

# Burn Injuries in North Dakota and Other Midwestern Agricultural States

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Each year fire continues to be a widespread national problem. A survey done by the National Fire Incident Reporting System in 1977-78 reported over three million fires causing a property loss of 5.31 billion dollars (U.S. Department of Commerce, 1980). These fires resulted in 8,600 deaths and over 90,000 injuries. Wood and paper products ranked first for materials that caused the greatest dollar loss and number of fires. However, fires in which textiles were first to ignite resulted in more deaths and injuries than any other class of materials. Fires involving textile products were responsible for nearly half of all fatalities and one-third of all injuries suffered by individuals in structural fires (Tovey and Katz, 1981).

A concern for consumer safety became evident as early as 1953 when legislation was enacted through the passage of the Flammable Fabrics Act (FFA). This act differentiated between normally flammable clothing fabrics and those that were dangerously flammable with the later mandated for removal from the marketplace (Flammable Fabrics Act of 1954). In 1967 the act was amended to broaden the spectrum of protected clothing and extended the coverage to include interior product items (Flammable Fabrics Act Amendment, 1967).

The Consumer Product Safety Act of 1972 established the Consumer Product Safety Commission (CPSC) which was given jurisdiction in matters concerning product safety (U.S. Congress, 1972). The act gave CPSC responsibility for identifying the most serious types of textile fires, analyzing characteristics of the fires, and developing appropriate and responsible test methods and flammability standards. As a result of the legislation, CPSC has established standards on children's sleepwear (DOC FF 3-71 and 5-74) as well as interior products which include carpets and rugs (DOC FF 1-70 and 2-70) and mattresses and mattress pads (DOC FF 4-72). Before making decisions on additional flammability standards for textile products, CPSC has been called upon to gather more accurate burn data. The American Textile Manufacturers Institute, the American Apparel Manufacturers Association, and the

National Cotton Council have requested that more accurate data be supplied on textile items involved and the exact causes of burn injuries and deaths (Byrne, 1977). Without adequate data to identify various areas of need, legislation could be put into effect in unneeded areas and neglected in essential areas.

Sources of data used most frequently by CPSC for determining injuries are (1) the National Electronic Injury Surveillance System (NEISS), (2) in depth investigations of accidents, and (3) death certificates when death was attributed to a consumer product (CPSC, 1975). Statistics tabulated by NEISS are collected from each product-related injury treated in 121 hospitals selected from 5,939 hospitals throughout the United States. Accident information is also collected by contacting victims and witnesses of the accident. National estimates of injuries associated with consumer products are projected from accidents treated in hospital emergency rooms (NEISS Data Highlights, 1980). During the 1980 fiscal year estimates for burn injuries among the United States population was based on only 66 cases. As a result of the limited observations, the Annual Flammable Fabrics Reports reflect five-year summations of NEISS data combined with other sources (CPSC, 1980).

A burn injury study which was done at the University of Nebraska in 1975 emphasized the need for studies that would accurately reflect burn injuries occurring from clothing and interior product involvement in states that are predominantly agricultural. Results of the Nebraska investigation differed from NEISS results in that male victims in Nebraska represented a noticeably larger number of burn injuries than the NEISS sample (Laughlin, Trautwein, & Parkhurst, 1978). The results of the Nebraska study indicated a need to determine if other midwestern states that were predominantly agricultural had similar results on burn accidents.

## PURPOSE OF THE STUDY

The purpose of the study was to determine whether national statistics collected in urban settings were similar to statistics collected from rural populations. To accomplish this comparison data were compiled from North Dakota (Leiseth, 1982) and in Kansas, Nebraska, and South Dakota. Regional data were compared for similarities and differences as to age, sex, heat source,

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location, activity, and time of burn injury accidents involving clothing and interior products (Mehlhoff, 1982).

## DATA COLLECTION

Data for the regional study were compiled from the data collected in the four states during the 1980 fiscal year. Information was obtained through hospital medical records and the state fire marshal's office in each state. Permission was granted by the hospital administration association in each state to allow medical records personnel to supply the needed information for each burn victim. The questionnaire used for the 1980 regional burn study was adapted from a questionnaire originally developed and pretested by investigators at the University of Nebraska in 1975. The state fire marshal's files were used to acquire information on burn injury deaths.

Frequency tabulations and percentages were tabulated for each of the four states for both clothing-related burn injuries and interior product-related burn injuries. Then individual state files were combined into a regional file and observed frequencies were compared to the expected frequencies for the regional data. Additional analysis was completed to detect areas of significant differences among the four states for clothing-related and interior product-related burn injuries.

## FINDINGS AND DISCUSSION

A total of 3,275 persons were involved in burn accidents in the four state region for the fiscal year 1980.

Of that number 2,213 (67.69 percent) were male and 1,060 (32.39 percent) were female (Table 1). Sex was not identified for two victims. In contrast, the total population of the four-state region was 49.12 percent male and 50.88 percent female. The four-state population ratio of male to female was similar to the national population ratio of 48.59 percent male, 51.42 percent female. Statistical comparisons of sex of burn victims and of population ratios showed a significant difference. Males were burned at a significantly greater ratio than females for their share of the population (Mehlhoff, 1983).

The regional findings which showed males at a much higher risk than females disagreed with NEISS findings. NEISS findings showed the sex distribution to be 59 percent male and 41 percent female. Some differences may be explained by the fact that the four states would show a greater proportion of agriculturally related industry than those states with more urban populations sampled by NEISS. Burn injury projections were made for the United States population based on the burn injuries for the four state region. National projections showed 8,566 clothing-related burns and 3,588 interior product-related burn injuries (Table 2). This contrasted by a large margin with NEISS projections of 4,096 clothing injuries and 1,125 interior product injuries (Table 2).

As this study dealt with burn victims hospitalized due to clothing-related and interior product-related burn injuries, the outpatients for the region were separated from the inpatients, leaving a total of 1,476 hospitalized burn victims. Of this number, 201 could be clearly identified as clothing related and 84 as interior product related.

Table 1. Regional Sex Distribution of Burn Accident Victims for 1980 Fiscal Year.

Sex of Victim	Total Hospital Treated Burn Victims					State Population and Percent				Region Total
	Kansas	Nebraska	North Dakota	South Dakota	Total	Kansas	Nebraska	North Dakota	South Dakota	
Male	780	735	432	266	2,213	1,156,720 (48.95%)	765,902 (48.80%)	328,409 (50.32%)	340,370 (49.32%)	2,591,401
Female	353	386	205	116	1,060	1,206,488 (51.05%)	804,104 (51.20%)	324,286 (49.68%)	349,808 (50.68%)	2,684,686
Undetermined				2	2					
Total	1,133	1,121	637	384	3,275	2,363,208 (100%)	1,570,005 (100%)	652,695 (100%)	690,178 (100%)	5,276,087

Table 2. Observed Burn Injuries and National Projections based on Four-State Study.

	Four State Region				Total n	%	Combined State Populations	National		NEISS	
	Kansas	Nebraska	North Dakota	South Dakota				Projection	Population	Observed	Projection
<b>Clothing Incidents</b>											
Male	72	47	23	25	167	83	2,591,401	7091	110,032,295	39	2256
Female	12	14	2	6	34	17	2,684,686	1475	116,472,530	27	1840
Total	84	61	25	31	201	100	5,276,087	8566	226,504,825	66	4096
<b>Interior Incidents</b>											
Male	4	18	5	34	61	73	2,591,401	2590	110,032,295	15	772
Female	1	9	—	13	23	27	2,684,686	998	116,472,530	8	353
Total	5	27	5	47	84	100	5,276,087	3588	226,504,825	23	1125

## CLOTHING RELATED BURN INJURIES

Of the 201 clothing burn accidents, 167 (83.08 percent) were male and 34 (16.92 percent) were female (Figure 1). This proportion was compared to the proportion of the male and female population of the region and the United States. When the number of males were compared to the percentage of males in the regional population, males were shown to be at a much higher risk than females to become involved in burn accidents (Figure 1). There was no significant difference in ratio of males to females between the regional population and the U.S. population.

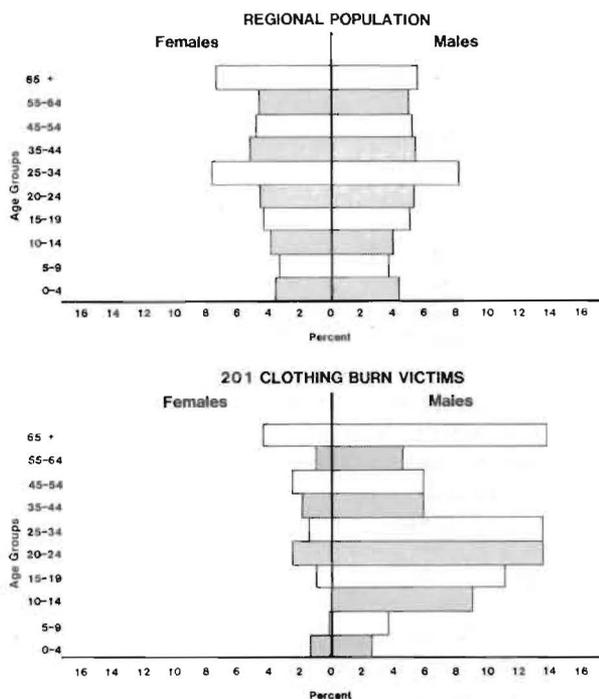


Figure 1. Comparison of regional population and clothing burn victims by sex and age.

The age group at greatest risk to clothing-related burn injuries was the 20-24 year old group. This age group had 32 reported injuries with only 20 expected according to the age group's percent of the population. The 65+ age group also had a higher number of burn injuries with 37 observed and 26 expected accidents. The 10-14 and 15-19 years olds were higher than was expected. All other age groups were lower than expected with the 55-64 year age group at the lowest risk. Each of the four states followed a similar pattern of burn injury distribution by age groups.

Characteristics which influenced burn injuries included heat source, location, activity, and time of the accidents. The most common heat sources were flame (62.69 percent) and explosion (19.4 percent). The major sources of ignition for burn accidents were open fires

(43), combustion engines (34), smoking materials (23), and matches (16). Over half of all burn injuries occurred at home, either indoors or outdoors. Of the 22 categories for activity, working with machinery was the single category with the highest number of accidents (23). Activity of the victim was one of the few areas where significant differences appeared among the states. In the open fires/burning trash category, South Dakota showed 16 injuries with only nine expected. In the category of "Other" which included cooking and welding, North Dakota showed 13 injuries with only seven expected.

The days with the highest incidence of clothing-related burn injuries were Saturday with 34, Sunday with 36, and Monday with 31. Afternoon was the most common time for the accident to occur. The greatest number of accidents occurred in the fall (54) followed by summer (53). In analyzing the time factor, there were no significant differences among the four states. The two clothing items with the highest fire incidence of burn injuries were pants with 82 and shirts/blouses with 74. Each of the other categories of clothing items were involved 10 or less times. There were two areas of differences among the four states in the area of clothing articles. Kansas was able to identify a greater proportion of clothing items than was expected. South Dakota had fewer shirts involved in burn injuries than was expected. Contrary to NEISS findings, the 1980 Regional Study showed little evidence of need for an adult sleepwear flammability standard. Areas which did indicate a need for flame retardant clothing were work-related activities such as working with machinery or refueling machinery and certain high risk occupations such as those of the oil field workers in North Dakota.

Flammable liquids were involved in approximately two-thirds of the clothing related accidents. Gasoline and propane were the flammable liquids most often involved in burn injuries. Of the 201 clothing burn victims, 64 died as a result of their injuries. The largest number of deaths occurred in the 65+ age group. An unusually high proportion of males (73 percent) were involved in accidents so severe as to cause death.

## INTERIOR PRODUCT BURN INJURIES

There were 84 interior product-related burn injuries in the four-state region (Figure 2). As in clothing-related accidents, males were at a much higher risk than females. Men were involved in interior product accidents in a ratio of 3.1 when compared to women. The four states were similar to each other in these findings.

The most vulnerable age group was the 35-44 year age category with 17 observed and nine expected injuries. This was almost twice the number of accidents expected for their share of the population. The second most vulnerable age group was the 65+ age group with 19 observed and 11 expected injuries. The 0-4 and 20-24 year old age groups were also higher than expected. Age groups 5-9, 10-14, 15-19, 25-34, 45-54, and 55-64 showed fewer injuries from textiles involving interior pro-

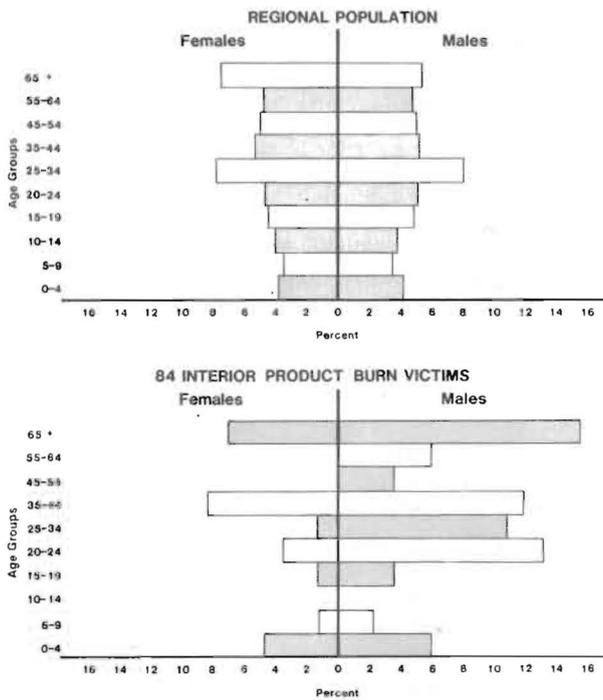


Figure 2. Comparison of regional population and interior product burn victims by sex and age.

ducts than was expected for their proportion of the population.

The majority of interior product burn accidents were started by an open flame. The most frequent source of ignition was some form of smoking materials. The interior product most often involved in burn injuries in the four state region was upholstered furniture. This contrasted with NEISS data which showed mattresses as the major interior product involved in a textile-related burn injury. Living room and bedroom locations had over three times the burn accidents as did kitchen locations. Over 40 percent of the victims were sleeping, falling asleep while smoking, or smoking. All four states showed no significant differences in these areas. The greatest number of interior product accidents occurred on Saturday during the morning hours and in the winter season. With 48 deaths, the mortality rate of interior product victims was a startling 57 percent. The degree of severity of the burn injury was unknown in 50 cases, indicating that many of these victims may have died at the scene of the fire.

## CONCLUSIONS

1. Sex was a significant factor in burn injuries. Males were burned at a much higher rate than females for their portion of population both in clothing-related and interior product-related burn accidents in each of the four states. This was true for every age group of the participating states.

2. The age category percentages of the four-state regional population were like those of the national population. Clothing-related injuries were most significant in the 20-24 year old age group. The age group at greatest risk for interior product-related injuries was the 35-44 year old age group.
3. The greatest number of injuries occurred in the 65+ group for both clothing and interior products. However, because this age group also had a larger proportion of population, the 65+ age group was second in risk of burn injuries in both clothing and interior product accidents.
4. Clothing-related accidents occurred most often in the afternoon. The most frequent time of day for an interior product-related accident was from 6:01 a.m. to Noon.
5. The day of the week with the most clothing accidents was Sunday, followed by Saturday. The day of most frequent burn accidents for interior products was Saturday.
6. The season of the year with the most clothing accidents was fall with 54, followed by summer with 53. Winter was the most dangerous time for interior product accidents.
7. Clothing items most often implicated in burn injuries were pants and shirts, with very little indication of need for additional standards for adult sleepwear. Upholstered furniture ignited by some form of smoking materials caused the greatest number of interior product burn accidents.
8. The heat source causing the greatest number of burn injuries for both clothing and interior products was an open flame. The two major ignition sources for clothing were open fires and combustion engines. The major ignition source for interior product accidents was cigarettes.
9. The location of most clothing burn accidents was at home followed by at work. The living room and bedroom locations each had more than three times the number of interior product accidents than did the kitchen.
10. Working with machinery was the activity with the single highest category of burn accidents involving clothing. Sleeping was the activity category with the highest burn accident rate for interior products.
11. Flammable liquids were involved in 69 percent of the total clothing burn injuries. Flammable liquid involvement increased the chance of hospitalization and the severity of the burn injury.
12. The number of deaths occurring in both clothing and interior product accidents was high in relation

to the number of injuries. There were 64 (31.44 percent) clothing and 48 (57.14 percent) interior product deaths. The highest number of deaths occurred in the 65+ age group for both clothing and interior products.

There were only two areas where the four states showed significant differences. These areas were in activity for the clothing victims and in clothing articles. South Dakota showed a higher percentage of burns from open fires than expected. Kansas was able to identify a greater proportion of clothing articles than expected. South Dakota had fewer shirts involved in burn injuries than expected.

### IMPLICATIONS

The high incidence of clothing burn injuries in the 20-24 year old category incurred when working with combustion engines would indicate a need for safety education programs. Greater emphasis on safety might be integrated into the driver education programs in high schools.

The high rate of deaths occurring from interior products would indicate a need for installation of smoke alarms, not only on one level, but on all levels of the home. Smoke alarms should be strongly recommended or required for every mobile home.

Individuals in high risk occupations and activities should be encouraged to wear flame retardant clothing which is available at a slightly higher cost.

The large number of burn injuries occurring in the 65+ age group would indicate a need for fire safety information to be distributed through senior citizen's organizations.

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In-depth interviews with centenarians used as the basis for this paper provide insights for further study of a larger group of those over 100. Some research topics on centenarians which seem to merit further study include support networks, continued physical and social abilities, attitudes toward life, and historical experiences. There is much the very old can contribute to our understanding of the past and of the aging process. From this modest beginning we need to branch out and continue to learn from those in their second century of life. In the near future, much of what they have to share with us will be lost.

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