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Fire Fatality In Maine: Part 1

Fire Fatality in Maine, 1983 – 1992: An Analysis of Who Died, When, Where, How and Why: What are the Implications for Fire Safety Policy in Maine?

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The National Fire Protection Association (NFPA) and the United States Fire Administration (USFA) provide a considerable amount of information on fire in the United States each year. This analysis was conducted primarily to examine fire fatality in Maine and to see if the data on fire fatality for the nation provided by the NFPA and USFA is statistically representative of what occurred in Maine between 1983 and 1992.

The primary source of analysis was the Maine Fire Marshal's Office fire fatality files for the years 1983 – 1992 with the unit of measurement being fatalities and in some instances (multiple fatalities) fire. The information from these files was entered into an Excel spreadsheet and data comparable to what was reported by the USFA National Fire Data Center for the same period was then selected for statistical analysis to determine statistical similarity. NFPA data on the overall trends in fire fatality for the nation was also compared to Maine data along with data from the U.S. Department of Health and Human Services Center for Disease Control.

This analysis also examined fire fatality in terms of human proximity to the fires ignition as well as the physical and behavioral environment in both the pre and post ignition phases of each fire. It is the author's hypothesis that understanding human proximity factors in varying environments will provide information that will assist fire service personnel in choosing what remedial approaches (code enforcement, direct intervention, or public awareness/education campaigns) might have the greatest impact in diminishing the frequency of these tragedies.

Fire fatality, injury, overall fire incidence studied in combination with current and historical fire suppression, mitigation, public education/awareness programming and regulatory efforts give us a picture of the State's fire burden in terms of societal and economic cost. This analysis on fire fatality is the first topical study by the Fire Marshal's Office and represents one step toward understanding the States overall fire burden. More topical studies will follow and become an integral part of the Fire Marshal's strategic plan to assess the states fire burden on an ongoing basis. That assessment will be the basis upon which the Fire Marshal's Office shall direct all rule-making, legislative, public education, and fire prevention policy initiatives.

An analysis of fire fatality in Maine from 1993 to present is already being planned as a follow-up to this study.

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Introduction

"We need to know what happened."[1]

The frequency and distribution of fire fatality found in the United States Fire Administration's (USFA) National Fire Data Center (NFDC) and the National Fire Protection Association (NFPA) publications are often cited as rationale for funding local or regional programs aimed at fire prevention and safety. This study will compare some of the more commonly used and comparable distributions from the USFA and NFPA with those obtained from the Maine State Fire Marshal's fire fatality investigators files. It should be noted that in searching the Fire Marshal's files of fire fatality, I discovered deficiencies in reporting details. These deficiencies need to be corrected so that a more detailed account of the physical and behavioral environment in which a fire occurred can be drawn. This is a strategic planning issue for the Fire Marshal's Office and the fire service in general. The era of assessing fires resulting in a death or injury focusing solely on where the fire started (origin) and what the source of ignition was (cause), as opposed to carefully assessing the entire physical and behavioral environment, is passing. We need to look at these two environments in addition to the proximity of human involvement to fire ignition to better understand fire fatality and injury. As one investigator put it: "We need to know what happened here." What happened reaches beyond where and how the fire starts.

[1] Sr. Fire Marshal's Investigator Stewart Jacobs in an interview at the scene of a fire in 1987. It was concluded that the 2 year-old who died in the fire started the fire with a lighter. FM-87-121.

Methodology

The data used to analyze Maine fire fatality in this study comes from the fire fatality files of the Maine State Fire Marshal's Office that are available at the Maine State archives. Each file contains the investigators' notes from the scene and a final report that includes his or her findings. The files also contain copies of depositions, affidavits, and interviews. Most have the medical examiners report with photographs and many contained newspaper clippings. Each item in the file served to help me understand what an investigator found, missed, or could not clarify in the report.

I conducted a literature search on research methods employed in previous fire fatality analyses, and relied frequently on the findings of the NFPA and USFA National Fire Data Center (NFDC) to establish a framework for developing a list of risk factors to examine in reviewing the files.

The control number for each report found in the State Fire Marshal Office (SFMO) fatality file was used as a control number in this research. This allowed me when necessary, to go back to a selected file for additional review. The primary unit of analysis was fatality, though fire counts were also used as a unit of analysis in some instances to examine multiple fatality incidences. The major source of national data was the *"Fire in the United States: 1983 – 1990"* summary analysis reported out of the NFDC which used data collected from the National Fire Incident Reporting System (fire departments) from the year 1990. Because the NFDC relied on state reports where not all the fire departments reported, there are inherent inaccuracies.

To get a picture of how a national organization saw the total death toll in Maine for the entire period, 1983 – 1992, I looked to the NFPA data. There are acknowledged problems with this data. The NFPA examines data from the National Center for Health

Statistics (NCHS). The NCHS data uses death certificates from each state to establish a count of “fire burn” related deaths nationally. As can be expected, there is some variation between the numbers the NFPA found and what was tallied from the SFMO fatality files.

In addition to quantitative analysis, I interviewed veteran fire service personnel for their thoughts on the patterns and distributions uncovered in this research. In some instances more questions about fire fatality have been raised than answered. These questions are now being used to establish a research agenda the Fire Marshal’s Office will establish to routinely examine Maine’s overall fire burden. This study represents a beginning study of fire fatality that will be continued through to the present time. In order to better understand all policy implications for the fire service in Maine regarding fire fatality, it is essential to look at all the

data from 1983 to present times.

Maine's Fire Burden

The term "fire burden" is used to summarize the social and economic costs of fire in a given geographic area. The burden takes into account the overall rate and count of fire incidence, fatality, injury, costs of fire suppression, mitigation, public fire safety and prevention efforts in addition to all state and local regulatory efforts made to reduce fires.

If you imagine the fire burden as a pyramid with five layers of fire burden, fire fatality would represent only a thin slice of the pyramid in terms of the number of incidents but a larger portion in terms of societal coast. A true analysis of the overall fire burden will take an integrated examination of all the layers. In this study we focus only on the fire fatality layer and the physical and behavioral environment in which they occur. Within that context we'll begin this analysis of fire fatality in Maine.

Fire Fatality in Maine: 1983 - 1992

Key Findings

- Between 1983 and 1992, 216 fires took the lives of 294 individuals in the state of Maine. 59% of these victims were male and 41% female. 25% of these fires claimed more than one life. Though Maine has suffered fire fatalities since 1992 it is critical to look back at this period for a number of reasons.

- The distribution of these fatalities in terms of origin of fire, age, time and other variables in Maine is often statistically different from those we find at the national level. The distributions differed in terms of age, origin and cause of fire, and time of day among other variables. Therefore, though efforts aimed at reducing fire fatality in Maine may begin with an examination of national data, a more local perspective/analysis is required to optimize the outcome of any policy or plan devised to reduce the frequency of these events.

- Like the nation, Maine shares a polarity of fatality in terms of the very young and the very old being the two most vulnerable population groups. Males 25 to 54 are three times more likely to die in a fire than women of the same age. No females age 40 – 44 were reported to have died in a fire during the period being examined in this study.

- 90.5% of fatalities occurred in a residence fire. Among residential fire fatalities, 82% occurred in one and two family dwellings and contrary to the perception by some in Maine's fire service that most fatalities occur in multifamily dwellings, multifamily dwellings accounted for only 15.4% of the fatalities.

- In Maine, 38.8% of the fatal fires in one and two family residences started in the living room and another 25.4% in the kitchen.

- In residential settings, smoke alarms were present and operating where 10.7% of fatalities occurred. In 40.5% of fatalities there was no detector and in 16.3% a detector was present but not operating. In one and two family dwellings Maine's did better in terms of smoke alarm performance than the nation when compared to NFDC data for the nation as a whole.

- 28.6% of fire fatalities took place in towns with fewer than 2,500 people. 59% of fatalities occurred in urban municipalities (defined in terms of functionality) with an overall mean population density of 419 people per square mile. This compares with the 1990 US Census that showed 22% of Maine's population lived inside urban areas and 23% lived outside urban areas with the remaining 55% in rural areas (1990 Census, P004 Urban and Rural Universe, STF 1).

- As is the case nationally, the careless disposal of smoking materials, a class 1 fire, resulted in more fatalities than any other determinable cause. Heating related fires are the second leading cause with arson and juvenile combined third.

- 55% of fire fatalities in Maine during the 1983 – 1992 period were class 1, interior proximate fires or, fires where an individual was involved directly in the ignition of the fire resulting in fatalities. Those igniting the fire did not always die in the fire.

The Death Toll Trend in Maine and the State Fire Death Rate vs. Potentially Explanatory Population Characteristics by Maine County

1. NFPA, NCHS, & SFMO Death Toll Patterns

Before analyzing the data let's compare Maine's fatality patterns as measured by the SFMO counts based on the investigator's reports with those of the NFPA that uses National Center for Health Statistics (NCHS) data. We'll also look at the NCHS data using the WISQUARS query available on-line for fire-burn related death. The comparison will be made for the 1983 – 1992 period. Figure 1 compares trends using these three sources to produce a line graph.

The pattern in terms of rising and falling counts is similar with some minor range variations between the three sources. It is important to illustrate this comparison because the three sources are used to assess fire fatality in Maine and, hence, conclusions in terms of who, what, when, where and how people died in fires can vary. The NCHS WISQUARS query, is death certificate data identified by the E890 – 899 range of codes for environmental events, circumstances, and conditions that caused a fatal injury. It is available to anyone on-line at the Center for Disease Control web page.

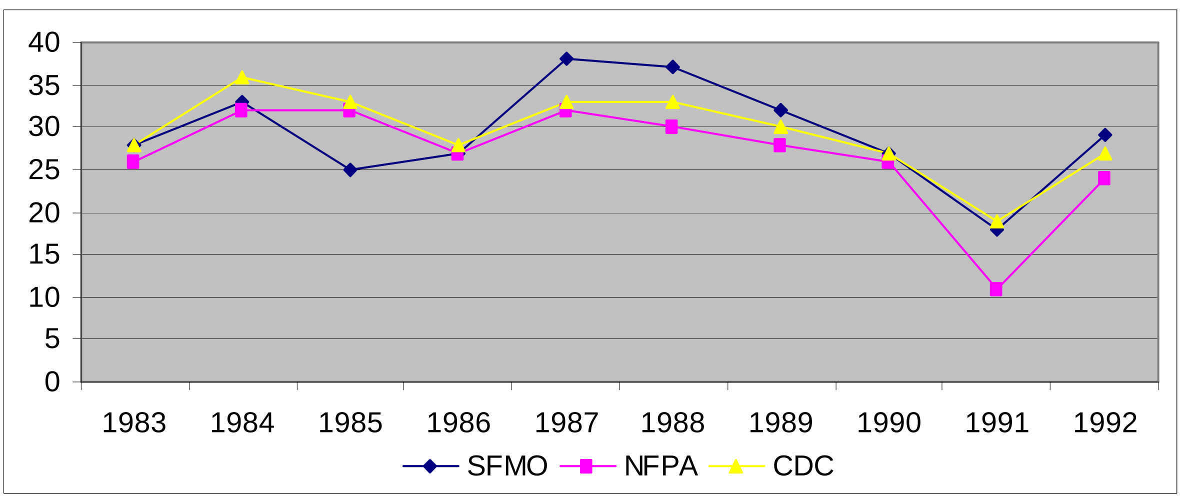

Figure 1. Fire Fatality in Maine

The death certificate data is compiled by states and submitted to the CDC and then provided to all interested parties through the NCHS. When you examine that NCHS data you'll see the total deaths for the period I studied matches exactly what I found in examining the SFMO fatality files. The NFPA and NCHS data often reveal differences due to the omission of some arson related and vehicular fire deaths from the NCHS data.

T his is because NCHS has looked at vehicle deaths outside of the fire/burn related category and arson, because it is an intentional act, falls outside the realm of unintentional fire/burn related deaths. It is easy to understand why the sources of data can vary when you consider the fact that nationally some arson events take multiple lives and many die in car fires. Veteran fire analyst John Hall of the National Fire Protection Association has recommended "active fire authorities work closely with public health authorities to improve the accuracy of coding the possible fire deaths…" Mr. Hall also believes that "the consistency achieved by using a single, well-organized data base provides a better means to analyze patterns and especially trends than improvised approaches that may appear to be more inclusive."[2]

I believe that despite the need for improvement in its reporting, the State Fire Marshal's Office investigative files provide the best single source of data, particularly over longer periods of time, to analyze patterns and trends essential to developing policy aimed at reducing fire fatality. In figure 1 the SFMO data produces a higher count than the NFPA. This is because the SFMO data includes vehicle fires. In this sense the SFMO files are more inclusive than the NFPA but less inclusive and are not based upon emergency room codes. Respectively, the three sources produce three means for the period studied. The NFPA produced a mean count of 26.8, the SFMO 29.4, and the CDC WISQUARS 29.4.

2. Fire Death Rate vs. Potentially Explanatory Population Characteristics by County in Maine

After reading the Schaenman and NFPA studies I decided to examine fire fatality

	% Below Poverty Level	*%>25 No Diploma*	*% Rural*	*% Housing Built before 1939*	*Fatal Rate*
% Below Poverty Level	1				
%>25 No Diploma	0.683305073	1			
% Rural	0.456807554	0.38818813	1		
% Housing Built before 1939	0.369489334	0.524529501	0.4692379	1	
Fatal Rate	0.243502533	0.224791529	0.2824905	-0.051717278	1
number of observations = 16					

Table 1. Correlation Matrix Using Four Potentially Explanatory County Characteristics

in Maine's counties over the 1983 – 1992 period using socioeconomic characteristics

[2] Hall, John. <u>*U.S. Fire Death Patterns by State: 1980 – 1996.*</u> Fire Analysis and Research Division, National Fire Protection Association. Quincy, MA: March 1999. p. V.

often associated with fire fatality and incident risk. Table 1 is a correlation matrix for the four variables considered to have a potentially high explanatory value for fire deaths. The characteristics used for each county included the % of population without a high school diploma (educational attainment); % living below poverty; % of housing built before 1939 and the % of the population living in a rural area. The same correlation was conducted by the NFPA for the nation and showed that the education and poverty characteristics were highly correlated with fatality rates.[3] Unlike the NFPA study none of the same characteristics produced strong associations for Maine's *counties*.

The percentage of the population living in a rural area in Maine does have a positive association with fire fatality. This means that there is a tendency, albeit weak, for a county with a large percentage of population living in a rural area to have a higher fatality rate. Poverty ranked second among this set of risk variables and again the association is positive but weak. In the area of educational attainment the association is similar. The only negative association was found between fatality rate and age of housing stock. There is virtually no association between these variables but what there is indicates that the larger the percentage of old housing (built before 1939) the lower the fatality rate. This is not what I anticipated finding. However, if you examine the scatter plots for this analysis in Appendix J you'll see that unlike the other characteristics, housing has few outliers in terms of the percentage of old houses. Essentially Maine has old housing stock and absent any county with an unusually high-recorded percentage of newer housing stock, this clustering is to be expected, as is the low association between that characteristic and fire fatality. Using a multiple regression model I found that the same four characteristics only explained 17% of variation in fatality rates.

The model used the same older housing, educational attainment, rural area population, and poverty variables used in the correlation analysis previously discussed. In the model, table 2, the coefficients represent partial slopes. If you assume the poverty level doesn't change (is held constant), and the % living in a rural area changes, then the fatality rate will change by .21 per unit of change in the % living in rural areas. The *t* statistic for each of the variables was less than two, which indicates that the coefficients for each variable are not statistically

[3] Ibid. p. 7

different from zero. We can therefore accept the null hypothesis that there is no significant

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.424233453
R Square	0.179974022
Adjusted R Square	-0.11821724
Standard Error	0.143438946
Observations	16

ANOVA

	df	SS	MS	F	Significance F
Regression	4	0.049672	0.012418	0.603552	0.668
Residual	11	0.226322	0.020575		
Total	15	0.275994			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.270173028	0.384143	0.703315	0.496476	-0.58	1.115665
%>25 No Diploma	3.084714783	5.164158	0.597332	0.56238	-8.28	14.45095
% Below Poverty Level	0.232659022	1.564233	0.148737	0.884453	-3.21	3.675515
% Rural	0.219758921	0.221026	0.994266	0.341462	-0.27	0.706235
% Housing Built before 1939	-1.21516039	1.171039	-1.03768	0.321693	-3.79	1.36228

Table 2: Regression Model

relationship between the variables and fire fatality in this model. The *p* value or two-tail probability for each variable also confirms that the null hypothesis is acceptable. It should also be noted that the negative sign shown on the coefficient for % of housing built prior to 1939 was also negative as it was in the correlation matrix. The fact that the direction of slope in terms of positive/negative for all variable coefficients in the regression model and in the correlation matrix did not change indicates colinearity, or variables canceling each other out, was not an issue. Finally, the standard error .14 from the regression statistics, which is expressed in the same units as the dependent variable (fire fatality rate), combined with the .27 coefficient for the dependent variable indicates that the model overall is weak in terms of explaining fire fatality.

A closer look at these characteristics using census track or even block level data might yield stronger associations between the four characteristics used in the regression analysis. Such an analysis would require drawing down the data for each town in which a fatality occurred. This would draw us closer to the behavioral and physical environments.

The fact that the model used by the NFDC revealed a stronger explanatory value at the national level than a similar model found at the county level in Maine suggests that we're probably going to see differences in the distributions and frequencies the two sets of data reveal in terms of who, when, where, why, and how people died in fires.

Who Died in Fires in Maine: 1983-1992

1. Age

Nationally and in Maine there is a polarity in terms of age distributions when it comes

to fire fatality. I'll examine the distribution of fatality by age in Maine and at the national level and then identify some reasons why we see this distribution. The distribution, as a percentage, of all fire fatalities for various age cohorts in Maine and nationally is illustrated in Figure 2 below.

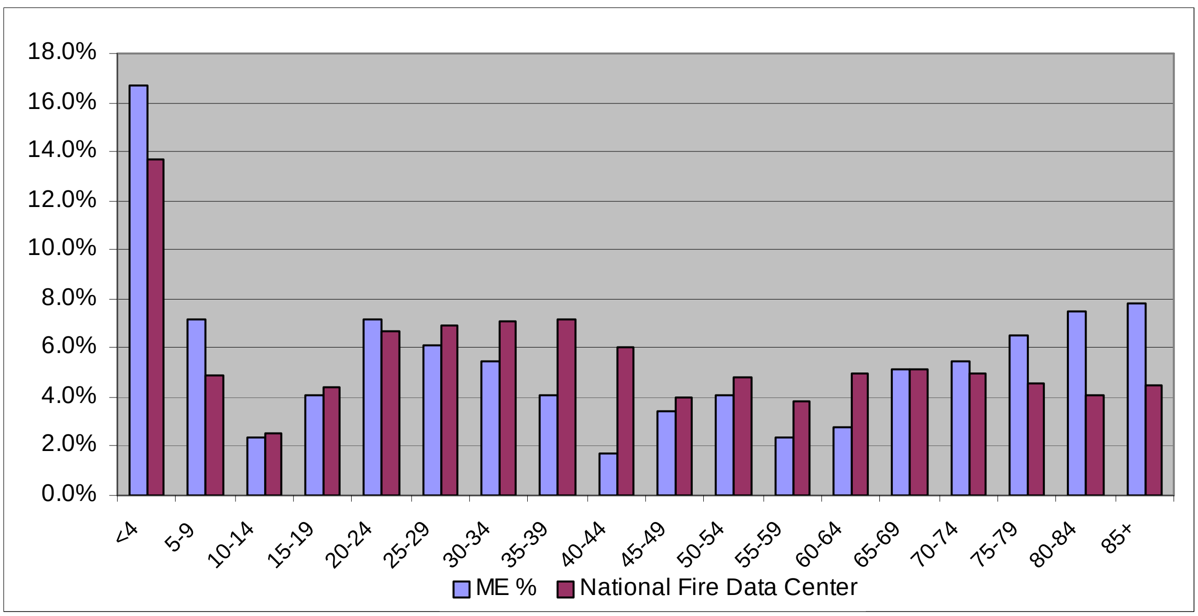

Figure 2. Percent of Fire Deaths by Age[4]

The degree of "polarity" is stronger in Maine than what we see nationally. Children under 14 and adults over 65 comprise 56% of fire fatalities in Maine though combined only makeup 37% of the population. I ran a cross tab of fire deaths by age with population of the same age group for Maine and the nation (see appendix B). The numbers confirmed the age dimension of fire fatality in Maine. The U.S. Census for 1990

[4] Figure 1 The national data was collected by the National Fire Data Center in Emmitsburg, MD and is based primarily upon National Fire Incident Reporting System (NFIRS) data. The data on Maine fatalities relies strictly on the SFMO fatality investigations files.

shows that the percentage of Maine citizens over sixty-five was 13.3% while nationally the same cohorts made up 12.6%. People in the < 1 to age 19 age group made up 28.2% of the population in Maine and 28.7% nationally. Maine citizen's sixty-five and older comprised 32.4% of deaths while at national level the same age group comprised 23.3%. People in the < 1 to age 19 in Maine comprised 30.4% while nationally the same group comprised 25% of deaths. A chi square test of this data shows that the differences are statistically significant. The test revealed that the distribution of fire death in Maine by age, 1983 – 1992, differs significantly from those found nationwide in the NFDC data for fire deaths reported in 1990. The difference was significant at the 001 confidence level. The null hypothesis that there is no difference was rejected.

Why are these groups so vulnerable and appear to be more so in Maine? Generally speaking there are obvious reasons for each group. Escape is more challenging for older citizens than it is for those in the more youthful to early middle years of life. Hearing impairment or other age related disabilities or limits diminish the mitigating advantage smoke detection devices can have. Failure to make a strategic evacuation plan can be devastating for people of this age involved in a bad fire. Both groups rely upon others more so than those in the middle. In terms of cause, NFDC data showed that smoking, heating and electrical distribution were the top three causes of fire death among the elderly. For children under five years of age playing with fire ranked number one among causes followed by heating and electrical distribution.[5] Comparable data for Maine mirrors national data with juvenile fire playing, heating and electrical being the top three causes for children under five. Smoking followed by heating and electrical causes reported most frequently for Maine's elderly citizens. Looking at these events in terms of cause alone oversimplifies the issue. For both age groupings class 1 (interior proximate), or fires where an individual was directly involved in the ignition, were reported most frequently. The proximity concept, which will be discussed further in detail later when we focus on cause alone, provides more insight into this age distribution.

It is difficult to ascertain with any certainty why Maine experienced a more severe fire fatality rate than what we saw nationally during the same time frame. A thorough explanation of these differing distributions and the policy implications they

[5] Fire in the United States: 1983 – 1990. National Fire Data Center. Emmitsburg, MD. 12-13.

have will require more scrutiny of a broader time frame. Many in Maine's fire service, including the current Assistant Fire Marshal and former Portland Fire Chief have acknowledged that juvenile fire setting interventions began during the 1980's due to some of the horrific incidents occurring at the time. However, the problem was not as clearly understood as it is today and institutional buy-in by the education and human services communities were not immediate. Yet the impact of these developments cannot be explained sufficiently absent an examination of fatalities occurring in the years following this study. An understanding of the policy implications for today will require searching in a broad time frame for answers.

2. Gender

As is the case nationally more males (59%) die in fires in Maine than females (41%).

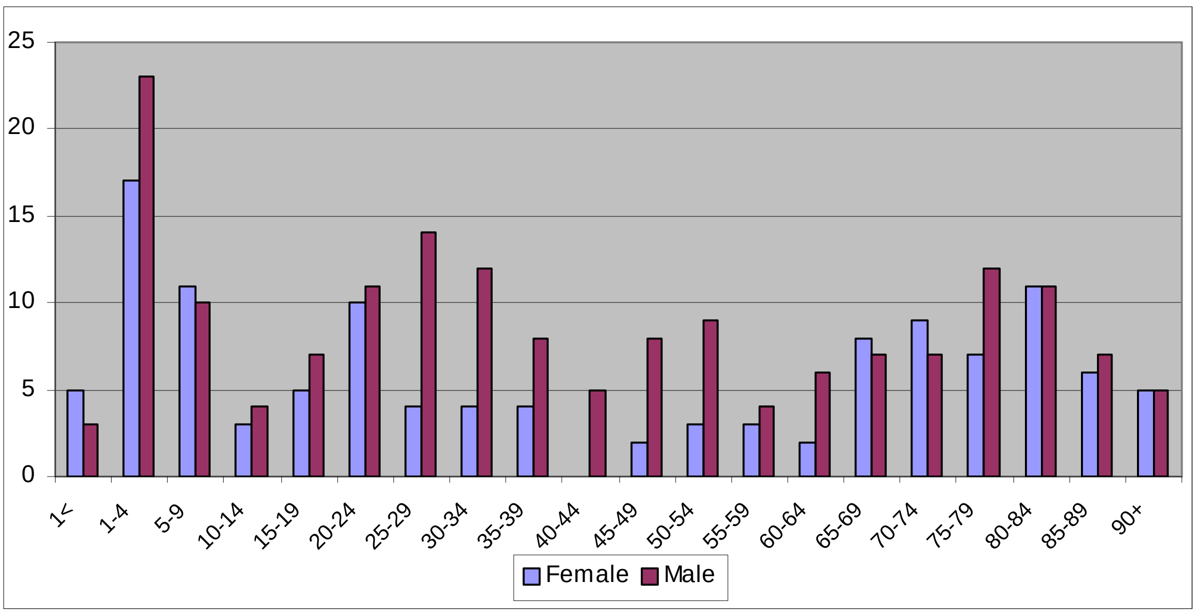

Figure 3: Fatalities by Age/Gender

Figure 3 illustrates the age distribution. Notice the gap between females and males between the ages of twenty-five and fifty-four. The leading cause of fire death in this age grouping for both sexes was smoking with heating and cooking following. All three of these causes *can* be proximate, or class 1 fires, as opposed to the distributions we see among the very young and old where there were definite proximate causes mixed with causes such as electrical which are, with rare exception, class 2 interior non-proximate fatal where no individual was directly involved in the ignition. Class 1, interior proximate fires are those fires where an individual was directly involved in fires ignition while Class 2, non-proximate fires are those where no one was present at the place of ignition. Common Class 1 fires include but are not limited to arson, juvenile firesetting and the accidental self-ignition of clothes that occur when an individual reaches over an open flame on a stove. Falling asleep with a cigarette is also a common Class 1 fire. Class 2 fires would include, but are not limited to the malfunction of equipment such as an oil heater in a trailer. Class 3, exterior proximate would be outdoor fires where, for instance, an individual attempted to jump start a fire to burn brush with gas and in the process set themselves on fire. The use of these classifications in future studies will require a more focused topical examination of aggravating circumstances such as alcohol use.

With regard to fatalities by gender that there appears to be a particularly large gap in the 25 to 55 age range. The gap, illustrated in figure 4, accounted for one-fifth of fire fatalities between 1983 – 1992.

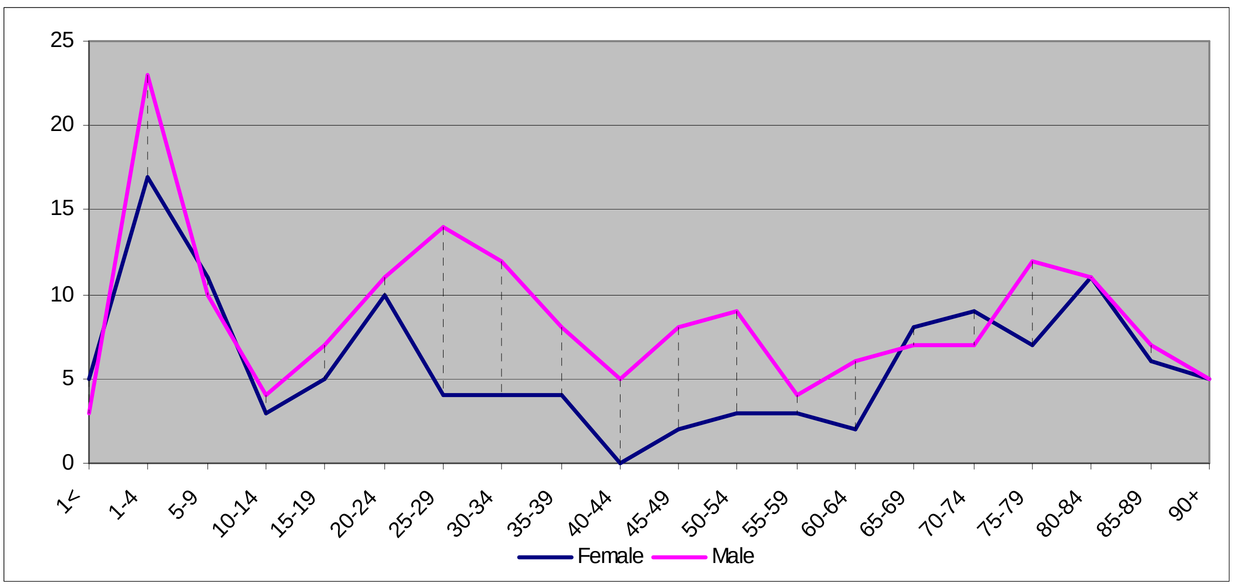

Figure 4. The Gender Gap

3. Regional Differences

Though this might appear more pertinent in the examination of where fatalities occurred, I wanted to include it here because there are regional attributes or characteristics associated with people from different parts of the State. Figure 5 simply ranks, from lowest at the top to highest at the bottom, the counties of Maine by fire fatality rate.

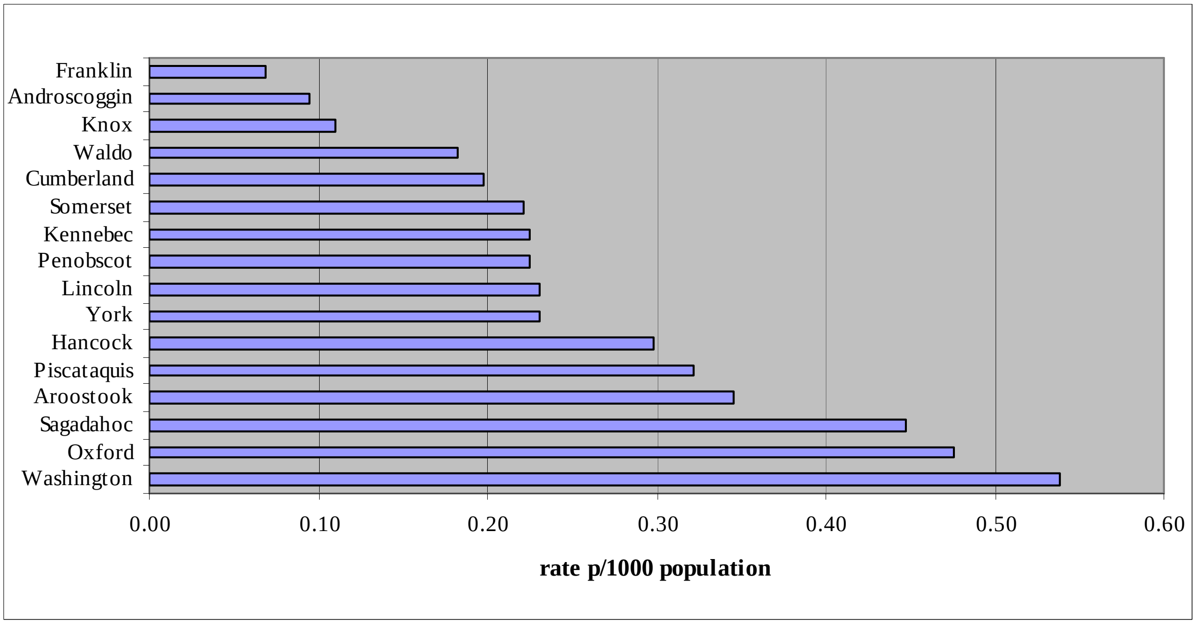

Figure 5. Fire Fatality Rate by Maine County 1983 - 1992

Where People Died in Fires in Maine

1. Types of Property

The distribution of fire death in terms of property type verifies what the majority of fire service personnel already know. Most fatal fires occur in the home and in

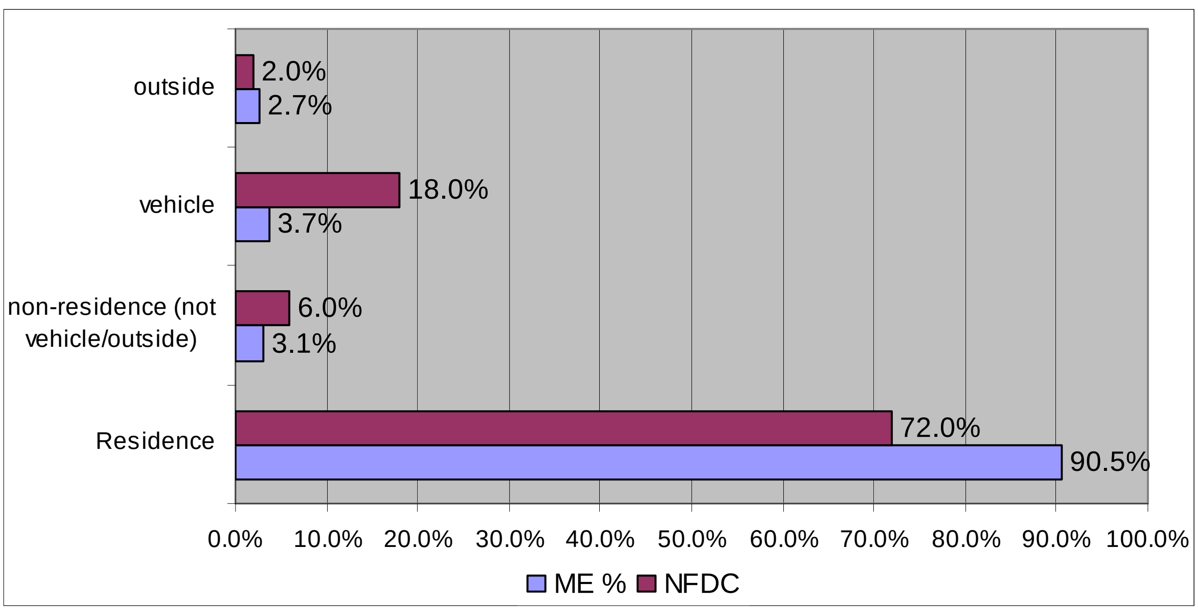

Figure 6. Fire Fatality by General Property Type

particular, one and two family dwellings. This long understood reality has considerable policy implications. Figure 6 on the previous page illustrates the distribution of fire fatality by general property type in Maine and the nation (NFDC). This concentration of fatalities in residential dwellings is something seen in national, state and regional data. However, as Figure 6 illustrates, Maine's distributions by property type differed significantly from those uncovered at the National Fire Data Center (see appendix C). Looking at national data I found fewer residential fatalities, as a percentage, than I found in Maine. Maine is a rural state with the seventh oldest housing stock in the nation and most structures are residential.[6] Maine does not have as many areas with a higher concentration of public assemblies and in such areas they experience more catastrophic disasters such as the Station House fire in Rhode Island that can skew fatality numbers. Finally, the large metro areas with more traffic volume also see a considerably larger number of fire fatalities occurring in vehicles.

2. Residential Fire Fatality

I wanted to examine Maine residential fire fatalities in terms of construction materials. When collecting available data from the Fire Marshal's files I broke construction type into three categories: masonry, wood frame, or mobile home. This revealed an issue Maine firefighters and fire protection engineers have been discussing at length for many years. The pie graph, figure 7, breaks residential fatalities down

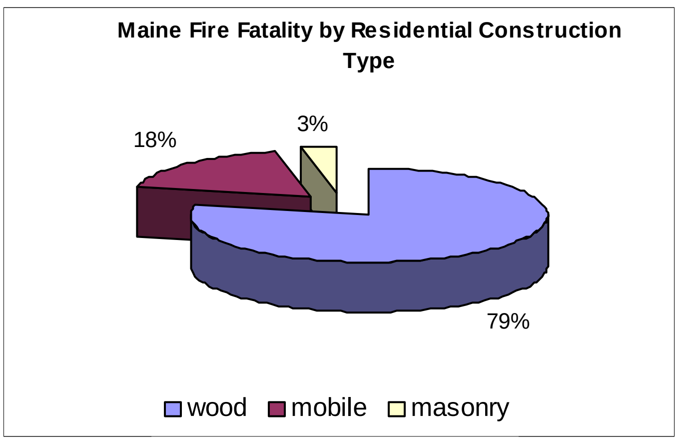

Figure 7 Construction Type

into the three types of construction. A considerable number of Maine's homes are mobile homes that have a history of burning fast and hot. The absence of any exterior covering below floor line and the highly combustible materials used in the interior, low ceilings and lack of adequate egress, all work to accelerate fire and decrease the opportunity for survival. The mobile home issue will be a topic of more focused analysis at a later time.

In looking at the distribution of residential fire fatality by number of family dwellings in Maine I found that they were similar to those we find nationally (see appendix D).[7] One or two family dwellings accounted for 82% of the residential

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[6] U.S. Census 2000

[7] The National Fire Data Center separates mobile homes from single-family dwellings. I separate them when examining construction type but combine them when the focus is on fatalities by number of dwelling

fatalities in Maine with 15% occurring in multi-dwelling structures or apartments. Some in the fire service may have anticipated a higher percentage of fatality in the multi-dwelling structures. Maine's legislature has considered and passed proposals to enforce more stringent regulations that would require additional sprinkler system coverage (suppression) or additional smoke detector placement (mitigation) in an effort to reduce injury and fatality in these structures. This is another area where a more focused analysis would be helpful. Historically the periodic push for more stringent regulation might be driven more by the emotions surrounding multiple fatality events that can and do occur in multi-family dwellings.

Finally, with regard to overall fire fatality by dwelling, it was found that approximately 53% of fatalities occurred in structures that were owned properties with 40% being rental properties. Drawing economic data from the SFMO Fire Fatality Investigators files was extremely difficult but this ratio of ownership to rental properties might provide clues as to the impact of income on fire fatality. In addition, the proportion of fatalities taking place in a rental building is out of proportion with the actual ratio of rental to owned homes in Maine. The implications are considerable however when you look at Maine policy regarding multi-family units. Legislation has required sprinkling some of these latter facilities as well as the installation of smoke detectors all based upon number of units. If only 15.4% of fatalities occurred in multi-family units, presumably rental, it is questionable if the policy which was intended to reduce the incidence of fatality, injury, property loss, and suppression costs to fire departments has been less effective by focusing on the number of units instead of ownership. 20% of the single- family dwellings experiencing a fatality were rented. 86.4% of the two-family dwellings were rented. There were a total of 196 single-family units in the study and 22 two family. In the universe of 1 and 2 family rented dwellings where a fatality occurred, the risk of fatality in a rented two-family unit, or duplex, appears to exceed that of a rented single-family unit. Overall however, the risk of a fatality occurring in an owned single-family dwelling is still higher than any other type of dwelling. This reality is understandable given the actual proportion of homes owned to those rented.

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units. For the chi test that indicated no difference between the national and state distributions, in terms of number of dwellings, I combined single NFDC % of single- family fatalities with mobile homes.

3. Room of Fire Origin: Where the Fire Started

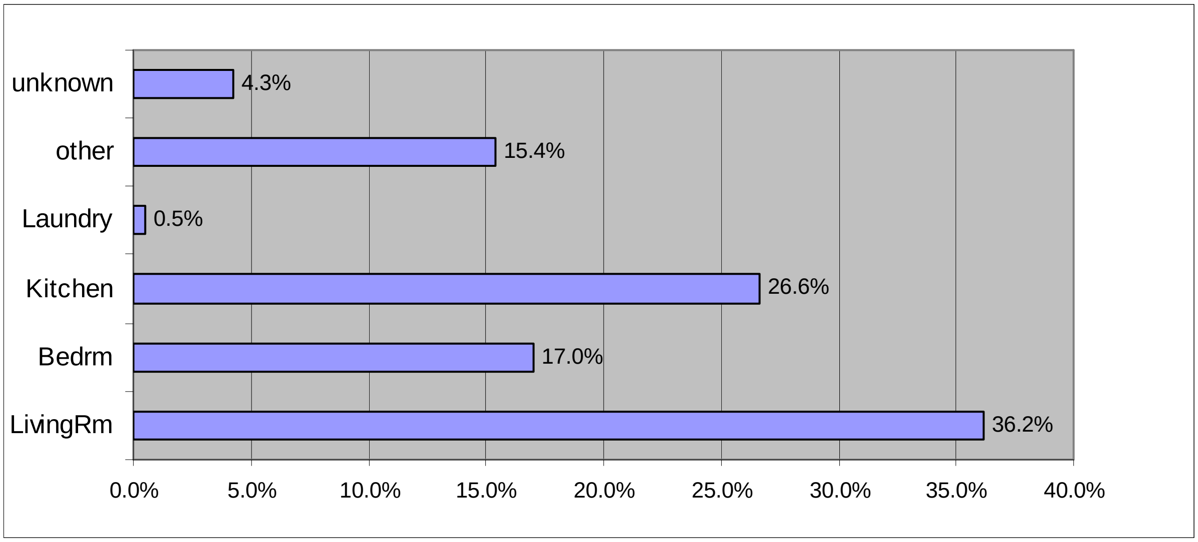

Figure 8. All Residential Fatal Fires in Maine by Room of Origin

Where in the structure a fire starts tells us a lot about the physical and behavioral environment in which these events occur, and collectively perhaps, something about "Mainers" lifestyles in addition to other health related issues. We'll compare the national distributions in one and two family dwellings to those we found in Maine.

To obtain the data in figures 8 and 9 I sorted out fires and deaths, residences, number of family dwellings and room of fire origin. Figure 8 shows that fatal fires in Maine started most frequently in the living room followed by the kitchen and then the bedroom. There were a total of thirteen different rooms of origin counted. In the NFDC analyses, the room most frequently found to be the room of origin was the living room or "lounge" area as it is called in NFDC analyses. An examination of cause of fire ignition will give us a better understanding of this distribution. Figure 9 illustrates the distribution of fatalities in only one and two family dwellings by room of fire origin for Maine and the nation. There were a total of 163 fires in these dwellings that account for 224 deaths or 76% of total fire fatalities in the given period.

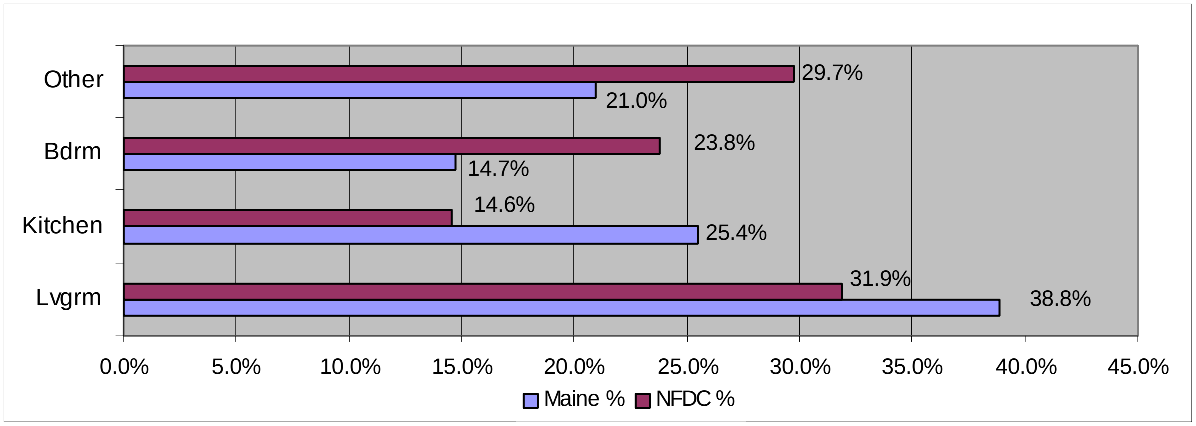

Figure 9. Distributions of Fatalities by Room of Origin In 1&2 Family Units

Note the distribution differences between Maine and what I found nationally. The most considerable difference comes in the "other" rooms where the top three areas included the entry, basement and unknown/undetermined areas with the basement ranking first on that list. Not one of these areas amounts to even half of the fires I found to have started in the bedroom, living room or kitchen. The chi square test comparing these distributions indicates that there is a significant difference between what we see nationally as opposed to what is seen in Maine (see Appendix E). In both distributions the lounge or living room area were found to be the primary area of origin. In the kitchen area however I found a difference not only in terms of percentages but rank as well. Nationally the kitchen area ranks third behind lounge and bedroom but in Maine the kitchen area ranked second. When I examine fire cause and in particular proximity to fire and cause by age we'll better understand these distributions. The cause of most fires originating in the living room is the careless disposal of smoking material. Aggravating factors such as alcohol and age can combine to create scenarios where someone falls asleep ignites the recliner or sofa and in the post ignition phase, and in particular where no alarm was set off, successful escape was inhibited.

4. Fatalities in Urban, Suburban, and Rural Areas and by Population Count and Population Density

The discussion over what is rural as opposed to urban has moved beyond the mere number of persons in a given area. For the purposes of this study Maine's State Planning Office courteously provided me with a breakdown of towns defined as urban, suburban or rural based upon the following characteristics:

a. An urban area serves a basic urban function, i.e. center for jobs and services for people living in the region;

b. Town's classified as suburban were in close proximity to urban areas, showed fast housing/population growth, and were losing there natural resource base and industries/economic activity associated with that base;

c. Finally, rural areas were those remote from urban areas and still possessing that basic natural resource base and a level of natural resource based economic activity.

With these characteristics in mind the towns where the fatalities occurred were divided into the three areas for fire fatality using the newer definitions, and illustrated in figure 10.

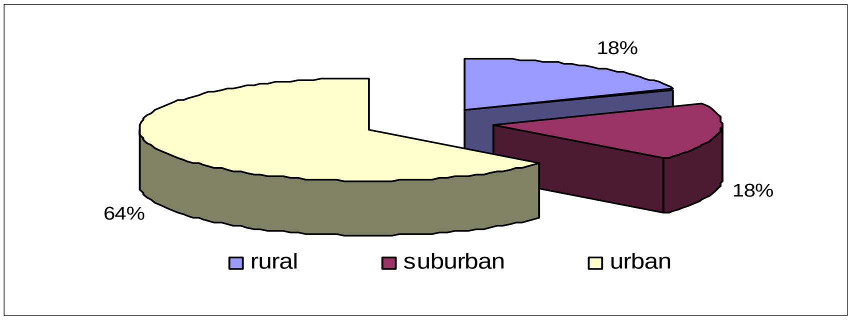

Figure 10. Fire Fatality by Area Function

Census data for 1990 showed that 55.4% of the population lived in rural areas with 22.9% outside urban areas and the remaining 21.7% inside urban areas. Using the newer definitions 53% of Maine's towns are classified as rural areas (where 18% of fatalities occurred), 24% classified as suburban (where 18% of fatalities occurred) and 21% classified as urban (where 64% of fatalities occurred). The long term policy implications of looking at data about fire fatality in urban and rural areas over a long period of time using the newer definitions are important for the following reason. The number of fire departments that existed in the 1980s is less than what we have today. As these departments have gone the areas they serviced now rely on another department that in turn expands that departments service area. Though it will require a more focused analysis, this expanded service area might impact the number of mutual aid agreements between existing departments. A department in a town that might not be considered urban under traditional definitions is urban under the new definition by virtue of its functionality. The decision to close a fire department has been largely a decision made at the local level. However, that decision process might be more cost effective if it is based upon a larger area and the fire suppression, fire safety and prevention programming needs of that larger area. A more in depth analysis examining the service needs of a larger area as opposed to the economic needs of a single town may be a better approach for policy makers in the public safety venue when they consider what department to close or where to relocate or build a new facility.

The fire service refers to "The Rural Fire Problem" as it has been identified in research literature. Nationally, the mortality data taken from the 1983 – 1987 indicates that the death rates for rural areas were significantly higher than those in non-rural areas. The same analysis also found that the distributions of fire fatality by age and gender were, to a degree, similar to those of non-rural areas.[8] Another study frequently cited for its conclusion that the fire fatality rate in rural areas was "2-1/2 times the non-rural rate" focused more specifically on cause, in terms of physical environment. This study concluded that "heating fires produced by far the largest rural fire fatality rate." The improper installation or misuse of solid fuel burning heating equipment was "found to be the most significant rural fire problem."[9]

Figure 11 provides us a break down of the frequency of fire fatalities and fatal fires by town population.

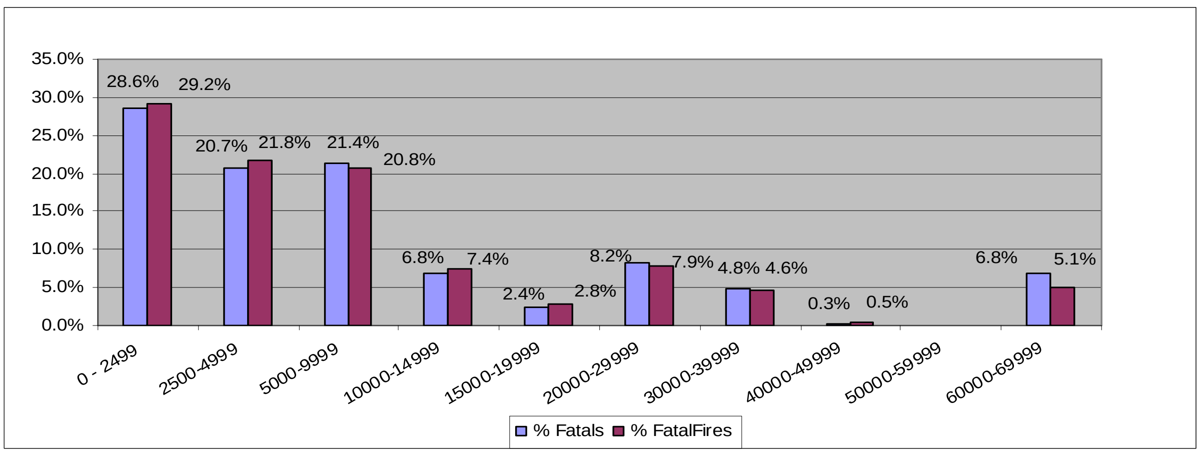

Figure 11. Fire Fatalities and Fatal Fires by Town Population In Maine

As you can see conclusions about fatality nationally seem to hold true in Maine as well. The range in terms of size is considerable but the distribution resembles the pattern we read about in studies conducted nationwide. By nature such analysis, as will be

[8] *The Rural Fire Problem in the United States.* Federal Emergency Management Agency, USFA. Emmitsburg, MD. 1997. pp. 4, 15, & 44. This study defined rural using the USDA Beale Codes which were matched with NCHS mortality data since both contained FIPS coding. NFIRS data were linked to the USDA set using the FIPS code for each FDID (Fire Department Identification number). The Beale Codes 7, 8, & 9 used county population count in combination with proximity to a metropolitan area. The range of population was < 2,500 to 19,999 all not adjacent to a metro area.

[9] Gomberg A. and Clark L. "*Rural and Non-Rural Civilian Residential Fire Fatalities in Twelve States.*" (NBSIR # 82-2519) U.S. Department of Commerce, National Bureau of Standards Center for Fire Research. Washington, DC: 1982, p. 36. This study used population count alone in determining what was rural. Areas with < 2,500 people were considered rural.

discussed in further detail, becomes more distant from the behavioral and physical environment in which these events actually occur.

Figure 12 provides the reader with a different view of the distribution of fatal fires using a scatter plot to examine frequency by population density. As you can see the higher frequency of fatal fires occurring in areas with lower population density is evident.

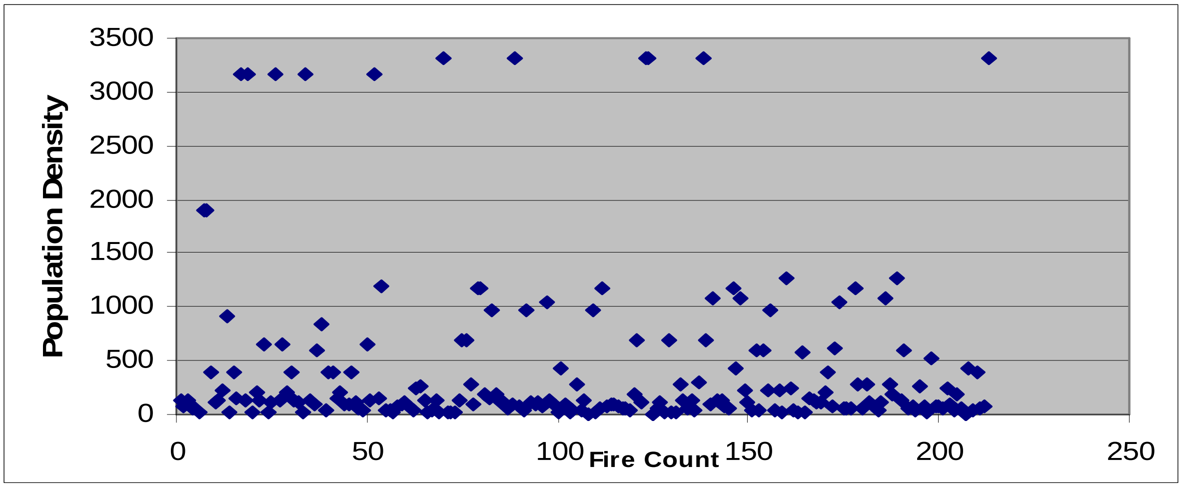

Figure 12. Fatal Fires by Population Density

Finally, rural fire fatality in a state like Maine will require additional analysis the results of which will have to be carefully weighed when considering any course of action to reduce these counts. As one study in particular indicates effective code enforcement in rural areas is a challenge.[10] Complicating matters in rural areas is the more limited fire suppression capacity. In addition, direct intervention programs to address issues such as juvenile fire setting or more general public awareness/education programs, designed to address the behavioral side of fire fatality are expensive. Because populations in rural areas may continue to diminish, these same areas may also experience reduced tax revenues, and the financial resources needed to deliver adequate suppression, fire prevention and safety programs or interventions may become scarce. Ironically, because these areas collectively experience more fatal fires and a higher percentage of fatalities they may be in more need of such programs. In essence all three of the traditional approaches employed to reduce fatalities or the coordination thereof become virtually impossible. Consideration also needs to be given to potential tax policy changes that might reduce revenues and expenditures at the municipal and state level. Some of these

[10] Clark, F.E. "*Firesafety in Rural America*." Fire Journal. July 1982.

changes may have the effect of ratcheting down spending regardless of the efficiency, fairness of equitability of the tax policy.[11]

When People Died in Fires in Maine

1. Residential Fatal Fires by Time of Day

To understand and reduce fire fatalities or injuries it is critical to determine when the events occur most frequently. Figures 13, 14 and 15 illustrate when fatal fires occur by hour of day, day of the week, and month of the year for Maine and the nation. You can see that in Maine and nationwide there are similar low and higher frequency periods. In terms of hour of days, Maine's pattern is less consistent than what we see nationally. There are spikes and peak times which appear to be more toward the waking hours as

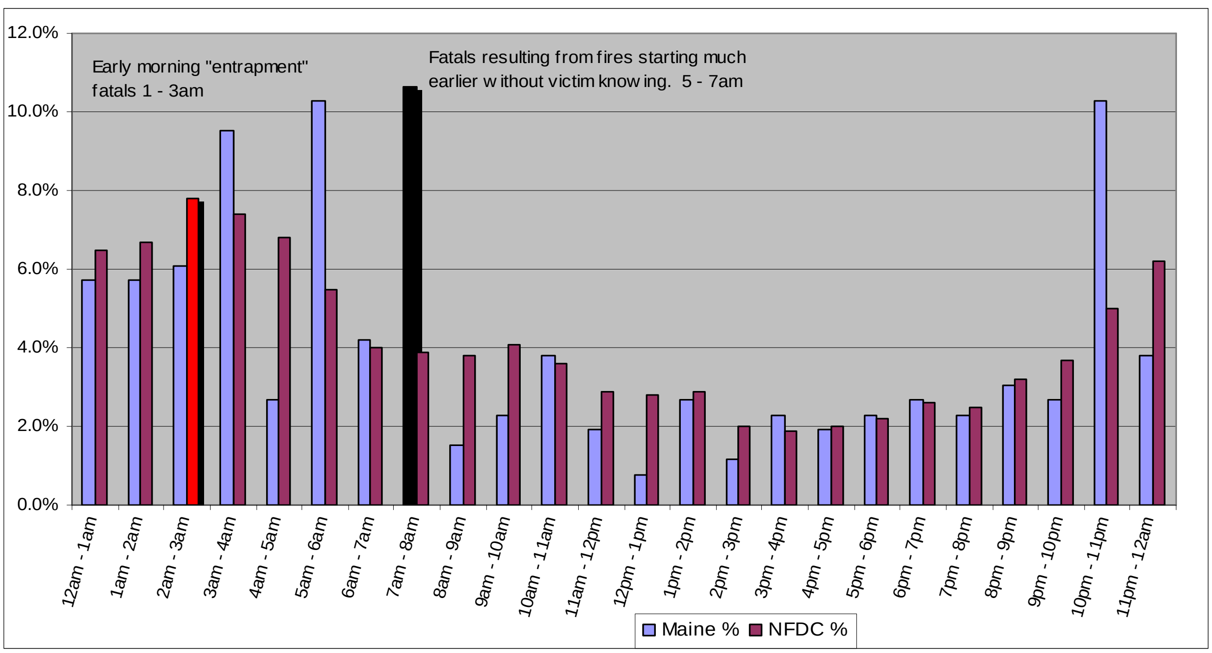

Figure 13. Residential Fire Fatalities by Hour of Day for Maine and the Nation

opposed to those nationally that occur more frequently at the early morning or sleeping period.

In figure 13 are notes describing a veteran firefighter's thoughts and analysis of fatalities by hour. Referring primarily to the post-ignition phase of a fire, former Portland Fire Chief Joseph Thomas differentiated fires in which no escape effort was made as

[11] Maine's TABOR, "An Act to Create a Taxpayer Bill of Rights" could have a similar impact. The TABOR in Maine could rachet down spending because expenditure and revenue ceilings are defined in terms of the previous year's amount of spending and revenue. During a poor economic period spending and revenue will likely drop and set the level of both for the next year. However, the TABOR does have mechanisms for increasing both revenues and expenditures.

opposed to those where entrapment, or failed escape, took place. Chief Thomas hypothesized that because so many individuals were found in bed in fires occurring in the waking hours that the fire itself likely started much earlier and burned slowly. The "slow burners" as they're described killed the victim as high levels of CO, heat, and smoke built up in the structure. No escape was attempted. In the early morning, or what for some is the bedtime hours, victims were often found out of bed apparently in transit to egress. Data looking at the position of were the body was found can be troublesome due to levels of destruction and other variables that would inhibit motion such as a disability or alcohol abuse. The position of body data should be cross referenced with time of fire, age, and aggravating circumstances such as smoking, alcohol and the presence of mitigation systems (alarms, detection) to better test the slow burn hypothesis.[12]

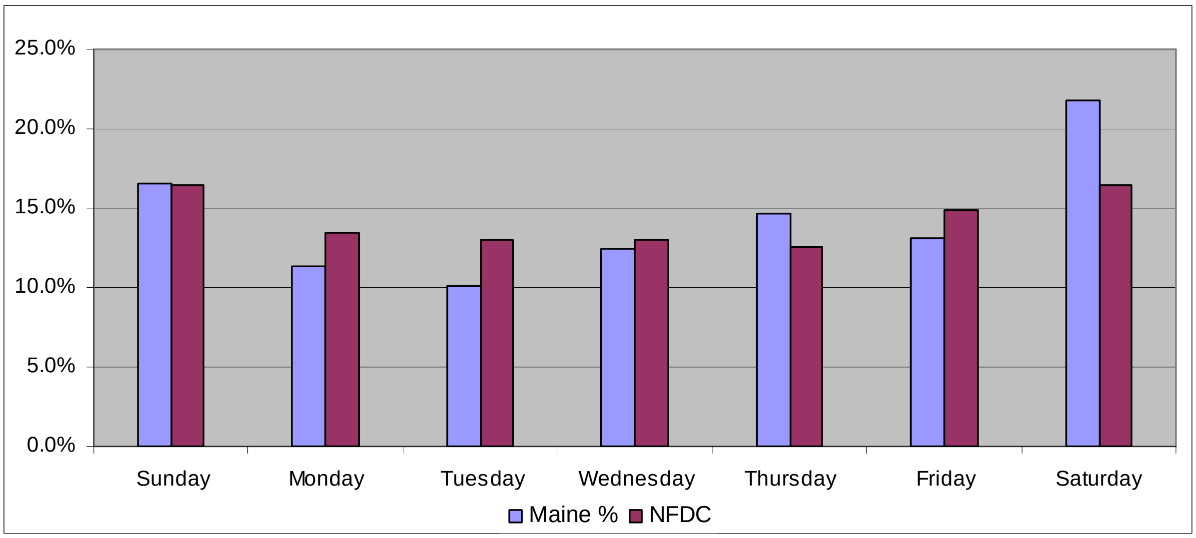

Figure 14. Residential Fire Fatality by Day of Week for Maine and the Nation

An examination of residential fatalities by day of week, Figure 14, verified that the Maine and national distributions are similar (see appendix F). Finally, let's look at fatalities by the month of the year.

[12] There is mounting evidence that smoke alarms do not work as well as hoped with the very young or elderly.

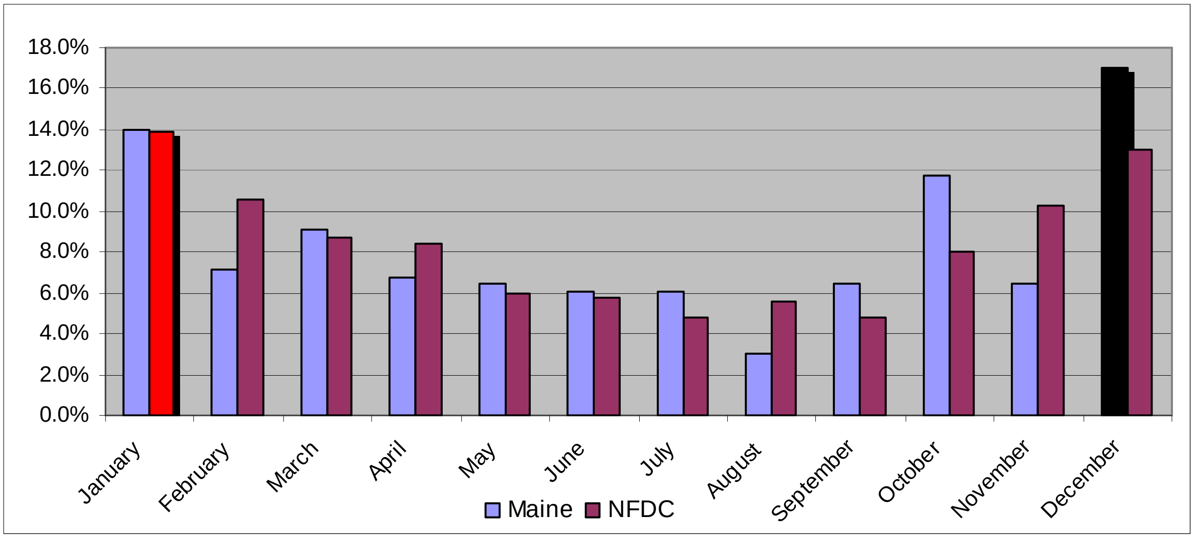

Figure 15. Residential Fire Fatality by Month of the Year

There is a definite seasonality to fire fatality in Maine and across the nation. Fire deaths are distributed most frequently in the winter months and this is, of course, attributed to heating problems. This national distribution is somewhat skewed however due to the higher fatality rates of the southeast where the cold weather doesn't actually set in until the winter months and people begin to use woodstoves and other solid fuel burning apparatus without conducting the proper safety and maintenance checks. In Maine we see the cold setting in earlier and the use of woodstoves and heating equipment commences in mid to late fall or October and November. Notice that October is Maine's third highest month for fatalities.

Though the distribution of fire deaths nationally and in Maine by month appears similar, a closer look at the two distributions reveals that there is a statistically significant difference (see appendix G). In Maine the months of October, November, and December vary the most from what is happening nationally. Maine's worst month was December followed by January. These two months accounted for 31% of the fatalities over the given time period. This distribution in Maine suggests that there is a flipside to the experience hypothesis of working with heating equipment mentioned previously. The fact that people are indoors for a longer portion of the year in Maine may in fact lead to a higher level of risky behaviors or carelessness.

The holiday season, Thanksgiving-Christmas-New Years, also augments the level of risk occurring during the winter months.[13] Summer July 4th celebrations have a similar impact though fatalities at this time are often outdoor related events.

The Cause of Fires Resulting in Fatality

As already indicated the cause of any fire resulting in a fatality is complex and involves a combination of physical and behavioral variables. For the sake of this analysis of cause I looked specifically at the "ignition factor" as opposed to the aggravating circumstances, fuel sources, or cause factors all of which play a critical role in each tragedy.

In examining each fire fatality file I assigned each fire to one cause in a list of the top six causes discussed predominantly in the literature (see Table 2). These causes included: heating, cooking, electrical, smoking, arson, juvenile fire setting (play), and undetermined. Often juvenile fire setting and arson are combined and categorized as intentional. There are anomalies that comprise "other" in the data set though, as you'll see, that count is small.

1. Overall and Residential Fatalities by Cause

In figure 16 you can see the distribution of all fatalities by cause. As you can see the leading cause is not a surprise. Smoking accounts for 23% of all fatalities in the selected period. Smoking is a class 1, proximate fire preventable primarily by behavioral

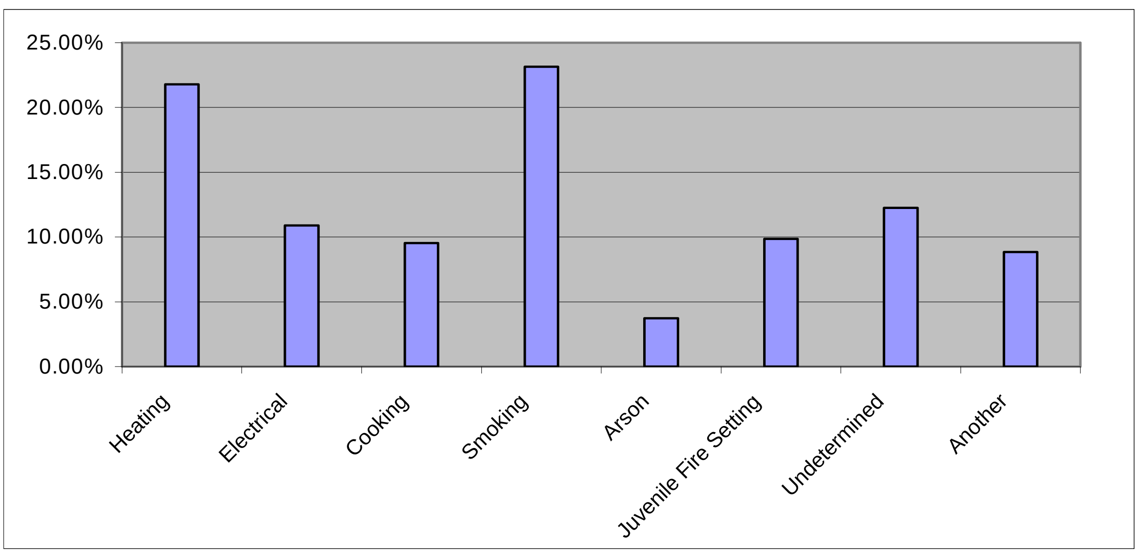

Figure 16. All Fatalities by Fire Cause in Maine

[13] There was only one fatal incident involving a Christmas tree during the 83 – 92 period record in the SFMO files.

modifications though mitigation and suppression systems would help reduce deaths in the post-ignition phase of a fire. One effort underway in Maine to reduce the numbers of fatal fires caused by the careless disposal of smoking materials is to restrict the sale of cigarettes to only "Fire Safe" brands.

A host of anti-smoking and fire safety organizations have been pursuing the "Fire Safe" brands effort for some time. In fact, according to the National Burn Foundation, Congress first looked at the fire safe cigarette in 1929.[14] Since that time legislation has been introduced numerous times and is currently pending at both the state and federal level. New York did enact a "fire safe" cigarette law that took effect in 2004. The impact of this legislation is being watched closely at the state and federal levels. The other leading known causes of fires resulting in a fatality overall, excluding undetermined, were heating followed by electrical. Both of these latter causes are primarily non-proximate incidents.

Figure 17 compares Maine's distribution of residential fatalities by fire cause with the nation. Smoking still ranks first in Maine followed closely by heating and then electrical. You'll notice that two of the top three causes in Maine, heating and electrical, are primarily class 2, non-proximate fires though juvenile and cooking related fires, frequently class 1, proximate fires, follow. This suggests that remedial approaches targeted at a particular

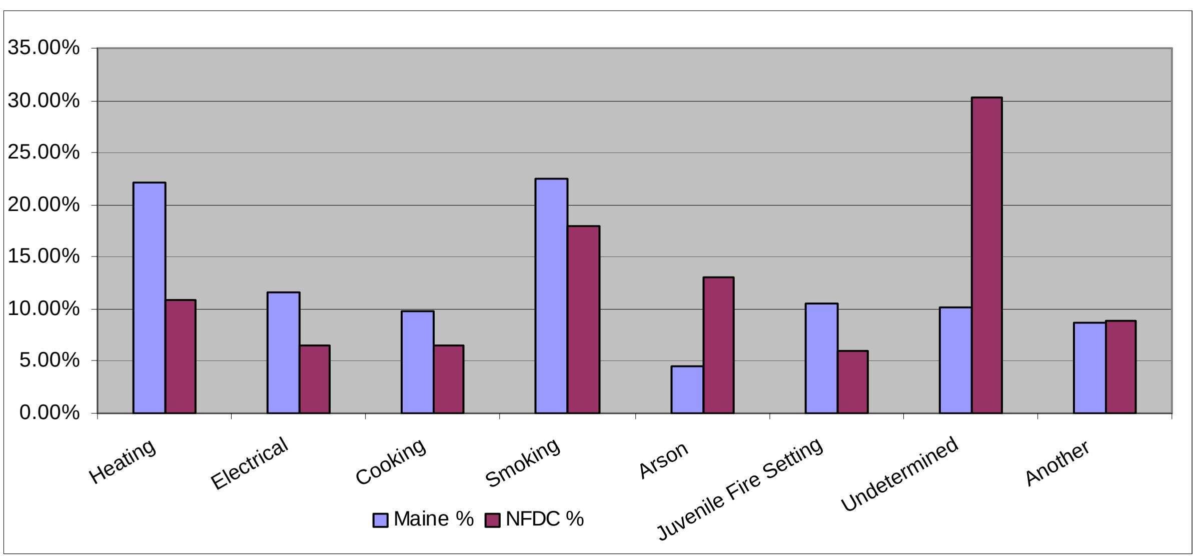

Figure 17. Residential Fatals by Cause of Fire in Maine and the Nation

[14] American Burn Association, *Fire-Safe Cigarette Legislative Update*, 2002. www.ameriburn.org/advocacy/fireSafeCig.htm

cause and associated behavior, i.e. smoking or juvenile fire play/setting, or more stringent regulatory efforts requiring that new homes be constructed with sprinkler systems might have a better outcome. An example of the former approach would include the NFPA's Fire Prevention Week campaign held annually that focuses on specific fire themes such as the 2006 cooking fire theme. Because such an approach attempts, indirectly at least, to modify behavior, they may not be as effective as a code requiring sprinklers that in essence remove the human behavioral element from the equation. The critical feature of the sprinkler system is that it eliminates, to a considerable extent, the impact of such causal factors as careless behavior or misuse in addition to mechanical failures (heater malfunctions). Like the "fire safe" cigarette, the idea of requiring sprinkler systems is being considered more seriously than ever particularly since the 2006 NFPA Life Safety Code has incorporated requirements for sprinkler systems in all new one and two family dwellings. Finally, figure 17 may also be interpreted as indicating Maine does a better job in determining the cause of fatal fires than investigatory agencies across the nation as a whole do.

Maine's distribution of residential fatalities by fire cause is not statistically similar to what is found nationally. As you can see from the chi square test below, the distributions are significantly different.

Table 3

Chi Test on Residential Fatalities by Cause of Fire in Maine to That Found Nationally

	Maine %	NFDC %	Actual	Expected	Difference	Sq. Difference	Sq./Exp.
Heating	22.2%	10.8%	59	29	30.3	916.4	31.9
Electrical	11.7%	6.5%	31	17	13.7	188.0	10.9
Cooking	9.8%	6.5%	26	17	8.7	75.9	4.4
Smoking	22.6%	18.0%	60	48	12.1	146.9	3.1
Arson	4.5%	13.1%	12	35	-22.8	521.9	15.0
Juvenile Fire Setting	10.5%	6.0%	28	16	12.0	145.0	9.1
Undermined	10.2%	30.2%	27	80	-53.3	2844.3	35.4
Another	8.6%	8.9%	23	24	-0.7	0.5	0.0
			266	266			109.7

Source: Figure 72, *Causes of Residential Fire Deaths--1990*
p. 70, <u>Fire in the United States: 1983 – 1990.</u>

	.05/95% CL	.001/99.9 level
Chi Sq. Value	109.7	109.7
DF	7	7
Critical Value	14.07	24.32

The difference might best be explained by looking at these incidents in terms of proximity to fire ignition.

Proximity and Fire Fatality

Over the period of measurement, the United States has a much worse record in fire fatalities in comparison with European nations. In the effort to explain this contrast, and fire fatality in general, more careful research was conducted during the 1970's. Perhaps the most frequently cited analysis was done in 1977 by Philip Schaenman. His publication on *Procedures for Improving the Measurement of Local Fire Protection Effectiveness* focused on socioeconomic and demographic data and its use in analyzing and improving fire department effectiveness.[15] Schaenman's paper fostered more critical examinations of fire incidents using aggregate data on educational attainment, poverty, rural/urban and age of housing stock factors.

However, in 1996 Charles Jennings, a doctoral student at Princeton produced a dissertation focused on conceptualizing the role played by socioeconomic factors and their complex relationship to the more immediate physical and behavioral environment in which these events occur.[16] Jennings believed that an attempt to model or predict the incidence of fire that "relies solely… on socioeconomic indicators without regard for in-depth and local investigation will yield at best only a limited theoretical understanding of fires."[17] From that study a model using the variable of proximity to fire ignition was developed for use in analysis and, indirectly, designing fire incident, injury, and fatality reduction efforts. It was with that model in mind that this present analysis was conducted. It is critical to remember that this level of analysis would essentially require heightened awareness during the investigation process. As previously described, each fire in this analysis was defined and coded as follows:

Class 1: An interior proximate fire. Proximate meaning the person was proximate to the fires ignition. These include arson and juvenile firesetting events but may also include heating, smoking, and cooking fires.

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[15] Schaenman, Philip. <u>Procedures for Improving the Measurement of Local Fire Protection Effectiveness</u>. National Fire Protection Association and Urban Institute: Boston (1977).
[16] *Socioeconomic Factors and The Incidence of Fire.* Federal Emergency Management Agency, USFA, Fire Data Center. FA 170/June 1997, pp 1 – 7; Jennings, Charles R. <u>Urban Residential Fires: An Empirical Analysis of Building Stock and Socioeconomic Characteristics for Memphis, Tennessee</u>. Unpublished doctoral dissertaton, 1996, pp. 105 – 107.
[17] Jennings, p 117.

Class 2: An interior non-proximate fire. Non-proximate meaning the individual was not proximate to the fire's ignition. Most heating and electrical fires are class 2 fires.

Class 3: An exterior (outside) proximate fire. Outside proximate fire that would include what we often hear of today as "wild land" fires started by an intentional burn or by a juvenile playing with fire, etc.

In examining each fire fatality file I assigned each fire to one of the three classes. The pie chart below, Figure 18, represents the distribution of fire fatalities in Maine by the proximity of individuals to the fires ignition where determined. You can see from the chart that few fatalities in our total count of 294 were outdoor events. Among those that did occur in a structure, an individual was proximate to the ignition 55% of the time. When you add the class 3 fires to class 1, 60% of fires involve people in the ignition process. This finding has considerable ramifications in the selection and design of fire safety and prevention approaches. Class 2 fires are most effectively addressed through code enforcement, social and housing policies, and changing economic conditions because they are commonly associated with the mechanical failure of heating devices or the improper installation of the same.[18] Class 2 fires come primarily within the purview of the SFMO who is a leader in establishing statewide laws, rules and policy. However, the SFMO code enforcement efforts focus on public assemblies, licensed day cares, assisted living homes and the like. Local code enforcement officers and fire department officials are in a better position to address the application of standards to residential dwellings. They are the primary enforcers of the codes adopted by the SFMO at the local level and must apply codes that are, at a minimum, meeting or exceeding standards set by the SFMO.

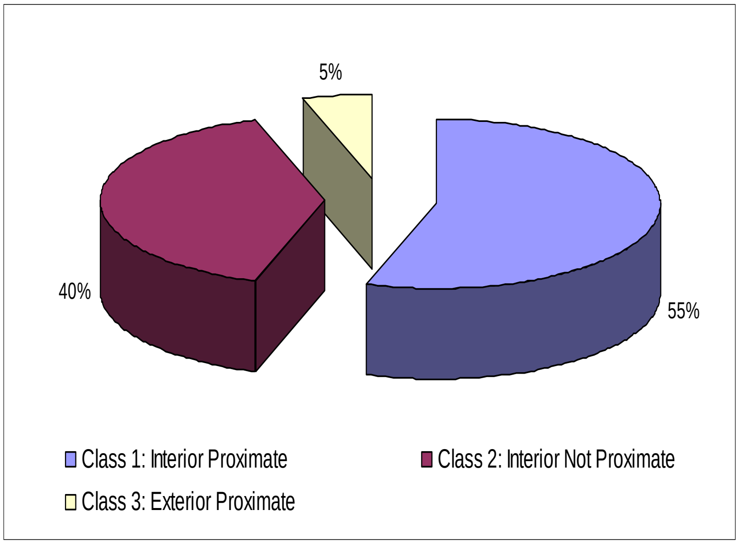

Figure 18: Fatality Distribution by Individual Proximity

[18] The February 2006 Limestone fire, killing three, was likely due to an improper installation of a woodstove.

Effective code enforcement depends upon the public financial resources that, at the local and state levels, are limited. In addition, the issue of local control can have a mitigating impact on codes being enforced as well. Code enforcement officers at a local level have closer ties to the local community and its local builders and other contractors. This pressure at the local level combined with, in some instances, limited resources makes it difficult for the local code officials to become familiar with National Fire Protection Association Standards/Codes which are the most frequently incorporated fire standards in the State of Maine. In addition, the State Planning Office in Maine that helps train code enforcement officers has focused primarily on land use issues. Finally, the lack of one code as opposed to having to use a combination of BOCA and NFPA codes in the construction inspection business has not helped local officials.

Class 1 & 3 fires, comprising the largest percentage of fires, can be addressed through public education, awareness or direct interagency collaborative intervention. The parties involved in code enforcement as opposed to education/awareness approaches usually differ. Code enforcement is public and involves law enforcement while education/awareness can be more inclusive and bring a set of community players to the table. Also, education and awareness efforts can address more directly mitigation and suppression issues that can save lives in homes regardless of the human proximity element because they focus on both the pre- and post-ignition behavioral and physical environment as well as strategy.

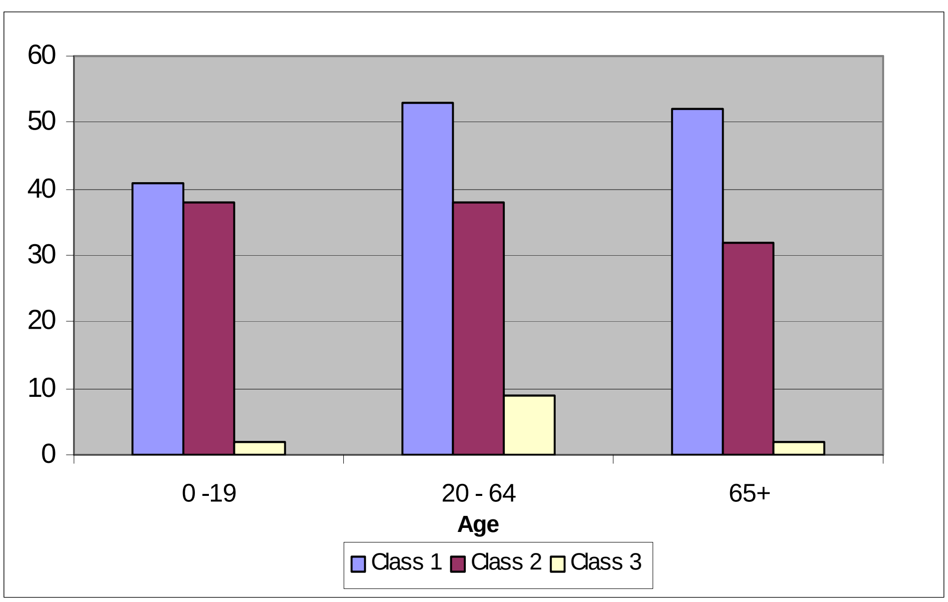

Figure 19. Proximity by Age

A question that frequently arises is "how do the proximity classes breakdown by age?" Figure 19 gives us that breakdown. Because class 1 fires are associated more with the two vulnerable populations I broke the distribution into three groupings including the young (<19), middle (19-64), and the old (65+). I expected to see the distribution for the vulnerable groups more prominent in the class 1 category but in fact I found that this class of fires leading for all three groups. However, based upon this observation it could be interpreted that among the younger age group the distribution between class 1 and 2 fatalities is more random than what we see among the middle and older age groups.

Finally, a complete analysis of proximity used to determine what approach to use in reducing fire fatality must incorporate the overall rate of fire incidence by cause as well the number of incidents resulting in injury and property loss amounts (the fire burden). Absent that incorporation the real costs and benefits of directed resources cannot be determined.

The Distribution of Fire Fatality by Age and Cause

Since the very young are most at risk in a fire, lets look at frequency by age and cause for these groups to see where fires associated with certain levels of proximity are distributed. Figure 20 represents the distribution of fatalities by cause for individuals below age 15.

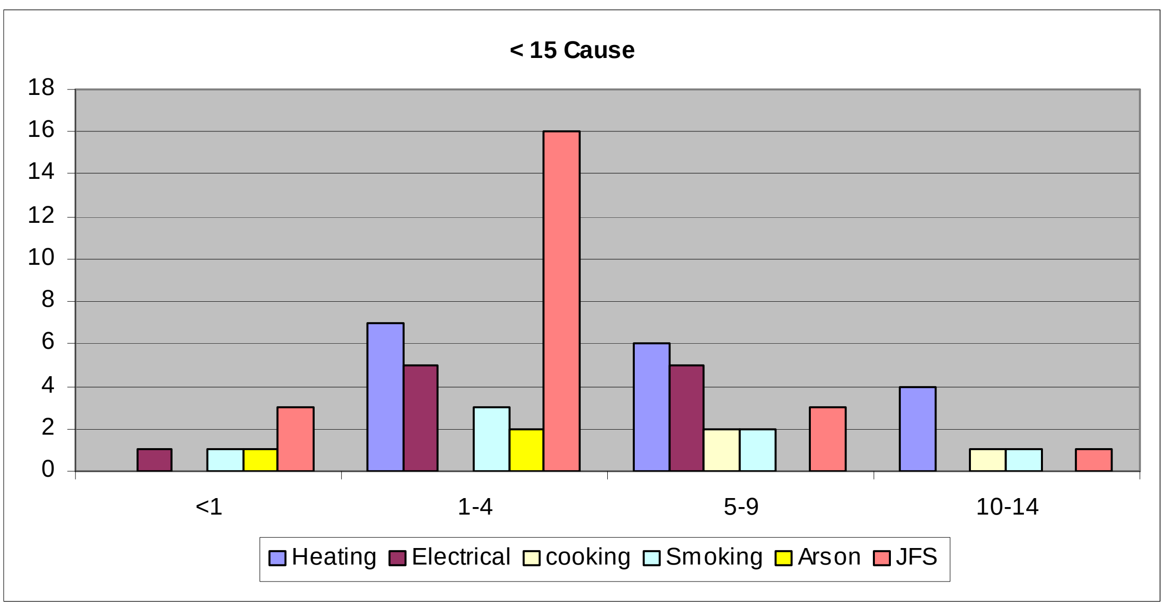

Figure 20: Fire Fatality by Fire Cause for Individuals below Age 15

You can see in Figure 20 the disturbing level of fires in which juveniles are involved in the ignition process. Figure 21 below provides the distribution of fatalities by

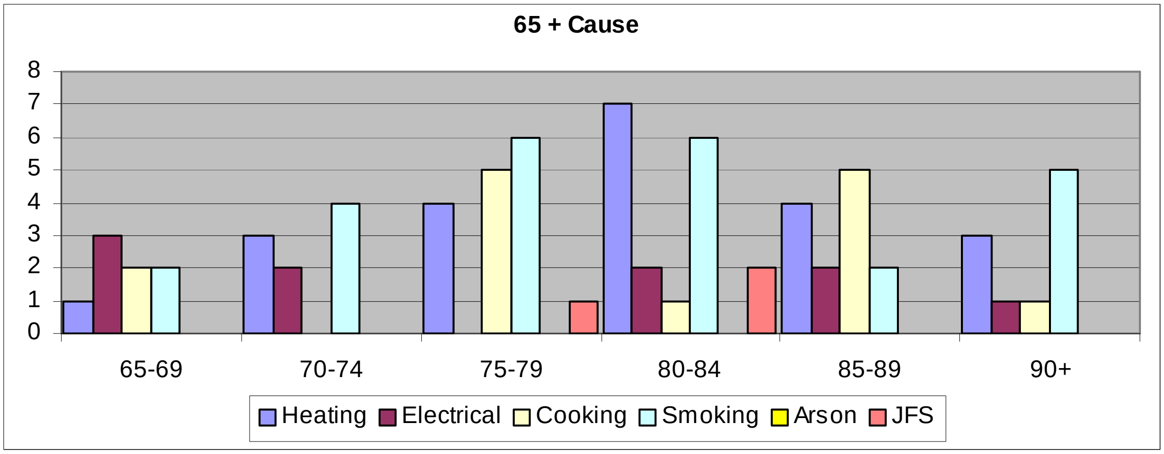

Figure 21: Fire Fatality by Fire Cause for Individuals Over 65

cause for older citizens. For older citizens smoking, a proximate event, takes the largest toll followed by heating. This is a considerable find when you consider Maine's increasingly aging population, the estimated numbers who smoke and the states older citizens living at or below poverty. These factors considered in combination with the percentage of people living alone in rural areas and the age of the housing stock they live in raise significant multi-agency policy questions.[19] In Maine and nationally I found that there is an indisputable trend toward delivering health care to older citizens at home as opposed to the traditional, and more tightly regulated, institution such as the nursing home. There are indisputable benefits to the aging at home philosophy in terms of quality of life but there are indisputable risks as well.[20]

Finally, though heating is often considered non-proximate, with the older population that is not always the case. Cooking and heating accidents often are the result of an accidental self-ignition. Some older Maine citizens have attempted to get the fire going sooner with an accelerant. The results have been unfortunate. In other cases an individual has simply allowed dangling clothing to ignite while tending to the wood in a stove or food on a range.

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[19] _State Profiles: Reforming the Health Care System_ (Flowers, Gross, Kuo & Sinclair, 2005**)** American Association of Retired Persons, Public Policy Institute; _Across the States: Profiles of Long-Term Care_ (Gregory & Gibson, 2002) AARP, Public Policy Institute.
[20] Use of oxygen, delivered to the home of an elderly individual has smoking resulted in 4 fatalities since 2002.

The Use of Alcohol and Smoke Alarms in Fire Fatalities in Maine

1. Alcohol Use

Because alcohol use and age have been shown to diminish the effectiveness of smoke alarms, a mitigation component, it warrants attention.[21] There were a total of 51 fires where alcohol was involved and 70 people died in those fires. Figure 22 provides you with the distribution by percentage of

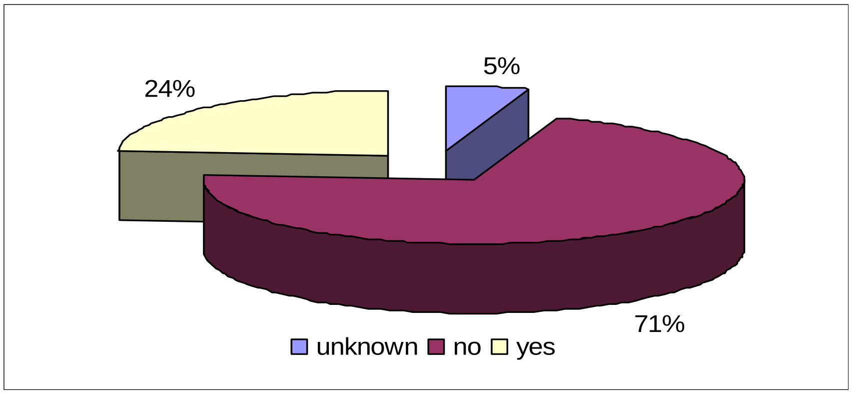

Figure 22. Alcohol and All Fire Fatalities

fatalities. As you can see 24% of all fatalities in this category occurred where someone who lost their life tested at or above the legal limit for being considered too impaired to drive. It should be pointed out that because an individual is counted among those who died in an *alcohol related* fire incident it does not mean that individual had been drinking. Some were victims of others who had been drinking. However, regardless of whether the individual started the fire, the person who has been drinking will likely have more difficulty escaping the fire. Alcohol and drug use play a role in both the pre- and post-ignition phases of the fire regardless of cause.

2. Smoke Alarm Performance

In looking at smoke alarm performance I looked only at the 266 fatalities

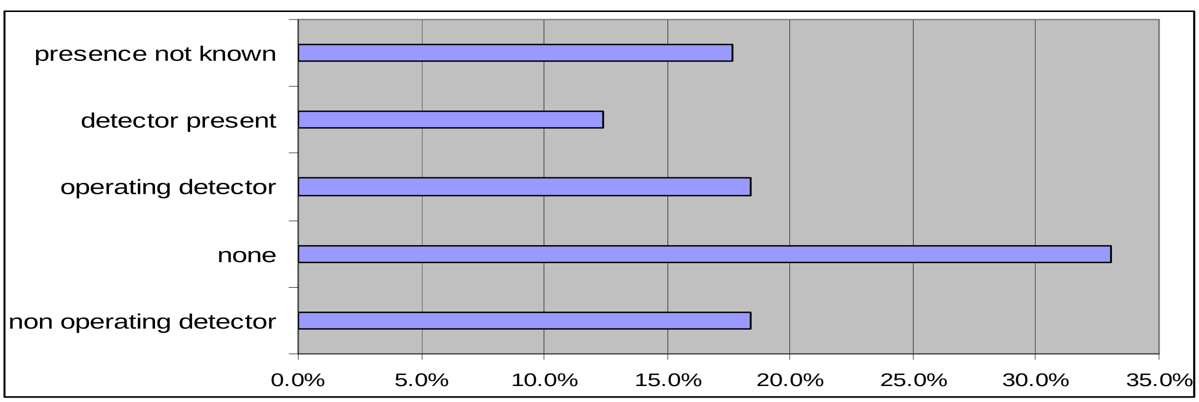

Figure 23. Residential Smoke Alarms Performance in Maine

[21] Home Smoke Alarms (Public/Private Home Safety Council) 2006.

occurring in a residence since such devices are not present in vehicles or outdoors and the major focus on smoke alarm use and analysis has been the home. Figure 23 on the previous page provides an illustration of smoke detector performance in residential structures in Maine during the period of this study. SFMO investigators determined there were no alarms over 30% of the time. They also determined they were present over 45% of the time even though the operational status was unknown or determined as not operating. The efficacy of smoke alarm distribution programs is debatable. Many programs simply distribute the alarms at school fairs, country fairs and other public events. Researchers began wondering whether or not they were actually brought home and installed. And if they were, were the batteries replaced? These questions and the evaluation methods for such programs are discussed quite often.[22] In the 1990's a new public awareness campaign focusing on replacing at the time we set our clocks ahead in October. It will be interesting to see what impact associating this critical yearly battery change with a specific annual, and high profile event, will have in the long term

Since the majority of fatalities in Maine occurred in one and two family dwellings I decided to compare national distributions of fire alarm performance in those units to what I found in Maine to see if the distributions were similar. Figure 24 provides us that visual comparison. The distribution of fire alarm performance by fatality in one and two family

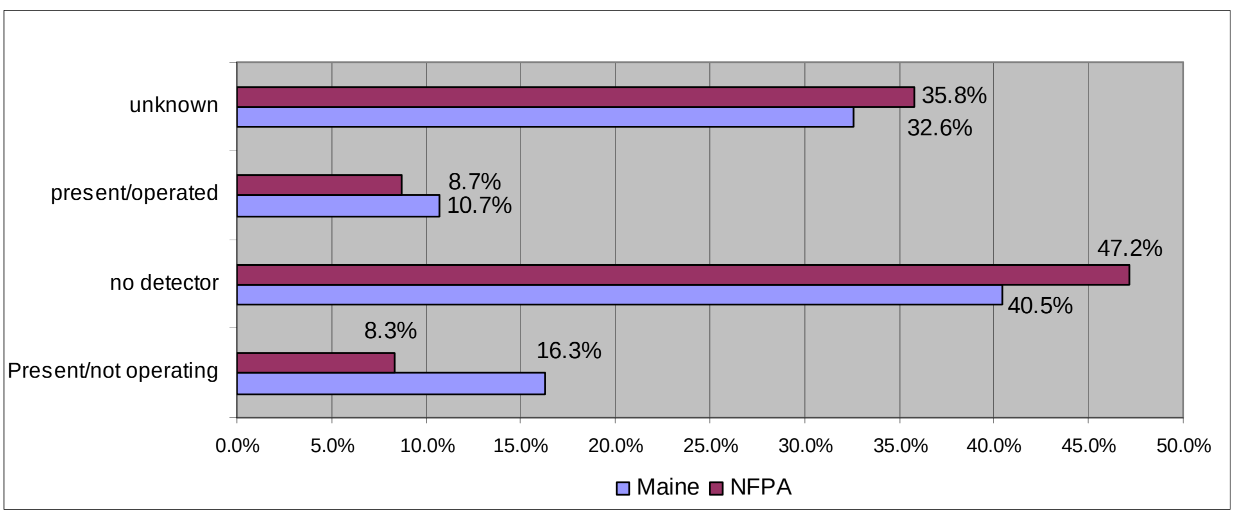

Figure 24. Residential Smoke Alarms Performance in 1 & 2 Family Dwellings

dwellings in Maine is not similar to what we find nationally though the overall patterns are similar (see Appendix I). The total presence of a smoke detector/alarm at both the

[22] Ibid. Home Smoke Alarms

national level and in Maine is dismal though Maine does better with a cumulative 27% presence between 1983 and 1992 in contrast to the national 17%.

Maine's performance in terms of operational alarms however is slightly poorer, proportionately, than what we see nationally. The graph illustrates why the issue of smoke alarms has moved beyond simply "having them" to "having them operational." The best solution to this problem is of course to have them hardwired into the home at the time of construction, or if possible, after. Recent efforts to acquire funding for smoke alarms in states are generally alarm installation programs but many fire departments and other organizations are unwilling to install the alarms due to concerns about liability. Nationally we see more alarms in multifamily dwelling occupancies than in single-family dwellings. This is due in part to laws requiring them. In 1985 Maine began requiring smoke alarms be installed in both single and multifamily dwellings.[23]

The efficacy of such a laws depends upon local resources needed to enforce them. A tenant in an apartment in Maine can contact the Fire Marshal's Office for resolution of such issues if there is no local authority to attend to the problem. For the single-family dwellings, where most die, the critical time for resolution is at the time of construction and that is a local issue. Again, efforts focused on presence alone may not have the impact of those focused on operation. In the future the language of statutes and regulations will likely reflect this shift and we'll see the move toward hard wired or inter-connected alarm systems which notify people on various levels of a structure or area, i.e. the bedroom, kitchen, upstairs, etc.

Finally, as previously indicated the effectiveness of an operational smoke alarm will vary depending upon aggravating circumstances such as age, alcohol or drug use. People who have consumed too much alcohol might not wake up. In addition, researchers have also discovered that young children simply do not respond to alarms like adults and elderly individuals are going to exit more slowly despite ample warning. Blocked exit routes can reduce the impact of alarms for all ages as well.

Conclusions

With some exceptions, the distribution of fire fatality in Maine is not statistically similar to what we found nationally. An examination of those fatalities in terms of

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[23] 25 MRSA §2464 requires the owner to "install,…, not less than one approved smoke detector upon or near the ceiling in areas within, or giving access to, bedrooms in…" single family units constructed after 1985 and all apartments and multifamily dwellings.

human proximity to the fire ignition reveals that in Maine at least, over half of the victims died due to careless and direct contact with fire. This would suggest that efforts focused on behavioral modifications or intervention as opposed to code enforcement might produce better long-term outcomes in the area of fatalities.

Maine's population distribution by age reflected the pattern in the nation. In Maine and across the nation young and older individuals are our most vulnerable populations. However, as a percentage of total fatalities Maine's vulnerable populations, in particular the elderly had a more severe experience. I referred to the high percentages of fatalities among the young and old as the "age polarity of fire fatality." In this sense there was an age dimension to fire fatality. It should be noted that for middle-aged people, Maine experienced lower rates of fatality by five-year age groupings in contrast to the nation and males experienced most of those fatalities in Maine. I referred to this middle aged male fatality anomaly as the "gender gap" in fire fatality. Most fire fatalities in Maine resulted from fires that began in the living room or as it referred to nationally, the lounge area. The citizens of Washington County experienced the highest rate of fire fatality per one thousand people during the period of this study.

In terms of when people died in fires in Maine as opposed to the nation I again found differences with the exception being the day of the week. Maine's October and December fatality levels were considerably different from what I found nationally. By hour of fatal fire, Maine's experience is more severe during the pre-waking to waking hours as opposed to the nations experience with early morning hours.

When I looked at cause I found what a consensus of people from the fire service and injury prevention community know, the careless disposal of smoking related incidents kill more people than any other ignition factor, followed by heating apparatus-related causes. I also found a higher than expected count of deaths due to juvenile fire activities. When I looked at cause by age and proximity I found that 1 – 4 year olds died more as a result of a juvenile fire setting incident/cause than any other cause. The other most vulnerable population, elderly, died most often as a result of smoking and heating related incidents.

Fire fatality in Maine during this period was clearly a residential issue with the majority of those residences being one and two family occupancies. This finding runs counter to what I often hear from individuals in the fire service. The perception that multiple family dwellings are the problem doesn't take into account the actual distribution of fire death by number of dwelling units in Maine. In terms of population, Maine was like the nation where more fatalities occurred in areas with a low population that is traditionally thought of as being rural. These same areas also have a low population density. However, in terms of town, service center area function (see figure 10) most fatalities occurred in towns defined or classified as being urban areas. Looking at Maine's distribution of fire fatalities based upon where the fire started (room of origin) in one and two family dwellings I found that more deaths were the result of fires starting in the living room as opposed to the bedroom as I found nationally.

Maine's record of smoke alarm performance was, as it was nationally, dismal though the distributions in terms of presence and operating status were not statistically similar. Maine had more operational and non-operational detectors in structures where people died than I found nationally and a lower percentage of dwellings without detectors. Alcohol was counted as a factor in 24% of the fatalities in Maine during the period of this study.

Unlike most studies of fire fatality I looked at where people were at the time of the fire's ignition. In doing so I discovered that over half of those who died in fires died as a result of carelessness. This unfortunate reality was verified when I examined fatalities in terms of cause and age suggesting, as previously stated, that approaches other than code enforcement might have better outcomes.

Finally, I wanted to compare what the NFPA found when it took variables it considered to have a high explanatory value for fire fatality in states across the nation to Maine's counties. Data on educational attainment, poverty level, rural count, and age of housing were used. At the national level these variables in combination explained 47% of fire fatality rates but in Maine at the county level they explained only 17%. The variable showing the most significant positive association in Maine was the percentage living in a rural area. Age of housing stock showed a negative relationship to fire fatality.

Policy Implications and Suggested Further Research

Given the conclusions identified above one can conclude fire fatality is a behavioral issue and that the greatest policy implication for the Fire Marshal's Office and fire service would be that the policy emphasis needs to shift from regulation to public awareness/education and intervention programs. However, it should be noted that to fully evaluate policies this study can only represent a beginning of that evaluation process. Combining this analysis with another focused on fire fatality from 1993 to present must be conducted for the following reasons.

Since the 1980's there have been changes made to the fire safety code, and legislation addressing fire safety in Maine. Manufactures have made attempts to use non-combustible materials in the production of furniture as opposed to more combustible materials previously used. The number of older mobile homes that contain the aluminum wiring that caused some fires has likely diminished as a result of national legislation. Programs such as juvenile fire setting interventions also started in the 1980's. Public awareness programs attempting to get people to change the batteries in their smoke alarms when daylight savings time begins were initiated during the 1990's. Also, Maine's distribution of the elderly population has increased since the time of this study and the State maintains a higher than national average of fire fatality among the elderly age cohorts. Because all these changes have occurred since the 1980's additional analysis covering a longer period of time would provide more valuable information. Just as fire fatality has a seasonal dimension, time is a variable that influences the behavioral and physical environment in which these tragedies take place.

New consideration also needs to be given to other state agencies approaches to housing, health and education and how they are changing and have changed over an extended period of time. With elderly service agencies now emphasizing aging at home models and the accompanying policy of delivering health care to these people at home, the fire service and in particular the SFMO is going to have to work closely with the Department of Health and Human Services (DHHS) as well as the Maine State Housing Authority (MSHA) and other associations advocating for elderly citizens to integrate fire safety awareness and education into newly emerging routines of social service programming. It might be wise to carefully consider codes that address such issues as the delivery of oxygen tanks to elderly citizens who are also receiving home health care through DHHS licensed caregivers.

If the level of juvenile fire incidents continues to be the leading cause of fire death among young children, the SFMO in particular may wish to work with the Department of Education (DOE) and DHHS in the same way suggested above, but focus the education and awareness on children. There is considerable opportunity here given the fact that the number of public elementary school pre-k programs operating is at an all time high increasing 700% since the latter 1990's.

Policy Options

1. *Regulatory*

Two devices that could be introduced through rule-making would be the mandatory installation of sprinkler systems (suppression) or, hardwired or interconnected dual level smoke detector systems (mitigation) at the time of construction. Sprinklers to some extent remove the human element from the scenario by slowing or extinguishing a fire, as well as confining its spread, to a given area. This could save lives or provide more time for egress. Likewise, smoke alarms and detectors also provide additional egress time particularly if they are interconnected at all levels of the home.

Primary consideration needs to be given to the issue of enforceability. It is certain the Fire Marshal's Office can not enforce such a regulation statewide. Additional help from fire departments and local code enforcement officers will help but the extent of that assistance is difficult to ascertain. It is highly unlikely that a regulatory approach can be adequately enforced so as to reduce the number of fatalities.

2. *Public Education/Awareness and Making Fire Safety a Desired Choice*

Integrating injury prevention programs focused on children, as opposed to a separated approach covering a variety of child related injuries might make child fire prevention and safety education more deliverable to the growing number of pre-k and kindergarten teachers in public schools. Reaching the children at an early age in an organized fashion as part of a health care curriculum might contribute to a culture of safety in the long term as opposed to brief awareness efforts that have been delivered primarily by the fire service working with schools in a random effort.

To address fire fatality among the elderly in Maine the Fire Marshal must collaborate, cooperate, and coordinate with the local area agencies on aging, Maine's Bureau of Elderly Services, AARP and other organizations to bring fire safety awareness programs to this audience. Again a key element to success would be to merge programs already focusing on elderly issues such as falls prevention, into an integrated and routine program.

The State Fire Marshal and the fire service must learn from other public safety organizations how it can make fire safety a consideration when Maine citizens' purchase a home or products for a home such as furniture. Just as heating costs, proximity to schools, and other issues determine what choices people make in the purchase of a home, so to should mitigation (smoke alarms systems), means of egress or escape in times of emergency, and eventually even sprinkler systems.

3. *Intervention*

Given the number of fire fatalities resulting from children playing with fire or setting a fire, particularly in the 1 – 4 age cohort, a protocol for direct intervention needs to be considered. Even if the number juvenile fire play related fatalities declines but the number of incidents remains steady, an interagency approach to this problem would be appropriate. Fire service personnel working with members from the human services, and mental health, and education communities need to work on this protocol to discern situations of serious danger that require the work of specialists from those situations where a more general educational approach will minimize or eliminate any future dangers.

Finally, to truly understand risk levels, we need to take fatality, injury, and incidence data along with suppression and regulatory costs in one model. More recent studies on fire fatality include data on overall incidence to assess the real risk.[24] Absent such data we can only assess risk based upon the distributions we see among fatalities. In addition, investigation of fires needs to move beyond the realm of origin and cause and extend itself into the bigger physical and behavioral environment essential to truly understanding these complex events. Who and how many people were home, how many dwellings were there in the given structure, what were their ages, and a host of other questions need to be asked and answered clearly as part of the routine investigation. If that is done then the investigators statement: "We need to know what happened" can be answered to the benefit of the greater public good.

[24] Runyan, C., Bangdiwala, S.I., Linzer, M.A., and Sacks, J.J. "Risk Factors for Fatal Residential Fires" New England Journal of Medicine, 327 (1992), 859-863

Appendix A

Chi Test on Fatality by Age in Maine compared to that found nationally.

	ME %	National %	Age	Actual	Expected	Difference	Sq. Difference	Sq./Exp.
1	16.7%	13.7%	<4	49	40.1	8.9	78.5	1.96
2	7.2%	4.9%	5-9	21	14.4	6.6	44.1	3.07
3	2.4%	2.5%	10-14	7	7.3	-0.3	0.1	0.01
4	4.1%	4.4%	15-19	12	12.9	-0.9	0.8	0.06
5	7.2%	6.7%	20-24	21	19.6	1.4	1.9	0.10
6	6.1%	6.9%	25-29	18	20.2	-2.2	4.9	0.24
7	5.5%	7.1%	30-34	16	20.8	-4.8	23.1	1.11
8	4.1%	7.2%	35-39	12	21.1	-9.1	82.7	3.92
9	1.7%	6.0%	40-44	5	17.6	-12.6	158.3	9.00
10	3.4%	4.0%	45-49	10	11.7	-1.7	3.0	0.25
11	4.1%	4.8%	50-54	12	14.1	-2.1	4.3	0.30
12	2.4%	3.8%	55-59	7	11.1	-4.1	17.1	1.53
13	2.7%	5.0%	60-64	8	14.7	-6.7	44.2	3.02
14	5.1%	5.1%	65-69	15	14.9	0.1	0.0	0.00
15	5.5%	5.0%	70-74	16	14.7	1.4	1.8	0.12
16	6.5%	4.6%	75-79	19	13.5	5.5	30.5	2.26
17	7.5%	4.1%	80-84	22	12.0	10.0	99.7	8.30
18	7.8%	4.5%	85+	23	13.2	9.8	96.3	7.31
								42.58

Source: Figure 37, *Percentage of Fire Deaths, by Age—1990*
p. 43, Fire In the United States: 1983 – 1990, USFA Fire Data Center, 8th Edition.

	.05/95% CL	.001/99.9 level
Chi Sq. Value	42.58	42.58
DF	17	17
Critical Value	27.59	40.79

Appendix B

	Maine Pop	ME Deaths	ME %Deaths	ME % TL Pop	US Pop	US %TL Pop	% US Deaths
<1	14,567	8	2.7%	1.2%	3,217,312	1.3%	
1-4	71,155	41	14.0%	5.8%	15,137,131	6.1%	13.70%
5-9	88,506	21	7.2%	7.2%	18,099,179	7.3%	4.90%
10-14	84,579	7	2.4%	6.9%	17,114,249	6.9%	2.50%
15-19	87,927	12	4.1%	7.2%	17,754,015	7.1%	4.40%
20-24	86,040	21	7.2%	7.0%	19,020,312	7.6%	6.70%
25-29	98,773	18	6.1%	8.0%	21,313,045	8.6%	6.90%
30-34	106,462	16	5.5%	8.7%	21,862,887	8.8%	7.10%
35-39	101,866	12	4.1%	8.3%	19,963,117	8.0%	7.20%
40-44	91,479	5	1.7%	7.4%	17,615,786	7.1%	6.00%
45-49	69,043	10	3.4%	5.6%	13,872,573	5.6%	4.00%
50-54	55,708	12	4.1%	4.5%	11,350,513	4.6%	4.80%
55-59	54,216	7	2.4%	4.4%	10,531,756	4.2%	3.80%
60-64	54,234	8	2.7%	4.4%	10,616,167	4.3%	5.00%
65-69	50,835	15	5.1%	4.1%	10,111,735	4.1%	5.10%
70-74	40,765	16	5.5%	3.3%	7,994,823	3.2%	5.00%
75-79	31,701	19	6.5%	2.6%	6,121,369	2.5%	4.60%
80-84	21,846	22	7.5%	1.8%	3,933,739	1.6%	4.10%

85+	18,226	23	7.8%	1.5%	3,080,165	1.2%	4.50%
	1,227,928	293			248,709,873		

Appendix C

Chi Test on Fire Fatality by Property Type in Maine to that Found Nationally

	ME %	National%	Actual	Expected	Difference	Sq. Difference	Sq./Exp.
Residence	90.5%	72.0%	266	212	54	2950.7	13.9
non-residence (not vehicle/outside)	3.1%	6.0%	9	18	-9	74.6	4.2
vehicle	3.7%	18.0%	11	53	-42	1757.3	33.2
outside	2.7%	2.0%	8	6	2	4.5	0.8
			294	288	6		52.1

Source: Figure 44*, General Property Types—1990 Fire Deaths*
p. 48, Fire In the United States: 1983 – 1990, USFA Fire Data Center, 8th Edition.

	.05/95% CL	.001/99.9 level
Chi Sq. Value	52.1	52.1
DF	3	3
Critical Value	7.81	16.27

Appendix D

Chi Test on Residential Fire Fatality in Maine by Residential Dwelling Type to that Found Nationally

	ME %	NFPA%	Actual	Expected	Difference	Sq. Difference	Sq./Exp.
Dwellings (1 & 2 Fam)	82.0%	77.0%	218	205	13	173.7	0.8
Apartments (multifam)	15.4%	20.1%	41	53	-12	155.4	2.9
other	2.6%	2.9%	7	8	-1	0.5	0.1
			266				3.8

Source: Figure 68, *Residential Fire Deaths by Property Types—1990*
p. 67, Fire in the United States: 1983 – 1990, USFA Fire Data Center, 8th Edition.

	.05/95% CL	.001/99.9 level
Chi Sq. Value	3.8	3.8
DF	3	3
Critical Value	5.99	13.82

The null hypothesis that there is no difference between distributions is accepted here. The distribution of fatalities in 1 & 2, apartment or multi-family dwellings are essentially the same with differences due to sampling or random variations.

Appendix E

Chi Test on Rooms of Fatal Fire Origin in Maine to that Found Nationally

	Maine %	NFDC %	Actual	Expected	Difference	Sq. Difference	Sq./Exp.
Lvgrm	38.8%	31.9%	87	71	16	242	3.38
Kitchen	25.4%	14.6%	57	33	24	590	18.05
Bdrm	14.7%	23.8%	33	53	-20	413	7.74
Other	21.0%	29.7%	47	67	-20	381	5.73
	100.0%	100.0%	224	224	0	0	34.90

Source: Figure 111, *Leading Rooms of Origin for Deaths in One-and Two-Family Dwellings—1990*
p. 98, Fire in the United States: 1983 – 1990, USFA Fire Data Center, 8th Edition.

	.05/95% CL	.001/99.9 level
Chi Sq. Value	34.9	34.9
DF	3	3
Critical Value	7.81	16.27

Appendix F

Chi Test on Fire Fatality by Day of Week in Maine to that Found Nationally

	ME	Maine %	NFDC	Expected	Difference	Sq. Difference	Sq./Exp.
Sunday	44	16.5%	16.5%	43.9	0.1	0.0121	0.00
Monday	30	11.3%	13.4%	35.6	-5.6	31.854736	0.89
Tuesday	27	10.2%	13.0%	34.6	-7.6	57.4564	1.66
Wednesday	33	12.4%	13.0%	34.6	-1.6	2.4964	0.07
Thursday	39	14.7%	12.6%	33.5	5.5	30.074256	0.90
Friday	35	13.2%	14.9%	39.6	-4.6	21.473956	0.54
Saturday	58	21.8%	16.5%	43.9	14.1	199.0921	4.54

Source: Figure 92. Residential Fire Deaths by Day of Week—1990
p. 86, Fire in the United States: 1983 – 1990, USFA Fire Data Center, 8th Edition.

	.05/95% CL	.001/99.9 level
Chi Sq. Value	8.6	8.6
DF	3	3
Critical Value	12.59	22.46

Appendix G

Chi Test on Fire Fatality by Month of the Year in Maine to that Found Nationally

Month	Maine	NFDC	actual	expected	Difference	Sq. Differ	Sq.Diff/expected
January	14.0%	13.9%	37	37	0	0.03	0
February	7.2%	10.6%	19	28	-9	82.63	3
March	9.1%	8.7%	24	23	1	0.89	0
April	6.8%	8.4%	18	22	-4	18.15	1
May	6.4%	6.0%	17	16	1	1.21	0
June	6.0%	5.8%	16	15	1	0.40	0
July	6.0%	4.8%	16	13	3	10.76	1
August	3.0%	5.6%	8	15	-7	46.79	3
September	6.4%	4.8%	17	13	4	18.32	1
October	11.7%	8.0%	31	21	10	96.04	5
November	6.4%	10.3%	17	27	-10	105.99	4
December	17.0%	13.0%	45	34	11	111.30	3

Source: Figure 90, *Residential Fire Deaths by Month—1990*
p. 85, Fire in The United States: 1983 – 1990.

	.05/95% CL	.001/99.9 level
Chi Sq. Value	21	21
DF	11	11
Critical Value	19.68	31.26

Appendix H

Chi Test on Fatalities by Cause of Fire in Maine to That Found Nationally

	Maine %	NFDC %	Actual	Expected	Difference	Sq. Difference	Sq./Exp.
Heating	22.2%	10.8%	59	29	30.3	916.4	31.9
Electrical	11.7%	6.5%	31	17	13.7	188.0	10.9
Cooking	9.8%	6.5%	26	17	8.7	75.9	4.4
Smoking	22.6%	18.0%	60	48	12.1	146.9	3.1
Arson	4.5%	13.1%	12	35	-22.8	521.9	15.0
Juvenile Fire Setting	10.5%	6.0%	28	16	12.0	145.0	9.1
Undermined	10.2%	30.2%	27	80	-53.3	2844.3	35.4
Another	8.6%	8.9%	23	24	-0.7	0.5	0.0
			266	266			109.7

Source: Figure 72, *Causes of Residential Fire Deaths--1990* p. 70, Fire inThe United States: 1983 – 1990.

	.05/95% CL	.001/99.9 level
Chi Sq. Value	109.7	109.7
DF	7	7
Critical Value	14.07	24.32

Appendix I

Chi Test on Fatalities and Smoke Detector Performance in Maine to that Found Nationally

	Maine	NFPA %	Actual	Expected	Difference	Sq. Difference	Sq./Exp.
Present/not operating	16.30%	8.3%	35	18	17	294	16.5
no detector	40.50%	47.2%	87	101	-14	210	2.1
present/operated	10.70%	8.7%	23	19	4	18	1.0
unknown	32.60%	35.8%	70	77	-7	49	0.6
			215		0	0	20.2

Sourc: Figure 114, *Smoke Detector Performance in One- and Two-family Dwellings Fire Deaths—1990* Page 103, Fire in the United States: 1983 – 1990.

	.05/95% CL	.001/99.9 level
Chi Sq. Value	20.2	20.2
DF	3	3
Critical Value	7.81	16.27

Appendix J

Table of Potential Explanatory Characteristics by County & Fatality Rate
Residual and Line fit plots for each of the four characteristics

	% Below Poverty Level	%>25 No Diploma	% Rural	% Housing Built before 1939	Fatal Rate
Franklin	12.5%	8.0%	85.5%	36.4%	0.07
Androscoggin	11.4%	8.9%	32.1%	39.0%	0.10
Knox	11.9%	8.8%	67.4%	46.0%	0.11
Waldo	16.0%	8.8%	81.3%	36.0%	0.18
Cumberland	8.0%	6.4%	41.4%	32.9%	0.20

Kennebec	10.2%	7.5%	48.6%	32.1%	0.22
Somerset	14.5%	10.7%	67.8%	39.3%	0.22
Lincoln	9.6%	8.5%	100.0%	39.2%	0.23
Penoboscot	13.0%	8.2%	46.6%	32.4%	0.23
York	6.8%	7.9%	50.3%	30.4%	0.23
Hancock	10.0%	7.3%	79.9%	37.0%	0.30
Piscatiquis	15.2%	10.1%	83.5%	36.8%	0.32
Aroostook	14.5%	8.3%	58.1%	33.2%	0.35
Sagadahoc	7.2%	8.2%	52.4%	34.0%	0.45
Oxford	12.5%	8.9%	84.0%	39.6%	0.48
Washington	19.3%	9.8%	91.0%	39.7%	0.54

All raw data was taken from the 1990 Census Summary files.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.424233453
R Square	0.179974022
Adjusted R Square	-0.11821724
Standard Error	0.143438946
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	0.049672	0.012418	0.603552	0.668
Residual	11	0.226322	0.020575		
Total	15	0.275994			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.270173028	0.384143	0.703315	0.496476	-0.58	1.115665
%>25 No Diploma	3.084714783	5.164158	0.597332	0.56238	-8.28	14.45095
% Below Poverty Level	0.232659022	1.564233	0.148737	0.884453	-3.21	3.675515
% Rural	0.219758921	0.221026	0.994266	0.341462	-0.27	0.706235
% Housing Built before 1939	-1.21516039	1.171039	-1.03768	0.321693	-3.79	1.36228

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Richard B. McCarthy, Plans Review, Maine Fire Marshal's Office.

Eric Ellis, Fire Prevention Engineer, Maine Fire Marshal's Office.