi or freckles[39] At 6-year follow-up there were no statistically significant difference between high intervention versus control groups in the mean number of nevi on the back or face and arms. Back Baseline mean: High intervention 3.3; control 3.5 Follow-up: High 8.6; control 10.1 Ratio of change: 0.89 (95% CI: 0.81 to 0.99, p=0.09) Face and arms Baseline mean: High intervention 14.2; control 14.7 Follow-up: High 22.5; control 25.2 Ratio of change: 0.92 (95% CI: 0.81 to 1.05, p=0.2) At 6-year follow-up there was a statistically significant difference (p=0.0004) in the mean number of nevi on the chest (boys only). Baseline mean: High intervention 2.7; control 2.7 Follow-up: High 7.3; control 8.6 Ratio of change: 0.82 (95% CI: 0.74 to 0.91)	

				At 4-year follow-up there were no statistically significant differences between high intervention and control groups for any body site.[40] Subgroup analyses There was a statistically significant difference at 6-year follow-up between boys in the high intervention compared to control group for back nevi (p=0.0009), but not for girls (p=0.7). Back (boys) Baseline mean: High intervention 3.8; control 3.5 Follow-up: High 10.2; control 11.4 Ratio of change: 0.83 (95% CI: 0.75 to 0.92) Back (girls) Baseline mean: High intervention 2.9; control 3.5 Follow-up: High 7.2; control 9.1 Ratio of change: 0.95 (95% CI: 0.83 to 1.08) There were no significant changes over time on the face and arms for boys or girls. Face and arms (boys) Baseline mean: High intervention 14.6; control 15.2 Follow-up: High 21.9; control 25.7 Ratio of change: 0.89 (95% CI: 0.76 to 1.04) Face and arms (girls) Baseline mean: High intervention	

				13.7; control 14.1 Follow-up: High 23.3; control 24.5 Ratio of change: 0.98 (95% CI: 0.85 to 1.14) At 6-year follow-up there was no evidence that the group-specific slopes in nevus counts on the back (p=0.3) or face and arms (p=0.6) varied by degree of baseline freckling. There was a statistically significant increase in the number of nevi on the back for children with freckles in the high intervention group but not in the moderate group (p=0.01). At 4-year follow-up freckling rates were similar across groups.[40] There was a significant difference between groups in skin reflectance on the back and forearm in 1997, with lowest reflectance (i.e. skin most tanned) in the control group. Back (n=1,310): Moderate adjusted mean difference 2.6 (95% CI: 1.0 to 4.1); high 3.7 (95% CI: 2.0 to 5.4), p=0.0002 Forearm (n=1,309): Moderate 1.4 (95% CI: 0.2 to 2.4); high 1.3 (95% CI: 0.1 to 2.5), p=0.03 There were no significant differences between groups in melanin density in 1999 or 2001. 1999 Back (n=1,140): -0.1 (95% CI: -0.2 to 0.01), p=0.1	

				Forearm (n=1,270): high 0.12 (95% CI: -0.02 to 0.05), p=0.6 2001 Back (n=1,000): -0.03 (95% CI: -0.2 to 0.1), p=0.9 Forearm (n=1,108): high -0.01 (95% CI: -0.05 to 0.03), p=0.9 In 2001 boys in the high intervention group were more tanned on the forearm than those in the control group (interaction, p=0.03), but there were no other significant differences by gender. Time spent outdoors between 11am and 2pm, Baseline (n=1,473): Control 31 minutes per day; moderate 28 minutes; high 27 minutes (adjusted means used). There were no statistically significant differences in 1997 (n=1,253) High versus control: 13 vs 16 minutes, 0.83 (95% CI: 0.68 to 1.01), p=0.2 The was a statistically significant difference in 1999 (n=1,182): Moderate versus control: 17 vs 21 minutes, 0.93 (95% CI: 0.76 to 1.14); high versus control: 14 vs 21 minutes 0.72 (95% CI: 0.58 to 0.91), p=0.02. There was no statistically significant difference in 2001 (n=924): High versus control: 23 minutes in both groups, 1.02 (95%	

				CI: 0.82 to 1.27), p=0.9 There were no significant differences by gender (p>0.05). **Attrition details** Initial participation for the Kidskin study was 70% (65% control, 73% moderate and 77% high). With the exception of 2001, 80 to 90% of eligible children had suntan measured and their parents returned questionnaires. In 2001, 60% (control), 75% (moderate), and 69% (high were assessed for suntan, and 60%, 68%, and 62% respectively returned questionnaires. Nevi and freckles [39] Data were available at baseline and 2001 for 67% of participants (n=1,081); high intervention n=272 (68%); moderate n=338 (72%); control n=471 (63%). Loss to follow-up in 1999 was low and varied little by group (p=0.1), but there was a significantly greater loss in 2001, with the highest attrition rates in the control group (p=0.001). There were also differences between those who dropped out and those who continued with the study.	
Author Reding et al.[37] **Year** 1996	**Country** United States **Setting** School	**Method of allocation** Four chapters out of the 10 sections were randomly selected and from each of the four schools/chapters, three schools	**Sun protection practices** Outcome not assessed **Sun exposure** Outcome not assessed	**Knowledge** There was a significantly higher proportion of children in the intervention group with knowledge gain on nine of 10	**Limitations identified by author** The authors highlight some limitations with the implementation of interventions such as that used in this study,

Study aim To educate young children about the risks of sun exposure to increase their sun protection knowledge **Study design** Non-randomised controlled trial **Internal validity** - **External validity** -	**Source population** Future Farmers of America (FFA) living in Wisconsin, USA and schools in that region **Eligible population** Four chapters in each of the 10 sections throughout Wisconsin (n=40 FFA organisations **Selected population** FFA facilitators (n=217) from 39 FFA organisations; n=3,142 third graders **Age** Third graders **Female** Not reported **Race/ethnicity** Not reported **Socioeconomic status** Not reported **Skin type** Not reported	were allocated to intervention and one to control. It is unclear how they were allocated . **Intervention** The intervention used the Children's Guide to Sun Protection K-3 (developed by the American Academy of Dermatology and the American Cancer Society, 1990). The intervention included: (1) training of Future Farmers of America (FFA) peer facilitators (teen educators) at a one-day workshop, which included background information on skin cancer and sun protection, the introduction and practice of the sun-protection curriculum, and some teaching skills training. They also received instructions on administering the pre- and post-surveys, (2) FFA facilitators administered two 30- to 40-minute education sessions to third graders over two days, which included background information on the basic anatomy of the skin, skin cancer, the sun, the damage it causes, and methods of sun protection, (3) posters, worksheets, and hand-outs on sun protection were also provided. Materials distributed at the end of the intervention to take home to the family included (1) a skin	**Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Children responded to a 10-item multiple choice knowledge based survey about sun protection. FFA facilitators responded to a 13-item survey about skin cancer/sun protection, including questions on attitude, behaviour, and knowledge. Data are not reported here as they did not receive sunscreen samples. **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Immediate and six months post intervention **Method of analysis** The number of students gaining knowledge (i.e. who responded	questions for pre- to post-intervention and at six month follow-up (both p<0.001). Question 1: When should you protect yourself from the sun? Baseline: Intervention 56.2%; control 53.5% Post intervention: 77.1%; 51.9% Six-months: 69.8%; 50.2% Question 2: The time of day when the sun is strongest is ..? Baseline: 83.0%; 84.8% Post-intervention: 84.1%; 85.4%, p=0.599 Six-months: 82.5%; 85.9%, p=0.077 Question 3: The best way to protect yourself from the sun is by using ...? Baseline: 81.8%; 78.3% Post-intervention: 97.8%; 85.1% Six-months: 97.4%; 90.1% Question 4: I will wear sunblock number ....when I'm outside Baseline: 51.0%; 50.4% Post-intervention: 97.8%; 54.0% Six-months: 91.9%; 62.5% Question 5: The skin type that needs the most sun protection is ? Baseline: 61.9%; 59.3% Post-intervention: 86.9%; 59.0% Six-months: 77.7%; 65.2% Question 6: In the ABCs of sun protection, the A means ...	but do not identify limitations with the study itself. **Limitations identified by review team** (1) only sunscreen samples were provided and it is not possible to determine the exposure and effect of these samples on children's knowledge and behaviours, (2) it is unclear how schools were allocated, (3) there were no differences between groups at baseline, but no details were provided about the schools and pupils and generalisability is therefore unclear, (4) only knowledge was measured, (5) short duration of follow-up. **Evidence gaps and/or recommendations for future research** None identified **Source of funding** National Institute for Occupational Safety and health (Grant no. U03/CCU506135-02)

		cancer brochure for adult farmers, (2) skin cancer information sheet from the American Cancer Society, (3) a sunscreen sample. **Comparator** Controls: no intervention **Intervention period** April and May 1993 (over two days within a one-week period) **Sample size** n=3,142 third graders **Baseline comparisons** There were no significant differences between the intervention and control groups on any of the baseline survey questions. Participant characteristics at baseline were not reported. **Study sufficiently powered** Not reported	incorrectly at baseline but correctly post-intervention) on each of the 10 questions on the post-intervention survey in the intervention and control groups, were compared using the chi-square test. The change in scores in the intervention and control groups was compared using the Mann-Whitney U test.	Baseline: 41.5%; 42.3% Post-intervention: 96.0%; 45.1% Six-months: 69.7%; 50.4% Question 7: In the ABCs of sun protection, the B means ... Baseline: 64.7%; 62.2% Post-intervention: 97.4%; 68.2% Six-months: 87.1%; 71.3% Question 8: In the ABCs of sun protection, the C means ... Baseline: 67.2%; 67.7% Post-intervention: 97.6%; 65.0% Six-months: 92.7%; 74.9% Question 9: What SPF number should be on sunblock that your family buys? Baseline: 46.9%; 47.5% Post-intervention: 97.8%; 56.7% Six-months: 90.6%; 62.6% Question 10: Which one does not protect you from the sun? Baseline: 66.2%; 69.7% Post-intervention: 94.1%; 71.3% Six-months: 86.5%; 70.0% The mean improvement from pre- to post-intervention was 3.04 questions (SD 1.91) for the intervention group and 0.26 (SD 1.62) for the control group. From pre- to six month follow-up survey, the mean improvement in the intervention group was 2.24 questions (SD 2.07) compared to 0.67 (SD 2.08) in the control group.	

				Baseline: Intervention mean 6.22 (95% CI: 6.05 to 6.33); control 6.16 (95% CI: 5.88 to 6.37), p=0.642 Post-intervention: 9.26 (95% CI: 9.14 to 9.37); 6.42 (95% CI: 6.22 to 6.63), p<0.001) Six-month: 8.45 (95% CI: 8.34 to 8.58); 6.83 (95% CI: 6.64 to 7.04), p<0.001) **Attrition details** Survey administered to 3,142 third graders, 2,676 (85%) completed all three surveys and were included in the analysis.	

Table E: Provision of multi-component interventions in healthcare settings evidence tables

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
Author Bolognia et al.[46] **Year** 1991 **Study aim** To investigate the effect of the education of mothers on the sun exposure of newborns. **Study design** Non-randomised controlled trial **Internal validity** - **External validity** -	**Country** United States **Setting** Hospital **Source population** Mothers of infants born at Yale-New Haven (Conn) Hospital, USA between March and June 1989. **Eligible population** Mothers of healthy infants, born full term and weighing at least 2.27 kg. **Selected population** 300 mothers were invited to participate, n=275 (92%) were included in the study. **Age** <20 years: 5 mothers; 4 fathers 20-24: 28 mothers; 14 fathers 25-29: 85 mothers; 58 fathers 30-34: 115 mothers; 111 fathers 35-39: 38 mothers; 63 fathers 40 years or over: 4 mothers; 25 fathers **Female** 100% female **Race/ethnicity** White: 94%	**Method of allocation** Half of the parents were enrolled in two consecutive periods, not randomly. **Intervention** High-level intervention: simple guidelines, pamphlets, and a postcard with the message to limit sun exposure. In addition, participants received "gifts" (sunscreen samples for the mother and other family members, a baby sun hat, and a sun umbrella). **Comparator** Low-level intervention: simple guidelines and a postcard about limiting sun exposure. Control group: received only the invitation to participate in the study **Intervention period** 1989 **Sample size** Mothers: n=275 Infants: n=275 High intervention group: n=94 Moderate n=96 Control: n=85	**Sun protection practices** Use of sunscreen Use of shade Use of protective clothing or hat Mothers completed a telephone survey relating to their sunscreen use (yes/no); the amount of time spent outdoors in the shade (0=none; 1 = 1 to 5 hours per week; 2 = 5 or more hours per week); and use of physical sun barriers. **Sun exposure** The amount of exposure to direct sunlight of the newborn and mother during summer weekdays, and weekends separately (0=none; 1 = 1 to 5 hours per week; 2 = 5 or more hours per week). **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed	**Sun-protection behaviours** Mothers and infants in the intervention group spent significantly less hours per week in direct sunlight without sunscreen compared with controls (p<0.001). High intervention (n=42): None (n=24); 5 hours or more (n=8), Controls: None (n=0); 5 hours or more (n=35) Mothers and infants in the high intervention group spent significantly less time outdoors per week than controls (direct sunlight plus shade) (p<0.001). High intervention (weekdays): 1 hour or less (mothers n=58; infants n=46); >1 hour (mothers n=42; infants n=54) Control (weekdays): 1 hour or less (mothers n=0; infants n=1); >1 hour (mothers n=42; infants n=54) High intervention (weekends): 1 hour or less (mothers n=23; infants n=49); >1 hour (mothers n=77; infants n=51) Control (weekends): 1 hour or less (mothers n=1; infants n=0); >1 hours (mothers n=99; infants n=100)	**Limitations identified by author** (1) Data were collected via a telephone survey and may not have been accurate, (2) potential bias through participants trying to please the interviewer, (3) some of the barriers used may have been inadequate to protect from the sun (e.g. stroller hoods). **Limitations identified by review team** (1) Allocation was not random, (2) small sample sizes, (3) the sunscreen, baby hat, and umbrella were presented as gifts and not as a component of the intervention, (4) only a small proportion reported the use of umbrellas and loose-fitting clothing. **Evidence gaps and/or recommendations for future research** The authors recommend further investigation into the most effective time for educating parents on sun exposure habits and the reinforcement of educational messages. **Source of funding**

	Socioeconomic status Paternal occupation was similar for all groups (a proxy for socioeconomic status) **Skin type** Not reported **Other** Both groups were similar in terms of hair colour, eye colour, day care attendance (22%), and family size (this was the first child for 46% of parents).	**Baseline comparisons** To control for baseline differences in sun exposure behaviour, mothers were assigned to a low (no days at the beach over the summer and vacations), moderate (1 to 9 days at the beach), or high (more than 9 days at the beach) sun exposure category at baseline. **Study sufficiently powered** Not reported	**Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** September to December 1989 **Method of analysis** Chi-square analysis. Groups were stratified by sunscreen use, paternal occupation, and family size.	There were no significant differences between groups in the use of hats (intervention 86%; control 96%), stroller hoods (intervention 48%; control 49%), umbrellas (intervention 10%; control 5%), and loose-fitting clothing (intervention 7%; control 2%). **Sun exposure** Mothers in the high intervention group spent significantly less time outdoors (hours per week) in direct sunlight compared with controls (p<0.001). High intervention: None (mothers n=47; infants n=96); 5 hours or more (mothers n=17; infants n=2) Control: None (mothers n=0; infants n=0); 5 hours or more (mothers n=85; infants n=99) The pattern of sun exposure (time in direct sunlight) in mothers reported at enrollment were: High intervention: Low (43%); moderate (32%); high (25%) Control: Low (29%); moderate (38%), high (33%) A greater number of mothers and infants in the high intervention group significantly reduced their amount of sun exposure after the intervention compared with controls (p<0.001).	Supported by the National Institutes of Health: Yale New Haven Hospital Auxiliary award; BRSG SO7 RR05443 (Biomedical Research Support Grant Programme); and grant 2PO1-CA42101. Baby hats were donated by the Dainty Kiddie Kaps, New York, and sunscreen samples were provided by Schering-Plough.

				High intervention: Increased (mothers 26%; infants 0%); decreased (mothers 35%; infants 53%); same (mothers 37%; infants 47%) Controls: Increased (mothers 67%; infants 65%); decreased (mothers 0%; infants 0%); same (mothers 33%; infants 35%) **Attrition details** Authors state that the results are presented for all participants in each group.	
Author Crane et al.[44] **Year** 2006 **Study aim** To evaluate the behavioural impact of a skin cancer prevention programme, delivered by health care providers during well-child visits. **Study design** Cluster RCT **Internal validity** - **External validity** -	**Country** United States **Setting** Health care setting (primary care practices). **Source population** 14 primary care practices within Kaiser Permanente of Colorado (a managed care organisation) serving 29% of the insured population of the Denver/Boulder area, USA. **Eligible population** Parents of children born between the 1st April 1998 and the 30th September 1998. **Selected population** A total of 2,148 births between 1st April 1998 and 30th September 1998, of which 1,177 families were contacted, and 728 (62%) were recruited.	**Method of allocation** The 14 primary care practices were matched into pairs according to patient volume, number and type of providers (paediatricians versus family physicians, and socio-demographic profiles of the populations served, and then randomly assigned to intervention or control groups). **Intervention** Health care providers and nursing staff were invited to attend meetings where the relationship between sun exposure during childhood and skin cancer, details on study design, and recommended anticipatory guidance messages were described in detail. Each year, 'booster sessions' were held. The intervention was based on the information, expert and	**Sun protection practices** Use of sunscreen Use of protective clothing or hat Use of sunglasses Parent's completed an annual telephone interview on sun protection of their child between 11am and 3pm over the summer months. Possible responses: always, frequently, seldom or never Composite measure of behaviours Responses from the 7 sun protection practices for their child between 11am and 3pm (stay inside, stay in the shade, use clothing that covers most of the arms and legs, use sunscreen with SPF 15 or more, use a hat, limit time in the sun and use sunglasses) were combined into a composite score for the overall number and frequency of	**Sun-protection behaviours** Sunscreen use 1-year follow-up (n=626): Intervention (90.0%); control (87.9%), p=0.41 2-year follow-up (n=595): Intervention (92.4%); control (92.2%), p=0.92 3-year follow-up (n=548): Intervention (94.2%); control (93.1%), p=0.60 Overall: p=0.46 Clothing use 1-year follow-up (n=626): Intervention (51.0%); control (43.8%), p=0.07 2-year follow-up (n=595): Intervention (38.4%); control (32.4%), p=0.12 3-year follow-up (n=548): Intervention (24.2%); control (25.5%), p=0.71 Overall: p=0.22 Hat use	**Limitations identified by author** (1) due to the small proportion of completed skin examinations, the statistical power may have been compromised for this outcome, potentially biasing the comparisons, (2) it was unclear whether the lack of effect for nevus development was because the intervention was too weak, or because differences may not have been detectable within a 3-year study, (3) the small difference in the composite measure suggests that the intervention may not be sufficient to make a clinical difference in the ultimate outcome of skin cancer, (4) disenrollment from the managed care organisation during the study. **Limitations identified by**

	Age Responding parents age 15-19 years: Intervention 3 (0.8%); control 2 (0.5%) 20-24: Intervention 30 (8.3%); control 43 (11.8%) 25-29: Intervention 73 (20.1%); control 70 (19.2%) 30-34: Intervention 121 (33.3%); control 124 (34.0%) 35-39: Intervention 94 (25.9%); control 90 (24.7%) 40+: Intervention 42 (11.6%); control 36 (9.9%) **Female** Child Intervention: 174 females (47.9%) Control: 188 females (51.5%) Responding parent: over 98% female **Race/ethnicity** White: Intervention 221 (79.8%); control 228 (84.1%) Black: Intervention 2 (0.7%); control 4 (1.5%) Hispanic: Intervention 40 (14.4%); control 21 (7.7%) Other: Intervention 14 (5.1%); control 18 (6.7%) Responding parent White (non-Hispanic): Intervention 276 (76.0%); control 278 (76.2%) Black: Intervention 5 (1.4%); control 6 (1.6%)	legitimate power of health care providers (Raven, 1982) and the Health Belief Model (Janz et al, 2002). It was delivered by healthcare providers at all well-child visits between 2 and 36 months. a) At the first visit, parents received: a tote bag and logo sun hat; Skin Cancer Foundation brochures, a fridge magnet, and an age specific 'Sun Protection Tips' sheet. b) At 6 months: a new 'Sun Protection Tips' sheet, and two sunscreen samples (0.3 ounces each; SPF 30). c) At 12 months: a new 'Sun Protection Tips' sheet, and ultraviolet protective sunglasses for the child. d) At 36 months: recommendations for parent-child activities to teach the importance of sun-protection. At each visit, parents also received guidance from health staff. These were based on anticipatory guidance alerts in medical records and lists of recommended messages were placed in medical records and examination rooms. Details of the guidance messages were provided to healthcare providers at an initial information session and at yearly booster sessions. **Comparator**	behaviour. Scale scores ranged from 7 (no strategies used ever) to 28 (all strategies used always). **Sun exposure** Length of time in sun or time when exposed See above Number of nevi or freckles Placement, number, and size of all nevi were assessed at 36 months by dermatologists and a paediatrician using previously published methods. Size was measured using a stencil, and placement was recorded by anatomic site on a body map. Other (specify) Skin colouration was measured using a Minolta Chomameter 300 (b colour space); five measurements were taken on the inner upper arm, two inches from the crease between the arm and trunk (unexposed skin colour), and on the outer lower arm, two inches from the crease between the upper and lower arm (sun-exposed skin colour). Tanning was defined as the mean difference in the b colour space between the outer lower arm and the upper inner arm. **Long-term outcomes** Outcome not assessed **Adverse consequences**	1-year follow-up (n=626): Intervention (61.9%); control (60.8%), p=0.77 2-year follow-up (n=595): Intervention (61.9%); control (56.1%), p=0.18 3-year follow-up (n=548): Intervention (57.3%); control (47.4%), p=0.02 Overall: p=0.08 Sunglasses use 1-year follow-up (n=626): Intervention (5.2%); control (8.3%), p=0.12 2-year follow-up (n=595): Intervention (24.2%); control (22.3%), p=0.58 3-year follow-up (n=548): Intervention (39.4%); control (29.9%), p=0.02 Overall: p=0.22 Composite score There was a significant effect for intervention (p=0.04) and time (p<0.0001). Sun protection behaviours declined over time in both groups. 1-year follow-up: Intervention (mean 18.55); control (18.40),p=ns 2-year follow-up: Intervention (18.52); control (18.05), p=0.04 3-year follow-up: Intervention 18.18); control (17.71), p=0.049 **Sun exposure** There were no significant	**review team** (1) it was unclear how primary care practices were randomised to intervention or control groups, (2) outcomes were reported through self-report rather than actual behaviours, (3) high attrition rates, (4) not a general population sample, participants were members of a managed care organisation, (5) limited details were provided on the provision of sunscreen samples, type of hats and sunglasses. Specific use of these items was not assessed. **Evidence gaps and/or recommendations for future research** The authors are evaluating a tailored, mailed intervention approach for older children, that follows them as they change insurance plans and health care providers. **Source of funding** National Cancer Institute (Ro1-CA74592); Schering-Plough (sunscreen samples and expenses for written materials); Imperial Headware (sun hats); while individuals provided funding for sunglasses and conducted skin examinations.

	Hispanic: Intervention 57 (15.7%); control 51 (14.0%) Other: Intervention 25 (6.9%); control 30 (8.3%) **Socioeconomic status** Family income (missing data n=37) <$25,000: Intervention 52 (15.1%); control 62 (17.9%) $25,000-$34,999: 53 (15.4%); control 54 (15.6%) $35,000-$49,999: 89 (25.8%); control 95 (27.5%) $50,000-$74,999: 84 (24.3%); control 85 (24.6%) $75,000+: 67 (19.4%); control 50 (14.6%) Responding parent's education level Less than high school: Intervention 29 (8.0%); control 21 (5.8%) High school graduate: Intervention 85 (23.4%); control 80 (21.9%) Some college/technical school: Intervention 90 (24.8%); control 114 (31.2%) College graduate: Intervention 97 (26.7%); control 88 (24.1%) Post-graduate training: Intervention 62 (17.1%); control 62 (17.0%) **Skin type** Child's skin colour Fair white: Intervention 160 (45.1%); control 158 (43.6%)	Usual care (discussion on the use of sunscreen in children aged 6 months and older, based on prompt sheet). **Intervention period** 1998 to 2001 **Sample size** n=728 families **Baseline comparisons** The groups were similar at baseline **Study sufficiently powered** It was estimated that 10 clusters with 50 participants per cluster would provide 80% power to detect a 2.5 point difference on the usual practices scale with a 2-tailed test (based on assumptions of intraclass correlation of 0.1). Representing a 12-15% difference between groups on the scale. For mole counts, power to detect a 4-mole difference between groups was estimated using a 2-tailed test.	Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** Health care providers completed surveys at baseline and 1, 2 and 3 year follow-up, which asked how often providers included anticipatory guidance topics in well-child care and how often they included the seven specific sun protection topics in discussions. **Follow-up period** 3 years (outcomes assessed at 12, 24, and 36 months) **Method of analysis** A mixed model analysis of variance was used (participants were nested within the primary care office then removed from the model as there was no intraclass correlation by office). To assess the differences between groups in individual sun practices, survey responses were collapsed to binary observations (always/'frequently versus	differences in mid-day sun avoidance and limited time in the sun between intervention and control groups at any time point. Mid-day sun avoidance 1-year follow-up (n=626): Intervention (70.6%); control (64.9%), p=0.13 2-year follow-up (n=595): Intervention (63.2%); control (62.0%), p=0.75 3-year follow-up (n=548): Intervention (64.2%); control (59.0%), p=0.21 Overall: p=0.14 Limit time in sun 1-year follow-up (n=626): Intervention (48.9%); control (47.5%), p=0.72 2-year follow-up (n=595): Intervention (38.1%); control (35.4%), p=0.49 3-year follow-up (n=548): Intervention (32.1%); control (34.3%), p=0.59 Overall: p=0.97 There was a statistically significant difference between intervention and control groups in the use of shade. Follow-up t-test indicated significant between group differences at year 2. Shade use 1-year follow-up (n=626): Intervention (90.0%); control (87.3%), p=0.29	

	Medium white: Intervention 119 (33.5%); control 133 (36.7%) Dark white: Intervention 64 (18%); control 58 (16.0%) Light brown: Intervention 10 (2.8%); control 10 (2.8%) Medium brown: Intervention 2 (0.6%); control 2 (0.6%) Dark brown or black: Intervention 0 (0.0%); control 1 (0.3%)		seldom/never). A binary Markov model was used to allow for serial correlation on all observations for each participant. t-tests were used to examine the differences in tanning and number of nevi between intervention and control groups, with a log transformation used on number of nevi due to skewed data. Chi-square analysis was used to test differences between groups in proportion of children with any freckling.	2-year follow-up (n=595): Intervention (79.2%); control (71.9%), p=0.04 3-year follow=up (n=548): Intervention (72.6%); control (65.2%), p=0.06 Overall: p=0.03 38% of children completed the skin examination (n=280). There were no statistically significant differences in freckling in the intervention group compared with controls (12.8% versus 17.1% respectively, p=0.20) and the number of nevi (6.30 versus 5.64 respectively, p=0.56). There were no statistically significant differences in mean unexposed skin colour between intervention (13.8) and control groups (13.9), p=0.71, exposed skin colour (intervention 18.0; control 18.4, p=0.13), or tanning (intervention 4.2; control 4.6, p=0.14). **Other outcomes** Parents indicated that sun protection advice was delivered significantly more often by health providers at intervention medical offices compared with controls over the 3-year follow-up (p<0.001). Provider discussed sun protection 1-year follow-up (n=626): Intervention (75.7%); control	

				(48.1%) 2-year follow-up (n=595): Intervention (73.5%); control (52.5%) 3-year follow-up (n=548): Intervention (75.0%); control (52.6%) Provider gave written or other materials about sun protection 1-year follow-up: Intervention (74.0%); control (36.8%) 2-year follow-up: Intervention (76.8%); control (34.9%) 3-year follow-up: Intervention (72.5%); control (40.2%) Provider discussed limiting time in sun 1-year follow-up: Intervention (13.2%); control (7.1%) 2-year follow-up: Intervention (12.2%); control (3.3%) 3-year follow-up: Intervention (11.4%); control (3.0%) Provider discussed sunscreen use 1-year follow-up: Intervention (67.2%); control (43.5%) 2-year follow-up: Intervention (65.5%); control (47.8%) 3-year follow-up: Intervention (66.9%); control (45.9%) Provider discussed avoiding the midday sun 1-year follow-up: Intervention (31.8%); control (7.1%) 2-year follow-up: Intervention (27.5%); control (15.4%)	

				3-year follow-up: Intervention (33.1%); control (13.8%) Provider discussed using clothing 1-year follow-up: Intervention (27.5%); control (10.6%) 2-year follow-up: Intervention (20.6%); control (7.0%) 3-year follow-up: Intervention (22.8%); control (6.0%) Provider discussed using shade 1-year follow-up: Intervention (18.2%); control (10.0%) 2-year follow-up: Intervention (13.2%); control (4.6%) 3-year follow-up: Intervention (19.1%); control (6.7%) Provider discussed using hats 1-year follow-up: Intervention (43.4%); control (20.0%) 2-year follow-up: Intervention (38.0%); control (17.4%) 3-year follow-up: Intervention (33.5%); control (16.8%) Exit interviews also confirmed that sun-protection advice was delivered more often by providers in the intervention group than the control group. **Attrition details** Continued enrolment declined over time: year 1 (78.6%); year 2 (64.4%); year 3 (60.4%). Response rates to each annual parent survey; 86% (1999); 82%	

				(2000); 75% (2001). 469/728 completed all four surveys (baseline and 3 follow-ups), and 144 completed three surveys. Skin examinations were completed on 280 (38%) children. Provider surveys were completed by 88% of providers in 1998, 84% in 1999, 83% in 2000, and 81% in 2001.	
Author Franklin et al.[47] **Year** 2003 **Study aim** To assess parents' knowledge, awareness, attitudes, beliefs and behaviour toward the sun and the level of parents' encouragement to have their children use sun protective measures. **Study design** Before and after **Internal validity** - **External validity** -	**Country** United States **Setting** Paediatric clinics **Source population** Five Cook Children's Physician's Network (CCPN) paediatric clinics **Eligible population** Parents and their children attending the clinic for a well child or six-month immunisation visit. **Selected population** Phase I: n=57 Phase II: n=51 agreed to be contacted, but only 23 (45%) completed the post-intervention questionnaire and are included in the analyses **Age** <20: 1 (4.3%) 20-30: 10 (43.5%)	**Method of allocation** Not applicable **Intervention** Based on key concepts and elements of the Health Belief Model, Social Learning Theory, and Self-efficacy. Slip! Slop! Slap! video (played randomly in waiting rooms, with the exception of one clinic that did not have a video player). Participants received a verbal message along with a a gift bag containing sun protective materials (tote bag with SLIP!, SLOP!, SLAP! slogan, pink floral or blue wide-brimmed hats with slogan, face moisturiser samples with SPF 15, sunblock samples with SPF 30, a white t-shirt with slogan, a manufacturer's sunscreen coupon and American Cancer Society educational materials). **Comparator**	**Sun protection practices** Use of sunscreen Use of shade Use of protective clothing or hat Use of sunglasses Parents were asked questions on their use of sun protection practices with their children (recorded as the number answering yes). Composite measure of behaviours Nine sun protection practices averaged (mean and standard deviation): (1) apply sunscreen 30 mins before going outdoors, (2) wear sunscreen/sunblock, (3) wear a wide-brimmed hat, (4) seek shade, (5) use an umbrella, (6) wear sunglasses with ultraviolet protection), (7) reapply sunscreen every 2 hours, (8) avoid midday sun, (9) wear protective clothing. Each response was given a score ranging from 1 (rarely engage in	**Sun-protection behaviours** Parents There was a statistically significant increase in the number of parents applying sunscreen 30 minutes before going outdoors after the intervention (p<0.10), seeking shade (p<0.10), using an umbrella (p<0.10), and in the number of parents wearing protective clothing (p<0.10). The remaining comparisons were non-significant. Apply sunscreen 30 mins before going outdoors: Pre-intervention n=4 (17.4%); post-intervention n=9 (39.1%) Wear sunscreen/sunblock: 15 (65.2%); 15 (65.2%) Wear a wide-brimmed hat: 2 (8.7%); 1 (4.3%) Seek shade: 13 (56.5%); 18 (78.3%) Use an umbrella: 0 (0%); 3 (13.0%) Wear sunglasses with ultraviolet protection: Pre 19 (82.6%); post	**Limitations identified by author** (1) small sample size (plus a pilot study), (2) the participant demographic characteristics (age, gender, ethnicity, race, education, and income) cannot be generalised to the population as a whole due to skewed data (highly educated Caucasians with high incomes). **Limitations identified by review team** (1) this was a non-randomized pilot study with a small sample size, (2) it was unclear how much exposure participants had to the components of interest (e.g. sunscreen) as these were presented as gifts rather than part of the intervention, (3) outcomes were self-reported rather than actual behaviours, (4)the significant level adopted for use with the McNemar test was p=0.10, (5) multiple comparisons were used without

	31-40: 12 (52.2%) **Female** n=20 (87.0%) **Race/ethnicity** White, non-Hispanic: 20 (87.0%) Black, non-Hispanic: 1 (4.3%) Hispanic: 2 (8.7%) **Socioeconomic status** Income <$21,000: 1 (4.3%) $21,000-$65,000: 12 (52.1%) >$65,000: 10 (43.5%) Highest level of education completed High school: 2 (8.7%) Some college: 9 (39.1%) Completed college: 8 (34.7%) Graduate/professional school: 4 (17.3%) **Skin type** Fair, always burns, never tans (Celtic, Irish): 2 (9.1%) Fair, easily burns, minimally tans (Caucasian): 6 (26.0%) Sometimes burns, gradually tans (dark Caucasian): 12 (52.0%) Minimally burns, always tans (Mediterranean, Asian, Hispanic): 2 (9.1%) Rarely burns, always tans (American Indian, Mid-Eastern, Hispanic): 0 (0.0%) Rarely burns, always tans (Black, American, or other origin): 1 (4.3%)	Not applicable **Intervention period** Phase I: April 2001 Phase II: January 2002 **Sample size** n=23 **Baseline comparisons** Not applicable **Study sufficiently powered** Not reported	sun protective practices) to 9 (highly engage in sun protective practices). **Sun exposure** Stay out of the midday sun, measured on a scale from 1 (rarely engage in sun protective practices) to 9 (highly engage in sun protective practices). **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Attitudes and beliefs were measured on an ordinal scale by the total number of items marked (ranging from 1 to 8; 1 indicating unhealthy attitudes and 8 indicating healthy attitudes). Knowledge about the areas of the body that should be protected from the sun were measured on a 10 item list, if more than 5 items were marked, participants received a score of 1 (highly knowledgeable), five items were a score of 2 (knowledgeable), less than five items a score of 3 (limited knowledge). A composite score was calculated for knowledge and attitudes toward the sun. **Intention to engage in sun protection practices**	18 (78.3%) Reapply sunscreen every 2 hours: 8 (34.8%); 12 (52.2%) Wear protective clothing: 0 (0%); 3 (13.0%) Composite score, including avoiding the midday sun (mean and standard deviation): Pre-intervention 3.1 (SD 1.34); post-intervention 4.0 (1.84), p=0.038. There was a statistically significant decrease in the number of parents using a tanning salon pre- versus post intervention (6 (26%) vs 3 (13%) respectively), but no differences in pre- and post intervention behaviours in the use of sunscreen/sunblock on cloudy and overcast days (11 (47.8%) at both times) or knowledge of sun protection factor (21 (91%) pre- and post intervention). Children There was a statistically significant increase in the number of parents using measures to encourage their children to seek shade after the intervention ($p<0.10$), but the remaining comparisons were non-significant. Apply sunscreen 30 mins before going outdoors: Pre-intervention 13 (56.5%); post-intervention 16 (69.6%)	any correction. **Evidence gaps and/or recommendations for future research** The authors suggest that paediatricians should consider incorporating and promoting sun awareness programmes in their practice, and the findings from this study may be a useful guide for future skin cancer awareness projects and community interventions. **Source of funding** Gift items were provided by the American Cancer Society, Chelsea & Scott, Johnson & Johnson, and Galderma.

	Other Number of children One: 11 (47.8%) Two: 8 (34.8%) Three: 3 (13.0%) Four: 1 (4.3%)		Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** No **Follow-up period** Approximately 9 months post phase I survey **Method of analysis** Paired t-tests, and McNemar paired 2 x 2 test with contingency correction were used to test for differences in parents' pre- and post-intervention scores. Chi-squared was used to assess the effects of parent's age, gender, ethnicity, race, education, and income on attitudes, knowledge, behaviours, and beliefs.	Wear sunscreen/sunblock: 18 (78.3%); 21 (91.3%) Wear a wide-brimmed hat: 12 (52.2%); 17 (73.9%) Seek shade: 15 (65.2%); 20 (87.0%) Use an umbrella: 5 (21.7%); 6 (26.1%) Wear sunglasses with ultraviolet protection: 14 (60.9%); 13 (56.5%) Reapply sunscreen every 2 hours: 12 (52.2%); 16 (69.6%) Wear protective clothing: 5 (21.7%); 3 (13.0%) Composite score, including avoiding the midday sun (mean and standard deviation): Pre-intervention 4.62 (SD 1.34); post-intervention 4.0 (1.84), p=0.13. **Sun exposure** Parents There was a statistically significant increase in the number of parents avoiding the midday sun after intervention (p<0.05): Pre 6 (26.1%); post 14 (60.9%) Sun protection measures used on children There was a statistically significant increase in the number of measures parents used to encourage their children to avoid the midday sun post intervention (p<0.05): Pre 10 (43.5%); post 18 (78.3%)	

				Knowledge, attitudes, beliefs Attitude There was a statistically significant decrease in the number of parents who believed that tans were healthy post-test (p<0.10), but for the other questions there was no significant difference between groups (p>0.01). Enjoy being out in the sun (attitude): Pre-intervention 22 (96%); post-intervention 21 (91%) Believe tans are healthy (attitude): 14 (61%); p 8 (35%) Believe being in the sun is healthy: 15 (65%); 16 (70%) Healthy and unhealthy attitudes towards the sun There was a significant increase in parents' knowledge toward the sun post-intervention on the following questions: Makes vitamins: Pre-intervention 9 (39.1%); post-intervention 18 (78.3%), p<0.05 Makes me feel good: 13 (56.5%); 21 (91.3%), p<0.10 Makes me look good: 14 (61.0%); 18 (78.3), p<0.10 Clears up my skin: 6 (26.1%); 14 (60.9), p<0.10 Causes cataracts: 5 (21.7%); 13 (56.5%), p<0.01 Causes wrinkling: 18 (78.3%); 23 (100%), p<0.05	

				There were no significant changes on parents knowledge or in attitudes towards sun as a cause of skin cancer: 22 (95.1%); 21 (91.3%), and a cause of sunburn: 21 (91.3%); 22 (95.7%) Composite score (mean and standard deviation): Pre 4.86 (1.52); post 6.45 (1.63), p<0.001 Areas of the body that should be protected There was a significant decrease post-intervention in parents' knowledge about parts of the body that should be protected: Nose: Pre-intervention 23 (100%); post-intervention 15 (65.2%), p<0.05 Ears: 21 (91.3%); 12 (52.2%), p<0.01 Neck: 21 (91.3%); 14 (60.9%), p<0.10 Shoulders: 22 (95.7%); 14 (60.9%), p<0.01 Scalp: 19 (82.6%); 10 (43.5%), p<0.05 Lips: 19 (82.6%); 10 (43.5%), p<0.10 Feet: 19 (82.6%); 10 (43.5%), p<0.05 Overall score Knowledgeable: Pre 21 (91.3%); Post 15 (65.2%) Limited knowledge: Pre 2 (8.7%); post 8 (34.8%)	

				Attrition details 23 of 51 Phase I participants who agreed to participate completed the post-intervention questions (45.1%)	
Author Geller[48] **Year** 1999 **Study aim** To assess the impact of sun protection education in the maternity unit on mothers' sun protection practices for their infants one year after receipt of materials. **Study design** Before and after **Internal validity** - **External validity** -	**Country** United States **Setting** Maternity section of a hospital. **Source population** Maternity unit, Falmouth Hospital, Massachusetts, US **Eligible population** All mothers with Falmouth addresses who were admitted to the maternity unit of Falmouth Hospital (prior to delivery) **Selected population** n=187 mothers; more than 50% of mother (n=70) had at least one child; 51% had intentionally sought a tan in the past two years prior to delivery; and 44% considered themselves to be at higher than average risk of developing skin cancer. **Age** Not reported **Female** 100% **Race/ethnicity** Not reported	**Method of allocation** Not applicable **Intervention** Mothers received educational kits about sun protection at the hospital (within 24 hours of delivery), including tip sheets, sun protection pamphlets, bibs, hats, magnets, and sand pails with the Falmouth Safe Skin Project 'Ban the Burn' logo. Some mothers also received one-to-one discussion with a member of staff about sun protection practices for their infants. Initially, half the mothers were to receive sun protection education kits and the other half was to receive kits plus personal discussion with health providers. However, some mothers in the kit-alone group asked for and received personal discussion as well. **Comparator** Not reported **Intervention period** February 1995 to February 1996 **Sample size** n=187 mothers	**Sun protection practices** Use of sunscreen Use of protective clothing or hat 12 item telephone survey. **Sun exposure** Number of hours per week their child spent outdoors in direct sunlight, based on survey question The number of burns their child received in the past year and how serious the burns were (slight, mild or severe), based on survey question. **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Mothers completed a 12-question survey, including	**Sun-protection behaviours** 114 of 136 (84%) mothers correctly did not use sunscreen on their infants in the first 6 months post delivery. 121 of 135 (89%) mothers reported their infants always or almost always wore a hat in direct sunlight. **Sun exposure** 122 of 136 (90%) mothers reported their child spent less than three hours per week outdoors in direct sunlight. 18 of 136 (13%) mothers reported their child received no more than one sunburn in the past year, of these 14 were reported as slight, three as mild, and one as severe. **Process and implementation** 88% of mothers stated that receiving educational materials in the maternity unit was a 'good time'. 120 of 136 (88%) remembered receiving and reading the materials; n=71 read at home, n=55 in the hospital, and n=22 read again during the previous summer.	**Limitations identified by author** (1) limited information on the mothers' sun protection practices for their infant during the one year follow-up, (2) no control groups, which means that any connection between the hospital intervention and the mothers' sun protection practices for their infants cannot be determined, (3) cannot account for other positive influences such as media coverage of skin cancer. **Limitations identified by review team** (1) The component of interest was only a small part of the intervention and it is not clear how many mothers used the hats provided and what design of hat was used, (2) it is unclear how the hospital was selected, (3) lack of data on mother and infant characteristics, (4) limited details on the intervention, in particular the component of interest, (5) (6) reliance on self-report, (7) limited outcome data, (8) high attrition rates, (9) small sample size, (10) short intervention period and short follow-up.

	Socioeconomic status Not reported **Skin type** Not reported	**Baseline comparisons** Not applicable **Study sufficiently powered** Not reported	questions on the appropriateness of sun protection education during the hospital stay; recollection of receiving materials (and where the materials were read); and other interactions with health providers regarding sun protection in the previous year. **Other outcomes** No **Follow-up period** 12 months **Method of analysis** Percentages were calculated	64% of mothers said the information received through the programme was their only source of sun protection information from a provider in the past year. **Attrition details** 51 (27%) of mothers unreachable at follow-up	**Evidence gaps and/or recommendations for future research** The authors state that further research is needed to replicate the high patient acceptance of timeliness of this intervention. Further research needs to include a more rigorous evaluation process, including a control group and a measurable change in the parents' sun protection practices. **Source of funding** Not stated
Author Norman et al.[45] **Year** 2007 **Study aim** To evaluate a 2-year, minimal intensity multi-component primary care-based intervention to increase sun protection behaviours in adolescents. **Study design** RCT **Internal validity** - **External validity** -	**Country** United States **Setting** Primary care setting. **Source population** Forty-five primary care providers from six clinic sites in San Diego County, California, USA **Eligible population** Adolescent children aged 11 to 15 years in 3366 households who could be contacted by telephone and parents and adolescents agreed to participate. **Selected population** 1,682 households were successfully contacted and	**Method of allocation** Randomised (no further details provided) **Intervention** (1) 20 minute interactive computer sessions (Sun Smart sun protection computer programme) at primary care office based on the transtheoretical model and tailored to assess and feedback on stage of change, decisional balance, self-efficacy, and processes of change, (2) two page printed tailored feedback containing feedback on computer session, (3) brief counselling (2-3 minutes) from primary care providers based on stage of change for sun protection (i.e. using sunscreen, covering up, avoiding midday sun), (4)telephone assessments with	**Sun protection practices** Use of sunscreen Use of shade Use of protective clothing or hat Composite measure of behaviours Participants responded to a 7-item scale using a 5-point Likert scale; 1 (never) to 5 (always). Items included (1) how often do you wear a shirt?, (2) how often do you stay in the shade?, (3) how often do you avoid the sun during the midday hours?, (4) how often do you limit your exposure to the sun during the midday hours?, (5) how often do you use a sunscreen?, (6) how often do you use a sunscreen with an SPF of 15 or more on your face?, (7) how often do you use a sunscreen with an SPF of 15	**Sun-protection behaviours** At 24 months, adolescents in the intervention group responded significantly more to 'often' or 'always' avoiding the sun, limiting exposure to the sun, using sunscreen, using SPF 15 sunscreen on the face, and using SPF 15 sunscreen on all sun-exposed body parts (all $p<0.05$). The data were presented as a graph rather than exact response frequencies. There were no significant differences between groups in the use of shirts or shade. Mixed effects repeated-measures model Baseline There was no statistically significant difference in baseline sun protection behaviour status	**Limitations identified by author** (1) self-report measures for outcomes, (2) test-retest reliability of the individual sun protection practices ranged from poor to good, making the interpretation of changes in individual behaviours less reliable, (3) generalisability of the findings may be limited to children under the age of 11 years, adolescents who have health insurance, and to regions of the US where there is little seasonal fluctuation in sun exposure and temperature and allows for year-round opportunities to be outside, (4) high drop-out rate, (5) small to moderate treatment effect. **Limitations identified by**

	agreed to participate. Baseline assessments were completed by 878 adolescents, 819 beyond the intervention, therefore data presented for n=819 (Intervention n=395; control n=424). Sample sizes may vary for demographics and stage of change characteristics due to missing data. **Age** Intervention (mean SD) (n=395): 12.7 years (1.4) Control (n=424): 12.7 (1.3) **Female** Intervention: 216 (54.7%) Control: 222 (52.4%) **Race/ethnicity** Asian/Pacific islander: Intervention 9 (2.3%); control 17 (4.0%) African American: Intervention 18 (4.6%); control 36 (8.5%) Native American: Intervention 3 (0.8%); control 3 (0.7%) Hispanic: Intervention 46 (11.6%); control 61 (14.4%) White: Intervention 246 (62.3%); control 232 (54.7%) Multiethnic/other: Intervention 73 (18.5%); control 75 (17.7%) **Socioeconomic status** Highest household educational level No high school to associate's degree: Intervention 127	health counsellor at 3-, 6-, 15-, and 18-months, (5) tailored feedback report following each telephone contact, (6) 90 mL bottle of SPF 15 sunscreen with each feedback report, (7) mailed tip sheets periodically sent by health counsellors. Participants could receive up to six intervention contacts consisting of two interactive sessions in the primary practice and four mailed feedback reports. **Comparator** Physical activity and diet intervention targeting physical activity, sedentary behaviour, total intake of fat, and servings per day of fruits and vegetables. Included (1) computerised expert system kiosk in the primary care provider's office, (2) monthly stage-matched telephone calls, (3) printed manual, and (4) mail contact for 24 months. **Intervention period** 2002 to 2004 **Sample size** n=819 adolescents **Baseline comparisons** No differences between intervention and control group in gender, age, highest household educational level, or sun sensitivity level at baseline. There	or more on all your sun-exposed areas? **Sun exposure** See above **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** Self-reported intention to avoid sun exposure, wear protective clothing, and use sunscreens with an SPF of 15. A short algorithm was used to classify adolescents into one of five stages of change: precontemplation, contemplation, preparation, action, and maintenance. **Follow-up period** Two years (outcome assessed at 6, 12 and 24 months) **Method of analysis** Mixed-model repeated-measures	for the two groups, parameter estimate -0.05 (95% CI: -1.43 to 1.32, p=0.94). Group X time There was a statistically significant increase in sun protection behaviours in both groups over time, parameter estimate 1.74 (95% CI: 0.66 to 2.82, p=0.002); with a greater increase over time in the intervention group compared with the control group, parameter estimate 2.36 (95% CI: 0.79 to 3.94, p=0.03). Quadratic parameter There was a statistically significant difference in the slope over time, parameter estimate -0.48 (95% CI: -0.84 to -0.13, p=0.008), indicating a curving of trajectories. There was no statistically significant change in slope over time between the two groups, parameter estimate -0.49 (95% CI: -1.01 to 0.02, p=0.06). There was no significant difference between intervention and control group being in the action or maintenance stage of change at 6 months (17.8% versus 14.3% respectively), OR 1.14 (95% CI: 0.74 to 1.76). There was a greater increase in the number of adolescents in the intervention group compared with the control group being in	**review team** (1) Did not assess provision of free sunscreen, only sunscreen samples were provided and use of these was not specifically assessed, (2) it is unclear how randomisation was performed. **Evidence gaps and/or recommendations for future research** The authors suggest conducting similar intervention programmes in older adolescents and adults. **Source of funding** Grants R01CA081495, R01CA113828, and R01CA085873 from the National Cancer Institute, National Institutes of Health. Adolescents in both study groups received lottery tickets for small cash prizes ($10-$50) conducted every six months. Dropout rates may behigher where interventions are provided without payment for participation. Participants also received payments after completion of assessments; $10, $15, $20, and $40 at 6-, 12-, and 24-months respectively.

	(33.0%); control 142 (34.1%) Bachelor's degree: Intervention 104 (27.0%); control 134 (32.2%) Graduate or professional degree: Intervention 154 (40.0%); control 140 (33.7%) **Skin type** Sun sensitivity (based on the skin's reaction to the sun, untanned skin colour, and hair colour - scored from 0 to 10) Good natural protection: Intervention 107 (27.1|%); control 146 (34.4%) Moderate sensitivity: Intervention 182 (46.1%); control 178 (42.0%) High sensitivity: Intervention 106 (26.8%); control 100 (23.6%) Other Stage of change for sun protection (based on avoiding sun exposure, wearing protective clothing, and using sunscreens with an SPF of 15) Pre-contemplation: Intervention 58 (14.7%); control 105 (25.1%) Contemplation: Intervention 95 (24.1%); control 86 (20.5%) Preparation: Intervention 198 (50.1%); control 168 (40.1%) Action and maintenance: Intervention 44 (11.1%); control 60 (14.3%)	was a significantly greater number of non-white adolescents in the control group (45.3%) compared with intervention group (37.7%) ($p<0.05$). **Study sufficiently powered** 760 adolescents needed to provide 80% power to detect a small effect size (Cohen d = 0.21) at significance level 0.05.	analysis that included a between-participants factor of treatment group, a within-participant factor of time (0, baseline; 1, 6 months; 2, 12 months; 3, 24 months), and the treatment x time interaction. The models were also run using quadratic parameters for time, and treatment x time. The sun protection score was standardised to T-scores (mean, 50; SD, 10). Logistic regression models were use to test the effect of the intervention on stages of change (from preaction at the start of the study to action or maintenance stage at 6-, 12-, and 24-months) including baseline stage, gender, age category, sun sensitivity, and treatment group.	the action or maintenance stage of change at 12 months (22.5% versus 13.4% respectively), OR 1.71 (1.09 to 2.68), and at 24 months (25.1% versus 14.9% respectively), OR 1.74 (95% CI: 1.13 to 2.68). **Sun exposure** As above **Attrition details** Baseline (number randomised and began intervention): Intervention n=395; control n=424 6 months: Intervention 371/395 (93.9%) completed assessment (24 discontinued); control 365/424 (86.1%) completed (34 discontinued, 25 were not assessed) 12 months: Intervention 297/395 (75.2%) completed (9 discontinued, 65 were not assessed); control 353/424 (83.2%) completed (9 discontinued, 29 were not assessed) 24 months: Intervention 315/395 (79.7%) completed (1 discontinued, 44 were not assessed); control 341/424 (80.4%) completed (3 discontinued, 37 were not assessed)	

Table F: Provision of multi-component interventions in work settings evidence tables

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
Author Azizi et al.[4] **Year** 2000 **Study aim** To assess the effects of a worksite graded intensity intervention programme for primary and secondary prevention of skin cancer and sun-related ocular lesions. **Study design** Non-randomised controlled trial **Internal validity** - **External validity** -	**Country** Israel (not an OECD country) **Setting** Work **Source population** All outdoor workers from four water units of Mekorot, the Israeli National Water Resource Company **Eligible population** Permanent workers from three water units located in different areas of south Israel (deployed up to 450 km apart); and one unit in central Israel (deployed up to 120 km apart). **Selected population** 144/280 (68%) male outdoor workers **Age** Mean age: 42 years (range 23-63) ≤35 years: complete (24.4); partial (26.4); minimal (31.4)	**Method of allocation** Not reported **Intervention** Participants received complete, partial, or minimal intervention in two waves, one year apart. The complete intervention included (1) assignment and training of safety officers, (2) a 90-minute health education session on the risk of skin cancer and eye lesions associated with sun exposure, educational brochures of the Israel Cancer Association, and skin examinations in the first wave, including screening of the entire skin area for phenotypic risk factors of skin cancer (fair skin colour, freckles, moles), diagnosis of acute and chronic sun-induced skin damage (sunburn, premature aging of the skin) and precancerous or skin cancer lesions. In the second wave, the above (1 and 2) were provided, plus the provision of personal sun-protective gear (wide brimmed hats, standard sunglasses, and topical sunscreens). **Comparator** The partial intervention included (1) assignment and training of safety officers, (2) a 90-minute health	Questionnaires were administered to all participants one week prior to the first intervention pulse, and 8 months following the first and second intervention pulses. **Sun protection practices** A single question (measured using an ordinal scale from 1 (no use) to 7 (use every day)) measured the change in frequency of sunscreen use. Inventories were taken to measure the number of sunscreen packages used. **Sun exposure** The amount of solar UVR reaching the outdoor workers during a working day was measured through change in working schedules and use of structural shadow (using a correction factor, with 1 indicating a non-shaded area, 0.5 indicating shade, and 0.05 indoors). The proportion of skin exposed to the sun was calculated according to the reported site-specific dress habits on a typical work day using the standard burn index.	**Sun-protection behaviours** The use of sunscreen pre-intervention was 1.8 (out of a score of 7) and was similar between groups. There was a statistically significant increase in the use of sunscreen in all three groups at interim- compared to pre-test, with no evidence of between group differences. A further significant increase was reported at post-test among the complete and partial groups (+80% and +52%, respectively). Inventories reported a 30% use of total volume of sunscreens in the complete group. The use of sunscreen was similar at interim- and post-test in the minimal group, but this was 53% lower compared to other groups ($p<0.01$). **Sun exposure** There was a decrease in the mean sun exposed area in the complete group; 20% to -35% at interim and to -25% at post-test, but there was no significant difference at interim or post-test in the partial group. The minimal group showed a	**Limitations identified by author** (1) Relatively small sample sizes, with high attrition rates, (2) potential for selection or referral bias due to differences in responders and non-responders, (3) potential bias through self-report questionnaires, (4) limitations with inadequate dose increments, and (5) some contamination between groups. **Limitations identified by review team** (1) There were significant differences between the three groups and it was unclear whether groups receiving personal sun-protection gear adhered to wearing the clothing. **Evidence gaps and/or recommendations for future research** The authors suggest that further research is warranted to achieve a 'gold standard' for successful primary and secondary prevention of skin cancer (ie. reduced morbidity and mortality). To further improve and increase the benefits of sun protection on the vulnerable target group, the extent and frequency of future interventions

	36-45 years: complete (45.9); partial (38.9); minimal (40.0) ≥46 years: complete (29.7); partial (34.7); minimal (28.6) **Race/ethnicity** Origin (%) Israel: complete (2.7); partial (8.3); minimal (12.1) Eastern (father born in Africa/Asia): complete (70.3); partial (59.7); minimal (66.7) Western (father born in Europe/America): complete (27.0); partial (31.9); minimal (21.2) **Socioeconomic status** The mean number of years in education was 12 (range 8-18) <12 years: complete (38.2%); partial (40.9%); minimal (27.3%) 12 years: complete (20.6%); partial (33.8%); minimal (48.5%) >12 years: complete (41.2%); partial (25.3%); minimal (24.2%) Approximately 50% of workers were blue-collar maintenance workers: and 50% were white-collar engineers,	education session, educational brochures, and skin examinations in the first wave, then (3) personal sun-protective gear (as above) only in the second wave. The minimal intervention included no intervention in the first wave, then a 90-minute health education session, educational brochures, and skin examinations in the second wave. **Intervention period** June 1995 for 20 months **Sample size** Complete: n=37 Partial: n=72 Minimal: n=35 **Baseline comparisons** Non-responders were characterised by lower levels of education compared with responders (10.8 years versus 12.0 years respectively, p<0.01); a higher rate of smokers (57.1% versus 30.0%, p<0.01); and a lower rate of previous sunburn episodes (31.5% versus 64.6%, p<0.01). **Study sufficiently powered** Not reported	**Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Outcome not assessed **Other outcomes** The rate of self examination of the skin for early signs of skin cancer was measured by the response to one question (never, once a year, more often). **Follow-up period** 20 months **Method of analysis** Independent sample t-tests were used to compare sunscreen use, sun-exposed skin surface and mean daily UVR, and Pearson chi-square tests were used to compare the rate of self-skin examination. Paired t-tests were used to measure between group changes in pre- to interim- and from interim- to post-tests for sunscreen use, sun-exposed skin surface and mean daily UVR. Chi-	significant reduction from 20% at pre-test to -32% at interim- (p<0.01) but this increased to 30% post-test (p<0.05) At post-test the least sun-exposed skin area (15%) was reported in the complete intervention group, -25% less than in the partial group (p<0.05). All three groups had a 17% to 37% drop in the range of daily occupation solar UVR exposure dose (p<0.05), with no significant between group differences. Multiple regression indicated that a lower mean daily occupational solar UVR exposure dose at post-test was associated with more extensive intervention, higher level of education, and lower seniority in outdoor occupation. The rate of self-examination of the skin in the complete group increased by 42% from interim- to pre-test (p<0.05), with an additional 20% increase at post-test (p<0.005) There was a 59% increase at interim- compared to pre-test rate in the partial group, and this remained stable at post-test. The rate of self-	should be further evaluated. In addition, the cost-effectiveness of more intensive interventions remains to be evaluated. **Source of funding** Research grant from the Committee for Research and Prevention in Occupational Safety and Health, Israel Ministry of Labour and Social Affairs.

	electricians and supervisors **Skin type** Sunburn susceptibility Never: complete (13.5%); partial (21.4%); minimal (11.4%) Sometimes: complete (67.6%); partial (57.1%); minimal (57.1%) Always: complete (18.9%); partial (21.5%); minimal (31.4%) **Other** Married: complete (97.3%); partial (94.6%); minimal (80.8%) Secular religion: complete (51.3%); partial (46.5%); minimal (52.9%) Cigarette smoker: complete (35.1%); partial (31.9%); minimal (25.7%) Participate in sports: complete (21.6%); partial (16.7%); minimal (8.6%)		square tests were used for rate of self-skin examination. Analyses of variance and chi square tests were used to assess baseline differences between participants. Multiple regression analyses were conducted to assess the association between mean daily occupational UVR exposure dose and potentially confounding variables.	examination in the minimal group was 35% lower than other groups at interim- and post-intervention (p<0.05). **Attrition details** Overall 32.4% non-responders: (67 (24.0%) non-responders to the pre-test; 10 (5.0%) non-responders to the interim test; 53 (24.9%) non-responders to the post-test).	
Author Mayer et al.[49] **Year** 2007 **Related papers** Mayer 2009[50]	**Country** United States **Setting** US postal service stations Mean high daily temperatures across the baseline, 1-year, and 2-	**Method of allocation** US postal service stations were randomised to intervention or control, stratified by region. **Intervention** The multi-component intervention was based on an ecological model of behaviour emphasising the roles of	**Sun protection practices** A self-reported questionnaire was used to measure the occupational use of sunscreen (SPF 15 or higher) and wide-brim hats (2.5 or more inches wide) during the past five workdays using the following responses: never, sometimes, about half the	**Sun-protection behaviours** (1) Postal workers in the intervention group used significantly more sunscreen than the control group at all time periods; group-by-time interaction, p=0.018. Baseline (always): Intervention	**Limitations identified by author** (1) Colorimeter data were not consistent between the two colour dimensions as the measure may not perform as well and may not be sensitive to actual changes in ultraviolet radiation protective behaviours among adults with long-term year-round sun exposure, (2)

Study aim To assess whether US Postal Service letter carriers who received a sun safety intervention would wear wide-brim hats and sunscreen significantly more often while working than those who did not receive the intervention **Study design** Cluster RCT **Internal validity** + **External validity** +	year evaluation periods were 23°C (San Diego County), 35°C (Riverside County, non-desert and San Bernardino County), and 41°C (Riverside County-desert). **Source population** 70 US postal service stations in Southern California: San Diego County (n=53), Riverside County, non-desert and San Bernardino County (n=11), and Riverside County, desert (n=6). **Eligible population** 3,387 letter carriers at San Diego County postal stations and postal stations located closest to San Diego County. **Selected population** 2,869/3,387 letter carriers consented, with 2,662 completing the baseline survey. **Age** Mean age 43 years (SD 8.6) **Female**: 30.1% **Race/ethnicity** Non-Latino white: 51.3% Latino: 19.3%	environment and policy, on key constructs from operant models emphasising reinforcement and environmental prompts for changing behaviour, and on Social Learning Theory constructs of modelling, social influence, reciprocal determinism, and self-efficacy. The intervention included: (1) provision of protective hats (brim four inches wide in the front and back and three inches wide on the sides), and discounts on replacement hats, (2) provision of sunscreen (SPF 30) bottles and refill pump bottles in locker rooms, and 12-ounce bottles for each postal worker, which could be refilled from the pump bottles , (3)visual cues that prompted use of solar protective strategies (poster, water bottles, mouse pads, key chains, magnetic clips), and (4) delivery of six 5-10 minute educational sun safety messages on UVR as a skin cancer risk factor and the amount of UVR workers are exposed to' a case example of a former postal worker who recently had a precancerous growth removed; feasible protection strategies; and specific information about the hats and sunscreen. **Comparator** Delayed intervention; control stations received two year evaluation procedures only, then received the intervention (as above) over a one year period.	time, often, and always. Research assistants observed clothing worn during mail delivery times, and monitored the amount of sunscreen removed from the communal bottles each station for each intervention year (adjusted by the number of letter carriers). **Sun exposure** Colorimeters were used to measure two dimensions of skin colour on each participants face (Face L* and Face b*). **Long-term outcomes** Outcome not assessed **Adverse consequences** Outcome not assessed **Knowledge, attitudes, beliefs** Outcome not assessed **Intention to engage in sun protection practices** Outcome not assessed **Process and implementation outcomes** Exploratory analyses were undertaken to evaluate whether the number of educational sessions attended was associated with the outcomes (always versus other frequencies of wide-brim hat use or sunscreen use during the past 5 days).	(26.9%), Control (23.5%) 3 months: Intervention (39.4%), Control (23.1%), OR 2.78 (95% CI: 2.20 to 3.51) 1 year: Intervention (41.6%), Control (28.1%), OR 2.11 (95% CI: 1.68 to 2.65) 2 years: Intervention (39.2%), Control (26.3%), OR 2.03 (95% CI: 1.60 to 2.58) At 3 year follow-up (control groups had received 1-year intervention) there were no significant differences between groups: Intervention (38.3%), Control (34.3%), OR 1.08 (95% CI: 0.85 to 1.36). (2) The intervention group wore wide-brim hats significantly more often than controls; group interaction OR 2.88 (95% CI: 2.31 to 3.61, p<0.001). 3 months: OR 3.13 (95% CI: 2.43 to 4.03) 1 year: OR 2.40 (95% CI: 1.87 to 3.09) 2 years: OR 2.64 (95% CI: 2.03 to 3.43) At 3 year follow-up the difference remained significant: Intervention (43.8%), Control (33.0%), OR 1.44 (95% CI: 1.12 to 1.85). There was no significant group-by-time interaction up to 2	inferences could not be made about which intervention components were the most effective. **Limitations identified by review team** Self-report measures were used for the primary outcomes, and there appeared to be some conflict in colorimeter data findings; colorimeter data on Face L* was consistent with the intervention group being less tanned, but Face b* data were variable across time and did not match Face L* data. **Evidence gaps and/or recommendations for future research** The authors recommend that future studies evaluate the effects of the availability of hats and sunscreen both with and without educational sessions. **Source of funding** The National Institutes of Health, National Cancer Institute (grant R01 CA085980, R01 CA085980S1, R01 CA085980S2, and K05 CA10051).

	Asian: 12.4% African American: 8.3% Pacific Islander: 4.3% American Indian: 0.6% Other: 3.7% **Socioeconomic status** 71.7% had completed at least some college **Skin type** Workers reported a relatively low level of sun sensitivity (Fitzpatrick skin types III or IV (77.0%)) **Other** The mean number of years working for the US postal service was: 12.4 (SD 7.9), with an average of 3.9 hours worked outdoors daily (SD 1.9). Approximately 5.1% of participants reported a history of some type of skin cancer.	**Intervention period** 2001 to 2003 **Sample size** Intervention (35 postal stations): n=1,257 Control (35 postal stations): n=1,405 **Baseline comparisons** The intervention and control groups did not differ at baseline in terms of age, gender, level of sun sensitivity, race/ethnicity, history of skin cancer, average number of daily hours worked outdoors, or level of education. **Study sufficiently powered** To meet the required number of postal stations, all but two stations in the San Diego area were included in the study.	**Other outcomes** Not reported **Follow-up period** Three months, one year, and two years **Method of analysis** All analyses were based on an intention to treat basis, including all participants providing data for at least one follow-up time point. Trends in wide-brim hat use and sunscreen use over the two years were analysed using generalised linear mixed models that treated each follow up period as a set of repeated measures on each participant. Adjustments were made for postal station clustering using a multilevel model. Analyses were adjusted for the baseline level of the corresponding outcome variable. The time-by-group interaction was also analysed to determine whether the intervention effect remained constant over time and the group main effect. Adjustments for age, gender, and race/ethnicity were also made for each analysis. Colorimeter data were analysed using mixed effects regression models, using similar modelling methods to those used in the	years, but the interaction was significant at 3 year follow-up ($p<0.001$). Adjustments for age, gender, and race/ethnicity did not significantly alter the results for either outcome. **Sun exposure** Face L* There were no significant differences between intervention and control groups, or for group-by-time interaction. 3 months (mean): Intervention 56.27 (SE 0.16); Control 56.06 (0.16) 1 year: Intervention 55.79 (0.16); Control 55.57 (0.16) 2 years: Intervention 55.80 (0.16); Control 55.63 (0.16) Face b* There were no significant differences between intervention and control groups, but there was a significant group-by-time interaction ($p=0.009$). 3 months: Intervention 16.47 (0.065); Control 16.47 (0.065) 1 year: Intervention 16.44 ((0.065); Control 16.39 (0.065) 2 years: Intervention 16.15 (0.066); Control 16.24 (0.065)	

			primary outcome analysis. Subgroup analyses were conducted for non-Latino white participants only.	Subgroup analyses showed similar results. **Process and implementation** Exploratory analyses showed that the odds for reporting 'always' wore a wide-brim hat was 21% higher for each increase in the number of educational sessions attended (OR 1.21, 95% CI: 1.06 to 1.38, p=0.005); and for 'always' use sunscreen OR 1.18 (95% CI: 1.03 to 1.34, p=0.017). **Attrition details** Active participants at baseline: Intervention (n=1,349), Control (n=1,520) Attrition rates from baseline to 3 months: Intervention 47 (3.48%), Control 60 (3.95%) Attrition rates from 3 months to 1 year: Intervention 69 (5.30%), Control 72 (4.93%) Attrition rates from year 1 to year 2: Intervention 130 (10.54%) (2 postal stations withdrew), Control 62 (4.47%) Attrition from baseline to 2-year follow-up: Intervention 246 (18.24%), Control 194 (12.76%) Attrition rates at 3 year follow-up: Intervention 67 (6.75%), Control 66 (5.52%)	

Table G: Economics evidence table

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
Author Gordon et al.[29] **Year** 2009 **Study aim** To assess whether an intervention for skin cancer prevention that promotes the daily application of sunscreen among Caucasians in a sunny environment is a sound economic investment. **Type of economic analysis** Cost-effectiveness analysis **Economic perspective** Societal, excluding productivity costs. **Quality score** Potentially serious limitations **Applicability**	**Country** Australia **Setting** Community **Source population** The township of Nambour, Queensland **Demographics** No demographic information of Nambour, Queensland was given. **Data sources** The clinical effectiveness data were obtained from primary research, a randomised controlled trial.	**Intervention** Supply of water-resistant, broad-spectrum sunscreen with a sun protection factor of 15+; advice on application to the head, neck, arms and hands; and quarterly encouragement by nurses over a 5 year period **Comparator** Usual discretionary use of sunscreen **Sample size** n=1,621 Intervention=812 Control=809	**Primary outcomes** The primary outcome was the number of skin cancers on the head, neck, arms and hands prevented. The number of skin cancers included both basal and squamous cell carcinomas, which were reported separately. These are objective clinical outcomes. **Secondary outcomes** The number of actinic keratoses (AKs) prevented was reported on the head, neck, arms and hands. **Time horizon** 6 years **Discount rates** No discounting was conducted **Modelling method** Both the costs and benefits were derived from a single randomised controlled trial. However, treatment distributions for skin cancers were obtained from a review of the literature and the proportion of AKs that would	**Primary analysis** The incremental cost per skin cancer prevented was US$ 3,041. The total incremental costs for the project were US$106,449. The number of skin cancers prevented was 35. Of which, 11 were basal and 24 squamous. A total of 838 AKs were estimated to be prevented. **Secondary analysis** No sensitivity analysis results were reported in units that were consistent with the primary analysis. It is not clear that the results had any meaningful interpretation.	**Limitations identified by author** Medical costs of treating skin cancers were underestimated because 100% were assumed to be treated in primary care . This assumption was conservative with respect to the intervention. It was not possible to precisely measure the total number of AKs given the high incidence and high rates of spontaneous regression. There was a lack of evidence regarding the treatment patterns of AKs. **Limitations identified by review team** No discounting was conducted. The time horizon appeared to be 6 years, costs and benefits would occur at different time points and discounting should have been done. No discounting is likely to favour the intervention. The cut-off point of 6 years for both the intervention costs and measurement of

Partially applicable			be treated was set at 50% given no information. Probabilistic sensitivity analysis was conducted as well as one-way sensitivity analysis.		benefits means that the full benefits related to the intervention costs are unlikely to be fully captured. This is conservative with respect to the intervention. The analysis is limited by the short time horizon. The units in which the results of the sensitivity analyses were reported were different to the units in which the base case results were reported and these units did not have any meaningful interpretation. Without knowing why 15% of participants were not active for the duration of the study, it is not possible to assess the authors' claim that this would not have materially affected the results. The time horizon was not clear. It appeared to be 6 years; however, the results were reported to be for a period of 5 years. The age distribution of those that got skin cancers was not reported so it is not clear if the authors' claim that productivity costs were not relevant is correct. **Evidence gaps and/or**

					recommendations for future research The authors do not make any research recommendations. **Source of funding** Funded by the National Health and Medical Research Council