



Comparing the performance of residential fire sprinklers with other life-safety technologies

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ABSTRACT

Residential fire sprinklers have long proven themselves as life-safety technologies to the fire service community. Yet, about 1% of all one- and two-family dwelling fires occur in homes protected by sprinklers. It has been argued that measured sprinkler performance has ignored factors confounding the relationship between sprinkler use and performance. In this analysis, sprinkler performance is measured by comparing 'like' structure fires, while conditioning on smoke detection technology and neighborhood housing and socioeconomic conditions, using propensity score matching. Results show that residential fire sprinklers protect occupant and firefighter health and safety, and are comparable to other life-safety technologies.

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1. Introduction

In 2007, 300,500 residential fires in the U.S. resulted in 2350 civilian deaths, 9650 civilian injuries, and \$6.2 billion in direct property damages (NFPA, 2008). These numbers have been fairly constant over the last decade. Back in 1975, in an effort to limit fire-related fatalities, injuries, and economic damages, the National Fire Protection Association (NFPA) produced NFPA standard 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, to ensure fire sprinklers installed in residences would limit flashover and allow for occupant egress and rescue, while maintaining system affordability (Madrzykowski and Fleming, 2008). Since then residential fire sprinklers have proven themselves as life-safety technologies to the fire service community, but homeowner adoption has been remarkably slow. The U.S. Fire Administration (USFA) advocates that all homes be equipped with smoke alarms and automatic fire sprinklers (USFA, 2008a). Still less than 1% of all homes involved in fires are protected by an automatic fire sprinkler system (Butry et al., 2007).

Only recently have residential fire sprinklers been shown to be cost-effective for homeowners, as installation costs have fallen and safety performance has been demonstrated statistically system (Butry et al., 2007; Butry, 2008). Earlier sprinkler research (Harmathy, 1988; Juas and Mattson, 1994; Ruegg and Fuller, 1984) suggested mixed economic performance, at best, which may

explain the low historical adoption rate. Thus it was only recently that the International Code Council (ICC) passed a modification (RB64) to the International Residential Code (IRC) requiring all new one- and two-family dwellings to be equipped with a fire sprinkler system beginning in 2011. The IRC is a set of model codes currently in use by 49 states and the District of Columbia.

While recent research has demonstrated that residential fire sprinklers yield reductions in fatalities, injuries, and property damage, it relied on the use of a national estimates approach, and ignored underlying differences between sprinklered and non-sprinklered homes related to structural characteristics, construction materials, demographical factors, and the presence of other fire safety technologies. The national estimates approach, as detailed in Hall and Harwood (1989), scales individual fire incidents reported to the USFA National Fire Incident Reporting System (NFIRS) by participating states with data provided by the NFPA.¹

Producing national estimates to compare fatalities and injuries in sprinklered homes with non-sprinklered homes is possible, but scaling incident data parsed into groupings related to sprinkler type, dwelling age, and presence of other fire safety technology (i.e.,

¹ Reporting to NFIRS is voluntary (at least at the national level), so using individual incident data to produce nationwide statistics may not be truly representative of fire problem in the United States. Therefore, USFA and NFPA rely on data produced from an annual survey (based on statistical sampling) conducted by NFPA of fire departments across the country to estimate the number of fire incidents, fatalities, and injuries for the country. This data is used to scale individual fire incident statistics, reported in NFIRS, into nationwide statistics—for example, to estimate the number of fatalities that occurred in one- and two-family dwellings without sprinklers. The USFA and NFPA regularly use this method to construct and publish detailed fire statistics on an array of subjects, nationwide.

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