Contemporary Clinical Trials 46 (2016) 67–76

Contents lists available at ScienceDirect

Contemporary Clinical Trials

journal homepage: www.elsevier.com/locate/conclintrial

Rationale, design, samples, and baseline sun protection in a randomized trial on a skin cancer prevention intervention in resort environments

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ARTICLE INFO

Article history:
Received 25 June 2015
Received in revised form 17 November 2015
Accepted 19 November 2015
Available online 22 November 2015

Keywords:
Skin cancer
Prevention
Intervention
Sunscreen
Clothing
Recreation

ABSTRACT

Introduction: Exposure to solar ultraviolet radiation during recreation is a risk factor for skin cancer. A trial evaluated 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 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 = 24° 78′ N to 50° 52′ N; elevation = 2 ft. to 9726 ft. above sea level), and had a variety of outdoor venues (beaches/pools, court/lawn games, golf courses, common areas, and chairlifts). At pretest, 4347 vacationers were observed and 3531 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 showed that the large, multi-state sample of vacationers were at high risk for solar UV exposure.

1. 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.

1.1. 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 beachgoers 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

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http://dx.doi.org/10.1016/j.cct.2015.11.015
1551-7144/

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.

1.2. 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].

1.3. 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.

2. Materials and methods

2.1. 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 an 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.

2.2. 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 detailbelow, 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. 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.

2.3. 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 min before sun exposure, reapplying it within 2 h 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