Preventing Skin Cancer: Interventions in Outdoor Recreational and Tourism Settings

Summary Evidence Table for Updated Search Period (June 2000–May 2011)

Study Details	**Population characteristics**	**Intervention Characteristics**	**Outcome measures**	**Results:** Effect Estimate (95% CI/ P-value)
Author, Year: Mahler, 2003 **Title:** Effects of appearance-based intervention on sun protection intentions and self-reported behaviors **Study Design:** Greatest (Group RCT) **Quality of Execution**: Fair **Location:** USA (San Diego)	**Target population:** Adult beach visitors **Setting** (Type of outdoor recreation setting): Public Beach **Demographics:** Gender: Female (79%) Age (Mean age): 35 yrs Skin type: Burn, never tan 9.2% Burn easy, then develop light tan 27.6 Burn moderately, then develop light tan 31.6 Race/Ethnicity: Caucasian (84%) SES (Education level): NR	**Intervention:** Appearance based intervention **Intervention implementation period:** Late July and early August 2000 **Intervention components:** <u>Educational:</u> Photoaging information: delivered via a brochure included factual information (e.g., the incidence and causes of photoaging, methods for protection) UV facial photo: UV facial photographs were taken with a modified instant Polaroid camera that has a special UV filter. Each person who had a UV photo taken also had a natural light instant photo taken for comparison. In all cases, the natural light black-and-white photograph was shown to participants first, followed by the UV photo <u>Environmental:</u> Both intervention and control groups received free sunscreen **Intervention for Control group:** Free sunscreen	**Follow-up period:** One month **Outcomes of Interest:** <u>Protective behaviors</u>: (self - reported) 1. Use of sunscreen: a) Frequency of overall sunscreen use b) Frequency of sunscreen use during sunbathing c) Frequency of sunscreen use during incidental exposure 2. **<u>Sun exposure</u>** (self-reported) a) Intentional sun exposure (estimated number of hours spent during sunbathing following the intervention.)	**Population size(n):** Intervention group: Arm 1 (Photoaging information): 19 ; Arm 2(UV photo): 17; Arm 3 (both): 11 Control group: 16 **<u>Protective behaviors: (Change in mean (SD))</u>** 1. <u>Use of sunscreen (post only data)</u>: a) Frequency of overall sunscreen use Intervention Control ES Arm 1 : 0.84 (0.38) 0.88(0.34) -0.04SD Arm 2 : 0.82 (0.39) 0.88 (0.34) -0.06SD Arm 3 : 0.82 (0.41) 0.88 (0.34) -0.06SD b) Frequency of sunscreen use during sun bathing Intervention Control (n=10) ES Arm 1 (n=9): -0.01(0.64) 0.48 (0.50) -0.49 SD Arm 2(n=8): -0.01(1.09) 0.48 (0.50) -0.49 SD Arm 3 (n=4): 0.19(0.74) 0.48 (0.50) -0.29 SD c) Frequency of sunscreen use during incidental exposure Intervention Control (n=11) ES p-value Arm1(n=7): -0.12 (0.75) -0.08(0.90) -0.04SD <0.53 Arm2(n=10): 0.59 (0.93) -0.08(0.90) 0.67SD <0.01 Arm3(n=12): 0.55 (0.51) -0.08(0.90) 0.63 SD <0.53 2. **Sun exposure:** a) Sun exposure during sunbathing Hours of sunbathing (Mean hrs.{SD}) Intervention Control ES Arm 1: 9.22 (14.88) 8.50 (7.37) 0.72 hrs Arm 2: 10.43 (20.10) 8.50 (7.37) 1.93 hrs

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		Intervention scale (implemented at single site vs. multisite): Single site **Intervention exposure** (one time exposure vs. multiple exposures): One time exposure	b) Incidental sun exposure (estimated number of hours spent in the sun doing other activities on a typical weekday and weekend)	Arm 3: -0.25 (2.90) 8.50 (7.37) -8.75 hrs p≤ .05 b) Incidental sun exposure Intervention Control ES Arm 1: 2.66 (1.78) 2.19 (0.75) 0.47 hrs Arm 2: 2.94 (1.79) 2.19 (0.75) 0.75 hrs Arm 3: 2.94 (1.12) 2.19 (0.75) 0.75 hrs p-value= NR
Author, Year: Pagoto, 2003 **Title:** Effects of a Multicomponent Intervention on Motivation and Sun Protection Behaviors Among Midwestern Beachgoers **Study Design:** Greatest (Before and After with concurrent comparison) **Quality of Execution:** Fair **Location:** USA (Midwestern city)	**Target population:** Midwestern beachgoers **Setting** (Type of outdoor recreation setting): Midwestern beach **Demographics:** Gender: Male (45%) Age (Mean age): 28 yrs Skin type: Type I (11%) Type I (28%) Type III (36%) Race/Ethnicity: NR SES (Education level): High school (17%) College degree (83%)	**Intervention:** Multicomponent Intervention on Motivation and Sun Protection Behaviors **Intervention implementation period:** Summer of 2000 during peak UV hours **Intervention components:** <u>Educational:</u> participants were provided with the American Cancer Society's pamphlet of safe sun recommendations b) UV images: photos were compared to three standard photos that reflected varying degrees of skin damage c) reminders by postcard and photo d)interactive activities: research assistants modeled proper sun protection by repeatedly applying sunscreens and wearing protective clothing, hats, and sunglasses <u>Environmental:</u> Free sunscreen **Intervention for Control group:** Questionnaire only	**Follow-up period:** Two months **Outcomes of Interest** **<u>Protective behaviors:</u>** Combined protective behavior (assessed using a composite score of items a) sunscreen use (SPF 15 or higher), (b) protective clothing use during sun exposure, both on a 4-point Likert-type scale, which ranged from *very seldom* to *always* and (c) the number of body parts protected from sun. Items assigned a rating that ranged from 0 (*no body parts covered*) to 3 (*all body parts covered*). Composite scores were calculated by adding the highest score from Items (a) and (b) to Item (c). **<u>Sun exposure</u>:** (average number of days per week and the average number of hours per week they spent (a) sunbathing and (b) engaging in outdoor activities over the past 2 months)- Composite scores were calculated by summing the number of hours per week sunbathing and	**Population size(n):** Intervention: 53 Control: 47 **<u>Protective behaviors:</u>** Combined protective behavior (Group mean score change{SD}) Intervention Control ES p-value BL: 5.52(1.84) 5.55(1.85) +1.28 pts <0.05 FU: 6.44 (1.80) 5.19 (1.84) **<u>Sun exposure</u>:** (# of hrs. /week) Mean (SD) Intervention Control ES p-value BL: 14.90 (16.90) 7.53 (7.01) -5.26 hrs/wk NR FU: 8.96 (9.00) 6.85 (5.09)

Study Details	Population characteristics	Intervention Characteristics	Outcome measures	Results: Effect Estimate (95% CI/ P-value)
		Intervention scale: Single site **Intervention exposure** (single exposure vs. multiple exposures): One time exposure	engaging in outdoor recreational–occupational activities	
Author, Year: Mahler et al., 2006 **Title:** Effects of Two Appearance-Based Interventions on the Sun Protection Behaviors of Southern California Beach Patrons **Study Design:** Greatest (Group RCT) **Quality of Execution:** Fair **Location:** USA (San Diego)	**Target population:** Residents of San Diego **Setting** (Type of outdoor recreation setting): One of 4 San Diego area beaches (either at Fletcher's Cove in Solana Beach, California, La Jolla Shores in La Jolla, California, Moonlight Beach in Encinitas, California, or Torrey Pines State Beach in La Jolla, California) **Demographics:** **Gender:** Female (60%) **Age** (Mean age): 36 yrs **Skin type:** Burn, never tan (8.6%) Burn easy, then develop light tan (22.6%) Burn moderately, then develop light tan (31.7%)	**Intervention:** Appearance based intervention **Intervention implementation period:** late June of either 2002 or 2003 **Intervention components:** <u>Educational:</u> Photoaging information: delivered via a brochure included factual information (e.g., the incidence and causes of photoaging, methods for protection) UV facial photo: UV facial photographs were taken with a modified instant Polaroid camera that has a special UV filter. Each person who had a UV photo taken also had a natural light instant photo taken for comparison. In all cases, the natural light black-and-white photograph was shown to participants first, followed by the UV photo **Intervention for Control group:** Questionnaire only **Intervention scale (implemented at single site**	**Follow-up period:** Two months **Outcomes of Interest** **<u>Protective behaviors:</u>** 1.Combined sun protective behaviors(*Sun protection index)* created by reverse scoring the intentional and incidental exposure measures and then z-scoring and averaging the 11 items on the scale ranging from 0-100%, SPF levels of sunscreen used during both exposures **<u>UV exposure</u>** (change in skin color): Lightness of skin on face (right cheekbone)and arm (outer side of the forearm) was measured with spectrometer.	**Population size(n):** Intervention:165 Control:55 **<u>Protective behaviors:</u>** 1.Combined sun protective behaviors(mean change in Z-score): Intervention Control ES p-value Arm 1(n=58): 0.16 (.50) –0.13 (.67) 0.29pts <0.01 Arm 2 (n=52):0.01 (.61) –0.13 (.67) 0.14pts <0.10 Arm 3 (n=55):0.04 (.51) –0.13 (.67) 0.17pts < 0.05 **<u>UV exposure</u>** (Median change in L-scale of spectrometer): Observed data N= Arm 1:58; Arm 2:52; Arm 3:55 **On Face** Intervention Mean(SD) Control Mean(SD) ES p-value Arm 1: 63.40 (6.37) 62.41 (6.60) 0.99pts <0 .10 Arm 2: 62.71 (7.41) 62.41 (6.60) 0.30pts < 0.12 Arm 3: 63.30 (6.37) 62.41 (6.60) 0.89pts <0 .12 **On Arm** Intervention Control ES p-value Arm 1: 58.94 (7.56) 58.03 (7.31) 0.91pts <0.12 Arm 2: 58.15 (8.80) 58.03 (7.31) 0.12pts <0.12 Arm 3: 58.47 (6.76) 58.03 (7.31) 0.44pts <0 .12

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	Race/Ethnicity: White (81%) **SES (Education level):** NR	**vs. multisite):** One condition at one site **Intervention exposure (single exposure vs. multiple exposures):** One time exposure		
Author, Year: Nicol et al., 2007 **Title:** Skin protection by sunscreens is improved by explicit labeling and providing free sunscreen **Study Design:** Greatest (Group RCT) **Quality of Execution:** Fair **Location:** France	**Target population:** Adult visitors (residents) **Setting** (Type of outdoor recreation setting): Beach resorts at French Mediterranean coast **Demographics:** Gender: Female (64%); Age (Mean age): 39 yrs Skin type: NR Race/Ethnicity: Caucasian (100%) SES (Education level): NR	**Intervention:** "Sun and Skin" **Intervention implementation period:** Late July-August, 2003 **Intervention components:** <u>Environmental:</u> Arm1: free SCs intervention (FS)= four types of SCs with their usual SPF label at free disposal; Environmental+ educational; ARM 2: same free SCs with an explicit labeling (FNL), including sunburn protection, likely protection against long-term effects of UV, and possibility to get a tan **Intervention for Control group:** None **Intervention scale (implemented at single site vs. multisite):** One condition at one site **Intervention exposure (single exposure vs. multiple exposures):** Multiple exposures	**Follow-up period:** 1 week **Outcomes of Interest** **<u>Protective behaviors:</u>** Sunscreen use: a) Sunscreen use per day (Declaration of individuals (coffee-spoon) b) Amount of SC per hour of sun exposure (Time spent in the sun in bathing suit or bare trunk =intense sun exposure) **<u>Sun exposure:</u>** Duration of intense sun exposure (h/day)**-** Median (interquartile range) **<u>Incidence of sunburn</u>:** Proportion of individuals with at least one sunburn during the week	**Population size(n):** Intervention (236): Arm1 (Free sunscreen-FS): 118; Arm2 (Free SS+ UV information on the label-FNL):118 Control group-NI =128 **<u>Protective behaviors:</u>** Sunscreen use: a) Sunscreen use per day {coffee-spoon(CS)} Median(SD) ES P-value Arm 1 (FS): 2.67 (2.21) 0.50 CS/day 0.006 Arm 2 (FNL): 3.00 (2.92) 0.83 CS/day <0.005 Control (NI): 2.17 (3.45) b) Amount of SC/hr of sun exposure {coffee-spoon(CS)} Median(SD) ES P-value Arm 1 (FS): 0.70 (0.91) 0.16 CS/day 0.005 Arm 2 (FNL): 0.92 (0.88) 0.38 CS/day <0.001 Control (NI): 0.54 (0.86) **<u>Sun exposure:</u>** (h/day)- Median (interquartile range) Median(SD) ES P-value Arm 1 (FS): 3.60 (1.92) -0.44 hr/day 0.17 Arm 2 (FNL):3.71 (1.88) -0.33 hr/da <0.001 Control (NI): 4.04 (2.2) **<u>Incidence of sunburn</u>:** (% of individuals) % ES 95%CI Arm 1 (FS): 29.9% -16.9 pct pt (-28.9, -4.9) Arm 2 (FNL): 21.2% -25.6pct pt (-36.9, -14.2) Control (NI): 46.8%
Author, Year: Walkosz et al., 2007	**Target population:** Parents and children	**Intervention:** Go Sun Smart program	**Follow-up period:** 1 week	**Population size(n):** N= 357 children

Study Details	Population characteristics	Intervention Characteristics	Outcome measures	Results: Effect Estimate (95% CI/ P-value)
Title: Randomized Trial on Sun Safety Education at Ski and Snowboard Schools in Western North America **Study Design:** Greatest (Group RCT) **Quality of Execution:** Fair **Location:** USA, Western North America (Alaska, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, and British Columbia)	enrolled in ski and snowboard schools at altitude resorts **Setting** (Type of outdoor recreation setting): Ski resorts (23) **Demographics:** Gender: Female (51%) Age (Mean age): 6.6 yrs Skin type: NR Race/Ethnicity: Caucasian (84%) SES (Education level): NR	**Intervention implementation period:** December 2001-April 2002 **Intervention components:** Educational: Program utilized written (brochures, electronic, visual (posters), and interpersonal channels of communication to promote sun safe practices to employees and guests at the ski resort. Slogan recommended 3 sun safe behaviors "Wear sunscreen, sunglasses and a hat." For children: brochures with games and puzzles about sun safety . Instructors incorporate sun safety into ski and snowboard lessons, including recommending sun safety to parents of students. **Intervention for Control group:** No intervention **Intervention scale (implemented at single site vs. multisite):** Implemented at multiple sites **Intervention exposure (single exposure vs. multiple exposures):** Multiple exposures	**Outcomes of Interest** **Protective behaviors:** 1. Use of sunscreen % children using sunscreen % children using lip balm 2. Use of sunglasses/ goggles: Proportion of children using sunglasses/goggles 3. Use of hat/helmet: Proportion of children using hat/helmet	Intervention (11 ski areas): 186 Control (13 ski areas): 171 **Protective behaviors:** (% of children)- only post data 1. Use of sunscreen % children using sunscreen Intervention (%) Control (%) ES (CI) 72% 52% 20.0 pct pt(10.1, 29.9) % children using lip balm Intervention (%) Control ES (CI) 60% 56% 4.0 pct pt (-6.2, 14.2) 2. Use of sunglasses/ goggles: Proportion of children using sunglasses/goggles Intervention (%) Control (%) ES (CI) 89% 86% 3.0 pct pt (-3.9, 9.9) 3. Use of hat/helmet Intervention (%) Control (%) ES (CI) 89% 92% -3.1 pct pt (-9.1, 3.1)
Author, Year: Walkosz et al., 2008 **Title:** Group randomized with in	**Target population:** Adult guests	**Intervention:** Go Sun Smart program;	**Follow-up period:** 1 year **Outcomes of Interest** **Protective behaviors:**	**Population size(n):** 6516 **Protective behaviors**: (% of children)

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cohort of ski areas present in both survey periods **Study Design:** Greatest (Group Randomized control Trial) **Quality of Execution:** Fair **Location:** USA (Western US) and Canada	**Setting (**Type of outdoor recreation setting): Ski resorts(26) **Demographics:** Gender: Male (72%) Age: <45 yrs Skin type: NR Race/Ethnicity: Caucasian (96%) SES (Education level): ≤High school (10%) Some college (23%) College degree (68%)	**Intervention implementation period:** January to April 2002**;** **Intervention components:** Educational: Using ***small media*** (Using print, electronic, and interpersonal messages) with 3 key messages appeared in all messages: wear sunscreen, sunglasses, and a hat. SM included posters and brochures for ski and snowboard schools, signage at the base of chairlifts and on chairlift poles, electronic signs and grooming reports, brochures, and table tents and posters in lodges. Employees advised guests against excessive sun exposure. **Intervention for Control group:** None **Intervention scale (implemented at single site vs. multisite):** Implemented at multiple ski resorts **Intervention exposure (single exposure vs. multiple exposures):** Single exposure	in moderate and high intervention groups Overall sun protective behaviors	Overall sun protective behaviors: No data available for protective behaviors. No significant change (Intervention did not improve sun protective behaviors among intervention group)
Author, Year: Pagoto et al., 2010 **Title:** A Beach Randomized Trial of a Skin Cancer Prevention Intervention	**Target population:** Female beach visitors ; **Setting** (Type of outdoor recreation setting): 2 public beaches in eastern Massachusetts	**Intervention:** Intervention promoting sunless tanning among beach visitors; **Intervention implementation period:** 11 days in June and July 2006;	**Follow-up period:** 1 year **Outcomes of Interest** **Protective behaviors:** 1. Sunscreen use (Frequency of sunscreen use in past 2 months. For	**Population size(n):** BL: I= 1019; C=1019 FU: I=884; C=885 **Protective behaviors:** 1. Sunscreen use (Change in scale)- Mean(SD) Intervention Control ES p-value BL: 2.41 (1.34) 2.41 (1.34)

Study Details	Population characteristics	Intervention Characteristics	Outcome measures	Results: Effect Estimate (95% CI/ P-value)
Promoting Sunless Tanning **Study Design:** Greatest (Group-randomized trial) **Quality of Execution:** Fair **Location:** USA, Massachusetts	**Demographics:** Gender: Female (100%) Age (Mean age): 31 yrs Skin type: Type 1 (7.6%) Type II (25.6%) Type III (45.2) Type IV (21.6%) Race/Ethnicity: White (89%) SES (Education level): <college degree (65%); College degree (23%)	**Intervention components:** Educational: -skin cancer education by written and interactive methods -UV imaging Environmental: Samples of sunscreen with SPF 30 and sunless tanning lotion **Intervention scale (implemented at single site vs. multisite):** Single site **Intervention exposure (single exposure vs. multiple exposures):** Single exposure	each, item, responses on a 5-point likert scale where 0 = never and 4 =always) 2. Use of protective clothing: Frequency of wearing shirt with sleeves on 5-point likert scale (0 indicates never; 1, rarely; 2, sometimes; 3, often; and 4, always.) **Sun Exposure:** Average sunbathing time spent in the sun with the intention of getting a tan in the past 2 months using a 7-point scale ranging from 0 (never) to 7 (every day)- 1, once; 2, twice; 3, once a week; 4, twice a week; 5, 3 to 5 times a week; and 6, every day. **Incidence of Sunburn:** Frequency of red or painful burn that lasted 1 day or longer in the past 2 months using a 6-point scale from 0 (not at all) to 5 (≥5 times)	FU2 (1 yr): 2.74 (1.11) 2.60 (1.27) 0.14pts 0.38 2. Use of protective clothing (Change in scale)- Mean(SD) Intervention Control ES p-value BL: 1.77 (0.87) 1.62 (0.78) FU2: 1.97 (0.75) 1.85 (0.68) -0.03pts 0.61 **Sun Exposure:** Average sunbathing {Mean(SD)} Intervention Control ES p-value BL: 4.12 (2.57) 4.46 (2.13) FU2: 2.70 (2.61) 3.81 (2.52) -0.77pts 0.02 **Incidence of Sunburn:** {Mean(SD)} Intervention Control ES p-value BL: 0.74 (1.06) 0.71 (0.80) FU2: 0.43 (0.82) 0.44 (0.66) -0.04pts 0.81

Study Details	Population characteristics	Intervention Characteristics	Outcome measures	Results: Effect Estimate (95% CI/ P-value)
Author, Year: Dubas et al., 2012 **Title:** Sunscreen use and availability among female collegiate athletes **Study Design:** Greatest (Group-randomized trial) **Quality of Execution:** Fair **Location:** USA	**Target population:** Outdoor female athletes (NCAA Division IA female golf teams); **Setting** (Type of outdoor recreation setting): Golf course **Demographics:** Gender: Female (100%) Age (Mean age): 19 yrs Skin type: Type I-III: Intervention (41%) Race/Ethnicity: NR SES (Education level): College students (100%)	**Intervention:** Extended version of Sunny Days Healthy Ways **Intervention implementation period:** First exposure: Spring 1996 Second exposure : Spring 1997 (in late February for 6 weeks); **Intervention components:** <u>Environmental:</u> study-supplemented sunscreen in their golf bags and locker rooms. In addition, each treatment participant received 5 tubes of SPF 30 sunscreen **Intervention for Control group:** participants were given free cosmetic samples (unrelated to skin health), had their picture picture taken with an instant camera, and were notified that they would be contacted for follow-up. **Intervention scale (implemented at single site vs. multisite):** Implemented at multiple sites **Intervention exposure (single exposure vs. multiple exposures):** Multiple exposures	**Follow-up period:** 1 month **Outcomes of Interest** **<u>Protective behaviors:</u>** 1. Sunscreen Use: (% of athletes applied sunscreen) a) Re-application of sunscreen -during practice -during competition b) Overall sunscreen use : (Mean days of SS use / week)	**Population size(n):** N= 83 Intervention: 39 Control: 44 **<u>Protective behaviors:</u>** 1. Sunscreen Use: (% of athletes) a) Re-application of sunscreen -during practice Pre Post ES (95% CI) Intervention 27% 20% -4.0 pct pt (-22.3, 14.3) Control: 31% 28% -during competition Pre Post ES (95% CI) Intervention: 45% 64% 22.0 pct pt (0.9, 43.1) Control: 54% 51% b) Overall sunscreen use {Mean days (SD)} Pre Post Intervention: 3.05(2.00) 3.80(2.26) Control: 3.10(2.04) 2.69(1.69) ES: +1.13 days, p-value =0.01