**Objective:** To estimate the economic impact of sunburn in a beachgoing population during the summer.

**Design:** Survey.

**Setting:** Galveston, Tex, beachfront.

**Participants:** Convenience sample of 56 sunburned beachgoers.

**Intervention:** None.

**Main Outcome Measures:** Days of work lost as a result of sunburn in the previous year.

**Results:** Thirty-eight respondents (68%) reported painful sunburn. Sunscreen use did not prevent painful sunburn (23/38 [60%]). Those consuming alcohol at the beach had more severe sunburns than nondrinkers and had a higher frequency of analgesic use after sunburn (69% vs 26%, *P* = .007). Five men (5/18 [28%]) and 4 women (4/38 [10%]) missed a total of 9 and 8 days of work, respectively, because of sunburn within the prior year. Based on these findings and attendant assumptions, it is estimated that sunburn may account for as many as 92,720 lost workdays by Galveston beachgoers each year. The annual economic impact for lost work and treatment may exceed $10 million.

**Conclusion:** Sunburn is a costly and preventable skin injury.

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THE DIAGNOSIS and management of precancerous skin diseases, nonmelanoma skin cancers, and melanoma are imposing increasing demands on health care as our population ages. Chen et al estimated the US Medicare expenditure for nonmelanoma skin cancer to be $426 million per year. Melanoma, although less common than basal and squamous cell carcinoma, is often more expensive to treat. Fader et al estimated the cost of treatment for cutaneous melanoma to Medicare to be $495 million annually, with projected costs to exceed $5 billion by the year 2010. Sunburn, the first step in the initiation of many cutaneous malignancies, has received little academic attention, particularly in regard to its acute morbidities and economic impact.

Although current analysis has focused on the cost of skin diseases such as skin cancer that arise many years after damaging UV-light exposure, little attention has been directed toward the acute morbidity associated with sunburn and its potential economic impact. To understand the costs associated with sunburn, the experience of 56 sunburned beachgoers was analyzed.

**METHODS**

After institutional review board approval, a 2-mile stretch of popular public beachfront on Galveston Island, Galveston, Tex, was surveyed by one of us (D.S.S.) during July and August 1999 for sunburned beachgoers. Sunburn was defined as uniform, confluent erythema on sun-exposed skin, with sparing of unexposed skin. A questionnaire that was designed to determine sunburn frequency and severity among respondents (Table 1) was completed by 96 participants at the beach (1 subject was excluded from statistical analysis because he did not have a sunburn). Participants rated sunburn pain on a scale from 1 to 10, with “no pain” rated 1 and “worst pain ever” rated 10. Telephone follow-up was conducted the next day (Table 2), with 56 subjects completing the survey (56/95 [59%]).

Statistical analyses were performed using SPSS 10.1 for Windows (SPSS Inc, Chicago, Ill). Descriptive statistics were used to summarize the data and to describe the distribution of the beachgoing population. Categorical variables were analyzed with the Pearson χ² test and the Fisher ex-
The study included 18 men (mean age, 36.4 years) and 38 women (mean age, 33 years) ranging in age from 18 to 56 years (mean age, 34.1 years). Most participants rated themselves as Fitzpatrick skin types I (n = 14), II (n = 18), or III (n = 23). Women reported an average of 3.2 hours of peak sun exposure (10 AM to 3 PM) and 4.3 hours of total sun exposure at the beach, while men reported an average of 3.6 hours of peak sun exposure and 4.7 total sun exposure at the beach, while men reported an average of 3.6 hours of peak sun exposure and 4.7 total sun exposure at the beach. Subjects using alcohol reported greater initial pain than nondrinkers (2.62 vs 1.67, P = .04) as well as more pain the next day (5.77 vs 4.07, P = .04). Drinkers also had a significantly greater body surface area sunburned than nondrinkers (42% vs 24%, P = .001) and were more likely to develop blisters (31% vs 5%, P = .02). However, drinkers did not report spending significantly more peak (3.42 hours vs 3.28 hours, P = .72) or total (4.73 hours vs 4.34 hours, P = .46) time in the sun than controls. Of the 9 subjects who had missed work within the previous year as a result of sunburn, 2 (22%) recalled drinking alcohol, but none recalled using drugs.

The mean pain of sunburn at the time of the beach interview was 2.1 (range, 1-5) for men and 1.9 for women (range, 1-8). Men had an average pain rating of 4.8 when reevaluated the next day (range, 1-10), while women had an average pain rating of 4.3 (range, 1-10). One day after the initial sunburn, of the 56 subjects, 51 (91%) reported residual erythema, 46 (82%) complained of tenderness in the area of the sunburn, 38 (68%) reported that the sunburn was painful, 29 (52%) reported difficulty sleeping the previous night, and 6 (11%) had blisters. Sunscreen use did not prevent painful sunburn (23/38 [60%]). Six (33%) of 18 men and 14 (37%) of 38 women used analgesics for the treatment of sunburn. Analgesic use was significantly higher in the alcohol-consuming sunburned group than in the group of nondrinkers (69% vs 26%, P = .007).

The Parks and Recreation Department of Galveston furnished the following statistics regarding beachgoers during the summer beach season: number of cars admitted to beach parking area during the summer, 200,000; number of occupants per car (estimated), 4; and total number of beachgoers to public beaches per summer, 800,000. The median income for Galveston County is $27,900 per year, according to statistics furnished by the Galveston Chamber of Commerce. According to our study findings, 9 (16%) of the 56 sunburned beachgoers missed work within the previous year because of sunburn. Assuming that 54% of all sun-
mertime public beachgoers in Galveston get sunburned and that 16% of those who get sunburned miss work (excluding those who did not identify themselves as “white alone” [29.025%, according to the 2000 US Census in Texas] because of a decreased risk for sunburn), it is calculated that 49058 individuals miss work as a result of sunburn each year. The average time at work lost (17 days) by individuals in our study as a result of sunburn (n=9) was 1.89 days. Therefore, the total workdays lost by all beachgoers would be 92720 per year (1.89 × 49058).

The median income for Galveston is $27900. This translates into a monthly salary of $2325 ($27900/12 months), or $581.25 per week ($2325/4 weeks). The salary earned per day during a typical 5-day workweek is $116.25 ($581.25/5 days). The total economic impact to Galveston beachgoers due to sunburn is $10778700 ($116.25 × 92720 workdays lost per year). This calculation does not take into consideration the subsequent economic impact of these injuries on employers and the public. However, it does assume that sunburn is independent of income. Since the risk of sunburn may not be independent of income, if higher income beachgoers were less likely to become sunburned, then mean income estimates would require downward adjustment. It is also possible that higher income beachgoers sunburn more frequently because they have a greater opportunity for travel to subtropical and tropical destinations, and this would require an upward adjustment of income estimates. We are unaware of any data that address this issue.

To our knowledge, there are no statistics that represent the number of individuals in the United States who are beachgoers. Nonetheless, the economic impact of sunburn, as demonstrated in this study, is potentially enormous. Additional statistics obtained from the Texas Economic Development Tourism Department estimated that there were 4.11 million visitors to the Galveston region in 2000. Approximately 73.81%, or a little over 3 million visitors, participated in beachfront/waterfront activities. While our study focused only on limited beach areas, if our estimates are applied to 3 million visitors, the immediate negative economic impact of sunburn acquired in Galveston County may be more than $40 million per year. Since this study did not take into account other expenses related to sunburn, such as visits to physicians’ offices or emergency departments, and the costs of prescription or over-the-counter medications for sunburn, the actual economic impact may be greater. However, the projected negative economic impact due to sunburn could be affected by several other variables. If sunburn occurred early during a week-long vacation, the economic impact of lost work would be mitigated. Indeed, depending on circumstances, the local microeconomic impact of sunburn could also be positive in the vacation venue, with sunburned tourists spending more money on indoor activities, such as movies and shopping, and on medical care for their injuries. Other confounders in a survey of this type are the nonresponders. Those not completing the survey may have had less severe sunburns than the respondents. Since those with less severe sunburns are probably less likely to miss work, their inclusion would lower the percentage of those missing work.

Outdoor recreational activities continue to occupy many Americans’ leisure time. Daytime outdoor activities, whether they are leisure time or work-related, involve sun exposure. Larger and more popular beaches in resort areas would be expected to demonstrate similar statistics, especially if they are located in subtropical or tropical regions. Participants in numerous other summertime outdoor sports with significant sun exposure, such as golf, tennis, swimming, fishing, and sailing, have not been specifically studied for sunburn incidence and severity. Likewise, the economic impact of lost work time because of sunburn by individuals whose occupations require outdoor UV-light exposure has not been well characterized. Until all of these potential environments for solar exposure are considered, the true negative economic impact of sunburn will not be recognized.

Education continues to be a key strategy for decreasing sunburn injury. Although the psychological utility of a tan remains high in our society, sunburn connotes pain. Providing information about the adverse financial impact of acute sunburn has the potential to motivate some beachgoers to avoid this preventable injury. Anecdotal reports about alcohol use at the beach have long been associated with severe sunburn. This study adds further evidence that alcohol use at the beach may lead to more severe sunburn. Although the mechanism is currently unknown, alcohol users in this survey did not report spending significantly more time in the sun than nondrinkers. Alcohol use may blunt the immediate sensation of sunburn, preventing subtle behavioral changes that could decrease further exposure to UV light and additional skin damage.

If alcohol use increases sunburn severity, it is possible that those using alcohol during UV-light exposure may later manifest a greater incidence of precancerous and malignant skin lesions. Current studies on this topic are not conclusive. A population-based cohort of hospitalized Swedish patients with psoriasis demonstrated an increased risk for cutaneous squamous cell carcinoma and alcohol-associated malignancies, but an Italian study did not show alcohol use to be significantly associated with basal cell carcinoma, and a study of Swedish alcoholics did not show an increased incidence of malignant melanoma. Investigation into the role of alcohol in potentiating sunburn severity, and its subsequent additional adverse economic impact, may be of value for developing further insight about sunburn’s causes and consequences.

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