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Environmental variables associated with vacationers' sun protection at warm weather resorts in North America

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ABSTRACT

Background: Vacationing at sunny, warm weather locations is a risk factor for excessive solar ultraviolet (UV) radiation exposure and skin cancer.
Objectives: This study examined the association of environmental variables related to UV levels with vacationers' sun protection.
Methods: Vacationers at 41 summer resorts in 17 states and 1 Canadian Province were interviewed ($n=3531$) and observed ($N=4347$) during 2012 and 2013. Clothing coverage, sunglasses, and shade use were observed. Use of sunscreen and sunburns were self-reported. Environmental information was recorded by research staff or acquired from ground stations and the weather service.
Results: Temperature was positively associated with sun protection behaviors; however clothing coverage was negatively associated with temperature. Cloud cover was negatively associated with sun protection, with the exception of clothing coverage which was positively associated with it. Elevation showed a mixed pattern of associations with vacationer's sun protection. Latitude of a resort was negatively associated with most sun protection behaviors, such that sun protection increased at more southerly resorts. Similarly, the farther south a vacationer traveled to the resort, the less sun protection they employed. The UV index showed a weak, positive relationship with some sun protection behaviors even when controlling for temperature.
Conclusions: Vacationers appeared aware that UV is higher at southern latitudes and may learn UV is intense when living in southern regions. However, many used temperature, an unreliable cue, to judge UV intensity and seemed to adjust clothing for warmth not UV protection. Efforts are needed to help individuals make more accurate sun safety decisions.

1. Introduction

The skin cancer epidemic continues to be a major global environmental health problem. In the United States alone more than 3.5 million new cases of skin cancer will occur this year including more than 76,000 new cases of melanoma, the deadliest skin cancer (American Cancer Society, 2014). Excessive ultraviolet radiation (UVR) accounts for most cases of skin cancer (American Cancer Society, 2014; Etzkorn et al., 2013; Gallagher et al., 1996; Green et al., 2011). Annually, 37% of the U.S. population sunburns, a direct outcome of excessive environment UVR exposure (Holman et al., 2014). Although sun protection should be a top priority in the fight against skin cancer (Espina et al., 2013), most Americans continue to engage in behaviors that put themselves at risk, including their sporadic use of sunscreen and their failure to wear sun protective clothing (Buller et al., 2011; Coups et al., 2008).

Studies conducted in Europe, Australia, Canada, and the United States at sunny, warm weather resorts show that vacationing at such venues is a major risk factor for excessive sun exposure and skin cancer. Research on Swedes and Danes, and beachgoers in Hawaii, found each cohort received excessive sun exposure, including sunburns attributable to purposeful suntanning (Boldeman et al., 2001; Bränström et al., 2006; Køster et al., 2011; O'Riordan et al., 2008). Data from Australia, Canada, Italy, and the US revealed that melanoma is associated with lifetime recreational sun exposure, beach and waterside activities, and vacations in a sunny climate (Kricker et al., 2007). Even mountain holidays were linked to increased melanoma among Czechs and Slovaks

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(Ondrusova et al., 2013; Vranova et al., 2012). Further, indicative of high risk vacation sun exposure were findings that travel to warm weather countries, particularly waterside vacations, were associated with more skin nevi, a correlate of melanoma, and skin damage (Dulon et al., 2002; Pettijohn et al., 2009; Silva et al., 2009). Indeed, low airfares and more travel to resort locations are associated with increased incidence of melanoma (Agredano et al., 2006). Understanding patterns of sun exposure and sun protection by vacationers at sunny resorts can be a major element in skin cancer prevention (Diaz and Nesbitt, 2013).

Vacationers' sun safety behavior at resorts may be driven by interacting environmental forces, primarily temperature and recreational activities and to a lesser degree latitude, elevation, and actual UV (Andersen et al., 2010). The current study examines environmental factors that influence sun protection attitudes and behaviors of vacationers visiting North American resorts in proximity to the summer solstice, the sunniest time of the year. Research suggests that vacationers are fairly insensitive to the prevalence of UV. In a study at North American ski resorts, Andersen et al. (2010) reported, "sun protection did not consistently increase when UV levels were elevated [and] overall sun protection was negatively related to UV" (Andersen et al., 2010, p. 1242). Because people do not sense UV, "they must infer UV levels from its link to temporal, geographic, or meteorological characteristics …" (p. 1245). Unfortunately, in that study vacationers tended to infer the need for sun protection from unreliable environmental cues such as temperature and cloud cover.

Vacationers tend to infer the need for sun protection from cues that are weakly related to UV (Andersen et al., 2010). Outdoor recreators erroneously use temperature as their UV index, particularly in winter (Andersen et al., 2010; van der Leun et al., 2008) and are more likely to get sunburned in cool weather (Hill et al., 1992). Likewise, cloudiness is negatively associated with sun protection (Andersen et al., 2010), putting people at greater risk because clouds still permit between 50% and 80% of UV to reach the skin (Andersen et al., 2010; Blumthaler and Ambach, 1988; Blumthaler et al., 1997; Fioletov et al., 2003; Kerr, 2005) and the transient nature of cloudiness produces UV variation throughout the day.

Other environmental features are more reliably associated with UV levels but only weakly associated with sun protection. Solar radiation is greater at high elevation, increasing 4–8% for each thousand-foot gain in elevation (Blumthaler et al., 1997; Piazena, 1996), but not associated with increased sun protection during winter outdoor recreation (Andersen et al., 2010). UV is also much higher at lower latitudes (Kerr, 2005; van der Leun et al., 2008) so vacationers traveling to the south will experience higher UV levels beyond what they normally experience. In fact, residents of the Midwest engaged in the most risky skin cancer behavior in one survey (Coups et al., 2008). By contrast, people living in southerly latitudes may have more experience with the effects of UV and practice more sun safety. Based on this rationale the following hypotheses and research questions will be tested.

H1: Temperature will be positively associated with vacationers' sun protection behaviors during warm weather recreation.

H2: Cloudiness at warm weather resorts will be negatively associated with vacationers' sun protection.

RQ1: What is the association between tourist sun safety behavior and elevation of a summer resort?

H3(a): Latitude of a resort is negatively associated with sun safety behavior such that vacationers at more southerly resorts engage in more sun protection.

H3(b): Latitude of vacationers' residence is negatively associated with sun safety behavior such that those from more northerly latitudes will engage in less sun protection.

H3(c): The difference between the latitude of vacationers' residence and the latitude of the resort they are visiting is negatively associated with sun safety behavior.

RQ2: What is the association between the UV Index at the time of the interview and vacationers' sun safety behavior?

RQ3: Will the association between amount of UV (i.e., UV Index) and vacationer sun safety behavior be entirely accounted for by temperature such that the partial correlation will be zero?

2. Methods

2.1. Participants

This study is based on two samples of vacationers, defined here as visitors spending one or more days at 41 North American summer resorts in seventeen states from March to September 2012/2013 when UV is high in the Northern Hemisphere. Although the vast majority of the participants were guests, vacationing at the summer resorts, some participants were day users at the resort. Nonetheless, the term "vacationer" is used to describe the participants throughout this paper. Both samples in the present study were from the baseline assessment within a randomized controlled trial conducted to evaluate an intervention promoting sun protection. The research protocols were approved by the San Diego State University Institutional Review Board and the Quorum Institutional Review Board. The full trial design, protocols, and measures were described previously (Buller et al., in press).

Sample one consisted of 3531 adult vacationers who completed intercept surveys and were also observed for sun safety behavior. The second sample consisted of unobtrusive observation of 4347 adult vacationers' sun safety behavior. Recruitment of 41 summer resorts occurred between fall 2011 and spring 2013. For this study, the term "resorts" refers to a full range of lodging that includes everything from high-end destination hotels to lodging at five state parks. Inclusion criteria required that a resort: (1) had vacationers who stayed overnight, (2) had on-site lodging controlled by the resort, (3) had at least three on-site outdoor venues where vacationers recreated either passively or actively (i.e., pool, beach, marina, golf course, court and lawn games, outdoor dining, outdoor activity areas, playgrounds, and mountain biking and hiking trails), (4) was located in North America, and (5) consented to participate. Resorts were contacted by mail, email, and telephone from lists provided by two large industry professional associations: the American Hotel and Lodging Association (AHLA) and the Hospitality Sales and Marketing Association International (HSMAI) and subsequent referrals and supplemented with resorts who were members of the National Ski Area Association (NSAA). A total of 385 resorts were initially selected; 124 (32%) failed to meet inclusion criteria, 114 (30%) refused to participate, 106 (28%) were never reached before the sample quota was achieved, and 41 participated (11%). Participating resorts were distributed throughout the United States and Canada, with 9 in Florida, 5 in Ohio, 5 in Vermont, 3 in California, 2 in Colorado, 2 in Oregon, 2 in Minnesota, 2 in New Mexico, 2 in New Hampshire, 1 in Georgia, 1 in New York, 1 in West Virginia, 1 in Michigan, 1 in Missouri, 1 in Utah, 1 in Wyoming, 1 in Arizona, and 1 in British Columbia.

2.2. Procedures

Resorts were enrolled in two waves to manage staffing and cost; 17 resorts were assessed March to September 2012 and 24 resorts were assessed February to September 2013. Assessment was conducted over a 2–3 day period at each resort, with the goal of surveying 95 vacationers and unobtrusively observing 100 vacationers. Two researchers trained in observation and interview techniques visited each resort and performed the data collection. The protocol instructed researchers in Sample 1 to interview and observe vacationers in outdoor recreation areas between 10 am