Poverty and the Risk of Fire

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Key findings

The connection between poverty and elevated fire risk has been documented in multiple studies, some going back as far as the late 1970s and early 1980s.

Factors associated with poverty and elevated fire risk include family stability, crowdedness, the percentage of owner-occupied homes, older housing, the proportion of vacant houses, and the ability to speak English.

Since 1967, the share of the US population living at or near the poverty level has fluctuated between 15 and 20 percent of the population.

Based on the rise in total US population, the number of people living in poverty in the US increased 34.6 percent between 2000 and 2017, with the number of poor people in suburbs and exurbs doubling.

Successful programs to reduce fire incident rates have been introduced in high-poverty areas. The process of community risk reduction, as described in NFPA 1300, shows promise for future success.

Does poverty influence the risk of fire?

We cannot expect to find poverty identified as a factor that contributed to a home fire in fire investigation reports, but its influence is real enough. Consider some real-life incidents that illustrate the impact of poverty conditions on fire, all of which have been drawn from reports to NFPA by US fire departments.

- Unbeknownst to her neighbors, a 24-year-old woman moved into a derelict house, her childhood home, which was boarded up and had no heat. She was attempting to restore the house with her boyfriend, and they were joined by the woman’s four small children. Power was supplied to the house by an illegal electrical hookup. Inside, extension cords and outlet strips snaked throughout the two-story structure; it had all the earmarks of a potential disaster. The fire, when it happened, originated in the knob and tube wiring in the ceiling on the second floor and spread throughout the second level. Arriving firefighters thought it was an abandoned house and, after tearing plywood off the windows, were shocked to find the victims — the woman and her children, ages 6, 4, 3, and 2 — in an upstairs bedroom.

- A 9-year-old boy and his 12-year-old brother were home alone and asleep when a fire started during the late-evening hours in a homemade wood stove. The dwelling consisted of two 40-year-old manufactured homes placed side-by-side. The structure had no emergency escape windows and only one door was operable, as the others had been screwed shut. The occupants were burning unseasoned wood in the woodstove, where a split in the stove pipe allowed built-up creosote and burning materials to drop onto combustible materials in the living room. Wood paneling throughout the interior facilitated rapid fire spread. Heat and smoke woke the boys, but not before the only available door was blocked by fire. Passersby discovered the fire and found the older boy, seriously injured, outside. They alerted the fire department and then attempted to rescue the younger boy, who perished in the blaze. Although the building owner reported that there were two smoke alarms in the home, none were found, and the surviving child said he did not hear an alarm. The structure was totally destroyed.
After the power had been shut off in their manufactured home, a family had been using candles for light. Three 20-lb propane cylinders and four oxygen cylinders were stored inside the structure. On returning home after midnight from an out-of-state trip, the family, consisting of a couple and their four young grandchildren, went to bed, leaving a lantern burning in the kitchen under a table. A short time later, a neighbor heard an explosion and discovered the house in flames. After an unsuccessful attempt to alert and rescue them, he called 911. The home was totally destroyed in the explosion and fire and all members of the family were killed.

This is not to say that poverty conditions invariably lead to fires. Admittedly, the problem of poverty and fire is complex, and the influences of poverty will vary from one situation to another. Addressing this problem in all its complexity represents a substantial policy challenge that will require the involvement of multiple stakeholders within and outside government.

What we know about poverty and fire

The connection between poverty and elevated fire risk has been documented in multiple studies, some as far back as the late 1970s and early 1980s. One study undertaken in 1976 compared census tracts in five large US cities and found strong associations between fire rates and a number of social indices, including poverty, family stability, crowdedness and the percentage of owner-occupied homes (Karter and Donner, 1978). Census tracts are small subdivisions of counties defined by the US Census Bureau. A study in 1981 identified a strong relationship between fire incident rates and income. The study found the major causes of fires in low-income Toledo, Ohio, neighborhoods were intentional fires, smoking, and children playing with fire (Gunther, 1981).

A similar study published in 2001 found that the risk of injury in home fires in the lowest income census tracts in Dallas, Texas, was eight times higher than in high-income census tracts (Isère, et al., 2001). The study looked at census tract data from 1991–1997 and included only one- and two-family houses (no apartments or mobile homes). The census tracts were then grouped by median income. The lowest income tracts (median income below $20,000) had a relative risk of injury 8.1 times higher than the highest income tracts (median income above $80,000), a relative risk of fire 2.5 times higher, and a relative risk of injury per 100 fires 4.1 times higher. The injury rate in census tracts with a median income below $10,000 was 20 times higher than the injury rate in the highest income tracts. Of the house fires in census tracts with incomes below $40,000, 80 percent were intentionally set. The lowest median income houses were least likely to have smoke alarms installed. The study concluded by recommending that high-risk populations be identified and targeted for special prevention efforts, including smoke alarm installation, fire safety education, and sprinkler system installation.

Another study, published in 2006, examined the relationship between older housing, low income and risk of injury in home fires (Shai, 2006). Using census tract data from Philadelphia, Pennsylvania, between 1993 and 2001, the researchers found that, in addition to low income and older housing, the proportion of vacant houses and ability to speak English were significant predictors of home fire injuries.

Research has been conducted with county-wide data across the United States, as well. One recent study examined poverty concentration in relation to fatality outcomes for six specific injury causes, including exposure to smoke or fire (Karb et al, 2016). Mortality rates were shown to be higher in the counties with higher concentrations of poverty. In 2012, the death rate due to exposure to smoke in fire in communities with 20 percent of the population or more below the poverty line was almost five times higher than in communities with less than 5 percent of the population below the poverty line (12.4 vs. 2.6 deaths per million population). Although the rates declined for both sets of communities from 1999 to 2012 (the time period studied), the decrease was greater for the more affluent counties.
This is not just an urban problem, but the connection between poverty and home fires in rural areas has not been as thoroughly researched in recent years. A US Fire Administration study published in 1982 examined fire death data from 1974 through 1978 and found that while the patterns in rural fire deaths in northern states varied with differences in climate, the pattern in the southern states was more tied to rural poverty (Gunther, 1982). Additional research is needed to examine rural poverty in relation to fire risk and identify unique patterns and potential areas for intervention.

**Comparing US Census data and fire incident reporting**

The relationship between poverty and fire is also suggested when examining county-level poverty data from 2014 through 2018 from the US Census Bureau in relation to residential fire deaths by state over the same period from the National Vital Statistics System (WISQARS, 2020). The map on the left in Figure 1 highlights the counties with the highest poverty rates in blue, while the map on the right outlines the 15 states with the highest home fire death rates, with the 10 states with the highest rates in red. Even at this relatively crude level, matching county and state data sets, the figure shows how the high poverty counties in the south overlay the highest fire death rate states. Poverty pockets in the Great Plains also match up with the states with high fire death rates.

One can take a closer look at the link between poverty levels and fire incident rates by comparing both within census tracts. Census tracts are intended to be generally homogeneous in terms of their population characteristics and have an average population of 4,000 people.

For this report, the authors prepared a comparison of poverty rates and fire incident rates for Cook County, Illinois. Cook County, which includes Chicago, has a population of over 5 million people and is the second-most populous county in the US. Fire incident rates (fires per 1,000 population) were calculated for each of Cook County’s 1,246 census tracts using fire incident data from 2009 to 2018 from the National Fire Incident Reporting System (NFIRS). The data was restricted to fires in homes (one- and two-family dwellings and apartments). Poverty rate data was obtained from the US Census for 2014 to 2018.

**Figure 1 — Comparison of high-poverty rate counties and high fire death rate states 2014–2018**

(State map source: https://en.wikipedia.org/wiki/File:Map_of_USA_with_county_outlines.png)
NFIRS, the world’s largest national database of fire incident information, is used by participating US fire departments to uniformly report details on all types of fire to which they respond. For this analysis, we restricted the cases to fires that extended beyond the stage referred to in NFIRS as “confined fires” (e.g., fires confined to cooking pots and fireplaces that rarely result in serious loss).

The Census Bureau collects data for individuals and households in surveys conducted at various time intervals. For example, the Decennial Census takes place every decade, while the American Housing Survey is done annually. The survey data reported for each census tract includes demographic information such as age, sex, race, educational attainment, employment status, income and poverty, work experience, family living arrangements, etc.

Each fire incident includes the address where the fire occurred. We geocoded these addresses and assigned them to their respective census tracts. The mapping of the data for Cook County’s 1,246 census tracts is shown in Figure 2 and indicates that higher fire incident rates are likely to occur in areas with higher poverty rates. This link needs further investigation. A more detailed statistical analysis is being considered for future work.

Figure 2 — Poverty and home fire incident rates in Cook County, Illinois

The studies mentioned above, as well as anecdotal evidence, point to several of the risk factors that increase fire incident rates in poorer communities. Substandard housing, outdated or illegal electrical service, crowding, lack of affordable childcare, and arson are some of the potential direct and indirect mechanisms that can influence the risk of home fires and resulting injuries and deaths.

Poverty trends

Since 1967, the share of the US population living at or near the poverty level has fluctuated between 15 and 20 percent. In 2019, the poverty threshold for a household of four was an annual income of $25,750. (Add or subtract $4,420 for each additional person.) That threshold applies nationwide — so it does not take into account variations in the cost of living (including housing, taxes, and medical care). The size of the population living at 125 percent of the poverty threshold is often used as a broader definition of the very poor. The poverty threshold is determined each year by the US Census Bureau for the previous year.

Figures 3 and 4 show the trends over the past 60 years. As Figure 4 shows, the number of people living in poverty has increased over time, even as the percentage of the population under the poverty level has remained fairly steady due to the rising US population, as shown in Figure 3.
The State of the Nation’s Housing 2019, published by the Joint Center for Housing Studies at Harvard University, reports that the number of people living in poverty in the US increased 34.6 percent between 2000 and 2017 (JCHS, 2019). Given the increase in the total population over the same period, this results in a reported increase in the percentage of people in the US living in poverty from 12 percent to 14 percent.

Over that period, the number of high-poverty census tracts, defined as those with at least 20 percent of the residents living below the poverty level, increased by 46 percent. By 2017, more than 25 percent of the census tracts in the country could be defined as high poverty. Although most poor people and poor neighborhoods are in dense urban areas, over the study period, the number of poor people and high-poverty census tracts in suburbs and exurbs doubled.

Source: https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-people.html (Table 6)
Although the poverty rate in the US declined slightly by 2019, the Center on Poverty and Social Policy at Columbia University recently projected that COVID-19 could push the nation’s poverty rate to its highest level since 1978 should unemployment reach 30 percent, and to levels similar to the 2008 recession if the unemployment rate returns to about 10 percent (Parolin and Winer, 2020).

**Challenges in addressing poverty risks**

A variety of codes and standards address a wide range of issues related to fire safety in homes. These include regulations regarding the installation of smoke alarms in homes, as well as relatively recent requirements for automatic suppression systems in new housing. Flammability standards limit the opportunity for the furnishings and contents of a dwelling, as well as its building materials and finishes, to contribute to fire and smoke development and spread. In addition, exiting requirements address safe egress from homes under fire conditions, while standards for electricity and electrical products protect consumers from possible fires and electrical hazards. However, there are challenges reaching poor populations with these life-saving methods.

Many poor families cannot afford safe housing that is equipped with properly installed smoke alarms and are even more unlikely to live in homes protected by residential sprinklers. When utilities are shut off, people resort to using candles, sometimes make unsafe connections to electrical power sources, or use makeshift heating devices. Safety standards that apply to new furniture or equipment can take years to impact homes that rely on used or hand-me-down products.

Codes and standards accordingly represent an important societal commitment to reducing the risk of fire through safety intervention. However, it’s important to recognize that a variety of factors associated with economic disadvantage can complicate the ability to realize the protections afforded by fire safety codes and standards. Special efforts will be needed to extend these protections to the most vulnerable in society.

**Success stories**

While addressing poverty and its impacts on fire safety are a challenge in any community, South Carolina provides an instructive example of how to approach this challenge. In 1988, South Carolina had the highest fire death rate in the country after ranking second in each of the two prior years (Hall, 1991). South Carolina also had the nation’s eighth-highest poverty rate (1979 data). To combat their fire problem, the state launched a public education program focused on smoke alarm installation called “Get Alarmed, South Carolina” (USFA, 1991). During this two-year program, more than 25,000 smoke alarms were installed throughout the state, and more than two-thirds of the fire departments in the state were involved in the installation and maintenance programs for smoke alarms in their jurisdictions.

By 1991, South Carolina’s death rate had dropped from highest to sixth highest in the nation as a result of a 48 percent reduction in deaths and a 49 percent decrease in the fire death rate. Progress continued in 1992 but was briefly curtailed by a temporary suspension of funding for the program in 1993. For the period from 1981 through 1985 to the period from 2012 through 2016, the state’s fire death rate dropped 63 percent and its ranking fell from second place to eighth (https://www.nfpa.org/News-and-Research/Data-research-and-tools/US-Fire-Problem/Fire-deaths-by-state — accessed October 2020).

A similar program launched in Tennessee in 2012 resulted in more than 100,000 smoke alarms being installed in high-risk areas in the state. By 2015, the program was credited with saving 121 lives, including 36 in 2015 alone (NFPA, 2016). The state experienced a 28 percent drop in fire deaths from the time periods from 2006–2010 to 2011–2015.

Other programs have been implemented in low-income areas to address fire safety without addressing the underlying socioeconomic issues, including poverty. Many of these programs focus on the installation of smoke alarms in homes without them. SAFE KIDS Coalition of Southeastern Pennsylvania, Children’s Hospital of...
Philadelphia, and Philadelphia’s fire department and school district undertook a study to evaluate the impact of a school-based fire safety program in two schools in a poor, urban, minority community in the city (Hwang, et al., 2006). The intervention group received a home visit from firefighters who installed smoke alarms and provided a home escape plan on a dry erase board. Four weeks later, the children in the intervention group were found to be more likely to report a written fire escape plan and to have a designated meeting place outside the home than children in the control group. Evaluation of the program with regard to a reduction in fire deaths and injuries was outside the scope of this study. This program differed from other school-based programs in that the fire safety training was directed at parents, not the children, but it did show that a program directed at parents could influence the fire safety knowledge of their school-age children.

Where do we go from here?

Fire departments cannot directly impact the socioeconomic challenges that face the communities they serve, but their unique understanding of local hazards affords them a vital role in risk mitigation efforts. Through their everyday work, fire departments are well-positioned to identify and prioritize specific local risks and contribute to effective, community-specific intervention strategies through the process of community risk assessment.

NFPA’s focus on community risk reduction (CRR) includes a new standard published in 2020, NFPA 1300, Standard on Community Risk Assessment and Community Risk Reduction Plan Development. In addition, NFPA has created an innovative digital dashboard called CRAIG 1300™ to assist communities using the standard to drive local risk assessments. The dashboard includes maps, charts, and graphs that visualize local community data in relation to relevant profiles in NFPA 1300, such as demographics, geographic features, economic factors, and past loss history. These profiles can provide a snapshot of the risks and capacities in the community. With details about the population characteristics that can contribute to risk, local communities can better allocate their resources to develop programs to address fire safety needs.

Fire is only one of the risks faced by those in low-income groups. Issues related to substandard housing, overcrowding, food insecurity, and neighborhood safety may take higher priority in their everyday lives. The recent impact of COVID-19 on employment and long-term health may increase these challenges, resulting in higher rates of poverty and increased homelessness, at least in the short term. All of these issues will impact community resources, with demands for assistance increasing while tax revenues may be declining.

Community-based prevention initiatives, such as those in South Carolina since the 1990s and Tennessee in the past decade, show that it is possible to address local risks and reduce fire incidents and the resulting injuries and deaths in low-income communities, even if the fire safety community cannot itself directly impact poverty. A community risk assessment that identifies the areas of a community that are at the highest risk of fire can also identify the challenges the people in that community face.

There are clearly challenges for the fire service and their partners when attempting to mitigate the full range of fire-related hazards in low-income communities. It is important for such programs to focus on issues relevant at the local level that are most likely to have a practical impact. Smoke alarm installation programs have been very successful in reducing fire risk in targeted communities.

But improving high quality codes and standards, such as flammability standards and smoke alarm and sprinkler requirements, while important protection for those they reach, will have little impact in the short term on fire risk linked to poverty. The challenge is to tackle the fire problem even as significant economic and social influences await future resolution. Although they are linked, we cannot wait.
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References


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