Fire Deaths in the United States: How Best to Keep Reducing Them

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INTRODUCTION

Over the past 40 years the United States of America has made profound progress reducing all types of fire deaths. Since 1960, the total number of fire deaths has declined by almost 60 percent, and the fire death rate has fallen by over 70 percent. This article begins by showing that these declines have been ongoing for decades, that the improvement has been nationwide (despite wide and persistent variations from state to state), and compared to other western industrialized democracies, the decline in the U.S. fire death rate has been the largest. If, however, the experiences of other nations are a guide, the rate of future improvements in the U.S. may decline.

The article then evaluates which demographic and housing unit characteristics best explain residential fire death rates. To anticipate the findings, inter-county fire death rate differences are strongly correlated with the percentage of new housing stock, differences in household wealth, the percentage of minorities, and the percentage of mobile homes. These findings suggest that a particularly effective way to reduce future fire deaths may be to focus prevention efforts in proportion to the level of these four variables in a community, as opposed to using traditional policies that are largely location invariant.

OVERVIEW

In 1960, the number of fire deaths in the U.S. was 7,645. Five years later, the number had fallen to 7,347.[1] Figure 1 shows that by 1979 the number had fallen to 5,998 and to just 3,326 in 2001, a total decline of more than 56 percent. However, this dramatic decline understates the true improvement in fire safety as the population of the U.S. increased by 105 million people during this 41-year period. Taking this into account, the decline in the fire death rate per million persons (FDPM) fell from 42.3 to 11.7, a decline of over 72 percent.

Equally impressive has been the decline in house fire deaths. Between 1979 and 2001, the number of such fire deaths fell from 4,863 to 2,604, a decline of 46.5 percent, while the residential FDPM declined from 21.7 to 9.13, a drop of 58 percent. Because the decline in residential fire deaths was larger than the reduction in all fire deaths, house fire deaths now account for 78 percent of all fire deaths, down from their recent high of 86 percent in 1993, and are now at their lowest rate since at least 1979.

These findings are based on the annual Multiple Cause-of-Death file collected and compiled by the National Center for Health Services (NCHS), a part of the Centers for Disease Control and Prevention (CDC). Death certificates are coded by local medical authorities and complied by the states and finally by the NCHS. The result is an annual data file that contains a record of all deaths in the U.S.

STATE-BY-STATE VARIATION

Table 1 (page 10) looks at house fire deaths in 2001 and FDPM rates for all 50 states in 1983 (the first year these data were available from this source) and 2001. With the exception of Kansas and Connecticut, every state registered a decline in its FDPM during the 23-year period, suggesting that the steep decline in U.S. residential fire deaths has benefited all states. However, the FDPM rate continues to vary dramatically across the states. In 1983, the rate varied from a low of 6.9 in Utah and Hawaii to a high of 53.2 in Vermont. By 2001, Colorado had the lowest rate in the nation at 2.3, while Arkansas had the highest rate in the land at 28.6.

To further illustrate the dramatic reduction in fire deaths, in 1983, there were four states with FDPM rates greater than 40 – Delaware, Mississippi, South Carolina, and Vermont. However, by 2001, the four states with the highest FDPM ranking were Arkansas, Mississippi, Delaware, and Alabama with FDPM rates of 28.6, 25.5, 21.3 and 19.5, respectively; about half as high as the rates for the four poorest performing states in 1983. Put another way, the average state in 1983 would rank 45th in 2001.

Despite these dramatic improvements, there are some constants. Both Delaware and Mississippi appear in lists of the four least fireworthy states in 1983 and 2001. Also, in 2001, eight of the 12 states with the highest FDPM rate were from the South, while in 1983, 10 of the 15 states with the highest FDPM rates were located in the South. Repeatedly finding the same states with relatively high (or low) FDPM rates suggests that, while improvements have been felt coast-to-coast, systematic unchanging state-specific problems remain.

INTERNATIONAL COMPARISONS

Interestingly, the U.S. findings of declining FDPM rates over time, substantial variation across place, and high rates of path dependence are also in evidence internationally. Figure 2 shows that, between 1979 and 2000, FDPM rates declined in 10 of 13 countries, stayed the same in one, and rose slightly in two others.[2]

FIGURE 1

Fire Deaths and House Fire Deaths, 1979-2001[1]

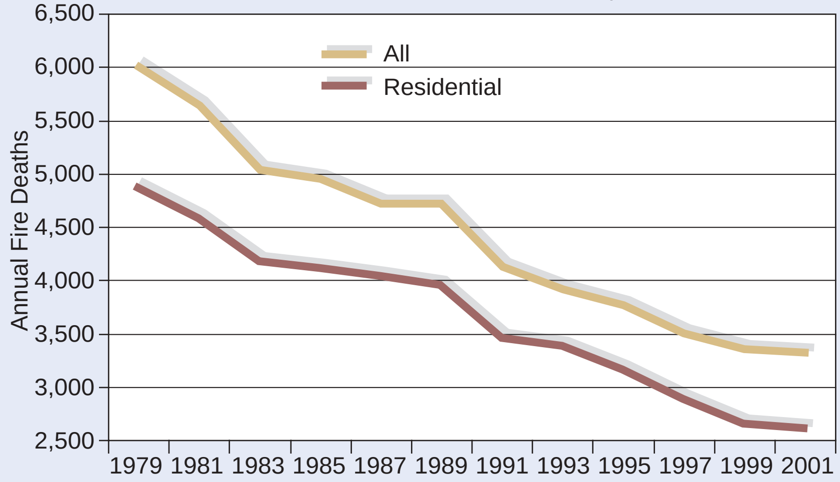


FIGURE 2

International Fire Death Comparisons, 1979-2000 [2]

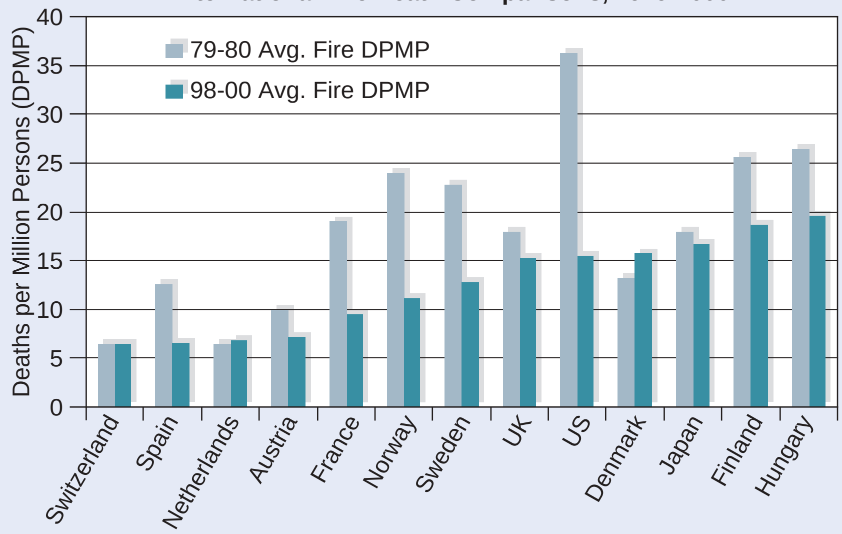
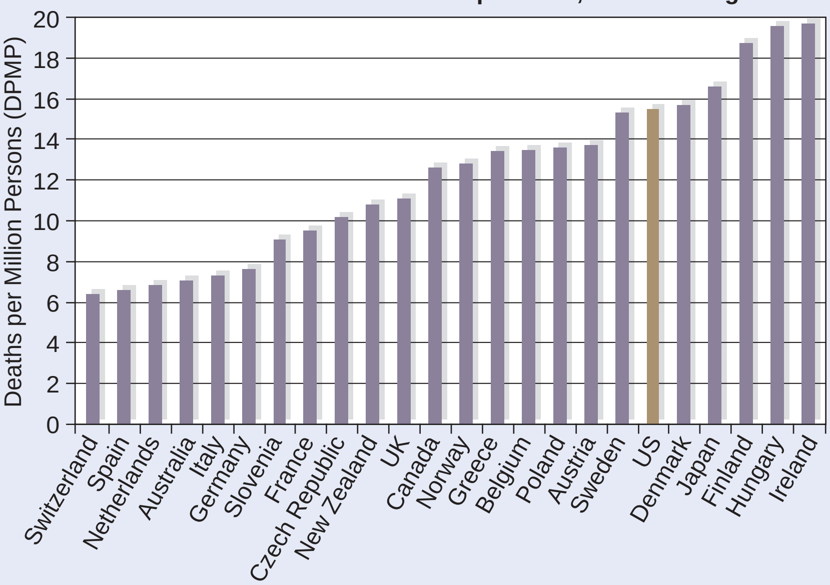


FIGURE 3

International Fire Death Comparisons, 98-00 Average



Even among countries that appear very similar, fire death rates vary considerably. For example, Finland, Denmark, Sweden, and the Netherlands are all Northern European countries with similarly high per capita GDP and small populations. Despite these parallels, their FDPM rates vary noticeably. In Finland, the FDPM is 18.7, while in the Netherlands, it is less than half as high. And these differences have persisted for quite some time.

Figure 2 also shows that improvements have been quite uneven. Between 1979 and 2000, the 57 percent decline in the United States fire death rate was larger than that experienced by any other country. Other countries that experienced very large percentage declines include U.K., France, Spain, and Norway, each of which saw their rates decline by between 47 and 54 percent. By contrast, fire death rates in Switzerland and Netherlands barely budged. This may, in large part, be because rates in those two nations were already so low by 1979 that further improvement is very difficult.

This explanation is given added weight by examining Figure 3 which provides the most recent fire death rate data for all countries that consistently provide data to the World Fire Statistics Centre (WFSC) in Geneva (except for Singapore, as it is not a democracy and because 80 percent of the population live in public housing) ranked by their fire death rates. (The WFSC does not get its data from NCHS. Thus, its fire death rates for the U.S. are different.) Figure 3 clearly shows that, among the top 24 countries, none has a fire death rate below 6.5 FDPM, and that the variation among the best-performing five or six nations is very small.

This observation was also noted in the 2003 WFSC report when they wrote "Progress has... been particularly marked in those countries which had in the 1980s been suffering relatively high losses (particularly fire deaths), while – naturally enough – those countries already enjoying relatively low loss rates have had difficulty in improving much further."[2]

As an aside, the best-performing nations in Europe are generally smaller or warmer than the U.S., and the two that are large (Italy and Germany) and have relatively low fire death rates have much higher population densities compared to the U.S., which works to their advantage. Conversely, the U.S. population is growing much faster than in any Western European state.

As a result of increasing U.S. population, progressively smaller improvements in fire deaths will manifest themselves differently in the U.S. than in Europe. In the U.S., the FDPM rate may continue to decline, but due primarily to increases in population and not declines in the number of fire deaths, while the number of fire deaths remains constant. As a matter of fact, this trend has recently appeared for the very first time. Between 1998 and 2001, the number of fire deaths fell by only 16, or less than one percent, while the FDPM rate fell by four percent due to rising population. While the decline in the FDPM rate looks impres-

TABLE 1. U.S. Fire Death Rates

	Deaths	Per Million		
	2001	1983	2001	2001 Rank
US	2604	17.8	9.1	NA
Alabama	87	30.8	19.5	48
Alaska	12	35.2	18.9	46
Arizona	35	7.7	6.6	14
Arkansas	77	34.0	28.6	51
California	126	9.4	3.6	4
Colorado	10	8.6	2.3	1
Connecticut	25	7.3	7.3	22
Delaware	17	51.3	21.3	49
District of Columbia	9	33.0	15.7	45
Florida	115	13.6	7.0	18
Georgia	124	32.8	14.8	43
Hawaii	3	6.9	2.4	2
Idaho	5	9.1	3.8	5
Illinois	135	17.1	10.8	34
Indiana	65	19.5	10.6	33
Iowa	23	8.6	7.8	24
Kansas	38	12.8	14.1	42
Kentucky	57	23.1	14.0	40
Louisiana	86	28.1	19.2	47
Maine	8	21.8	6.2	13
Maryland	53	22.8	9.8	29
Massachusetts	46	21.2	7.2	19
Michigan	118	17.9	11.8	38
Minnesota	31	14.7	6.2	12
Mississippi	73	41.8	25.5	50
Missouri	66	17.5	11.7	37
Montana	3	19.6	3.3	3
Nebraska	13	12.5	7.6	23
Nevada	9	7.8	4.3	7
New Hampshire	14	18.8	11.1	35
New Jersey	47	15.5	5.5	10
New Mexico	10	7.8	5.5	9
New York	138	12.5	7.2	21
North Carolina	96	24.2	11.7	36
North Dakota	6	11.7	9.4	26
Ohio	119	17.9	10.4	31
Oklahoma	33	26.6	9.5	27
Oregon	25	15.0	7.2	20
Pennsylvania	125	20.5	10.2	30
Rhode Island	7	15.7	6.6	15
South Carolina	57	42.1	14.0	41
South Dakota	9	10.0	11.9	39
Tennessee	88	24.3	15.3	44
Texas	184	19.1	8.6	25
Utah	9	6.9	3.9	6
Vermont	3	53.2	4.9	8
Virginia	48	19.2	6.7	16
Washington	58	10.7	9.7	28
West Virginia	19	26.0	10.5	32
Wisconsin	37	13.5	6.8	17
Wyoming	3	7.8	6.1	11

sive, it masks the serious problem that over the four-year period there was, at best, a very small decline in the number of deaths.

CHANGING U.S. ENVIRONMENT

The large decline in fire death rates in the U.S. has been the result of several factors, including the adoption of increasingly stringent building codes across the country. For example, building and fire codes require improved fire blocking and stopping – which results in better fire containment, which in turn provides more time to escape and/or extinguish the fire – along with better heating and electrical design, which have resulted in the use of fewer extension cords and space heaters. Also, improved fire ratings on upholstered furnishings, bedding and sleeping attire, and the increased use of childproof devices have all helped reduce U.S. fire deaths.

Technological innovation has also played a key role. Table 2 shows how building codes progressively mandated both more and better smoke detectors over time. In 1969, smoke alarms were often unreliable, battery-operated, poorly placed, in few homes, and, most importantly, not required by any of the building codes. Today, all new homes must have hard-wired, interconnected smoke detectors, and many older homes have been retrofitted with them too. In short, homes and their contents are now safer than they have ever been.

In addition, there has also been a strong push to reduce smoking since the first Surgeon General's report linking smoking and lung cancer in 1964.[3] Since smoking is the leading cause of residential fire deaths,[4] any success in reducing it (along with drug and alcohol abuse) necessarily translates into fewer fire deaths. However, since 1990, the percentage of the U.S. population that smokes has declined very little.[5] Thus, this trend will no longer be of much help in reducing the number of fire deaths further.

Collectively, these interventions, public awareness campaigns, and code improvements have cumulatively saved about 155,000 lives since 1960. However, the across-the-board solutions that have worked so well until now are likely to be less effective in the future. In part, this is because many of the most effective solutions have already been adopted, public awareness regarding house fires is quite high, smoking rates are lower than ever, and because fire death rates are much lower than they were in the past. Thus, substantially reducing the number of fire deaths in the future will become increasingly more difficult unless solutions tailored to at-risk populations are considered.

To implement such solutions, more must be known about who is dying, the condition of the house when the fire occurred, as well as any other relevant demographic information. With this knowledge, it would then be appropriate to focus future fire prevention efforts at entire subpopulations, devoting more resources to communities at greater risk – an approach akin to the emergency room practice of triage, where patients with the greatest need get treated first.

Regrettably, much of the available data is not helpful. For example, no data are collected on the age of the structure where a house fire death occurs, despite the obvious link between the two. Similarly, very little data are available linking income, wealth, population density, and other demographic variables to residential fire death rates. And when this information is analyzed, it is done so one variable at a time. For example, a published analysis concluded that "African-Americans and American Indians have significantly higher fire death rates per capita than the national average" and that "male fire death rates exceed that of females by 1.5 to 2 times, or that the elderly of all ethnic groups have the highest fire death rates." [6]

While these results are informative, what is needed is a more complete model that can better account for the many relationships between the different variables. Only this way will it be possible to better understand why fire death rates have behaved as they have in the past and where they may be headed in the future. With this knowledge, targeted interventions can be used and, in the process, save lives.

TABLE 2

Building Code Requirements and Changes Smoke Detectors – 1970s to Present	
1967 National Building Code	No requirements for smoke detectors.
1976 National Building Code	1 smoke detector required.
1979 Southern Building Code	1 smoke detector required.
1983 CABO 1- & 2-Family Dwelling Code	1 smoke detector in sleeping areas (i.e., hallway outside of bedrooms), and smoke detector must be hardwired (not just battery).
1986 CABO 1- & 2-Family Dwelling Code	Smoke detectors now required on each story of structure and in the basement.
1989 CABO 1- & 2-Family Dwelling Code	No changes to the smoke detector requirements.
1992 CABO 1- & 2-Family Dwelling Code	Smoke detectors are required to be interconnected; if one alarm sounds, they all sound.
1995 CABO 1- & 2-Family Dwelling Code	Smoke detectors are now required in each sleeping room in addition to other current requirements.

CABO stands for Council of American Building Officials.

ECONOMIC THEORY

Findings from a number of existing studies consistently show that newer homes experience fewer fire deaths than older homes. A study conducted by the National Association of Home Builders (NAHB) in 1987[7] found that fatality rates increased with the age of homes. For example, houses less than seven years old had fatality rates one-third of houses seven to 17 years old, and one-sixth the rate of houses that were more than 25 years old.

Nearly identical results were obtained in a California Building and Industry Association study released in 1996.[8] That study found that the average fatality rate in residential dwellings in California consistently increased as the housing stock aged. Interestingly, they found this relationship to be true for every successive four-year period going back all the way to 1956. More recently, it's been found that, in Dallas, residential fire-related injuries declined in every decade for houses built after 1949.[9] That is, houses built in the 1980s were found to be safer than those built in the 1970s, which, in turn, were found to be safer than those built in the 1960s, and so on.

Other research has found[10, 11] that those at greater risk include persons living in manufactured or substandard housing. This may be because mobile homes are smaller and depreciate at a faster rate than site-built and modular homes; it is rare to see a 50-year-old or 100-year-old mobile home. By contrast, there are tens of millions of 50-year-old homes and millions of 100 year-old homes. Also, as mobile homes are built to a national building code rather than a local building code, they may be less well-suited to local environmental conditions than other homes. Moreover, it may well be that, as mobile homes reach the end of their useful life, preventive maintenance and replacement of old systems, such as heating and air conditioning units, is not done, as the cost of replacement may be very high compared to the value of the mobile home. As a result, the fire risk of such dwellings may well increase over time, relative to traditional units of comparable age.

In addition to structural variables, wealth is highly correlated with reduced house fire death rates.[12] Wealthier households are less likely to defer maintenance, are more likely to be proactive about eliminating potential

TABLE 3

Summary Statistics							
Variable Type	Variable Description	Var. Name	# of Obs.	Minimum	Maximum	Average	Std. Dev.
Dependent Variable	Fire death rate	fdpermill	458	0	75.48	8.94	10.68
Housing Stock Age Variables	Percent of stock built after 1994	pctpost94	458	1.10%	34.64%	10.03%	5.67%
	Percent of stock built after 1989	pctpost89	458	2.09%	50.07%	17.83%	8.82%
	Percent of stock built after 1979	pctpost79	458	5.41%	77.33%	33.98%	14.53%
	Percent of stock built after 1969	pctpost69	458	10.56%	92.05%	52.63%	17.55%
	Percent of stock built after 1959	pctpost59	458	20.91%	96.84%	66.29%	16.85%
	Percent of stock built after 1949	pctpost49	458	35.38%	99.22%	78.77%	13.91%
	Percent of stock built after 1939	pctpost39	458	47.12%	99.56%	85.65%	11.27%
Wealth & Income Variables	Percent high school graduates	pctHS	458	11.72%	49.91%	29.04%	6.58%
	Percent college graduates	pctBA	458	6.64%	33.31%	16.12%	5.22%
	Median household income	medhhinc	458	$24,863	$81,050	$44,423	$10,197
	Median family income	medfaminc	458	$26,009	$92,146	$52,792	$11,350
	Per capita income	percapinc	458	$9,899	$44,962	$21,928	$4,810
	Median rent	medrent	458	$361	$1,185	$600	$131
	Log median house value	lmedhseval	458	10.773	13.816	11.682	11.176
	Median house value	medhseval	458	$47,700	$1,000,001	$118,500	$71,392
	Percent in poverty	pctpov	458	2.48%	35.45%	10.88%	4.83%
Housing Market Control Variables	Percent white	pctwhite	458	21.16%	97.94%	78.43%	15.31%
	Percent mobile homes	pctmb	458	0.03%	37.55%	6.48%	6.45%
	Percent urban	pcturban	458	34.49%	100.00%	83.09%	14.38%
	Population density/sq. mile	popdensity	458	21	66,940	1,229	4,202
	Percent occupied	pctocc	458	64.47%	98.46%	92.33%	4.60%
	Percent owner-occupied	pctown	458	19.54%	88.08%	67.26%	9.28%
	Percent single-family detached	pctsfdet	458	0.29%	83.17%	62.14%	12.02%
	Percent of population over age 54	pctage55up	458	11.19%	49.18%	20.89%	4.83%
	Percent of population over age 64	pctage65up	458	4.60%	34.71%	12.38%	3.80%
	Percent of population over age 74	pctage75up	458	1.70%	16.29%	5.83%	2.00%
	Percent of population over age 84	pctage85up	458	0.04%	4.13%	1.44%	0.05%

fire hazards, and are more likely to install smoke detectors.[13, 14, 15] Moreover, to the extent that wealth and education are correlated,[16] wealthier households are less likely to smoke. As a result, as wealth rises, residential fire death rates are expected to fall. However, the relationship is nonlinear as, beyond some level, the added benefit of more wealth, while always positive, declines. As a proxy for household wealth, average house value is used, and to account for the nonlinear relationship between wealth and education, the logarithm of house value is used.

Other things that may systematically impact residential fire death rates are the characteristics of a housing market. To give an example, the fireworthiness of a unit in Phoenix, AZ, may be quite different than a unit in Birmingham, AL. To account for these differences, it is necessary to include the percentage of the stock that is single-family detached, occupied, owner-occupied, and urban. It has also has been found that the age and race of the occupants are meaningfully related to fire deaths rates.[17, 18] While the signs and coefficients on all the housing market control variables mentioned in this paragraph are not central to the research question being asked, excluding them will bias the coefficients for house stock age, house value, and the percentage of mobile homes – the dependent variables of primary interest – to the extent that any of the housing market variables are correlated with the three variables of primary interest.

For example, were one to regress annual income on the age of a person, the result will be that age appears to increase income. However, the relationship between age and income is more complex; older people are more likely to have more education and more savings. And since education and age, and savings and age, are positively correlated, excluding education and savings will cause the coefficient on age to be larger than it really is. To prevent this, as many variables as possible that affect income should be included in the equation. In fire death research, the housing market variables mentioned in the previous paragraph are analogous to the education and savings variables in this paragraph.

Thus, the multiple regression equation to be estimated is:

$$FDPM = k + \alpha H + \beta M + \gamma WLOG + \delta R + e$$

Where *FDPM* is the county-specific fire death rate per million persons in 2001, *k* is a constant or intercept term, *H* is a measure of housing stock age, *M* is the percentage of mobile homes, *WLOG* is the logarithm of house value, *R* is a vector of real estate market condition control variables, *e* is a normally distributed error term, and the Greek symbols α, β, γ, and δ are the respective coefficients for *H*, *M*, *WLOG*, and *R*.

TABLE 4

Fire Death Rate Regression Results	
Variable	Model 1
Intercept	96.71
	(6.12)
Percent white	-17.01
	(5.55)
Log median house values	-6.43
	(4.80)
Percent post-1989	-9.95
	(1.65)
Percent mobile homes	21.49
	(2.45)
Observations	458
Adj R^2	0.133
F Value	18.53

Absolute value of the t-values are in brackets.

DATA SOURCES

Fire death data come from the NCHS Multiple Cause-of-Death File for 2001. Death certificates are issued and coded by local medical authorities, using internationally agreed-upon codes (ICD-10 codes) defined by the World Health Organization (WHO). Death certificate data are then complied by the states and then the NCHS. As a result, this database includes data on the cause of all deaths in the U.S. for each calendar year. For this study, the fire had to occur in a home, and the death had to be the result of exposure to a controlled or uncontrolled fire in the building (X00, X02), exposure to ignition or melting of nightwear (X05) or other clothing and apparel (X06). It ignores, however, fire deaths from campfires, forest fires, and from ignition of highly flammable material.

Data from the National Fire Incident Reporting System (NFIRS), which is developed by the United States Fire Administration (USFA), or the NFPA National Fire Experience Survey (NFES) were deliberately not used for several reasons. First, NCHS data are available at the county level, while NFIRS and NFES data are not. Second, NCHS data are specifically designed to capture the cause of death, while NFES and NFIRS are primarily designed to measure fires. As a result, deaths from nonreported fires will appear in the NCHS data, but not the NFES or NFIRS data. Lastly, the NCHS database is comprehensive, while both NFIR and NFES rely on sampling.

The county is the unit of analysis for several reasons. First, intercounty variation in the independent variables is much greater than at the state level, and with greater variation, coefficients can be estimated with greater precision. Second, performing a state-level analysis would not provide sufficient enough observations to perform a cross-sectional analysis of this sort. Finally, the smaller the geographic area analyzed, the easier it is to target and implement intervention.

Variable definitions and descriptive statistics are provided for all demographic data in Table 3. The data in the table come from the SF3 (long form) Census 2000 and are at the county level. These data were then merged with the Multiple Cause-of-Death data by county. Since the NCHS suppresses death data for counties that had a population of less than 100,000 in 1990, the sample includes data for the 458 largest counties rather than for all 3,141 counties. Of the counties in the sample, 343 of the counties reported at least one fire death in 2001, and the total population of the counties in the sample is 207 million, or 73 percent of the total U.S. population in 2000.

The county with the highest residential fire death rate in 2001 was Richmond County, VA, with a rate of 75.48 deaths per million persons – almost eight times the national average, but only slightly higher than the next highest county. Not surprisingly, the highest house prices were found in New York County (Manhattan). The county with the newest housing stock, defined as the percentage of its housing stock built after 1979 and after 1989, is Collin County, TX (just north of Dallas-Fort Worth), with half of its stock built after 1989 and 77 percent built after 1979. For purposes of comparison, Clark County, NV, where the fast-growing city of Las Vegas is located, has the eighth-highest percentage of its stock built since 1979 and the second-highest percentage of units built since 1989.

The oldest county in the nation, as measured by percent of housing stock built before 1939, is Schuylkill County, PA – where 53 percent of the stock is more than 60 years old – followed very closely by Suffolk County, MA, and San Francisco County, CA. Manhattan, NY, is the eighth-oldest county in the country, with 43 percent of its housing stock built before 1939.

RESULTS

While several different models were run – some with a slightly larger set of independent variables and some that looked at the FDPM rate in earlier years – the results were surprisingly robust across specifications. Table 4 reports the result for the above cross-sectional FDPM equation with the t-statistics reported for the coefficients in parentheses.

AGE OF STRUCTURE

As expected, the coefficient estimate for the percentage of houses built after 1989 (pctpost89) is negative and statistically significant. This implies that, in counties with newer housing stock, all else equal, the fire death rate is lower. Interestingly, when identical regressions to model 1 were run using different cutoff points for new stock, such as the percentage of houses built after 1979 or 1969 or 1959, the coefficients were of roughly similar size, were always negative, and the associated t-statistics were at least as significant.

MOBILE HOMES

Here, too, the results were as anticipated. The finds show that, in counties with a higher percentage of mobile homes, the fire death rate is higher than in counties that are otherwise identical but with a lower percentage of mobile homes. While this result is not new, the relationship between mobile homes and fire deaths may be complex. For example, it may be that mobile homes are in areas where public services are consistently not as good as elsewhere. In addition, it may be that mobile homes are more likely to be occupied by persons who are relatively old and/or who smoke more.

WEALTH

The negative coefficient for the logarithm of the median house value (logmedval) was strongly negative and statistically significant. Confirming earlier speculation and research, wealth is inversely related to the chances of dying in a house fire. Thus, all else equal, higher wealth is associated with a lower chance of dying in a house fire. Here, too, when similar regressions to model 1 were estimated, using slightly different functional forms for this variable or a slightly different proxy variable, the results were very similar.

HOUSING MARKET CONTROLS

In addition to the variables discussed, a number of housing market control variables were included in the initial regressions. However, except for race, none were statistically significant. In particular, the percent of houses in urban areas, population density, percent of units occupied, percent of owner-occupied units, percent of units that are detached, and the age of the occupants were not found to be significant regardless of the model specification.

While these findings may seem surprising, it may simply be a result of the sample. Were the sample to have had more than just the biggest counties, it is likely that more of the housing market control variables might have been significant. However, because rural counties are not included, the differences in the control variables across the 458 counties in the sample may not be large enough for a correlation to be found. That limitation notwithstanding, the model is well-suited to analyzing counties with large populations.

FUTURE TREND

At present, the model predicts about 8.9 fire deaths per million persons, if average values for all the independent variables are used. However, to better understand the results shown in Table 3, the model can also be used to simulate alternative scenarios by making slight changes to the values of the independent variables.

For example, assuming that household wealth rises by three percent would reduce the fire death rate to 8.72 FDPM and would save 23 lives. The number is not any larger despite the large fall in the FDPM rate because the population is assumed to grow by three million persons per year as well. If household wealth increases by three percent per year for five years, the cumulative increase in wealth could be expected to lower the fire death rate to about 8 FDPM and save roughly 150 lives annually.

The impact of new home construction on fire deaths is slightly more complex. Newly built houses lower the fire death rate as they are safer than existing homes, but they do not lower the number of fire deaths in existing houses. This is because construction of a new house does not, generally, make an old house safer. However, every year, some new houses are built simply to replace previously occupied units lost through demolition or disaster. And in those cases, the number of fire deaths can be expected to fall.

In 2003, about two million new residential units were built, and on average, about 200,000 occupied units per year are lost due to demolition or disaster.[19] Assuming production in 2004 is the same as in 2003, the percentage of new housing stock will rise by about 1.4 percent and result in the fire death rate falling to 8.8 FDPM, which translates into roughly 12 fewer fire deaths each year. Over five years, the cumulative impact of building 10 million new homes and losing one million older units will reduce the fire death rate to 8.3 FDPM, an improvement of 7.3 percent, and, in the process, reduce the number of fire deaths by about 60 per year, an improvement of only 2.4 percent.

Collectively, these findings suggest that, over the next decade, fire death rates should continue their graceful and gradual decline, with the rate of decline in the fire death rate substantially outpacing the slower rate of decline in the number of fire deaths because of continued population growth. There is, however, a caveat which will in all likelihood exacerbate this phenomenon.

A TROUBLING TRUTH

Increases in household wealth and new home construction do not occur evenly across the nation. To the extent that they do not, the results just provided in the two simulations are optimistic. For example, a hypothetical scenario could be constructed where households in Los Angeles experience a 10 percent increase in household wealth next year, while household wealth is stagnant everywhere else. While algebraically this may be the same as every household in the U.S. having their wealth rise by one-third of one percent, the impact is quite different. This is because Los Angeles has a very low fire death rate, about 2.5 FDPM, and as a result, the increase in wealth will result in relatively few deaths being prevented. By contrast, were an imaginary city equal in size to Los Angeles but with the average fire death rate to enjoy the same rise in household wealth, the number of fire deaths averted would be almost four times as great.

Thus, the distribution of the increases in household wealth matters, and to the extent that areas with high fire deaths experience smaller increases in household wealth and fewer housing starts, this reduces the impact of these variables.

Looking at this same phenomenon slightly differently, in 1979, Maryland had 100 fire deaths, with half of them in Baltimore City. At that time, Maryland had a population of 4.3 million, while Baltimore had a population of 770,000. As a result, the FDPM rate for Baltimore was 61 while it was only 14.4 outside of Baltimore.

Between 1983 and 2001, Maryland experienced a 50 percent decline in its number of fire deaths – in line with the rest of the nation. And, just like in 1983, half of the fire deaths in 2001 were still in Baltimore. However, between 1983 and 2001, the population of Baltimore fell by 125,000 to 645,000, while the population of the rest of the state grew to 5.4 million persons. As a result, the FDPM rate in Baltimore fell from 61 to 39, while in the rest of the state it fell from 14.4 to 6. That is, between 1983 and 2001, the FDPM rate fell by 36 percent in Baltimore but by a whopping 58 percent in the rest of Maryland. As a result, the relative chances of dying in a fire in Baltimore, compared to the rest of the state, went from being less than four times as high to almost seven times as high.

Because increases in wealth do not move in lock-step across the U.S., and because new home construction does not occur evenly in all counties in the U.S. – because not all counties grow at the same rate – many locations, including, but by no means limited to, Baltimore City, can be expected to suffer an increasingly disproportionate number of fire deaths. As a result, their FDPM rates will decline much more slowly than the rest of the nation, and thus their relative fire death rates will precipitously rise. Also, reducing the number of fire deaths in these cities will become increasingly difficult.

Unless this problem is successfully addressed, these locations will increasingly become home to a higher and higher percentage of all U.S. fire deaths. As new homes are rarely built in these areas, building code improvements will not help much, and since wealth gains in these areas are often small, relying on increased wealth to help is also likely to be disappointing. Rather, to overcome this problem, and in the process drive fire death rates and the number of fire deaths down still further, narrowly focused interventions based primarily on the age of housing stock and the wealth of the occupants, within a defined geographic area, are likely to be much more effective.

APPLICATION

This research offers a very powerful, clear-cut, and proscriptive recommendation for saving lives: increase fire prevention efforts where, for example, the housing stock is old and households are poor, with the magnitude of the intervention increasing the older the housing stock and the poorer the area. Doing otherwise wastes resources and withholds help from those who stand to benefit from it most. ▲

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