HHS Public Access
Author manuscript
Contemp Clin Trials. Author manuscript; available in PMC 2017 January 01.

Published in final edited form as:
Contemp Clin Trials. 2016 January ; 46: 67–76. doi:10.1016/j.cct.2015.11.015.

Rationale, Design, Samples, and Baseline Sun Protection in a Randomized Trial on a Skin Cancer Prevention Intervention in Resort Environments

David B. Buller, PhD[1], **Peter A. Andersen, PhD**[2], **Barbara J. Walkosz, PhD**[3], **Michael D. Scott, PhD**[4], **Larry Beck, PhD**[5], and **Gary R. Cutter, PhD**[6]

David B. Buller: dbuller@kleinbuendel.com; Peter A. Andersen: westone47@gmail.com; Barbara J. Walkosz: bwalkosz@kleinbuendel.com; Michael D. Scott: michael.granker@gmail.com; Larry Beck: lbeck@mail.sdsu.edu; Gary R. Cutter: cutterg@uab.edu

[1]Senior Scientist and Director of Research, Klein Buendel, Inc., 1667 Cole Boulevard, Suite 225, Golden, CO 80401

[2]Professor Emeritus, School of Communication, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182

[3]Senior Scientist, Klein Buendel, Inc., 1667 Cole Boulevard, Suite 225, Golden, CO 80401

[4]Professor Emeritus at California State University and President of Mikonics, Inc., 40 B Old Road South, Santa Fe, NM 87540

[5]Professor, L. Robert Payne School of Hospitality and Tourism Management, Room PSFA 445, San Diego State University, San Diego, CA 92182

[6]Professor, Department of Biostatistics, School of Public Health, RPHB 401B, University of Alabama, 1720 2nd Avenue South, Birmingham, AL 35294

Abstract

Introduction—Exposure to solar ultraviolet radiation during recreation is a risk factor for skin cancer. A trial evaluating an intervention to promote advanced sun protection (sunscreen pre-application/reapplication; protective hats and clothing; use of shade) during vacations.

Materials and Methods—Adult visitors to hotels/resorts with outdoor recreation (i.e., vacationers) participated in a group-randomized pretest-posttest controlled quasi-experimental

Conflict of Interest

David Buller's spouse owns stock in Klein Buendel, Inc. and he receives a salary from this company. Peter Andersen, Barbara Walkosz, Michael Scott, and Larry Beck declare that they have no competing interests. Gary Cutter participated on Data and Safety Monitoring Committees focus on medical research for Apotek, Ascendis, Biogen-Idec, Cleveland Clinic, Glaxo Smith Klein Pharmaceuticals, Gilead Pharmaceuticals, Modigenetech/Prolor, Merck/Ono Pharmaceuticals, Merck, Neuren, PCT Bio, Teva, Vivus, NHLBI (Protocol Review Committee), NINDS, NMSS, and NICHD (OPRU oversight committee), and consulted, received speaking fees, and served on advisory Boards for Alexion, Allozyne, Bayer, Consortium of MS Centers (grant), Klein Buendel, Inc., Genzyme, Medimmune, Munck Wilson Mandala LLP, Novartis, Nuron Biotech, Receptos, Revalesio, Sanofi-Aventis, Spiniflex Pharmaceuticals, Somahlution, Teva Pharmaceuticals, and Xenoport. Gary Cutter owns Pythagoras, Inc., a private consulting company.

design in 2012–14. Hotels/resorts were pair-matched and randomly assigned to the intervention or untreated control group. Sun protection (e.g., clothing, hats, shade and sunscreen) was measured in cross-sectional samples by observation and a face-to-face intercept survey during two-day visits.

Results—Initially, 41 hotel/resorts (11%) participated but 4 dropped out before posttest. Hotel/resorts were diverse (employees=30 to 900; latitude=24o 78′ N to 50o 52′ N; elevation=2 ft. to 9,726 ft. above sea level), and had a variety of outdoor venues (beaches/pools, court/lawn games, golf courses, common areas, and chairlifts). At pretest, 4,347 vacationers were observed and 3,531 surveyed. More females were surveyed (61%) than observed (50%). Vacationers were mostly 35–60 years old, highly educated (college education = 68%) and non-Hispanic white (93%), with high-risk skin types (22%). Vacationers reported covering 60% of their skin with clothing. Also, 40% of vacationers used shade; 60% applied sunscreen; and 42% had been sunburned.

Conclusions—The trial faced challenges recruiting resorts but result show that the large, multi-state sample of vacationers were at high risk for solar UV exposure.

Keywords

skin cancer; prevention; intervention; sunscreen; clothing; recreation

Introduction

In 2014, the U.S. Surgeon General issued a call to action to prevent skin cancer.[1] U.S. rates of melanoma, the most deadly form, are increasing at 3% per year[2] and over 3 million cases of non-melanoma skin cancer (NMSC) occur annually.[2] Exposure to ultraviolet radiation (UV) from solar and non-solar sources is a primary cause of skin cancers.[3–13] Prevention is a priority due to skin cancers' high prevalence,[14,15] recurrence,[16–18] treatment disfigurement,[19–22] cost ($2.1 billion for treatment[23]), and association with other cancers.[18,24,25] Primary prevention relies on reducing UV exposure by limiting time in the sun when UV is high (i.e., at midday sun, at lower latitudes, and in proximity to the summer solstice), using shade, and wearing protective clothing and broad-spectrum sunscreens.

Rationale

Recreational UV exposure is associated with every form of skin cancer[26] so it is not surprising that vacationing at sunny venues such as the mountains or the beach is also associated with increased risk for sunburn and skin cancer. One study estimated that vacation beach-goers receive on average 500% more UV than required for a sunburn[27] and two other studies indicated that a substantial number of sunburns occur on vacations.[28,29] Data from Australia, Canada, Europe, and the United States shows: a) vacationing children and young adults are at higher risk for developing nevi, a precursor for melanoma melanoma[30–32] and b) lifetime preference for vacationing in sunny climates and at alpine and waterside venues is associated with increased risk for melanoma.[33–38]

Interventions that improve sun protection and reduce UV exposure on vacation could benefit millions of Americans, but most prior interventions have met with mixed results.[39] Annually, 59% of U.S. adults take out-of-town vacations,[40] with 56% of them traveling for the purpose of pleasure[41] As much as 75% of this leisure travel involves recreating outdoors, mostly in the spring and summer when solar radiation is high. Considering that risk is compounded by outdoor activities that require prolonged sun exposure or skin-revealing clothing (e.g., golfing, hiking, swimming, tennis) and the skin types of many leisure travelers (81% high risk non-Hispanic white,[42] although such travel is growing among minority populations[43]), the need for vacationers to practice sun safety is obvious.

Objectives of the Trial

The primary objective of the overall trial was to expand our successful sun safety program at high-altitude ski areas[44–47] to promote comprehensive sun protection to adults vacationing at warm-weather resorts during late spring and summer and to evaluate it in a group randomized quasi-experimental design for effects on sun protection practices. Secondary objectives included improving advanced sun protection behaviors, including a) pre-application and reapplication of sunscreen and use of wide-brimmed hats, protective clothing, and shade and b) consideration of time of day and season on sun safety decisions. Despite considerable effort to promote sun protection, the skin cancer epidemic has escalated[2] and excessive UV exposure and sunburning still prevails among vacationers, despite a variety of interventions.[39,48] While a fairly large portion of the population uses sunscreen,[49] it is only one of several sun protection behaviors that can be employed to create optimal protection. The focus on advanced sun protection should help overcome suboptimal use of sunscreen,[44,45,50–52] unsatisfactory use of hats and clothing,[53] inadequate use of shade,[44,54] and reliance on unreliable indicators of high UV (e.g., cloud cover and hot temperature).[55]

Purpose of Paper

In this paper, the design, procedures, and measures used in the trial are presented. Data is presented on the success of recruiting resorts and descriptive pretest data on the characteristics and baseline sun protection in the samples of vacationers assessed by the observations and intercept surveys.

Materials and Methods

Population and Recruitment Methods

Given the fact that 60% of all U.S. vacationers book commercial hotels/resorts,[40] the present study employed resort venues representing a unique research context where vacationers can be systematically treated to an intervention designed to reduce their solar UV exposure. The population was adult vacationers (i.e., guests 18 or older) at destination hotels/resorts with outdoor recreation venues. Initially, we obtained support and a list of member hotels/ resorts from two leading travel industry professional associations, the American Hotel and Lodging Association and Hospitality Sales and Marketing Association International. Hotels/resorts met the following inclusion criteria: a) had at least three outdoor recreation areas, b) had at least one waterside recreation area, c) were located in the continental United States or Canada, d) had overnight lodging, and e) agreed to participate. Recruitment rate was lower than expected so we added ski areas from the National Ski Areas Association membership that met the above criteria in their summer operations.

The list was randomly ordered by the project's biostatistician and hotel/resorts were enrolled in two annual waves in 2012–13 and 2013–14 to control for seasonal weather variation and increase feasibility. The hotel's/resort's contact manager for the professional association was contacted by email and telephone to secure the hotel's/resort's participation. Repeated attempts were made to reach the senior manager(s) until the resort either agreed or refused or the sample quota of 40 resorts was filled (determined by a priori power analysis). Adult vacationers were enrolled that met the following inclusion criteria: a) present at the hotel/resort on the assessment days, b) in an outdoor venue between 10 am and 4 pm, and c) were 18 or older. For the intercept surveys, vacationers were read an informed consent statement by the interviewer. The term vacationer is used to capture the idea that these individuals visited the hotels/resorts to actively use their amenities for pleasure while on vacation. While the majority of our respondents were staying at the resort, some individuals were day visitors or local residents who used the hotel/resort amenities (e.g., a water park) without actually staying in the lodging, some were regular visitors (e.g., members of the resort golf club), and some combined business activities (e.g., a conference) with recreational pursuits at the hotels/resorts. Nonetheless, in this paper, "vacationer" is employed as a umbrella term to include all the resort guests who participated in the study. Power calculations, based on a small effect size (0.15), intraclass correlation within hotels/resorts of r=0.01 and p=0.05 (2-tailed), resulted in quotas of 95 observations and 95 interviews per hotel/resort. All procedures were approved by the San Diego State University and Quorum Institutional Review Boards.

Experimental Design and Procedures

The trial design was a group-randomized pair-matched pretest-posttest controlled quasi-experimental design. Before randomization, hotels/resorts were pair matched within wave on latitude, elevation, mean annual sunshine hours, primary operational season (summer/winter), number of summer employees, and number of vacationers visiting the hotel/resort for just the day and at waterside recreation areas surveyed at pretest. Members of each pair were randomly assigned to either the *Go Sun Smart* intervention or an untreated control group. The *Go Sun Smart* intervention, which is described in greater detail elsewhere, was distributed to senior managers in the intervention group by researchers during a visit with the primary contact manager and other senior managers at the beginning of the warm-weather season.

Vacationers were assessed in two annual cross-sectional panel samples at pretest (first spring/summer) and posttest (second spring/summer) over two years, making this a quasi-experimental design. Such designs eliminate threats to validity created by pretesting cohort samples.[56] It was impossible to create a repeated-measures cohort of vacationers because most vacationers do not repeatedly visit the resort. The independent samples avoided contaminating testing, history, and maturation effects due to pretesting that can arise in cohort samples.[56] Vacationer assessments were performed by trained research staff using an observation measure and a face to face intercept survey during two-day visits at times when managers confirmed that number of registered vacationers in the lodging was high. Posttest data collection visits were scheduled at approximately the same time of year as the pretest visit (±3 week) to control seasonality effects. Resorts in semi-tropical or desert regions with high summer temperatures were visited in the spring (March to May) so heat would not keep vacationers indoors at midday. Resorts in northern regions or at higher elevations were visited in the summer (June to September). Nearly all visits occurred within three months of the summer solstice when UV was highest (i.e., March 20 to September 20). Assessments were conducted until the sample quotas were met or the two-day period was completed.

Go Sun Smart Intervention

The *Go Sun Smart* intervention intended to promote comprehensive, advanced sun protection beyond the application of sunscreen. Advanced practices included applying sunscreen 30 minutes before sun exposure, reapplying it within 2 hours of initial application, wearing wide-brimmed hats and protective clothing, using shade, and relying on time of day, season, latitude, altitude, and cloudiness as indicators of UV intensity. The intervention communication used persuasive principles proposed in Transportation Theory (TT).[57,58] TT holds that people construct narratives or stories that help guide their future behavior, and when confronted with a narrative with which they identify, their susceptibility to influence is raised. Pre- and post-vacation narratives may be persuasive. As people anticipate a vacation, they formulate scripts around expected activities, for example, sunning themselves poolside. Moreover, the hospitality industry markets stories suggesting experiences beyond the norms of daily life (e.g., excessive alcohol and substance use and high-risk recreation and adventure sports), including long periods spent in the sun, that their vacationers *can make their own* by vacationing at the venue. Such anticipatory stories often involve themes of pleasure, escapism, and some risk-taking but rarely include taking precautionary measures to avoid excess sun. Over their lifetime, vacationers repeatedly are “transported” into these vacation stories where the rules for everyday behavior do not apply (“What happens on vacation stays on vacation”) and time in the sun is a source of pleasure and seldom, if ever, is associated with sunburn and skin cancer.

In contrast to traditional health behavior theories which suggest that risky behavior owes to ignorance about potential consequences,[59] i.e., long-term damage from UV exposure, TT suggests that risk-taking is an inherent feature of both the stories vacationers construct and cultural narratives about vacationing with which they identify.[57,58] Moreover, these scripts[60] can be more powerful than conventional persuasive admonitions.[61] When promoting sun protection, sun safety messages gain power by using narrative forms that a) transport people into a story likely to change their beliefs;[62] b) increase identification with characters in a narrative, a process that can be used purposefully to exert influence[63,64] (e.g.., in Social Cognitive Theory,[59] people who identify with role models are substantially influenced[65,66]); and c) shift normative beliefs about risks while vacationing by helping vacationers anticipate risks in unfamiliar destinations, especially common risks not included in their personal narratives such as severe sunburns, and preparations to take precautions (e.g., packing sunscreen, clothing, hats, and sunglasses). The latter may be particularly important to the extent that the tourism industry’s advertising reinforces risk taking that may encourage disinhibition[67–74], and persuades vacationers to engage in non-normative activities.

Intervention messages were delivered on posters/signs and tip cards placed in the hotel/ resort environment and print and electronic materials used to reach vacationers before their visit (e.g., pre-arrival messages and packing lists) or at check-in. Social media messages and a 92-second animated video on sun safety while vacationing were also provided to hotels/ resorts. If requested by the hotels/resorts, sun protection training for their outdoor workers and ways of recommending sun safety to resort vacationers was delivered. Talking points and docent lectures were created to aid employees in these conversations with vacationers. Hotels/resorts were provided a press release and a certificate to be displayed announcing their participation in the program. Narrative elements were incorporated in most messages using visual elements in the posters (e.g., photos of a family walking on a beach; newsreel showing photos of adults and children practicing sun safety) and the animated video showing a family checking in, recreating outdoors, using sun protection, and recounting their enjoyable day.

Prior to the warm-weather season, research staff met with managers at intervention hotels/ resorts to initiate intervention implementation. Based on diffusion of innovations theory principles,[75,76] researchers stressed the importance of sun protection for skin cancer prevention, discussed how to easily fit *Go Sun Smart* into hotel/resort operations, helped plan for implementation, and addressed barriers to implementation. Researchers maintained contact with managers throughout the spring and/or summer to replenish program materials and troubleshoot problems. This protocol elevated program implementation in a previous study with ski areas.[76]

Measures

The primary outcome was sun protection practices of adult vacationers assessed by observation and an intercept survey. Research staff selected vacationers for both observations and surveys by plotting as straight a line as possible across the outdoor venue and observing or interviewing vacationers who were located on either side of the line. Staff stood in locations to remain unobtrusive while performing observation; for surveys, staff recorded hat, clothing, and shade use after completing the interview without respondent awareness. Staff had bags with the study logo but no other identifiers. Observations were performed between 12 pm (noon) to 2 pm (± 1 hours of solar noon during daylight savings time) and intercept surveys, between 10 am and 4 pm (±3 hours of solar noon) on each day. On a few days with either few vacationers available or periods of inclement weather, interviews were outside of those time frames. Observations and interviews were anonymous; rather, vacationers were identified by hotel/resort.

Observation of Vacationer Sun Protection Practices—The observation protocol was modified from a measured used in Australia to assess sun protection in public venues.[77] Research staff (4 females, 4 males) were trained to observe the sex (male/female) and age (18–34/35–60/60 or older) of each vacationer and record their use of head covering (no hat/ visor/narrow hat/baseball cap/legionnaire hat/wide-brimmed hat), sunglasses (yes/no), shirts (yes/no), sleeve length (strapless/sleeveless/¼ length/elbow length/¾ length/wrist length); collar (yes/no); neckline (low/high); midriff coverage (covered/cut-out/partially exposed/ exposed), leg covering (bikini/short shorts or skirt/mid-thigh/knee length/¾ cover/ankle length), socks (no socks/ankle length/calf length/knee length), and shoes (no shoes/sandals/

shoes). Observers recorded whether the individual was in no shade, partial shade (25%/50%/75%), or full shade. Observers did not record sunburns.

The observational assessment was programmed in a mobile app for Android tablet computers (paper versions were available if the sun created too much screen reflection). To increase accuracy, a human figure was displayed on the screen and "dressed" as the observer recorded hats, clothing, and sunglasses. Observers visually checked that the dressed figure on the screen matched what the vacationer was wearing. Each day, observations were first performed at low-use recreation areas (e.g., courts and marinas) and then at high-use areas (e.g., swimming pools/beaches and outdoor dining areas). The individual hat and clothing items were combined to estimate the percentage of skin covered, using Wallace's "rules of nine" clinical assessment of amount of burned skin area.[78]

Intercept Survey with Vacationers—The intercept survey was modified from one used in previous research with vacationers at ski areas.[45,47] Vacationers were asked whether they were wearing sunscreen with SPF 15 or higher and if so, what time they first applied it and if they had reapplied it. The time when they first came outdoors was recorded and used to estimate whether sunscreen was applied before going outdoors (no/15 minutes prior/30 minutes prior). Reapplication was defined as reapplying sunscreen if the vacationer was interviewed within two hours after first applying it. Vacationers were asked the number of times they had been sunburned in the past 12 months and whether they had been sunburned during the current visit to the hotel/resort (defined as red and/or painful from exposure to the sun, following published guidelines[79,80]). Vacationers reported on exposure to sun protection communication. They recalled whether they had seen or heard any messages at the hotel/resort that advised them to protect their skin, lips, or eyes from the sun and if so where (i.e., poster or sign/brochure, pamphlet or flyer/hotel or resort website/social media message from the hotel or resort). At posttest, vacationers also indicated if they recognized the *Go Sun Smart* logo. Vacationers' perceived importance of sun protection, injunctive norms for sun protection (i.e., "most people who matter to me think people should protect their skin from the sun"), and intention to sun tan were assessed with three 5-point Likert-type questions (strongly agree/strongly disagree). A fourth Likert-type question measured disinhibition during vacation ("I'm a different person when I'm on vacation than when I'm at home"[81]). Skin phenotype based on a validated measure of melanoma risk was measured combining eye color, skin tanability, and natural hair color.[82] Vacationers were asked their home zip code (to determine latitude of home), date of first arrival at hotel/resort (if a member of a resort, date first arrived/year-round resident), age, education, Hispanic ethnicity, and race. Finally, interviewers recorded vacationers' sun protection attire using the observation measure described above. Interviews were collected at both low-use and high-use recreation areas. The interviewer's name, hotel/resort name, date, time interview started, and the outdoor recreation area were also recorded.

Environmental Information on Resorts—Research staff obtained environmental information for the data collection days. At the time of each observation and survey, research staff estimated cloud fraction by indicating if the sky was clear (0%), had high thin clouds, was partly cloudy, or was overcast (100%). For high thin or partly cloudy, staff estimated the amount of sky covered by clouds in 10% increments (10% to 90%). The UV Index in 15-minute intervals and high temperature and average humidity for the day were gathered from public databases from the closest weather station reported by weather.org or ground-based UV sensor in the U.S. Department of Agriculture's UV-B Monitoring and Research Program. The latitude and elevation of the hotel/resort was recorded.

Results

Sample of Resorts

Participation Rates—A total of 362 hotels/resorts were invited to participate in the trial. Of these, 12 were ineligible; 83 never responded; 38 replied but did not indicate whether they would participate; 76 refused to participate (20%); and 41 resorts agreed to participate (11%). Reasons for refusing included concerns over disrupting the vacationer experience, being in the business of "selling sunshine," being too busy, and having recent ownership/ manager changes. Wave 1 contained 17 hotels/resorts and Wave 2, 24 hotels/resorts. Participating hotels/resorts were located in 17 states (Arizona, California, Colorado, Florida, Georgia, Michigan, Minnesota, Missouri, New Hampshire, New Mexico, New York, Ohio, Oregon, Utah, Vermont, West Virginia, and Wyoming) and one Canadian province (British Columbia). Four hotels/resorts dropped out after the pretest (1 in California, 2 in Florida and 1 in New Mexico) due to a change in ownership or no longer wishing to participate.

Hotel/Resort Characteristics—Nearly all of the hotels/resorts were private organizations (4 part of large hotel chains, 14 ski areas, and 1 dude ranch; 5 state park lodges). Furthermore, 25 were open only during the summer. They ranged in size from 30 to 900 employees (M=341) and were located in latitudes from 24° 78′ N to 50° 52′ N, and at elevations from 2 ft. to 9,726 ft. above sea level. The average high temperature was 80 during the pretest (std. dev.=8; range=53 to 93). Many of the hotels/ resorts were located in rural, relatively isolated areas along beaches, in mountains, or on lakes. A few were located in resort towns or were communities unto themselves.

Outdoor Recreation Areas—Usually, hotels/resorts had outdoor recreation areas in waterside areas (i.e., ocean or lake beaches and pools; n=39 hotels/resorts), court and lawn games (i.e., tennis, volleyball, basketball, and croquet; n=35 hotels/resorts), golf courses (n=34 hotels/resorts), and hiking and biking trails (n=33 hotels/resorts). Less-common outdoor venues were outdoor dining areas (n=26 hotels/resorts), common areas (e.g., courtyards, lawns, and porches; n=19 hotels/resorts), marinas (n=17 hotels/resorts), and chair lifts and trams (n=14 hotels/resorts). One hotel/resort had swimming pools enclosed in a large waterpark, with a retractable roof.

Sample of Hotel/Resort Vacationers

Number of Vacationers—All vacationers at pretest were surveyed and observed during recreational activities. At pretest, 4,347 vacationers were observed (range=18 to 125 per hotel/resort; mean=106) and 3,531 were interviewed (range=21 to 100 per hotel/resort; mean=86). The refusal rate for the pretest survey was low (387 [10%]) and few were deemed ineligible (163 [4%], i.e., were a resort employee, previously interviewed, or not a guest of the hotel/resort, or did not speak English). Reasons for refusing included not being interested in sun safety, not wanting to be bothered or stop current activity or to be distracted while watching children, or had just arrived or were just leaving the hotel/resort.

Vacationer Characteristics—As Table 1 shows, the majority of vacationers observed and surveyed were middle-aged (35–60 years old), with younger and older vacationers approximately equally represented. An equal number of males and females were observed but for the intercept survey women outnumbered men. Compared to those observed, more middle-aged and female vacationers completed the survey. Vacationers completing the surveys were highly educated (college/post graduate=68%) and mostly non-Hispanic white (over 90%). Nearly a quarter had skin types at highest risk for melanoma.

Time and Location of Assessments—The majority of the observations occured between 12:00 pm and 2:00 pm (Table 1). However, nearly a quarter of the observations occurred before noon (mainly between 11:00 am and 12:00 pm), with only a small proportion (approximately 7%) occurring after 2:00 pm. Similarly, most of the surveys occurred between 10:00 am and 4:00 pm; very few occurred outside of those times. Pools were the most frequent location for both observations and surveys. Observations were relatively more frequent at golf courses, outdoor dining areas, and activity and common areas. For surveys, activity areas, common areas, pools/beaches and golf courses were frequent locations. Court and lawn game areas and marinas were uncommon locations for assessing vacationers.

Environmental Characteristics—Approximately half of the observations and surveys were performed during periods of high solar UV (i.e., UV Index of 7 or higher; Table 1). Ten percent or less of the observations and surveys were conducted during periods of low UV (UV Index of 2 or lower). Over a third of the observations and surveys were performed within 30 days of the summer solstice. Likewise, nearly 70% of observations were performed within one hour of solar noon but just over 40% of surveys, within 90 minutes of solar noon. Thus, it is not surprising the more observations than surveys were performed at the highest UV levels. Most observations and surveys were performed on days when skies were relatively clear., i.e., approximately 20% under clear skies and half under 30% cloud coverage or less (Table 1).

Sun Protection Practices of Hotel/Resort Vacationers

Most sun protection practices were performed by only a minority of vacationers while recreating at the hotels/resorts (Table 2). The most prevalent practice was applying sunscreen, with nearly 60% reporting use. However, many of vacationers did not use it optimally, with half waiting until they went outdoors to apply it and only one-third reapplying it within two hours. Use of hats, protective clothing, and shade was far less common. Only a third wore any hat covering and just 5% wore a wide-brim or legionnaires hat with maximum protection. Baseball caps were the most common head covering. The body coverage score revealed that vacationers covered on average 62% of their body (std. dev.=20; lower quartile=42%, median=67%, upper quartile=76%) in the observational measure and 59% of their body (std. dev.=21%; lower quartile=39%, median=63%, upper quartile=75%) in the survey. However, this measure also showed that one-quarter of vacationers covered less than 40% of their skin when outdoors. Use of long pants was more common than long-sleeved shirts and a majority of vacationers wore no shoes or sandals, exposing the tops of their feet to the sun. Just over half of vacationers protected their eyes with sunglasses.

Many vacationers (42.3%) had a history of sunburn in the past year and nearly 20% experienced two or more sunburns in the past 12 months (Table 2). Sunburn was relatively rare during the current visit to the hotels/resorts, with only 6.6% reporting one.

Most sun protection practices recorded in the observations showed statistically significantly differences from those in the survey. However, these differences were relatively small and emerged primarily due to the large samples and high statistical power. Compared to the observation sample, more vacationers in the intercept survey wore sunglasses, very short leg covering, strapless or sleeveless shirts with no collars, low necklines and exposed midriff; were not wearing socks or shoes; and were in the shade. There was evidence of clustering effects within hotels/resorts, with intra-class correlations ranging from 0.002 (shirt) to 0.178 (shirt collar) in the observations and 0.000 (leg covering and shoes) to 0.158 (shirt collar) in the surveys.

Conclusions

A diverse group of 41 hotels/resorts were enrolled, despite considerable challenges in recruitment. They ranged widely in location although the south central and northwest United States were under-represented. The resorts also had a diverse array of recreation venues that presented vacationers with excessive exposure to solar UV. Waterside recreation venues were most common and an inclusion criterion, because vacations to waterside locations have been associated with melanoma in past research.[30–35] Although we had the support of two major industry associations, they focused mainly on sales and marketing, not hotel/resort operations where many decision makers regarding trial participation were located. It was often difficult to reach the appropriate decision maker when the first contact was with a marketing director. However, even when an appropriate manager was contacted, it usually took several conversations and more information to convince them to participate. Many managers were reluctant to participate because of potential problems with disrupting the vacationer experience and engendering customer complaints about surveys. However, neither the observations nor the surveys generated any complaints to our knowledge; sample quotas were achieved at most of the two-day data collection visits; and the more intrusive intercept survey achieved high completion rates. Moreover, vacationers were very compliant with requests to complete the survey, with only 10% of those approached refusing to be interviewed. This is similar to the high compliance rates we achieved when interviewing vacationers at ski areas.[45] This suggests that concerns about disrupting vacationers were unfounded. Also, the high compliance rate reduced the possibility of selection bias overall. However, the tendency for women rather than men to complete the survey may introduce a bias in the data obtained from that assessment. The observation protocol achieved more balance on sex and thus possibly was affected less by selection bias. Yet, some of the sun protection variables, which will serve as outcomes in the evaluation of the intervention at posttest, demonstrated stronger clustering effects within hotels/resorts than expected in our original power analysis. This can reduce the power to detect intervention effects, if they are small.

A more problematic issue pertaining to the vacationer experience was that some managers felt the sun protection purpose of the trial was inconsistent with their "product," i.e., selling outdoor recreation and time in the sun. Like indoor tanning salons, some hotels/resorts are in the business of selling high-risk sun exposure. Concerted efforts are needed to convince managers that they can deliver sun safe outdoor recreation that their vacationers will enjoy. In our work with the ski industry,[83,84] resort managers were most supportive initially of sun protection promotion to their employees but many eventually saw sun safety as a value-added safety effort for vacationers. Whether this same approach through workplace safety will work with warm-weather resorts needs to be explored.

There was remarkable consistency in the vacationer population across both years. Many were at high risk for developing skin cancer due to their skin type and UV levels at the hotels/resorts. Vacationers were mainly non-Hispanic white, the racial group at highest risk for skin cancer,[85] and about 1 in 5 vacationers had high-risk skin phenotypes. Also, half of vacationers were male and about a quarter were under age 34; both groups practice less sun protection than their female and older counterparts.[49] UV levels were often very high to extreme as defined by the U.S. Environmental Protection Agency and the World Health Organization in the global UV Index.[86,87] Both agencies advise adults to minimize their time outdoors, and if outdoors staying in the shade, when UV Index is above 8, the exposure level for about one-quarter of the vacationers when interviewed/observed. Hence, many risked sunburn if they were outdoors for even short periods without protection. The timing of the measures, relatively close to the summer solstice and to solar noon, ensured that the samples of adults were outdoors when UV was elevated. The lack of cloud cover during most data collection days also meant that UV was at its maximum. Past research has associated vacations in sunnier climates with melanoma.[33,36]

Thus, the vast majority of vacationers were outdoors at UV levels when most sun protection practices are advised by health authorities but unfortunately, many vacationers were not taking full precautions. Even the most common precaution, using sunscreen with SPF 15 or higher, was not employed by 2 in 5 vacationers. Still, far more vacationers used sunscreen when outdoors at the hotels/resorts than has been reported in surveys of the general U.S. population (nearly double the prevalence),[49] a trend also seen in other studies in outdoor recreation.[88,89] Adults who vacation at outdoor recreation venues may be more cognizant of the dangers of sunburn and skin damage. Also, they may be spending longer times outdoors engaged in recreational activities at the hotels/resorts. Thus, vacationers may be more likely to apply sunscreen to protect themselves and prolong their time outdoors without becoming sunburned.[88,90–94] To the extent that the recreational endeavor (e.g., a round of golf) is determining the time spent outdoors, sunscreen is an appropriate sun protection strategy and is not in and of itself increasing UV exposure.

Optimal the use of sunscreen, including pre-application before going outdoors and reapplication, was infrequent in these outdoor recreation venues, as we saw with vacationers at North American ski areas. Compared to ski areas, more adults used sunscreen; far fewer pre-applied it; though reapplication rates were similar.[95] Pre-application is needed to allow the sunscreens with chemical absorbers to be absorbed by the skin and be effective. Many of those who did pre-apply sunscreen were likely doing so through routine use of beauty and personal care products (e.g., aftershave, face lotions, and make-up foundations), which may be one way of achieving routine sunscreen use with preapplication.[96] However, the formulations may not have enough photo-stability to confer protection[97] and are usually limited to the face and neck, rather than full body protection. Sunscreens need to be reapplied to ensure enough sunscreen is used on the skin. Most adults use less than needed to achieve the maximum published SPF and some sunscreens can wash or rub off, depending on the outdoor recreation activity.[98] Our intervention specifically advocated for multiple sun protection behaviors, including the pre-application and reapplication of sunscreen, which are essential advanced sun protection measures, recognizing that use of sunscreen is the most common and well-known sun protection behavior and will be central in vacationers' sun protection behaviors. These pretest data indicated that there are many vacationers who could benefit from these practices.

We also targeted the advanced sun protection through the use of hats, clothing, and shade in the intervention because, as revealed by pretest data, these sun safety precautions are even less common than sunscreen, with only 30% – 40% practicing them. These rates are not much higher than reported in surveys of the general U.S. population.[49] Most vacationers expose nearly 40% of their skin to the sun while outdoors at the hotels/resorts and a substantial number are covering even less skin. It appears that even when spending large amounts of time outdoors, U.S. adults infrequently rely on hats, clothing, and shade to protect themselves from UV exposure. This is unfortunate, since these barriers can be even more effective than sunscreen at blocking UV. Fashion and function undoubtedly underlie some clothing choices. Type of recreation and unavailability of shade structures also probably caused the low use of shade; however, many vacationers also may deliberately select sunny locations to stay warm[55] or seek a suntan.

Vacationers at hotels/resorts are a high-risk population. The sunburn prevalence in the pretest samples of this trial were about one-third higher than reported by U.S. adults in general population surveys.[49] Combined with the large number of individuals who were not practicing sun protection and high UV levels at most outdoor recreation venues, these data clearly demonstrate a large need to create effective means for promoting sun protection during outdoor vacations.

Our sun protection measures had several strengths that improve our confidence in the findings. Most of the sun safety practices were observed rather than self-reported. The measures also assessed vacationer behavior in the moment during recreation rather than relying on retrospective recall. Thus, these measures should have avoided demand, social desirability, and memory errors. Still, concerns exist about the self-reports of sunscreen use and sunburn. Vacationers could have over-reported sunscreen use to please the interviewer. Also the failure to distinguish between sunscreen included in beauty products from specific sunscreen lotions may have introduced error, in that the beauty products are often just applied to the face. Likewise, interviewers reported anecdotally that some vacationers appeared to be sunburned but claimed they had not been sunburned in the past year or at the hotel/resort (staff were not trained to observe sunburns). While a demand effect could have caused some vacationers to deny being sunburned, others may not consider redness without pain to be a sunburn.

We attempted to select vacationers for observations and surveys in the same way and the lack of differences in characteristics and sun protection practices suggested we succeeded. Still, a few differences did occur. Vacationers in some venues were easier to observe than survey due to activity (i.e., court/lawn games, golf, and outdoor dining). Locations where surveys were easier, such as pools and beaches, may have included more females and vacationers in these waterside areas may have worn less clothing but used shade and sunglasses instead.

Studying sun protection and a sun safety intervention in warm-weather destination hotels/ resorts was difficult in terms of recruitment and labor-intensive in regard to assessing vacationers. Still, the results can advance our understanding of skin cancer risks and prevention behaviors during vacations when many Americans are exposed to a substantial and often dangerous amount of UV and fail to take precautions, increasing the risk of harming their skin and developing skin cancer.

Acknowledgments

This research was support by a grant from the U.S. National Cancer Institute (CA152411). The design, conduct, and interpretation of this research is solely that of the authors.

References

1. U.S. Department of Health and Human Services, Office of the Surgeon General. The Surgeon General's Call to Action to Prevent Skin Cancer. U.S. Department of Health and Human Services;Office of the Surgeon General; 2014.
2. American Cancer Society. Cancer Facts & Figures 2014. Atlanta, GA: American Cancer Society; 2014.
3. Armstrong, BK.; English, DR. Cutaneous malignant melanoma. In: Schottenfeld, D.; Franmeni, JF., editors. Cancer Epidemiology and Prevention. 2. New York, NY: Oxford University Press; 1996. p. 1282-1312.
4. Emmett EA. Occupational skin cancer: a review. J Occup Med. 1975; 17(1):44–49. [PubMed: 1091721]
5. Marks R. Nonmelanotic skin cancer and solar keratoses. The quiet 20th century epidemic. Int J Dermatol. 1987; 26(4):201–205. [PubMed: 3298089]
6. Rosso S, Zanetti R, Martinez C, et al. The multicentre south European study 'Helios' II: different sun exposure patterns in the aetiology of basal cell and squamous cell carcinomas of the skin. Br J Cancer. 1996; 73(11):1447–1454. [PubMed: 8645596]
7. Koh HK, Kligler BE, Lew RA. Sunlight and cutaneous malignant melanoma: evidence for and against causation. Photochem Photobiol. 1990; 51(6):765–779. [PubMed: 2195564]
8. Kricker A, Armstrong BK, English DR, Heenan PJ. Does intermittent sun exposure cause basal cell carcinoma? A case-control study in Western Australia. Int J Cancer. 1995; 60(4):489–494. [PubMed: 7829262]
9. MacKie RM, Aitchison T. Severe sunburn and subsequent risk of primary cutaneous malignant melanoma in Scotland. Br J Cancer. 1982; 46(6):955–960. [PubMed: 7150488]

10. Marks R, Jolley D, Lectsas S, Foley P. The role of childhood exposure to sunlight in the development of solar keratoses and non-melanocytic skin cancer. Med J Aust. 1990; 152(2):62–66. [PubMed: 2296232]
11. National Health and Medical Research Council of Australia. Primary Prevention of Skin Cancer in Australia: Report of the Sun Protection Working Party. Sydney, Australia: 1996.
12. Weinstock MA, Colditz GA, Willett WC, et al. Nonfamilial cutaneous melanoma incidence in women associated with sun exposure before 20 years of age. Pediatrics. 1989; 84(2):199–204. [PubMed: 2748244]
13. Weiss J, Bertz J, Jung EG. Malignant melanoma in southern Germany: different predictive value of risk factors for melanoma subtypes. Dermatologica. 1991; 183(2):109–113. [PubMed: 1743370]
14. American Cancer Society. Cancer Facts & Figures 2008. Atlanta, GA: American Cancer Society, Inc; 2008.
15. Espinosa AJ, Sanchez Hernandez JJ, Bravo FB, et al. Cutaneous malignant melanoma and sun exposure in Spain. Melanoma Res. 1999; 9(2):199–205. [PubMed: 10380943]
16. Marghoob A, Kopf AW, Bart RS, et al. Risk of another basal cell carcinoma developing after treatment of a basal cell carcinoma. J Am Acad Dermatol. 1993; 28(1):22–28. [PubMed: 8425966]
17. Hoy WE. Nonmelanoma skin carcinoma in Albuquerque, New Mexico: experience of a major health care provider. Cancer. 1996; 77(12):2489–2495. [PubMed: 8640697]
18. Karagas MR, Stukel TA, Greenberg ER, Baron JA, Mott LA, Stern RS. Risk of subsequent basal cell carcinoma and squamous cell carcinoma of the skin among patients with prior skin cancer. Skin Cancer Prevention Study Group. J Am Med Assoc. 1992; 267(24):3305–3310.
19. Girschik J, Fritschi L, Threlfall T, Slevin T. Deaths from non-melanoma skin cancer in Western Australia. Cancer Causes Control. 2008; 19(8):879–885. [PubMed: 18386140]
20. Essers B, Nieman F, Prins M, Smeets N, Neumann H. Perceptions of facial aesthetics in surgical patients with basal cell carcinoma. J Eur Acad Dermatol Venereol. 2007; 21(9):1209–1214. [PubMed: 17894707]
21. Bariani RL, Nahas FX, Barbosa MV, Farah AB, Ferreira LM. Basal cell carcinoma: an updated epidemiological and therapeutically profile of an urban population. Acta Cir Bras. 2006; 21(2):66–73. [PubMed: 16583057]
22. Hannuksela-Svahn A, Pukkala E, Karvonen J. Basal cell skin carcinoma and other nonmelanoma skin cancers in Finland from 1956 through 1995. Arch Dermatol. 1999; 135(7):781–786. [PubMed: 10411152]
23. Bickers DR, Lim HW, Margolis D, et al. The burden of skin diseases: 2004 a joint project of the American Academy of Dermatology Association and the Society for Investigative Dermatology. J Am Acad Dermatol. 2006; 55(3):490–500. [PubMed: 16908356]
24. Rosenberg CA, Greenland P, Khandekar J, Loar A, Ascensao J, Lopez AM. Association of nonmelanoma skin cancer with second malignancy. Cancer. 2004; 100(1):130–138. [PubMed: 14692033]
25. Kahn HS, Tatham LM, Patel AV, Thun MJ, Heath CW Jr. Increased cancer mortality following a history of nonmelanoma skin cancer. J Am Med Assoc. 1998; 280(10):910–912.
26. Moehrle M. Outdoor sports and skin cancer. Clin Dermatol. 2008; 26(1):12–15. [PubMed: 18280899]
27. O'Riordan DL, Steffen AD, Lunde KB, Gies P. A day at the beach while on tropical vacation: Sun protection practices in a high-risk setting for UV radiation exposure. Arch Dermatol. 2008; 144:1449–1455. [PubMed: 19015419]
28. Boldeman C, Branstrom R, Dal H, et al. Tanning habits and sunburn in a Swedish population age 13–50 years. Eur J Cancer. 2001; 37(18):2441–2448. [PubMed: 11720841]
29. Branstrom R, Kristjansson S, Dal H, Rodvall Y. Sun exposure and sunburn among Swedish toddlers. Eur J Cancer. 2006; 42(10):1441–1447. [PubMed: 16737807]
30. Silva IS, Higgins CD, Abramsky T, et al. Overseas sun exposure, nevus counts, and premature skin aging in young English women: A population-based survey. J Invest Dermatol. 2009; 129(1):50–59. [PubMed: 18615111]
31. Dulon M, Weichenthal M, Blettner M, et al. Sun exposure and number of nevi in 5- to 6-year-old European children. J Clin Epidemiol. 2002; 55(11):1075–1081. [PubMed: 12507670]

32. Pettijohn KJ, Asdigian NL, Aalborg J, et al. Vacations to waterside locations result in nevus development in Colorado children. Cancer Epidemiol Biomarkers Prev. 2009; 18:454–463. [PubMed: 19190148]

33. Kricker A, Armstrong BK, Goumas C, et al. Ambient UV, personal sun exposure and risk of multiple primary melanomas. Cancer Causes Control. 2007; 18(3):295–304. [PubMed: 17206532]

34. Vlajinac HD, Adanja BJ, Lazar ZF, et al. Risk factors for basal cell carcinoma. Acta Oncol. 2000; 39(5):611–616. [PubMed: 11093369]

35. Agredano YZ, Chan JL, Kimball RC, Kimball AB. Accessibility to air travel correlates strongly with increasing melanoma incidence. Melanoma Res. 2006; 16(1):77–81. [PubMed: 16432460]

36. Gefeller O, Tarantino J, Lederer P, Uter W, Pfahlberg AB. The relation between patterns of vacation sun exposure and the development of acquired melanocytic nevi in German children 6–7 years of age. Am J Epidemiol. 2007; 165(10):1162–1169. [PubMed: 17337756]

37. Ondrusova M, Mrinakova B, Ondrus D, Polakova K, Durdik S. Recent patterns in cutaneous melanoma descriptive epidemiology in the Slovak Republic. Neoplasma. 2013; 60(6):706–713. [PubMed: 23906306]

38. Vranova J, Arenbergerova M, Arenberger P, et al. Incidence of cutaneous malignant melanoma in the Czech Republic: the risks of sun exposure for adolescents. Neoplasma. 2012; 59(3):316–325. [PubMed: 22296501]

39. Rodrigues A, Sniehotta FF, Araujo-Soares V. Are interventions to promote sun-protective behaviors in recreational and tourist settings effective? A systematic review with meta-analysis and moderator analysis. Ann Behav Med. 2013; 45(2):224–238.10.1007/s12160-012-9444-8 [PubMed: 23229160]

40. Peterson M, Lambert SL. A demographic perspective on U.S. consumers' out-of-town vacationing and commercial lodging usage while on vacation. Journal of Travel Research. 2003; 42:116–124.

41. U. S. Department of Transportation, Bureau of Transportation Statistics. NHTS 2001 Highlights Report. Washington, DC: 2003.

42. U. S. Cancer Statistics Working Group. United States Cancer Statistics: 1999–2005 Incidence and mortality web-based report. Atlanta, GA: U.S. Department of Health and Human Services; Centers for Disease Control and Prevention, National Cancer Institute; 2009.

43. Patkose, M.; Stokes, AM.; Cook, SD. The Minority Traveler. Washington, DC: Travel Industry Association of America; 2003.

44. Buller DB, Andersen PA, Walkosz BJ, et al. Randomized trial testing a worksite sun protection program in an outdoor recreation industry. Health Educ Behav. 2005; 32(4):514–535. [PubMed: 16009748]

45. Walkosz BJ, Buller DB, Andersen PA, et al. Increasing sun protection in winter outdoor recreation: a theory-based health communication program. Am J Prev Med. 2008; 34(6):502–509. [PubMed: 18471586]

46. Andersen PA, Buller DB, Walkosz BJ, et al. Expanding occupational sun safety to an outdoor recreation industry: a translational study of the Go Sun Smart program. Transl Behav Med. 2012; 2(1):10–18. [PubMed: 23105954]

47. Walkosz BJ, Buller DB, Andersen PA, et al. Dissemination of Go Sun Smart in outdoor recreation: effect of program exposure on sun protection of guests at high-altitude ski areas [published online ahead of print Mar 11, 2014]. J Health Commun. 2014; 19(9):999–1016. [PubMed: 24617350]

48. Saraiya M, Glanz K, Briss PA, et al. Interventions to prevent skin cancer by reducing exposure to ultraviolet radiation: a systematic review. Am J Prev Med. 2004; 27(5):422–466. [PubMed: 15556744]

49. Buller DB, Cokkinides V, Hall HI, et al. Prevalence of sunburn, sun protection, and indoor tanning behaviors among Americans: systematic review from national surveys. J Am Acad Dermatol. 2011; 65(5 Suppl 1):114–123.

50. Buller DB, Andersen PA, Walkosz B. Sun safety behaviours of alpine skiers and snowboarders in the western United States. Cancer Prev Control. 1998; 2(3):133–139. [PubMed: 10093624]

51. Jennings, E.; Whiteley, J.; Marcus-Blank, B.; Weinstock, M. Physical activity and sun protection behaviors in a randomized controlled physical activity trial. Paper presented at: 2008 SBM Annual

Meeting & Scientific Sessions; 2008; San Diego, CA. http://www.sbm.org/meeting/2008/am08_finalpro.pdf

52. Andersen PA, Buller DB, Walkosz BJ, et al. Testing a theory-based health communication program: a replication of Go Sun Smart in outdoor winter recreation. J Health Commun. 2009; 14(4):346–365. [PubMed: 19466647]
53. Walkosz, B.; Buller, D.; Buller, M.; Andersen, P.; Dignan, M.; Cutter, G. Sun Safety 2.0: new directions in health communication. Paper presented at: CDC Health Communication and Marketing Conference; Atlanta, GA.
54. Andersen PA, Buller DB, Voeks JH, et al. Testing the long term effects of the Go Sun Smart worksite sun protection program: a group-randomized experimental study. J Commun. 2008; 58(3):447–471.
55. Andersen PA, Buller DB, Walkosz BJ, et al. Environmental cues to ultraviolet radiation and personal sun protection in outdoor winter recreation. Arch Dermatol. 2010; 146:1241–1247. [PubMed: 21079060]
56. Campbell, DT.; Stanley, JC. Experimental and Quasi-Experimental Designs for Research. Chicago, IL: Rand McNally; 1963.
57. Green MC, Brock TC. The role of transportation in the persuasiveness of public narratives. J Pers Soc Psychol. 2000; 79:701–721. [PubMed: 11079236]
58. Green, MC.; Brock, TC. In the mind's eye: transportation-imagery model of narrative persuasion. In: Green, MC.; Strange, JJ.; Brock, TC., editors. Narrative Impact: Social and Cognitive Foundations. Mahwah, NJ: Erlbaum; 2002. p. 315-341.
59. Bandura, A. Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs NJ: Prentice Hall; 1986.
60. Petraglia J. Narrative intervention in behavior and public health. J Health Commun. 2007; 12(5): 493–505. [PubMed: 17710598]
61. Reinhart, AM.; Feeley, TH. Comparing the persuasive effects of narrative versus statistical messages: a meta-analytic review. 2007 NCA Annual Convention Communicating Worldviews: Faith-Intellect-Ethics; November 15–18; Chicago, IL.
62. Green MC. Narratives and cancer communication. J Commun. 2006; 56(Suppl 1):S163–S183.
63. Cohen J. Defining identification: a theoretical look at identification of audiences with media characters. Mass Communication and Society. 2001; 4(3):245–264.
64. Slater MD, Buller DB, Waters E, Archibeque M, LeBlanc M. A test of conversational and testimonial messages versus didactic presentations of nutrition information. J Nutr Educ Behav. 2003; 35(5):255–259. [PubMed: 14521825]
65. Potter WJ. Perceived reality and cultivation hypothesis. J Broadcast Electron. 1986; 30:159–174.
66. Austin EW, Pinkleton BE, Fujioka Y. The role of interpretation processes and parental discussion in the media's effects on adolescents' use of alcohol. Pediatrics. 2000; 105(2):343–349. [PubMed: 10654953]
67. Bellis MA, Hughes K, Lowey H. Healthy nightclubs and recreational substance use. From a harm minimisation to a healthy settings approach. Addict Behav. 2002; 27(6):1025–1035. [PubMed: 12369470]
68. Eiser J, Ford N. Sexual relationships on holiday: A case of situational disinhibition. J Soc Pers Relat. 1995; 12:323–339.
69. Bellis MA, Hughes K, Thomson R, Bennett A. Sexual behaviour of young people in international tourist resorts. Sex Transm Infect. 2004; 80(1):43–47. [PubMed: 14755035]
70. Bellis MA, Hughes KE, Dillon P, Copeland J, Gates P. Effects of backpacking holidays in Australia on alcohol, tobacco and drug use of UK residents. BMC Public Health. 2007; 7:1. [PubMed: 17199891]
71. Benotsch EG, Nettles CD, Wong F, et al. Sexual risk behavior in men attending Mardi Gras celebrations in New Orleans, Louisiana. J Community Health. 2007; 32(5):343–356. [PubMed: 17922205]
72. Hughes K, Bellis MA, Calafat A, Juan M, Schnitzer S, Anderson Z. Predictors of violence in young tourists: a comparative study of British, German and Spanish holidaymakers. Eur J Public Health. 2008; 18(6):569–574. [PubMed: 18784183]

73. Ragsdale K, Difranceisco W, Pinkerton SD. Where the boys are: sexual expectations and behaviour among young women on holiday. Cult Health Sex. 2006; 8(2):85–98. [PubMed: 16641059]
74. Tutenges S, Hesse M. Patterns of binge drinking at an international nightlife resort. Alcohol Alcoholism. 2008; 43(5):595–599. [PubMed: 18503081]
75. Rogers, EM. Diffusion of Innovations. New York, NY: Free Press; 2003.
76. Buller DB, Andersen PA, Walkosz BJ, et al. Enhancing industry-based dissemination of an occupational sun protection program with theory-based strategies employing personal contact. Am J Health Promot. 2012; 26(6):356–365. [PubMed: 22747318]
77. Dobbinson SJ, Jamsen K, Dixon HG, et al. Assessing population-wide behaviour change: concordance of 10-year trends in self-reported and observed sun protection. Int J Public Health. 2014; 59:157–166. [PubMed: 23519893]
78. Wallace AB. The exposure treatment of burns. Lancet. 1951; 1(6653):501–504. [PubMed: 14805109]
79. Shoveller JA, Lovato CY. Measuring self-reported sunburn: challenges and recommendations. Chronic Disease in Canada. 2001; 22(3–4):83–98.
80. Lovato C, Shoveller J, Mills C. Canadian national workshop on measurement of sun-related behaviours [Workshop report]. Chronic Disease in Canada. 1999; 20(2):96–100.
81. Benotsch EG, Martin AM, Espil FM, Nettles CD, Seal DW, Pinkerton SD. Internet use, recreational travel, and HIV risk behaviors in men who have sex with men. J Community Health. 2011; 36(3):398–405.10.1007/s10900-010-9321-y [PubMed: 20924778]
82. Kanetsky PA, Rebbeck TR, Hummer AJ, et al. Population-based study of natural variation in the melanocortin-1 receptor gene and melanoma. Cancer Res. 2006; 66(18):9330–9337. [PubMed: 16982779]
83. Buller, DB.; Walkosz, BJ.; Andersen, PA.; Scott, MD.; Dignan, MB.; Cutter, GR. The Go Sun Smart campaign: achieving individual and organizational change for occupational sun protection. In: Rice, R.; Atkin, C., editors. Public Communication Campaigns. Vol. 4. Thousand Oaks, CA: Sage; 2012. p. 191-204.
84. Scott MD, Buller DB, Walkosz BJ, Andersen PA, Cutter GR, Dignan MB. Go sun smart. Communication Education. 2008; 57(4):423–433. [PubMed: 20148119]
85. Wu XC, Eide MJ, King J, et al. Racial and ethnic variations in incidence and survival of cutaneous melanoma in the United States, 1999–2006. J Am Acad Dermatol. 2011; 65(5 Suppl 1):S26–S37. [PubMed: 22018064]
86. UV index scale. Environmental Protection Agency Web site; Available at: http://www2.epa.gov/sunwise/uv-index-scale. Published. Updated [Accessed May 4, 2015]
87. World Health Organization, World Meterological Organization, United Nations Environment Programme, International Commission on Non-Ionizing Radiation Protection. Global Solar UV Index: A Practical Guide. Geneva, Switzerland: World Health Organization; 2002.
88. Thieden E, Philipsen PA, Sandby-Moller J, Wulf HC. Sunscreen use related to UV exposure, age, sex, and occupation based on personal dosimeter readings and sun-exposure behavior diaries. Arch Dermatol. 2005; 141(8):967–973. [PubMed: 16103325]
89. Dobbinson S, Wakefield M, Hill D, et al. Prevalence and determinants of Australian adolescents' and adults' weekend sun protection and sunburn, summer 2003–2004. J Am Acad Dermatol. 2008; 59(4):602–614. [PubMed: 18691790]
90. Autier P, Dore JF, Reis AC, et al. Sunscreen use and intentional exposure to ultraviolet A and B radiation: a double blind randomized trial using personal dosimeters. Br J Cancer. 2000; 83(9): 1243–1248. [PubMed: 11027441]
91. Autier P, Boniol M, Dore JF. Sunscreen use and increased duration of intentional sun exposure: still a burning issue. Int J Cancer. 2007; 121(1):1–5. [PubMed: 17415716]
92. Saraiya M, Glanz K, Briss P, Nichols P, White C, Das D. Preventing skin cancer: findings of the task force on community preventive services on reducing exposure to ultraviolet light. Morbidity and Mortality Weekly Report. 2003; 52(RR15):1–12.
93. Moloney FJ, Collins S, Murphy GM. Sunscreens: safety, efficacy and appropriate use. Am J Clin Dermatol. 2002; 3(3):185–191. [PubMed: 11978139]

94. Vainio H, Miller AB, Bianchini F. An international evaluation of the cancer-preventive potential of sunscreens. Int J Cancer. 2000; 88(5):838–842. [PubMed: 11072258]
95. Buller DB, Andersen PA, Walkosz BJ, et al. Compliance with sunscreen advice in a survey of adults engaged in outdoor winter recreation at high-elevation ski areas. J Am Acad Dermatol. 2012; 66(1):63–70. [PubMed: 21742410]
96. Manova E, von Goetz N, Hauri U, Bogdal C, Hungerbuhler K. Organic UV filters in personal care products in Switzerland: a survey of occurrence and concentrations. Int J Hyg Environ Health. 2013; 216(4):508–514.10.1016/j.ijheh.2012.08.003 [PubMed: 23026542]
97. Sehedic D, Hardy-Boismartel A, Couteau C, Coiffard LJ. Are cosmetic products which include an SPF appropriate for daily use? Archives of Dermatological Research. 2009; 301(8):603–638.10.1007/s00403-009-0974-2 [PubMed: 19543900]
98. Neale R, Williams G, Green A. Application patterns among participants randomized to daily sunscreen use in a skin cancer prevention trial. Arch Dermatol. 2002; 138(10):1319–1325. [PubMed: 12374537]

Table 1

Demographics of hotel/resort vacationers and time, location, and environment characteristics of observations and surveys at pretest

	Observation		Survey		p
Characteristics	**N**	**Percent**	**N**	**Percent**	
Demographics					
Age					
18–34	4091	29.7%	3469	20.4%	<0.001
35–60		47.9%		58.2%	
60+		22.4%		21.4%	
Gender					
Female	4339	49.6%	3520	61.2%	<0.001
Male		50.4%		38.8%	
Education					
High school or less				10.6%	
Technical education or some college	N/A	N/A	3519	21.1%	N/A
4-year college graduate				40.8%	
Postgraduate degree				27.5%	
Ethnicity and race					
Non-Hispanic White	N/A	N/A	3457	93.1%	N/A
Hispanic White				2.3%	
Non-White				4.6%	
Skin phenotype					
darkest skin and lowest risk - 1	N/A	N/A	3516	19.0%	N/A
2				24.9%	
3				33.7%	
4				20.3%	
lightest skin and highest risk - 5				2.1%	
Time and Location of Assessments					

	Observation		Survey		p
Characteristics	**N**	**Percent**	**N**	**Percent**	
Time of assessments					
9:00 and before	4347	0.4%	3488	0.1%	<0.001
9:01–10:00		1.6%		3.0%	
10:01–11:00		5.2%		15.3%	
11:01–12:00		17.8%		22.2%	
12:01–13:00		38.1%		10.8%	
13:01–14:00		29.9%		14.8%	
14:01–15:00		4.4%		16.6%	
15:01–16:00		2.2%		14.5%	
after 16:00		0.4%		2.7%	
Location of assessments					
Swimming Pool	4347	30.4%	3531	41.3%	<0.001
Private Beach		6.4%		10.6%	
Outdoor Dining		19.0%		5.3%	
Court and Lawn Games		5.5%		3.3%	
Golf Course		15.0%		10.8%	
Marina		3.3%		4.3%	
Activity Area		6.0%		12.0%	
Commons and Reception		7.1%		12.4%	
Other		7.3%		0.0%	
Environmental Characteristics					
UV Index					
2 or lower	4297	3.9%	3476	10.2%	<0.001
(2, 4]		17.2%		20.5%	
(4, 6]		16.6%		22.1%	
(6, 8]		30.2%		25.2%	
(8, 10]		25.0%		17.2%	

	Observation		Survey		p
Characteristics	**N**	**Percent**	**N**	**Percent**	
Higher than 10		7.1%		4.8%	
Cloud cover					
0%	4328	22.5%	3505	22.7%	<0.001
10%		9.8%		11.0%	
20%		9.8%		12.4%	
30%		12.7%		10.5%	
40%		8.9%		8.4%	
50%		11.0%		8.3%	
60%		6.9%		3.6%	
70%		4.0%		4.8%	
80%		2.8%		4.2%	
90%		3.3%		4.3%	
100%		8.3%		9.8%	
Average daily high temperature (SD)	4239	79.8°F (8.40)	3435	79.7°F (8.40)	0.528
Proximity to summer solstice					
0–15 days	4347	14.4%	3531	15.8%	0.008
16–30 days		19.6%		20.2%	
31–45 days		22.0%		24.0%	
46–60 days		22.4%		20.9%	
61–75 days		13.3%		12.4%	
76+ days		8.3%		6.7%	
Proximity to noon					
0–30 minutes	4347	36.9%	3488	11.9%	<0.001
31–60 minutes		32.6%		14.6%	
61–90 minutes		14.4%		19.9%	
91–120 minutes		6.4%		19.4%	
121–150 minutes		3.6%		16.7%	

	Observation		Survey		p
Characteristics	N	Percent	N	Percent	
151–180 minutes		3.8%		12.4%	
181+ minutes		2.3%		5.1%	

Table 2

Sun protection practices of hotel/resort guests at pretest

Sun Protection Practice	Observation			Survey			p
	N	Percent	ICC*	N	Percent	ICC*	
Hat							
No hat		68.2			69.9		
Visor		5.0			5.2		
Narrow brim hat	4344	1.3	0.051	3488	1.1	0.045	0.170
Baseball cap		20.6			18.3		
Legionnaire hat		0.4			0.4		
Wide-brim hat		4.5			5.1		
Sunglasses							
No sunglasses	4333	48.1	0.058	3511	41.9	0.063	<.001
Sunglasses		51.9			58.1		
Shirt							
No shirt		10.1			9.9		
Strapless		4.0			5.9		
Sleeveless		24.0			28.5		
¼ length sleeves	4337	29.1	0.002	3506	29.5	0.002	<.001
Elbow length sleeves		20.0			13.7		
¾ length sleeves		3.6			3.9		
Wrist length sleeves		9.2			8.6		
Shirt collar							
No collar	4300	70.5	0.178	3419	76.4	0.158	<.001
Collar		29.5			23.6		
Neckline							
Low		33.4			46.5		
High	4331	55.1	0.064	3505	43.6	0.073	<.001

Sun Protection Practice	Observation			Survey			p
	N	Percent	ICC*	N	Percent	ICC*	
No shirt		10.1			9.9		
Can't see		1.4			0.0		
Midriff							
Exposed		6.3			8.5		
Covered	4331	83.1	0.081	3487	81.6	0.074	<.001
No shirt		10.1			9.9		
Can't see		0.5			0.0		
Leg Covering							
Short shorts/skirt		9.3			13.0		
Bikini/speedo		9.3			15.2		
Mid-thigh		20.1			21.0		
Knee length	4323	39.0	0.045	3480	29.3	0.000	<.001
¾ length		7.1			9.3		
Angle length		13.2			12.1		
Can't see		2.0			0.1		
Socks							
No socks		57.4			67.5		
Ankle length		28.0			24.3		
Calf length	4334	3.0	0.057	3498	2.9	0.053	<.001
Knee length		0.1			0.2		
Can't see		11.5			5.1		
Shoes							
No shoes		26.1			40.4		
Thong/flip-flops/sandals	4344	25.3	0.043	3506	22.7	0.000	<.001
Shoes		44.3			36.5		
Can't see		4.3			0.4		
Shade							

Sun Protection Practice	Observation			Survey			p
	N	Percent	ICC*	N	Percent	ICC*	
No shade/in full sun		65.1			57.5		
In partial shade	4330	15.1	0.038	3489	17.8	0.006	<.001
In full shade		19.5			24.6		
Can't see		0.3			0.1		
Shade coverage							
0%		65.5			58.0		
25%		4.2			5.6		
50%	4307	7.1	0.118	3462	6.9	0.130	<.001
75%		3.6			4.7		
100%		19.6			24.8		
Sunscreen (SPF 15+)							
Did not apply	N/A	N/A	N/A	3530	40.2	0.067	N/A
Applied					59.8		
Pre-application of sunscreen**							
After going outside	N/A	N/A	N/A	2091	22.9	0.038	N/A
When going outside					29.2		
1–29 minutes before going outside					9.4		
30 or more minutes before going outside					38.5		
Reapplication of sunscreen**							
Did not need to reapply (first application<2 hours ago)					44.1		
Did not reapply	N/A	N/A	N/A	1626	35.6	0.127	N/A
Reapplied					20.3		
Sunburns in the past 12 months							
0					57.7		
1	N/A	N/A	N/A	3523	22.3	0.035	N/A
2					11.2		

Sun Protection Practice	Observation			Survey			p
	N	Percent	ICC*	N	Percent	ICC*	
3 or more					8.8		
Sunburned while recreating at this hotel/resort							
Not sunburned	N/A	N/A	N/A	3523	93.4	0.061	N/A
Sunburned					6.6		

* Intra-class correlation – a measure of the similarity of behaviors within a hotel/resort (i.e., the cluster effect).

** Reported for those who applied sunscreen.

N/A=not assessed in observational measure