Hospitalized Burn Injuries in Massachusetts: An Assessment of Incidence and Product Involvement

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Abstract: We assessed the frequency of hospitalized burn injuries in Massachusetts, and product involvement in causing burns, by reviewing the hospital inpatient records and emergency room logbooks for 240 of New England's 256 acute-care hospitals. Children less than two years of age, males, and Blacks experienced higher burns rates than did older individuals, females, or Whites. Products frequently associated with burn injuries included those involved in food preparation and consumption, flammable liquids, and clothing. (*Am J Public Health* 1986; 76:1341–1343.)

Introduction

Burns are the fourth leading cause of injury death in the United States, accounting for approximately 6,000 deaths each year.[1] An additional 90,000 people are hospitalized annually for the treatment of burns.[2] The epidemiology of hospitalized burns in well-defined, regional populations, however, is not well-known because few large-scale studies have been undertaken.[3–6] In addition, few studies have identified the role of products in causing burn injuries.[7]

The objectives of this study were to assess the frequency of hospitalized burn injuries in the State of Massachusetts with respect to the age, sex, and race of the victims and to gauge the contribution of consumer and industrial products in causing burn injuries.

Methods

The New England Regional Burn Program (NERBP) was one of six projects within the National Burn Demonstration Project established under contractual agreements with the Division of Emergency Medical Services of the US Department of Health and Human Services (then the Department of Health, Education, and Welfare) to collect data on burn injuries occurring over a 26-month interval, May 1978 to June 1980.[8]

Among the NERBP's data collection efforts was identification of persons admitted to any of 240 of New England's 256 acute-care hospitals for treatment of a new burn injury. Patients were identified primarily by review of hospital inpatient records and emergency room logbooks. Types of injuries included in the effort were scald, flame, flash, contact, electrical, chemical (ICDA codes 983.0, 983.1, 983.2 and phosphorus in 983.9), and ultraviolet radiation burns.

Demographic information and information regarding the nature of the burn injury and products involved were obtained by review of the medical record for each case. Product involvement was summarized using a four-digit "victim activity code" that discriminated among the various types of burns and sequences of events that result in burn injury. Use of the victim activity code was unique to the New England site of the National Burn Demonstration Project.

The present study is based on a subset of the NERBP data. The subset consists of information for inpatients who were Massachusetts residents on the date of the burn injury and who were burned between July 1, 1978 and June 30, 1979. The approximately 30 burn victims who died before hospitalization are not included in the present study. In addition, residents of 12 Massachusetts cities and towns, representing 5 per cent of the total population of Massachusetts, are not included in the analysis because three hospitals primarily serving these communities did not participate in the NERBP. The demographic characteristics of these residents are similar to the characteristics of the Massachusetts residents included in the study.

We calculated crude and age-, race-, and sex-specific incidence rates by relating the number of inpatient burns in each category to the number of person-years during which the burns were observed to occur. The numbers of person-years used to calculate these rates were based on data reported in the 1980 United States census for Massachusetts, minus the data for the 12 Massachusetts communities not included in the study.[9]

Results

A total of 1,237 burn injuries were identified among Massachusetts residents for the one-year period, July 1, 1978 to June 30, 1979, yielding a burn incidence rate equal to 22.7 hospitalized burns per 100,000 person-years. Children less than two years of age experienced the highest burn rates for both males and females (143.8 and 110.4 hospitalized burns per 100,000 person-years, respectively). The overall rate for males was 2.6 times higher than the rate for females. The burn rate for the Black population was 3.1 times the rate for the White population, and 2.3 times the rate for the remaining racial groups in Massachusetts combined.*

Table 1 summarizes the data for type of burn according to age categories and sex of the victims. Scalds were the most frequent type of burn for children less than five years of age for both sexes, and for females for all age categories except five to 14 years. Flame and flash burns predominated among males aged five years or older.

Products associated with food preparation and consumption, the most common sources of scald injury for both non-work- and work-related scalds, were involved in 48 per cent of all scalds (Table 2). Flammable liquids were involved in 87 per cent of the non-structural flame or flash burns that were work-related, and in 42 per cent of non-structural flame or flash burns overall. Clothing ignition, motor vehicles, and stoves or ovens were involved in 36, 12, and 14 per cent of all non-structural flame or flash burns, respectively.

*Tabulations of burn rates for these subgroups are available by request to Dr. Rossignol.

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TABLE 1—Burn Incidence Rates by Type of Burn, Sex, and Age of Inpatients, Massachusetts Residents, July 1, 1978–June 30, 1979

Sex	Age Category (years)	Type of Burn: Flame/Flash Incidence Rate*	Flame/Flash Number of Burns	Scald Incidence Rate*	Scald Number of Burns	Other Incidence Rate*	Other Number of Burns	All Types Incidence Rate*	All Types Number of Burns
Male	<5	8.6	14	59.9	98	25.7	42	94.1	154
	5–14	13.9	56	8.9	36	4.7	19	27.5	111
	15–54	14.7	221	11.0	166	7.8	117	33.4	504
	≥55	8.7	45	6.2	32	4.5	23	19.4	100
	All Ages	13.0	336	12.8	332	7.8	201	33.6	869
Female	<5	6.4	10	47.0	73	15.4	24	68.9	107
	5–14	2.1	8	1.5	6	2.8	11	6.5	25
	15–54	3.8	60	3.9	61	2.2	34	9.8	155
	≥55	4.2	31	5.2	38	1.6	12	11.1	81
	All Ages	3.8	109	6.2	178	2.8	81	12.9	368
Both Sexes	<5	7.5	24	53.6	171	20.7	66	81.8	261
	5–14	8.1	64	5.3	42	3.8	30	17.2	136
	15–54	9.1	281	7.4	227	4.9	151	21.4	659
	≥55	6.1	76	5.6	70	2.8	35	14.5	181
	All Ages	8.2	445	9.4	510	5.2	282	22.7	1,237

*Number of burns per 100,000 person-years.

TABLE 2—Products Frequently Involved in Scald Injuries by Work-relatedness among Inpatients, Massachusetts Residents, July 1, 1978–June 30, 1979

Product Involvement	Work-relatedness: Non-work Per Cent of 396 Non-work-related Scalds	Non-work Number of Scalds	Work Per Cent of 114 Work-related Scalds	Work Number of Scalds	Both Categories Per Cent of All 510 Scalds	Both Categories Number of Scalds
Food Preparation and Consumption	55	216	25	28	48	244
Motor Vehicle Radiator	8	33	7	8	8	41
Bathroom Tub or Shower	9	37	0	0	7	37
Industrial Process	0	0	14	16	3	16
Tar or Asphalt	0	0	11	12	2	12
Home Medical Remedy	3	12	0	0	2	12
Molten Metal	0	0	10	11	2	11
Other Product	13	52	12	14	13	66
Unknown	12	46	22	25	14	71
Total	100	396	100	114	100	510

Discussion

The epidemiology of hospitalized burn injuries in Massachusetts is similar to the epidemiology reported for other geographic regions[3–6] with respect to the higher burn rates for children less than two years of age than for older individuals, for males compared with females, and for the Black population compared with the White population. In addition, the frequent involvement of products associated with food preparation and consumption, flammable liquids, clothing, and motor vehicles in burn injuries is consistent with the findings of these same studies.

Of the total of 1,237 burns, 23 per cent (289 burns) were known to involve products associated with food preparation or consumption. Cups were involved in 34 per cent (99 of 289 burns) of these burns; stoves or ovens were involved in 20 per cent (59 of 289 burns) of such burns. Clearly, engineering and administrative control strategies could prevent such burn injuries. Such strategies include improved design of cups to prevent easy spillage, and stove and oven designs that discourage users from reaching across burners to gain access to control knobs.

Similarly, strategies are needed to control flame or flash burns from flammable liquids. Such strategies include the placing of unambiguous warning labels on containers of flammable liquids, motor vehicle carburators, and industrial equipment or processes that use flammable liquids, and the elimination of ignition sources, such as lighted cigarettes, from areas in which flammable liquids are being used.

Because of the frequent involvement of products in causing burn injuries, increased instruction of engineers and engineering students about the relations between product design and burn hazards seems warranted.

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The Delivery and Uptake of Nicotine from an Aerosol Rod

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Abstract: Nicotine aerosol rods were assessed for their possible usefulness as substitutes for cigarettes. Under standard FTC conditions, the per puff delivery of the aerosol rod averaged 0.3 μg nicotine/puff after 10 puffs and 6.4 μg nicotine/puff after 60 puffs. After puffing on the rods, no nicotine was detected in the plasma or urine of seven subjects. (*Am J Public Health* 1986; 76:1343–1344.)

Introduction

Nicotine addiction accounts, in part, for the continuation of cigarette smoking in spite of well recognized risks it imposes on the smoker.[1–5] A variety of alternatives to smoking can deliver nicotine to the subject and yet eliminate the other tobacco specific compounds that have been implicated as agents of disease. These alternatives include, nasal nicotine solutions, transdermal and intravenous nicotine administration, and oral nicotine delivery in the form of nicotine gum.[6–9]

A nicotine aerosol delivery method was marketed in the Fall of 1985 in Texas for use by smokers and others who desire nicotine. The possibility exists that nicotine supplementation by inhalation of nicotine as an aerosol could alter smoking behavior patterns and reduce the uptake of other toxic and carcinogenic tobacco smoke constituents. For this reason, we became interested in the nicotine aerosol rod as a substitute source of nicotine for smokers who were trying to reduce their smoking habit.

Methods

The aerosol rods were first examined under standard FTC (Federal Trade Commission) machine smoked conditions. Nicotine was trapped on a Cambridge filter pad and quantitated by gas chromatography.[10,11]

We measured the physiological uptake of nicotine in three non-smokers and four smokers who were asked to abstain for at least 12 hours prior to reporting to each session. An indwelling catheter was inserted into the antecubital vein of the right forearm and an automatic blood pressure cuff was placed on the left arm according to previously described methodology.[12] Three puffs of aerosol were taken every two minutes for six minutes.

Plasma and urinary nicotine and cotinine concentrations were determined by a modification of the radioimmunoassay developed by Langone, *et al.*[13] The inter- and intra-assay variation of the nicotine and cotinine assays is 6 per cent.

TABLE 1—Nicotine Yield of Nicotine Aerosol Rod under Standard Machine Smoked Conditions*

Puffs	Average Nicotine/Puff (μg)	Total Nicotine (μg)
1–10	0.3	3
11–20	1.8	18
21–30	3.5	35
31–40	4.4	44
41–50	5.8	58
51–60	6.4	64
Total Nicotine		222

*Smoked on a H. Borgwaldt single port piston smoking machine (1 puff/min, 35 ml volume of 2 sec duration). Nicotine was trapped on a Cambridge filter pad and quantitated by gas chromatography.

Results

Under standard FTC conditions, the average nicotine delivery of the rod increased with the number of puffs taken from 0.3 μg/puff in the first 10 puffs to 6.4 μg of nicotine after 60 puffs (Table 1).

No nicotine was observed in the plasma or urine of smokers or non-smokers after using the aerosol rod. Smokers' plasma cotinine concentrations remained constant before and after using the aerosol rod. No cotinine was detected in the plasma of nonsmokers. Urinary cotinine was assessed daily for four days after aerosol rod use in nonsmokers. No urinary cotinine was detected.

Discussion

We theorize that the amount of nicotine delivered per puff was the equivalent of a hypothetical 0.01 mg nicotine content cigarette which would provide per puff deliveries too small for nicotine absorbed to be detected in the plasma. Only after a total of 60 puffs could this rod approximate the nicotine delivery of a 0.2 mg nicotine content cigarette.

The results of the study lead us to believe that in its present form the nicotine aerosol rod will not provide a suitable vehicle for nicotine delivery. The absence of nicotine or cotinine in plasma or urine of both subject groups indicates that nicotine concentrations of these rods, on a per puff basis, does not approximate the nicotine yield of a cigarette. The most frequently used cigarettes based on sales weighted averages in the United States deliver nicotine in the 0.7–1.0 milligram range.[14]

Conceptually, the aerosol rod represents an ideal nicotine delivery system that mimics the route of absorption of nicotine in cigarette smokers who inhale. Puffing on the

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