Increased Incidence of Heater-Related Burn Injury During a Power Crisis

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Hypothesis: Recent power shortages in California resulted in rolling blackouts and increased utility prices. Residents turned to alternative heating devices, such as space heaters, to decrease utility bills. Our hypothesis is that the incidence of heater-related injuries increased owing to the use of alternative heating methods during the power crisis.

Design: Retrospective case-series database and medical record review of all burn admissions for the 4 months of November through February for the period 1998-2002.

Setting: Regional pediatric and adult burn unit in northern California.

Patients: Patients admitted during the study interval with burn injury.

Main Outcome Measures: Parameters recorded included patient demographics, cause of burn, total body surface area burn, number of operative procedures, and hospital length of stay during each of the 4 months in the interval.


Conclusions: The number of heater-related burn admissions, as well as their magnitude, increased during the energy crisis, resulting in increased resource use and health care costs. The economic stresses of the power shortage had societal costs that extended far beyond the price of electricity.

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The power shortage in northern California from November 2000 through February 2001 resulted in a substantial increase in the price of natural gas and electricity throughout the state. As a result many residents, in an attempt to lower their utility bills, took a variety of measures to decrease these costs, ranging from lowering the temperature on the thermostat to the use of alternative heating sources such as space heaters, wood-burning stoves, and fireplaces. Improper or inadequate use, installation, or supervision of these devices can result in house fires or direct burn injury from the heating source.

Each year more than 100,000 persons are admitted to burn units with severe burns. The incidence of burn injury, owing to a variety of reasons, has been decreasing over the last 20 years. However, the number of admissions to the University of California Davis Regional Burn Center and Shriners Hospitals for Children Northern California Burn Center increased markedly during the winter months of 2000-2001, coinciding with the peak of the energy crisis.

Although the financial and economic consequences of the energy shortage have been widely publicized, the potential increase in burn injury and its socioeconomic effect have not been explored. The purpose of this study is to determine if the incidence in heater-related injuries in northern California increased during the power crisis.

PATIENTS, MATERIALS, AND METHODS

The study was approved by the University of California at Davis institutional review board. The University of California at Davis Regional Burn Center and Shriners Hospitals for Children Northern California Burn Center admit patients from northern California, the central valley, and the adjacent states. Analysis of the Trauma Registry of the American College of Surgeons burn database and retrospective patient

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A total of 512 patients were admitted in the 4 months from November through February in years 1998 through 2002. Medical records were reviewed for patient demographics, cause of burn, percentage total body surface area (TBSA) burn, survival, number of operative procedures required, and hospital length of stay (LOS). The mean monthly temperature for each of the study months was obtained from the Western Regional Climate Center. Differences between the total number of burns, heater-related burns, and the number of heater-related burns by month during the power shortage months (November 2000-February 2001) were compared with each of the 2 periods immediately prior (November 1999-February 2000 and November 1998-February 1999) as well as to the ensuing year (November 2001-February 2002) using the chi-square test. Mean hospital LOS and TBSA burn percentage differences between the power shortage months and each of the other 3 intervals were compared using the t test. Results are given as the mean (SEM).

### RESULTS

The greatest increase in heater-related burn injuries occurred in January 2001. Coincidentally, on January 1, 2001, Pacific Gas and Electric increased rates by 16.5%, and Southern California Edison raised rates by 9.9%. As the shortage became more severe, stage 3 alerts (declared when an operating reserve shortfall of 1.5% is unavoidable or when the operating reserve is forecast to be <1.5% after using all available resources) were instituted. On January 17 and 18, 2001, rolling blackouts were ordered statewide. A statewide stage 3 alert continued for 24 consecutive days. The rate of rotating blackouts increased from 1 in 2000 to 38 in the period from January to May 22, 2001. During this same interval, stages 1 and 2 notifications increased from 91 to 127.

### Demographic Data of Burn Admissions During Study Period*

<table>
<thead>
<tr>
<th>Interval</th>
<th>Total No. of Admissions</th>
<th>Total No. of Heater-Related Injury Admissions</th>
<th>Age, Mean (SEM), y</th>
<th>TBSA Burn, Mean (SEM), %</th>
<th>Hospital LOS, Mean (SEM), d</th>
<th>No. of OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 1998-February 1999</td>
<td>117</td>
<td>25</td>
<td>33.2 (4.6)</td>
<td>16.5 (4.5)</td>
<td>9.9 (2.3)</td>
<td>7</td>
</tr>
<tr>
<td>November 1999-February 2000</td>
<td>124</td>
<td>26</td>
<td>45.7 (5.5)†</td>
<td>12.3 (2.7)</td>
<td>12.3 (2.7)</td>
<td>18</td>
</tr>
<tr>
<td>November 2000-February 2001</td>
<td>151</td>
<td>36‡</td>
<td>32.4 (3.8)</td>
<td>24.0 (4.6)§</td>
<td>15.0 (3.5)§</td>
<td>55</td>
</tr>
<tr>
<td>November 2001-February 2002</td>
<td>152</td>
<td>29</td>
<td>42.0 (3.7)†</td>
<td>12.0 (2.9)</td>
<td>7.0 (1.5)</td>
<td>19</td>
</tr>
</tbody>
</table>

*TBSA indicates total body surface area; LOS, length of stay; and OR, operations.
†P < .006 by t test compared with 1998-1999 totals.
‡P < .001 by chi-square test compared with November 1998 through February 1999, November 1999 through February 2000, and November 2001 through February 2002 totals.
§P < .001 by t test compared with November 1998 through February 1999, November 1999 through February 2000, and November 2001 through February 2002 totals.
The fiscal impact of the California energy crisis has been the focal point of published reports. The financial effects of the shortage on California power companies, the state, and consumers have been well documented. California residents were encouraged to conserve electricity and gas during times of severe shortages, and the high cost of electricity further reinforced this request. Measures taken to conserve energy ranged from decreasing the set point on the thermostat to using alternative devices such as space heaters, wood-burning stoves, and fireplaces. Cost restraints frequently lead people to use unsafe heating sources. These alternative heating sources have the potential to cause serious injury if not used properly. To our knowledge, to date the potential effect of the shortage on consumer health has not been addressed.

This article is the first to document an increase in consumer-related burns after the implementation of rolling blackouts and increased energy costs. The greatest increase in the incidence of heater-related burns occurred in January 2001, coinciding with the electricity rate increase and the institution of blackouts. The increased number and severity of burn injuries, as indicated by a significantly greater number of operative procedures performed during this period, had a detrimental effect on consumer physical and financial health. This will likely result in long-term morbidity for the affected consumers. Prevention of these injuries could result in lower financial and consumer health costs. Implementation of preventive strategies, such as installation of smoke detectors in homes, have been successful in decreasing the incidence of burn injury. A similar strategy may well be of benefit in preventing heater-related burn injuries in the future. Although economic or societal events may increase the risk of this type of burn injury, education regarding appropriate behaviors in response to the power shortage may help to ameliorate these effects.

The full impact of the California energy crisis remains unclear. Although current studies have centered on the financial impact of the crisis, further investigation into the effects on consumer health needs to be undertaken.

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REFERENCES