Available online at www.sciencedirect.com
SCIENCE DIRECT
Preventive Medicine 42 (2006) 291–296
Preventive Medicine
www.elsevier.com/locate/ypmed

Observed use of sunglasses in public outdoor settings around Melbourne, Australia: 1993 to 2002

Magdalena Lagerlund [a], Helen G. Dixon [a,*], Julie A. Simpson [b], Matt Spittal [a], Hugh R. Taylor [c], Suzanne J. Dobbinson [a]

[a] Centre for Behavioural Research in Cancer, The Cancer Council Victoria, 1 Rathdowne Street, Carlton, Victoria 3053, Australia
[b] Cancer Epidemiology Centre, The Cancer Council Victoria, Carlton, Victoria 3053, Australia
[c] Centre for Eye Research Australia, University of Melbourne, East Melbourne, Victoria 8002, Australia

Available online 20 February 2006

Abstract

Background. Wearing sunglasses may reduce the risk of cataract and of skin cancer in the periorbital area. Understanding predictors of sunglasses use may help identify groups with lower usage patterns.

Methods. An annual observational field survey of teenagers and adults at leisure at outdoor venues around Melbourne, Australia was conducted between 11 am and 3 pm on mainly sunny, summer weekends (n = 42,207). The serial cross-sectional survey assessed sun protection behaviors, including use of sunglasses from 1993 to 2002, and other variables hypothesized to predict sun-related behavior (sex, age, SES, activity level and setting, size of social group, and weather conditions). Predictors of use of sunglasses were assessed using multivariate logistic regression.

Results. 36.2% of those observed wore sunglasses, and this increased only slightly over the years. Sunglasses use was most common among those observed on sunny days, in no or partial shade, in parks/gardens and at pools/beaches, less active people and people on their own or in pairs, people observed in higher socio-economic areas, females, people 20–50 years of age, and people wearing head and clothes cover.

Conclusion. Sunglasses use should be encouraged among the population in general and especially among golfers, tennis players, teenagers, males, and people in lower SES areas.

Keywords: Cataract; Eye diseases; Skin neoplasms; Eye protective devices; Sunlight; Ultraviolet rays; Public health; Observation; Australia

Introduction

Cataract is the leading cause of blindness and visual impairment worldwide (Thylefors et al., 1995). Sunlight exposure (particularly UV-B exposure) appears to be an important risk factor for cataract (McCarty and Taylor, 2002; World Health Organization, 1994; English et al., 1997). Sunglasses can provide an effective method of reducing ocular solar UV exposure (Gies et al., 1998). This should be beneficial in relation to cataract prevention and prevention of skin cancer in the periorbital area.

Australia has extreme levels of solar UV radiation (Lemus-Deschamps et al., 1999). It was the first country to introduce mandatory standards for sunglasses in the 1980s; UVR protection provided by sunglasses has increased substantially since then (Gies et al., 1998). In Victoria, Australia, skin cancer prevention campaigns have recommended use of sunglasses as part of sun protection since the 1980s (Montague et al., 2001).

Published reports on use of sunglasses during peak UV periods are relatively rare in the literature and have tended to be one-off observational surveys conducted in a single setting (e.g. Robinson and Rademaker, 1998; Threlfall, 1992; Whiteman et al., 1994; Zitser et al., 1996), one-off self-report surveys (Lee et al., 1994; Cokkinides et al., 2001; Richards et al., 2001), or cross-sectional self-report surveys conducted over a number of years (Dobbinson et al., 2002; Dobbinson, 2004; Livingston et al., 2003; Tamir et al., 2002). Use of sunglasses varies widely across studies, from as low as 28% to as high as 63%. It is unclear to what extent variations in sunglasses use observed in different studies are attributable to differences in the settings in which the studies were conducted, variations in the

* Corresponding author. Fax: +61 3 9635 5380.
E-mail address: Helen.Dixon@cancervic.org.au (H.G. Dixon).

0091-7435/$ - see front matter © 2006 Elsevier Inc. All rights reserved.
doi:10.1016/j.ypmed.2006.01.003

demographic characteristics of those surveyed, varying weather conditions, or to other differences in the methods of the respective studies. Few studies make detailed descriptions of predictors of use of sunglasses since they have generally not focused on use of sunglasses as their primary outcome. Among the predictors of use of sunglasses that have been presented are age (Dobbinson et al., 2002; Lee et al., 1994; Robinson and Rademaker, 1998), sex (Cokkinides et al., 2001; Dobbinson et al., 2002; Lee et al., 1994; Livingston et al., 2003; Richards et al., 2001; Robinson and Rademaker, 1998; Threlfall, 1992; Zitser et al., 1996;), and clothes cover (Threlfall, 1992).

The aim of this study was to describe differences in use of sunglasses related to environmental factors and individual factors, and to examine cross-sectional trends in use of sunglasses among teenagers and adults at leisure in public, outdoor places around Melbourne, Australia between 1993 and 2002.

Methods

Subjects and setting

This study was part of an observational field survey of sun protection behavior that was conducted as a serial cross-sectional survey annually from 1992 to 2002 by the Centre for Behavioural Research in Cancer. Use of sunglasses was measured from 1993 onward. The survey targeted people who appeared to be 14 years or older and were at leisure at parks, gardens, golf courses, tennis courts, pools, or beaches located within a 25 km radius of Melbourne's General Post Office, Australia. The survey was conducted between 11 am and 3 pm on mainly sunny and warm weekends in February and March; times of the day and year when solar UV levels peak. 46,432 participants were observed between 1993 and 2002. 9.1% (n = 4225) of the total sample were missing data on one or more variables. 4.9% (n = 2255) had missing values for sunglasses; most of these (n = 1935) were caused by a misprint in many of the record sheets in 1996. Official wind data were missing for 3% of cases, but among the variables assessed by the field workers, missing data did not exceed 1.2%. This study reports on 42,207 participants with complete data on all variables included in a multivariate model assessing predictors of sunglasses use. There was an approximately equal distribution of subjects across venue types and survey years.

Procedures

A precoded record sheet was used by trained field workers to document observations on each subject's sun protection behavior (use of sunglasses, clear lens prescription glasses not included; hat use; extent of clothes coverage; shade use) and other personal and contextual variables hypothesized to predict the level of sun exposure/protection (sex, age, venue type, activity level, number of people with the observed, and weather conditions). The details of observations made for each measure are shown in Table 1.

At each venue, the date, time, type of leisure venue, and suburb were recorded. A proxy indicator of SES was assigned to each subject based on the postcode of the suburb in which people were observed. The Australian Bureau of Statistics' 1996 urban index of relative socio-economic advantage was used (Australian Bureau of Statistics, 2003).

The aim was to achieve an annual sample size of 1000 people per venue type—a total of approximately 4000. A general data collection criterion for each location was spending a maximum of 30 min at the location, or sampling a maximum of 50 people, or observing all people present—whichever occurred first.

Weather data

Official weather information (temperature, wind and cloud cover) from the Bureau of Meteorology (BOM) and solar ultraviolet (UV) radiation levels from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) were added to individual data.

Interrater/coder reliability

On two days in 1997, pairs of coders independently coded sun protection behavior on a random subset of the same 529 subjects (1%) of the full sample. Reliability of the between-observer coding was assessed with Cohen's kappa for nominal data and with the intraclass correlation coefficient for ordinal data. Cohen's kappa reached a satisfactory level of 0.89 for sunglasses, 0.97 for venue type, and 0.95 for sex, but only 0.59 for shade availability and use, which was more difficult to observe. The intraclass correlation coefficients were above 0.90 for activity level, group size, head cover, shirt, and leg cover, which indicate good interrater agreement, but were somewhat lower for age (ρ = 0.81) and cloud cover (ρ = 0.58).

Analysis

Univariate and multivariate logistic regression analyses of the effects of the independent variables on the odds of using sunglasses were performed. Those variables significantly associated with sunglasses use in the univariate analysis were then entered simultaneously as independent variables in a multivariate logistic regression analysis with use of sunglasses as the dependent variable. The final best-fitting model predicting use of sunglasses was estimated, with independent variables that were intercorrelated or redundant excluded. SPSS statistical software version 12.1 (SPSS, 2003) was used for the exploratory analyses and the final multivariate logistic regression model was run in Stata version 8.2 (StataCorp, 2003) using robust standard errors to estimate variance. The final model treated all predictor variables as categorical, with the exception of year, which was treated as a continuous variable in order to achieve a more parsimonious model.

Further regression analyses were conducted to examine the possible effects of clustering by specific outdoor venues and by social groups within venues for 1 year of the survey (2001) where these data were collected. The multivariate logistic regression model predicting sunglasses use was run in 3 ways: (i) with individual participants treated as independent observations, (ii) with social groups as a random factor, and (iii) with specific venues as a random factor. Results for the respective models were compared to determine the effect of clustering within the data set.

The effects of weather on use of sunglasses were analyzed using the scientifically robust readings of UV measured by ARPANSA and temperature and wind measured by BOM. However, cloud cover as measured locally by the fieldworkers was used since cloud varies somewhat with location (Commonwealth Bureau of Meteorology, 2004) and the interrater reliability for cloud cover was acceptable.

Results

Descriptive statistics for use of sunglasses by different observed characteristics are shown in Table 1. Overall, 36.2% (n = 15,261) wore sunglasses. Table 1 also shows the results of the best fitting multivariate logistic model predicting use of sunglasses (Wald $\chi^2(37) = 4382.89$, $P < 0.001$). In general, the direction of association and trends found in the univariate logistic regression analyses were confirmed in multivariate logistic regression analysis.

Environment

People were significantly more likely to wear sunglasses on sunny days than when cloud cover was "mixed thick" or "overcast thin". People in total shade were significantly less likely to wear sunglasses compared to people situated where shade was not available. Compared to people at parks and