

# Prevention of Tap Water Scald Burns: Evaluation of a Multi-Media Injury Control Program

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**Abstract:** A prospective study was designed to evaluate a mass media injury prevention program reaching two million people to determine its impact on risk awareness of hot tap water burns and injury-prevention behavior. Liquid-crystal thermometers for testing hot water temperature were offered at no cost; 140,000 were requested. Pre- and post-program general population random surveys (N = 337 and 318, respectively) found increased awareness of the danger of hot tap water, from 72 per cent to 89 per cent, but no increase in testing or lowering of water heater temperatures. A third random sample survey (N = 325) among thermometer requesters found a higher rate of testing (difference 58.1 per cent, 95 per cent CL 55.3 per cent, 60.9 per cent) than in the general population. Of those

who tested, 43 per cent reported temperatures in the dangerous range of 54.4°C (130°F) or greater; 52 per cent of this group lowered their water heater thermostat.

These findings indicate that: more than 25 per cent of the public is unaware of the potential danger of hot tap water; a safety education program which increases awareness will not necessarily result in injury-control behavior; and most people motivated to request a free thermometer will test their hot water temperature and lower it if necessary. As a result of this effort, thermostats of an estimated 20,000 water heaters were lowered from dangerously high levels. (*Am J Public Health* 1987; 77:1195-1197.)

## Introduction

Burns and fires result in more than 6,000 deaths and over one million days of inpatient care each year,<sup>1</sup> including 2,500-4,500 individuals hospitalized for scald burns caused from hot tap water.<sup>2-4</sup> With an annual incidence of 1.05-1.89 hospitalizations per 100,000 population, tap water scald burns have been targeted by the Surgeon General's 1990 "Objectives for the Nation" as a priority area for prevention.<sup>5</sup>

At typical household hot water temperatures of 60-65.6°C (140-150°F),<sup>6</sup> full-thickness burns may occur in as little as two to five seconds of exposure.<sup>7</sup> Approximately 85 per cent of tap water burns occur in young children, the elderly, or the handicapped.<sup>2</sup> Many serious burns could be prevented by the one-time lowering of the maximum household water temperature to 54.4°C (130°F) or less.

The primary goal of the prospective study reported here was to evaluate the impact of a large multi-media injury control program that sought to:

- increase public knowledge about the danger of hot tap water and about the increased safety (and energy savings) which would result from lowering the water heater thermostat;
- encourage people to *measure the maximum temperature of their hot water*; and
- encourage people to *lower their hot water heater thermostats* when the temperature exceeded 54.4°C (130°F).

## Methods

### Educational Program and Thermometer Requests

In August 1982, the Wisconsin Electric Power Company enclosed a pamphlet with the electric bill sent to each of its approximately 750,000 residential subscribers. Subscribers were invited to request, at the time of their bill payment, a free liquid-crystal thermometer for tap water testing (Hot Water Gauge, Clinitemp, Inc., Indianapolis, IN) and an educational brochure. The brochure described the dangers and energy wastefulness associated with hot tap water and

gave instructions on how to use the thermometer to measure the maximum water temperature at the tap and how to lower the water heater thermostat setting, if necessary. During the same month, educational messages about hot tap water appeared in all major newspapers in the greater Milwaukee metropolitan and outlying areas, as well as on prime time television and radio. These messages provided a toll-free phone number for requesting the free educational brochure and thermometer. In addition, doctors' offices, hospitals, and social service agencies received posters and pamphlets containing postage-paid coupons for ordering the free materials. Four weeks after completion of the active four-week educational program, 122,000 requests for thermometers had been received; without further publicity, a total of 140,211 requests were received by July 11, 1983.

### Surveys

Three telephone surveys were conducted by the Wisconsin Survey Research Laboratory at the University of Wisconsin-Extension in Madison. Before the educational program, a computer-generated random telephone survey was conducted (July 19-30, 1982) of adults in residential dwellings in an area defined by telephone exchanges in metropolitan Milwaukee. Of the initial 1,147 numbers selected for the sample, 458 were potentially eligible households. Completed interviews were obtained from 337 (74 per cent) and are reported here as Survey I (Pre-Program).

A similar survey was conducted in the same area August 30-September 13, 1982, immediately after the educational program. Duplicate phone numbers were not permitted between the two surveys. Of 1,061 numbers generated for this second sample, 388 were potentially eligible households. From these, 318 completed interviews were obtained (82 per cent) and are reported as Survey II (Post-Program).

A third survey sampled only those households that had requested a thermometer and brochure by September 24, 1982. From 122,000 such requests, 447 households were selected at random for a telephone interview. Of these, 80 were not eligible for an interview (13 respondents were under 18 years of age, and 67 claimed that they themselves had not sent for or received a thermometer). From the 367 remaining respondents, 325 completed interviews were obtained (89 per cent) and are reported here as Survey III (Post-Program "Requesters").

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**TABLE 1—Sociodemographic Characteristics of the Survey I (Pre-Program), Survey II (Post-Program), and Survey III (Post-Program "Requesters") Samples**

Characteristics	Survey I (N = 337)	Survey II (N = 318)	Survey III (N = 325)
Mean age $\pm$ SD (yr)	45.2 $\pm$ 18.2	46.1 $\pm$ 18.5	45.7 $\pm$ 18.7
% Male interviewee	32.0	30.2	39.7
% High school graduate	84.3	87.4	85.8
Median family income	\$20,000–29,999	\$20,000–29,999	\$20,000–29,999
Mean number in household $\pm$ SD	2.98 $\pm$ 1.60	2.74 $\pm$ 1.47	2.73 $\pm$ 1.30

**Telephone Survey Questionnaire**

A fixed-choice pretested questionnaire was administered by telephone to the survey respondents. The questionnaire assessed the following items: the frequency of actual burn injuries from hot water; sociodemographic background variables; scald knowledge; increased performance of two specific injury-prevention behaviors; and the relative effectiveness of different media.

**Results****Reported Frequency of Burn Injuries**

Of the 655 respondents in Surveys I and II, 155 (23.7 per cent) said they had personal knowledge of someone who had received tap water burns and 77 (11.8 per cent) said that it had happened to someone in their own household. Of these household burns, 6.5 per cent caused blisters and 9.1 per cent were reported to be "bad enough to see a doctor."

**Demographic Variables**

Except for slightly higher male representation among Requesters (Survey III), the three sample groups displayed similar sociodemographic characteristics (Table 1).

**Impact of Educational Program**

**Increased Knowledge**—When asked whether they were aware that hot tap water could cause "severe burns in only a few seconds," more respondents answered affirmatively in Survey II (89.2 per cent), after the educational program, than in Survey I (72.1 per cent), and the difference was program related, with radio/television being the most important instrument. On the other hand, when asked whether they knew that lowering the water heater thermostat could save money

and energy, respondents showed little or no change in knowledge, perhaps because almost 90 per cent had already been aware of this fact prior to the program (Table 2).

**Temperature Testing and Thermometer Lowering**—Although 47 per cent of Survey I and 56 per cent of Survey II respondents reported owning a candy or a meat thermometer, either of which can be used to test hot water temperature, only 22 (3.4 per cent) of the 655 combined survey respondents said they had ever done so. In contrast, among those who received the free thermometer, 200 (61.5 per cent) reported that they had used it to test their hot water temperature (difference 58.1 per cent, 95 per cent confidence limits [CL] 55.3 per cent, 60.9 per cent), and 177 were able to report the test results (Table 3): 43.0 per cent reported hot water temperatures of 54.4°C (130°F) or greater, and 25.4 per cent reported temperatures of at least 60.0°C (140°F). Among testers reporting high temperatures, 52.1 per cent of those with access to their water heater lowered their thermostats. There was no difference in the frequency of temperature testing between those Survey III respondents with a family member at high risk for tap water burns and those respondents having no high-risk family member. Requesters who did not test their hot water gave general excuses, such as "forgot about it" or "too busy." More male (68.8 per cent) than female respondents (38.5 per cent) reported lowering the water heater thermostat when unsafe temperatures were found (difference 30.3 per cent, 95 per cent CL 19.0 per cent, 41.6 per cent).

Survey III respondents generally reported learning about the free thermometers by television (44.9 per cent) or by the utility bill insert (44.0 per cent) (Table 3). According to utility company records, however, 67.5 per cent of the

**TABLE 2—Impact in the General Population of Educational Program on Knowledge about Hot Tap Water, and Reported Sources of Information**

Knowledge and Source of Information	Survey I (Pre-Program) (N = 337)		Survey II (Post-Program) (N = 318)		Difference (95% CL) %
	%	(N)	%	(N)	
Aware of Danger of Hot Tap Water	72.1	(243/337)	89.2	(282/316)	17.1 (14.1, 20.1)
<i>Non-Program Related:</i>					
Common sense	20.6	(50/243)	13.5	(38/282)	7.1 (3.8, 10.4)
Personal burn experience	32.9	(80/243)	25.9	(73/282)	7.0 (3.1, 10.9)
<i>Program Related:</i>					
Radio and/or television ads	1.2	(3/243)	30.5	(86/282)	29.3 (26.5, 32.1)
Utility bill insert	1.6	(4/243)	5.3	(15/282)	3.7 (2.2, 5.2)
Newspaper or magazine	11.1	(27/243)	8.2	(23/282)	2.9 (0.3, 5.5)
Aware of Energy Savings	89.8	(300/334)	87.9	(276/314)	1.9 (-0.6, 4.4)
<i>Non-Program Related:</i>					
Common sense	24.7	(74/300)	27.5	(76/276)	2.8 (-0.9, 6.5)
<i>Program Related:</i>					
Radio and/or television ads	10.0	(30/300)	13.4	(37/276)	3.4 (0.7, 6.1)
Utility bill insert	14.7	(44/300)	12.3	(34/276)	2.4 (-0.4, 5.2)
Newspaper or magazine	16.7	(50/300)	12.0	(33/276)	4.7 (1.8, 7.6)

**TABLE 3—Information Sources and Behavioral Results among Survey III Respondents (Post-Program "Requesters")**

Information Sources and Behavioral Results	All Respondents (N = 325)		Respondents with Water Heater Access (N = 304)	
	%	(N)	%	(N)
Source of Instructions for Ordering Thermometers:				
Television	44.9		—	
Utility Bill Insert	44.0		—	
Newspaper	7.7		—	
Radio	1.5		—	
Doctor's Office	0.0		—	
Magazine	0.0		—	
Behavioral Results:				
Tested Water Temperature	61.5	(200)	60.2	(183)
Reported Results	88.5	(177/200)	90.7	(166/183)
Temperature $\geq 54.4^{\circ}\text{C}$	43.0	(76/177)	42.8	(71/166)
Lowered Thermostat if Water $\geq 54.4^{\circ}\text{C}$	—		52.1	(37/71)

requests were actually received through the bill-insert process, more than five times the number of telephone requests (11.9 per cent); presumably the television messages prompted additional written requests. Neither magazines nor office displays were mentioned as an informational source. Newspaper ads received only small attention from respondents (7.7 per cent), but were more important as a source of information for men (12.6 per cent) than for women (4.7 per cent).

#### Program and Evaluation Costs

Approximately \$200,000 was required to reach the utility company's 750,000 residential customers directly and potentially to reach about 2.1 million people in the total target area. These funds covered the preparation of 900,000 utility bill inserts; preparation of two newspaper advertisements and a full run in 30–50 newspapers; preparation of one television and two radio commercials and prime-time airing for one month; preparation and distribution of educational pamphlets and posters; and purchase of 200,000 liquid-crystal thermometers, the single largest expense of the program. Evaluation expenses, including the costs of generating the proportionate stratified random samples of phone numbers for the surveys, conducting the telephone interviews, and computer data analysis, added an additional 5 per cent (\$10,000).

#### Discussion

Most of the increased awareness can be attributed to radio and/or television messages rather than brochures placed in such strategic locations as physicians' offices and hospital waiting rooms. This finding is consistent with earlier work that reported the relative ineffectiveness of educational literature about injury prevention when merely passively offered in a medical setting.<sup>8</sup>

On the other hand, television was not necessarily a more effective medium than printed material in stimulating thermometer requests. Although requesters cited television messages and utility bill inserts equally, actual thermometer requests came primarily from the bill insert request forms. Thus reported educational impact was not identical with behavior-initiation impact. We can infer, however, that television messages contributed significantly to the number of people requesting thermometers through the utility bill insert and that neither medium would have been so effective without the other.

To be effective, health education programs for injury

control must not only increase awareness but must also demonstrate changes in behavior.<sup>9</sup> Although the educational campaign in this study succeeded in raising public awareness of hot tap water risks, the study detected no increase in injury-preventing behavior among the general population. Our program would have fallen short of its goals if nothing more had been accomplished.

However, the addition of a facilitating agent—the free liquid-crystal thermometer—prompted 61.5 per cent of the thermometer requesters to measure their hot water temperature. This finding substantiates findings that people who receive certain free injury-control devices, such as smoke detectors<sup>10</sup> and covers for electrical outlets,<sup>11</sup> tend to use them. Free distribution alone, however, does not guarantee the desired injury-reducing behavior, as was shown by free distribution of locking devices for cabinets<sup>11</sup> in one study and free distribution of car seats<sup>12</sup> in another.

After measuring the maximum hot water temperature at the faucet and finding it to be at least  $54.4^{\circ}\text{C}$  ( $130^{\circ}\text{F}$ ), more than half of the respondents reported lowering their water heater thermostat. Thus it may be estimated that approximately 20,000 dangerously high residential water heater temperatures were lowered as a result of this program.

The expense of providing the so-called facilitator, the liquid-crystal thermometer, can be justified, since it is demonstrably effective in prompting a relatively large number of people to identify the existence of dangerously hot water temperatures and to lower these unsafe temperatures to a safe range. Further educational programs might target high-risk groups and might emphasize the use of candy or meat thermometers as alternative means to test water temperature. If such alternatives were used, program costs could be further reduced.

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