Burn Injury from Products in the Home: Prevention and Counseling

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ABSTRACT

Each year in the United States, fire and burn injury is responsible for a high degree of morbidity and mortality. In 1996-1998, Wisconsin's mortality rate from unintentional fire and burn injury (1.22 deaths/100,000 population) was similar to the average United States mortality rate for such injuries (1.40), and significant morbidity leads to hospitalization, invasive procedures, and psychological trauma. This article describes the common types of product-related burn hazards in the home, the injuries associated with these hazards, prevention measures, and the health professional's important role in burn injury prevention.

INTRODUCTION

Heat-related injuries disproportionately affect children and the aged.[1,2] Such injuries may be mild, requiring ambulatory treatment at home, in the office, or in the emergency department (ED). However, many heat-related injuries are severe, requiring hospital care or critical-care management. Heat-related injuries include burn and inhalation injuries sustained during house fires, contact burns from hot objects or liquids, flash fires from explosives or flammable liquids, and electrical injuries. Although heat-related injuries may occur anywhere, many occur in the home, and these injuries are often predictable and preventable. In general, the most effective means of prevention of these injuries involve modifying the environment and working to support changes in building codes and legislation that lead to a healthier and safer home environment. Individual, professional, and public education may also be of benefit.

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This article focuses on the household products that commonly cause heat-related injury and the physician's role in preventing such injury. Epidemiological information regarding the primary causes of home product-related fire and burn injury is presented. Prevention ideas are provided in the form of a handout that physicians may distribute to patients. The primary focus of this article is not on structural house fires and the means of preventing such fires (i.e., smoke alarms, sprinkler systems, and escape plans)—topics that are reviewed elsewhere.[3]

EPIDEMIOLOGY

Injury is the leading cause of death of Americans ages 1-34 years.[1] From 1996 to 1998, fires and burns were the sixth most common cause of unintentional injury and death in the United States (after motor vehicle collisions, falls, poisoning, suffocation, and drowning) and caused more than 11,000 deaths. In 1998, fires and burns were the third leading cause of unintentional injury and adverse effect among 1- to 4-year-old children, comprising 13.6% of deaths in this age group. In the same year, fires and burns were the fifth leading cause of unintentional injury among adults, resulting in 2.8% of unintentional injury deaths, and among elderly adults greater than 65 years were the sixth leading cause, resulting in 3.6% of unintentional injury deaths. In Wisconsin from 1996–1998, fires and burns caused 1.22 deaths per 100,000 population, a rate slightly below the national average (1.40), comprising approximately 3% of the state's unintentional injury death.[4] Of all fire and burn injury, burns and inhalation injuries resulting from residential fires are by far the major cause of death, and product-related burn injury is responsible for a substantial portion of the remaining deaths.

Aside from mortality, fire and burns are also responsible for a great deal of morbidity, hospitalization, and invasive procedures.[2,5,6] Each year, more than 1.25 million heat-related injuries result in 50,000

acute hospital admissions in the United States. The epidemiology of heat-related injury differs between patients who sustain fatal injuries and those who survive their injuries and require hospitalization or other treatment. For example, although house fires result in more than 90% of all unintentional fire and burn-related deaths in children, most hospital admissions for heat-related injury in children involve scald burns.[3] In one study done at a Shriner's burn hospital in 1997,[5] the majority (54.4%) of burn admissions for children less than age 2 was the result of hot liquid scalds; contact with burning clothing or curling irons caused another 23.5%; tub scalds caused 12.5%; and the remainder were a combination of direct flame contact, corrosive chemicals, high voltage, or other conditions. These hospitalizations frequently involve peripheral or central venous access, intravenous sedation for wound care, intubation, and invasive imaging procedures. Complications of these admissions can include serious nosocomial infections such as pneumonia, urinary tract infection, bacteremia, and candidemia.

In children, the causes of non-fatal burn injuries relate to the age and developmental stage of the injured child. Infants are most likely to sustain burns from microwaved liquids and hot bath water, while toddlers are more likely to be injured by hot liquid spills and hot surfaces. Preschool and early school-age children frequently play with matches and lighters, and are more likely to leave the room after starting a fire and not tell an adult. Adolescents tend to be exposed to adult-type hazards—usually scalds from hot food or beverages, electrical burns, flammable liquids, and contact burns.[3]

For every admission, many more heat-related injuries require only ambulatory treatment from EDs or outpatient clinics. Most ED-treated injuries result from food and beverage spills. Although ED visits generally result in lower-intensity treatments, children treated in the ED suffer pain, infection risk, and the psychological trauma of an ED visit. Many more individuals with burn injuries are treated in physicians' offices, and even more do not seek medical attention.

Although fire and burn injury is an important cause of morbidity and mortality, recent statistics show reduction of occurrences. Between 1971 and 1991, the national rates of both fire and burn-related deaths and acute hospital admissions for burn injury showed a decline of almost 50%.[6] Between 1988 and 1997, Wisconsin showed a decline of approximately 25% in unintentional fire and burn-related deaths.[4] Many reasons are postulated for this decline, including changes in American social lifestyle (less smoking, changes in cooking and canning practices), stronger building fire codes and standards, a higher prevalence of smoke alarms, and public fire and burn safety education. Physicians are responsible for a portion of burn safety education to families.

SOURCES OF PRODUCT-RELATED BURNS IN THE HOME

Cooking Equipment

Cooking equipment includes appliances used to cook or warm food, such as ranges, toaster ovens, deep oil fryers, hot plates, and pressure cookers. Cooking equipment is the leading cause of home fires reported to US fire departments every year. In recent years, 250-350 deaths and more than 4000 injuries per year occurred as a result of home cooking fires.[7] The leading cause by far of cooking equipment-related fires is unattended cooking. Other modes of cooking equipment-related burns include contact burns with hot cooking equipment and electrical burns from electrical kitchen equipment. In addition, electric stoves can tip forward when children step on an open oven door, thereby causing contact burns and scald burns from spilled hot liquids.

Home Heating

Home heating equipment includes central systems and independent units—kerosene, oil, and electric heaters; floor furnaces; radiators; fireplaces; and wood stoves. Fire and burn injury caused by home heating equipment can come from open flame, or from equipment without open flames that can become hot enough either to cause contact burns or to ignite nearby combustibles like drapes, paper, clothing, furniture, and flammable liquids. Portable and space heaters cause 75% of home-heating related fires and deaths, as well as many contact burns (exact numbers have not been well documented). The Consumer Product Safety Commission (CPSC) estimated that in 1994 electric space heaters were associated with 2400 fires, 80 deaths, and 240 injuries.[8] Home heating equipment provides a substantial opportunity for error in installation, maintenance, fueling, operation, and placement. Portable electric heaters are much less likely to cause contact burns than are kerosene heaters, wood or coal stoves, or gas-fueled heaters.[9]

Clothing

Each year, more than 200 clothing-related fire deaths are reported, along with many more non-fatal clothing-related burns. The severity of these burns is marked, often resulting in hospital stays longer than 1 month.[3] The most burn-injury-prone garments

include those that are lightweight, those with fuzzy or napped surfaces, loose-woven, or loose-fitting garments. Garments made of cotton, cotton-polyester blends, rayon, or acrylic are easy to ignite and burn quickly. Pajamas, nightgowns, and robes are the garments most commonly ignited. Also, costumes, such as those worn for Halloween, are often at risk because of their loose sleeves, long skirts, and flimsy materials. "Flame-resistant" labeling indicates that garments are made from inherently flame-resistant fabrics or are treated with flame-retardants to make them less likely to ignite and more apt to self-extinguish.

In the 1970s and 1980s, the federal government passed strict standards limiting the garments that could be purchased for children's sleepwear to certain styles and certain flame-retardant fabrics. In 1996, the CPSC voted to relax the flammability standards as of January 1997,[10] partially as a result of consumer pressure for cotton sleepwear for children. Now the sale of tight-fitting garments made of any fabric is allowed for the purpose of sleepwear; e.g., cotton long underwear. Tight fitting garments are defined by their dimensions, and must be nearly skintight at the wrists, ankles, and waist. The reason for changing the standards cited by the CPSC was that tight-fitting clothing, regardless of fabric type, was less likely to come in contact with flame or other ignition sources, and that there would be less air between the garment and the child, resulting in slower burning. The relaxation of the sleepwear standards also included expanding the sleepwear choices for infant sizes 9 months and younger (corresponding to the clothing industry's sizing practices for infants ages 6 months and younger) to include all types of sleepwear, regardless of fabric or fit, since infants are arguably "insufficiently mobile" to expose themselves to sources of fire.[11]

Scald Burns

Most scald burns occur from contact with hot food and drink or from hot tap water. Scald burns from hot liquid spills are the major cause of non-fatal burn-related ED visits and hospitalizations.[12] They are more likely to affect young children, elderly individuals, or those with disabilities.

Tap water from the faucet is also a major cause of burn injury to children. Each year approximately 34 deaths occur and 3800 to 5100 injuries are seen in EDs as a result of scalding from hot tap water—approximately 28% requiring hospitalization.[13-15] In general, tap water scalds are more severe than other types of scald burns, because they usually involve a larger portion of the body (mean of 20% of body surface area)[13,14] and because immersion is measured in seconds or minutes rather than hot liquid spills, which tend to run off the skin immediately. Tap water burns occur most frequently in the bath or shower, but may also occur in the bathroom or kitchen sink.

High risk groups for tap water scald burns include infants and toddlers (usually 6 months to 3 years), disabled persons, and individuals older than 65. These 3 risk groups account for almost 90% of those burned by hot tap water.[13] These individuals have in common slower reaction time, decreased perception of danger, and less control over their environment.

Although newer water heaters are preset by manufacturers at 120°F,[16] many water heaters are still installed or thermostats are turned up to 140°-150°F. At these latter temperatures, a full thickness (deep second- or third-degree) burn would occur in adult skin in 2 to 5 seconds.[17] Children probably require one-third to one-fourth of that time to sustain these severe burns.[18] These burns may be prevented by the one-time lowering of the water heater thermostat such that the hottest temperature at the tap is 120°F.

A variety of other types of scald burns at home have been reported in specific risk groups. Infants have experienced mouth and splash burns as a result of nursing bottles and baby food jars being warmed in microwave ovens.[19-21] The container may feel cool to the touch but the contents might be extremely hot. Scald burns may also occur when chemical hot packs are used during rewarming of hypothermic patients.[22] Scald burns related to the use of hot water vaporizers have been reported both from contact with steam and from tipping over the vaporizer.[23] Finally, tap water scald burns to the lower extremities of individuals with diabetic neuropathy are well documented.[24]

Smoking materials, matches, and lighters

Smoking materials (e.g., cigarettes, pipes, and cigars) are the leading causes of deaths from residential fires, and cause three-fourths of all such fires. Adults most commonly start fires while using smoking materials, especially when falling asleep on a combustible item such as a couch or mattress while smoking a cigarette. Alcohol and other drug use often contribute to careless use and disposal of smoking materials, hence, to smoking-related fires and burn injuries.[3] When children start fires with smoking materials and related objects, matches and lighters are the most common heat sources. The majority of children who start fires by playing with lighters are between the ages of 3 and 4 years.[25] When smoking materials and lighter-related fires involve bedding, mattresses,

upholstered furniture, and clothing, they are more likely to be deadly.[26] Attempts to reduce morbidity and mortality from smoking materials-related fire and burn injury include modifications (in the 1970s and 1980s) to mattresses and furniture to make them less flammable, and the more recent work to develop cigarettes that are both less likely to ignite other items and that that more easily self-extinguish.[27,28]

BURN COUNSELING: GENERAL CONCEPTS

Periodic counseling of families regarding measures to reduce the risk of unintentional household and recreational injuries is recommended by the US Preventative Services Task Force.[29] In one large study, parents who received individualized child safety counseling during well-baby visits demonstrated a greater knowledge about home hazards of all types and had fewer hazards in the home when their homes were tested 1 month later.[30] Counseling regarding reducing unintentional household injuries occurs in many settings, including schools, hospitals, workplaces, health fairs, and in the physician's office. TIPP (The Injury Prevention Program) curriculum[31] and other material from the American Academy of Pediatrics[3] provides information that will assist physicians in counseling patients to reduce the risk of fire and burn injuries in the home.

General principles of fire and burn-prevention counseling include adequate supervision of children and elderly adults; removal of certain hazards from the home; appropriate use of potentially dangerous appliances by alert, properly prepared adults; smart choices of products and clothing, and simple behavioral changes to make potentially dangerous objects more safe. Counseling strategies specific to each category of sources of fire and burn injury can be found in the patient information table.

ADVOCACY

In addition to using the prevention messages in the Table as a counseling guide in the office, health care providers can work in the community or with governmental agencies to advocate for safer home environments. In most communities, the local fire department has extensive school and community fire-safety education programs. Local law enforcement, EMS, SAFE KIDS Coalition, schools/PTA/PTO, home-improvement stores, service organizations, public health agencies, and health-professional organizations may sponsor other community education programs. Health care providers can participate in public information and education efforts by speaking to local school and parent groups, writing editorials and letters to newspapers, and giving support to legislation requiring improved safety standards for household products and safer building codes. For example, health professionals have been instrumental in the legislation requiring lower settings on new water heaters sold in Wisconsin, as well as in the creation of self-extinguishing cigarettes.

SUMMARY

Product-related burn injury can be sustained from a wide variety of hazardous objects commonly found and used in the home. By taking simple steps to modify the home environment, families can significantly reduce these hazards and risk of thermal injuries resulting from them. Health professionals can play an important role in prevention of these injuries by providing anticipatory guidance counseling to at-risk patients in the office, joining community coalitions, and supporting stronger building codes and legislation for creating a safer home environment.

RESOURCES FOR FIRE AND BURN PREVENTION INFORMATION

National Center for Health Statistics
6525 Belcrest Rd
Hyattsville, MD 20782
301.436.8500
http://www.cdc.gov/nchs/

US Consumer Product Safety Commission
Office of Information and Public Affairs
Washington, DC 20207
301.504.0580
http://www.cpsc.gov/

US Fire Administration
11825 S Seton Ave
Emmitsburg, MD 21727
301.447.1000 • Fax: 301.447.1052
http://www.usfa.fema.gov/

American Burn Association Central Office
625 N Michigan Ave, Ste 1530
Chicago, IL 60611
312.642.9260 • Member Toll-free: 800.548.2876
Fax: 312.642.9130
e-mail: info@ameriburn.org
http://www.ameriburn.org/

National Fire Protection Association
1 Batterymarch Park
PO Box 9101
Quincy, MA 02269-9101
617.770.3000
Fax: 617.770.0700
http://www.nfpa.org/

Patient Information Sheet: Prevention of Burns in the Home

Cooking equipment

- Be attentive to small children when an adult is cooking, and carefully supervise older children who are cooking.
- Turn handles of pots and pans to the back of the stove to avoid children grabbing and tipping a pan of hot liquid.
- Avoid using counter-top appliances with dangling cords that can be used to pull the appliance off the counter.
- Do not use cooking equipment to heat the home; it was not designed for that purpose.
- Maintain a "kid-free zone" at least 3 feet around cooking equipment.
- Maintain a clean, neat, safe kitchen, with flammable cleaners and other products stored away from the stove.
- Understand the proper methods for extinguishing grease fires.
- Do not store candy, cookies, or other child-attracting items above the stove.
- Do not leave hot stove doors open; install anti-tip devices on electric stoves.

Home heating

- Purchase heating devices equipped with the proper safety equipment, including guards and safety switches.
- Use heating equipment with proper ventilation and clearance (at least 3 feet from combustible materials), and away from where people can trip on it.
- Keep children away from central heating units.
- Equip fireplaces and wood stoves with metal or heat-tempered glass screens. Burn only seasoned wood, and dispose of all ashes properly.
- Never fill kerosene heaters beyond the full line, and never fill them with gasoline.
- Have central-heating units inspected regularly.

Clothing

- Purchase clothing for children made from sturdy fabrics with a smooth, tight weave, such as denim, wool, 100% polyester, nylon, and silk. If natural fibers such as cotton are purchased, garments should be tight fitting.
- Purchase fire-retardant sleepwear; such products can be identified by the bright yellow required labeling.
- Teach children the "stop, drop, and roll" technique of extinguishing fires on their person.

Smoking material, matches, and lighters

- Do not leave children unsupervised.
- Purchase only child-resistant lighters, and store matches and lighters in locked cabinets out of children's reach.
- Never use matches and lighters in front of children for purposes other than lighting smoking materials.
- Never smoke in bed, while sleepy, or after drinking alcohol.
- Dispose of lit smoking materials properly. TRY TO QUIT SMOKING.

Scalds

- Using a candy or meat thermometer, test the maximum temperature at the faucet after no water use in the house for at least 1 hour. If the temperature exceeds 120°F, the water heater thermostat should be lowered and the test repeated the following day.
- Install anti-scald devices on home faucets.
- Do not hold children while carrying hot liquids.
- Avoid microwave heating of baby formula or food.
- Do not leave cups or dishes of hot food or liquids near edges of counters or on tablecloths.
- Use cool mist vaporizers instead of hot-steam vaporizers.
- Never leave infants or small children alone in the bathtub or bathroom.

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