

<b>QUICK SEARCH:</b> [advanced]		
<b>Author:</b>	<b>Keyword(s):</b>	
<b>Year:</b>	<b>Vol:</b>	<b>Page:</b>

PEDIATRICS Vol. 102 No. 1 Supplement July 1998, pp. 256-258

***Tap Water Scald Burns in Children, by  
K. W. Feldman, R. T. Schaller,  
J. A. Feldman, and M. McMillon,  
Pediatrics, 1978;62:1-7***

**ABSTRACT OF ORIGINAL ARTICLE**

Tap water scald burns account for 7% to 17% of all childhood scald burns that require hospitalization. Often the burns are severe and disabling. Toddlers and preschool children are the most frequent victims. In 45% of the injuries, the unsupervised victim or peer turned on the tap water; in 28% the cause was abuse. Eighty percent of the homes tested had unsafe bathtub water temperatures of 54°C (130°F) or higher, exposing the occupants to the risk of full-thickness scald with <30-second exposure to hot water. Such burns may be prevented passively by limiting household water temperatures to <52°C (125°F). New water heaters could be preset at this temperature, and families could be taught to turn down the temperature on existing units.

**COMMENTARY**

Each year in the United States, ~1200 children die from fires and burns. Mortality from burns has decreased dramatically since the famous Coconut Grove Fire killed 491 people in Boston, MA, in 1942.<sup>1</sup> Of this tragedy was born the modern treatment of burns, leading to the development of effective fluid resuscitation and management and the use of topical antimicrobial drugs. It also fostered the study of grief and attention to grief counseling for families and victims of acute trauma. Most children with burns currently survive because of these advances in care.

The morbidity from burns among these survivors is considerable. There are >20 000 children

**This Article**

- ▶ [Abstract](#) **FREE**
- ▶ [Full Text \(PDF\)](#)
- ▶ [P<sup>3</sup>Rs: Submit a response](#)
- ▶ [Alert me when this article is cited](#)
- ▶ [Alert me when P<sup>3</sup>Rs are posted](#)
- ▶ [Alert me if a correction is posted](#)
- ▶ [Citation Map](#)

**Services**

- ▶ [E-mail this article to a friend](#)
- ▶ [Similar articles in this journal](#)
- ▶ [Similar articles in PubMed](#)
- ▶ [Alert me to new issues of the journal](#)
- ▶ [Add to My File Cabinet](#)
- ▶ [Download to citation manager](#)

**PubMed**

- ▶ [PubMed Citation](#)
- ▶ [Articles by Rivara, F. P.](#)

**Related Collections**

- ▶ [Office Practice](#)

hospitalized for the care of burn injuries each year.<sup>2</sup> Scald burns are the most common cause of burn requiring hospital admission in young children; flame burns predominate in adolescents and adults. Most of these children undergo at least one excision and grafting, and many children with larger burns undergo multiple grafting procedures over the ensuing months and years. The problem of scarring in burns has yet to be solved. Hypertrophic scarring leads to contractures, functional disability, impaired bone growth, heterotopic calcification, and more surgery. Although most children with burn scars cope reasonably well with their injuries, the stress on these children and their caretakers is considerable. Most of us who work in burn centers and see these children daily realize that although our current care is good, it is not good enough.

The best care of children with burns is clearly to prevent these burns from occurring in the first place. One of the outstanding success stories in pediatric injury prevention was initiated and catalyzed by the lead article in the July 1, 1978, issue of *Pediatrics*: "Tap Water Scald Burns in Children," by Kenneth W. Feldman, MD, and colleagues in Seattle, WA. As in many important studies, this arose from Dr Feldman's clinical experience. His experience with the scald burns of an office patient led him to question why such a seemingly preventable injury had occurred. Dr Feldman expanded his own anecdotal experience in two ways. He conducted a chart review at Children's Hospital and at the regional burn unit at Harborview Medical Center in Seattle as well as obtained national estimates of the frequency of these injuries from the National Electronic Injury Surveillance System of the Consumer Product Safety Commission.

These two data sources confirmed that tap water scalds were common both in Seattle and in other cities in the United States. Tap water scalds accounted for 7% to 17% of all childhood scald burns requiring hospitalization. In addition, children, especially younger than 5 years of age, account for more than half of all hospitalized victims with tap water scalds. These scalds tend to be more severe than other scalds, involve larger surface areas, and frequently lead to grafting and hypertrophic scarring. In Feldman's original series, 12% of burned children died.

The unique contribution of Feldman and his colleagues was in their pursuit of how and why these injuries occurred. Once this was understood, how to prevent these scalds was obvious. This study illustrates quintessential shoe-leather epidemiology. Feldman, his wife Ann, and a community health aide from his clinic, Molly McMillon, literally knocked on doors and measured tap water temperature in homes and apartments surrounding the Odessa Brown Children's Clinic, an inner city neighborhood health center operated by Children's Hospital where Feldman worked. They found that the mean bathtub water temperature in these homes was 61°C (142°F); 80% of homes visited had bathtub water temperatures higher than 54°C (130°F). Feldman conducted a literature search (by hand—this was in the precomputer days) and uncovered an article by Moritz and Henriques published in 1947.<sup>3</sup> This demonstrated that full-thickness burns can occur in adult skin in 2 seconds at 66°C (150°F) and in 30 seconds at 54°C (130°F).

The method of prevention was obvious: lower the temperature setting of the water heater! At 49°C (120°F), it would take 10 minutes and at 52°C (125°F) 2 minutes to cause full thickness burns in adult skin. Persisting in his shoe leather epidemiology, Feldman contacted the Consumer Product Safety Commission, appliance manufacturers, utility companies, and detergent manufacturers and found that gas water heaters were factory preset at 60°C (140°F) and electric heaters at 66°C (150°F). The local power company in Seattle recommended and set water heater temperatures of 60° to 66°C (140° to 150° F).

The findings in this simple study were confirmed subsequently by other investigators. For example, 25% of scald burns resulting in hospitalization in upstate New York were found to be attributable to tap water; 50% of these were to children younger than 5 years of age.<sup>4</sup> Similar findings were reported by authors in Wisconsin<sup>5</sup> and New Zealand.<sup>6,7</sup> Most important, the publication of this report fostered efforts in the United States and in Canada to prevent these scalds, using the strategy proposed by Feldman: lower the temperature. Feldman himself led an educational campaign in conjunction with the local utility company for homeowners and utility company service people to lower the temperature setting on the heaters. Utility companies became interested not only because it was good for community relations, but lowering water heater settings saved 10 000 BTUs per day for electric heaters and nearly 5000 BTUs per day for gas heaters. Katcher conducted an extensive intervention in Wisconsin, again in conjunction with the local power company.<sup>8</sup> Educational materials were sent out with utility bills, and liquid crystal thermometers were offered. The program resulted in an estimated 20 000 homeowners lowering their water heater temperatures. Educational programs in other settings<sup>9,10</sup> and in countries such as Norway<sup>11</sup> and New Zealand,<sup>12</sup> in which the focus was on lowering the water heater setting also were successful.

Although the educational program was successful, Feldman realized that a more definitive solution would be to require that water heaters be preset either at the factory or at installation at a lower, safer temperature (49°C to 52°C, 120°F to 125°F). He led a campaign to pass state legislation authorizing such a requirement. Florida became the first state in the nation to mandate lower tap water temperatures, and Washington state followed suit in 1983. This law has been very effective: 84% of homes with water heaters installed after the law went into effect remained set at the lower temperature.<sup>13</sup> Most important, the incidence of these burns has decreased. Through the efforts of Feldman, Katcher, and others, the appliance manufacturers have agreed voluntarily to factory preset electric water heaters at 49°C (120°F) and to lower the temperature at which gas water heaters are installed to 49°C (120°F).

I always have admired this work for a number of reasons. There are three main strategies we have to reduce harm from injuries: education, product or environmental change, and legislation or regulation. Feldman used them all, and to maximum effectiveness. The educational campaign that resulted from this study was not focused on exhorting parents to supervise their children more closely; rather, the efforts targeted the behavior change of walking down to the basement and turning down the water heater. The

focus on changing the heater (the product) rather than continued "better" supervision of children (changing the host) is a classic example of a passive injury prevention strategy, which works automatically once in place, in contrast to active strategies, which require repeated behavior change on the part of individuals. The ultimate change in regulation and legislation has effectively solved the problem of these burns in young children.

Only a few other injury preventive strategies have proven so simple yet so effective. Child resistant packaging of poisons, smoke alarms for residential fires, and bicycle helmets for the prevention of head injuries are similar types of common sense strategies that have worked. Other types of scald burns in children, such as those attributable to hot foods, have proven difficult to prevent and still populate our burn wards.

This study is a wonderful example of the power of clinical observation and what one clinician can do. Feldman was and continues to be primarily a clinician, but a clinician with a keen sense of observation and great persistence. He cared for burned children and asked how the injuries occurred? What are the similarities between a children burned accidentally, one burned through neglect, and another burned as part of a pattern of abuse? Can these burns be prevented? What prevention strategy will get at the root of the problem and eliminate it once and for all?

In these days of multimillion dollar grants, it is more than a bit refreshing that the total cost of this study was \$20 for the thermometer and was funded out of the pocket of the principal investigator, a practicing pediatrician. I think the best studies I have ever done have been the least costly.

In the keynote address at the 50th anniversary meeting of the American Academy of Pediatrics, David Rogers, president of the Robert Wood Johnson Foundation, discussed the need to conduct research that involved practicing pediatricians and focused on interventions that really do improve the health of children.<sup>14</sup> One of the examples he cites of studies that made a difference is Feldman's work. As Rogers states, this study "couples careful clinical observations, thoughtful interventions, and validation of results in ways that have had payoff for better-functioning healthier children."

### **Comments by Frederick P. Rivara, MD, MPH**

From the Harborview Injury Prevention and Research Center and the Departments of Pediatrics and Epidemiology, University of Washington, Seattle, Washington.

### **FOOTNOTES**

Received for publication Mar 19, 1998; accepted Mar 19, 1998.

Address correspondence to: Frederick P. Rivara, MD, MPH, Box 359960, 325 Ninth Ave, Seattle, WA 98104.

## REFERENCES

1. Saffle JR The 1942 fire at Boston's Coconut Grove nightclub. *Am J Surg*. 1993; 166:581-591 [\[Medline\]](#)
2. McLoughlin E, McGuire A The causes, cost and prevention of childhood burn injuries. *Am J Dis Child*. 1990; 144:677-683 [\[Abstract\]](#)
3. Moritz AR, Henriques FC Studies of thermal injury: the relative importance of time and surface temperature in the causation of cutaneous burns. *Am J Pathol*. 1947; 23:695
4. Baptiste MS, Feck G Preventing tap water burns. *Am J Public Health*. 1980; 70:727-729 [\[Abstract\]](#)
5. Katcher ML Scald burns from hot tap water. *JAMA*. 1981; 246:1219-1222 [\[Abstract\]](#)
6. Langley J, Dodge J, Silva PA Scalds to preschool children. *N Z Med J*. 1981; 93:84-87 [\[Medline\]](#)
7. Waller AE, Marshall SW Childhood thermal injuries in New Zealand resulting in death and hospitalization. *Burns*. 1993; 19:371-376 [\[Medline\]](#)
8. Katcher ML Prevention of tap water scald burns: evaluation of a multi-media injury control program. *Am J Public Health*. 1987; 77:1195-1197 [\[Abstract\]](#)
9. Katcher ML, Landry GL, Shapiro MM Liquid-crystal thermometer use in pediatric office counseling about tap water burn prevention. *Pediatrics*. 1989; 83:766-771 [\[Abstract\]](#)
10. Thomas KA, Hassanein RS, Christopherson ER Evaluation of group well-child care for improving burn prevention practices in the home. *Pediatrics*. 1984; 74:879-882 [\[Abstract\]](#)
11. Ytterstad B, Sjøgaard AJ The Harstad Injury Prevention Study: prevention of burns in small children by a community-based intervention. *Burns*. 1995; 21:259-266 [\[CrossRef\]](#)[\[Medline\]](#)
12. Waller AE, Clarke JA, Langley JD An evaluation of a program to reduce home hot tap water temperatures. *Aust J Public Health*. 1993; 17:116-123 [\[Medline\]](#)
13. Erdmann TC, Feldman KW, Rivara FP, Heimbach DM, Wall HA Tap water burn prevention: the effect of legislation. *Pediatrics*. 1991; 88:572-577 [\[Abstract\]](#)
14. Rogers DE, Blendon RJ, Hearn RP. Some observations on *Pediatrics*: Its past, present and future. *Pediatrics*. 1981;67:775-84

### *This Article*

- ▶ [Abstract](#) **FREE**
- ▶ [Full Text \(PDF\)](#)
- ▶ [P<sup>3</sup>Rs: Submit a response](#)
- ▶ [Alert me when this article is cited](#)
- ▶ [Alert me when P<sup>3</sup>Rs are posted](#)
- ▶ [Alert me if a correction is posted](#)
- ▶ [Citation Map](#)

### *Services*

- ▶ [E-mail this article to a friend](#)
- ▶ [Similar articles in this journal](#)
- ▶ [Similar articles in PubMed](#)
- ▶ [Alert me to new issues of the journal](#)
- ▶ [Add to My File Cabinet](#)
- ▶ [Download to citation manager](#)

### *PubMed*

- ▶ [PubMed Citation](#)
- ▶ [Articles by Rivara, F. P.](#)

### *Related Collections*

- ▶ [Office Practice](#)