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Review

Social and economic characteristics as determinants of residential fire risk in urban neighborhoods: A review of the literature

Charles R. Jennings*

Department of Security, Fire, and Emergency Management, John Jay College of Criminal Justice, The City University of New York (CUNY), 445 West 59 Street, New York, NY 10019, USA

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ABSTRACT

The article reviews the literature on social, economic, and building stock characteristics as they relate to residential fire risk in urban neighborhoods. The article updates a previous review of the literature, and provides an overview of recent activity and emergent research directions. A multidisciplinary review of the literature includes sociology, geography, urban planning, and interdisciplinary studies. Whereas multiple regression modeling was the most prevalent technique, the adoption of geographic information systems and advancement of theories on fire risk have deepened and expanded the techniques used, particularly in the area of geography and spatial statistics. Despite recent progress, the state of research continues to be underfunded and isolated within disciplines, frustrating broader application of findings to actual preventive activity by governments. The article also offers suggestions for further research.

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1. Scope

This paper will review the literature on residential fire risk, and its relationship to social and economic characteristics. Direct losses from fires account for between .05 and .22 percent of GDP among industrialized nations [1]. Residential fires are a worthy area of inquiry, consistently accounting for roughly 75 percent of fire casualties in the United States [2]. A similar profile of casualties occurs in other nations as well [3]. Although this review is limited to English-language literature and emphasizes the United States, its findings are more widely generalizable across developed urban

areas to the degree that underlying social dynamics and the built environment are common across nations. Indeed there is much common work being done across several English-speaking countries. This article is intended to update a previous review of the literature [4].

This review will, of necessity, discuss complementary literature that predates some of the key research in this area. The review will emphasize inquiries from fields of sociology, urban planning, geography, and interdisciplinary studies. The literature will be limited to residential fires, and will deal primarily with intra-city analysis from the perspectives of the neighborhood and household level.

There is a sizable literature from the public health and medical fields dealing with fire risk as it pertains to casualties. However, this literature will not be reviewed. Similarly, this review will not include literature related to protective measures in the built

* Tel.: +1 646 557 4638.

E-mail address: cjennings@jjay.cuny.edu

environment, or engineering dimensions of building codes or fire behavior. From a public policy perspective, preventive activities will be discussed only as they offer logical outcomes of the fire risk-related research within this review. As such, the engineering literature on fire extinction is not included in this review.

The paper begins with a brief history of research on fire and its effects on communities and individuals, and then reviews the literature from its inception through the present, with a distinction between eras in research and analysis. Theories of fire risk are reviewed, including a review and commentary on the role of race in determining fire risk. The paper closes with a discussion of future research directions and a discussion of policy interventions arising from scholarly research in this area.

2. The impetus for understanding fire in the built environment

Fire in the built environment is a topic of sustained interest to society, and much of the seminal work in this area arose from concerns of the insurance industry and the prevention of urban conflagrations. Great urban fires destroyed parts of many U.S. urban centers in the late nineteenth and early twentieth century. The response to these fires took place mainly in the realms of engineering and public administration, concerned with fire safety techniques in building design and practice, and planning regulation and fire protection services, respectively [5,6]. Despite this long history, research into fire in the community residential context has remained fragmented and isolated by discipline.

Indeed, fire is both a social and physical phenomenon. Fire transcends the individual, and simultaneously affects the built environment, which includes knock-on effects for the economic livelihood of communities and viability of individual buildings and their surrounding neighborhoods as effective locations for healthy and productive human activity, including both societal reproduction and economic sustainment and progress.

In the years following the control of the conflagration problem, steady progress was made in the reduction of fire losses mainly in non-residential properties – such as business and manufacturing occupancies – that were subject to increased regulation from government, insurance, and industry forces. Despite these areas of progress, residential fires continued to exact a significant toll on people who reside in these structures, and gathered additional attention.

2.1. The history of residential fire research

The understanding of residential fires has traditionally received limited and sporadic attention from a diverse set of scholarly disciplines. As a consequence, much work was done in disciplinary isolation, and with little or no follow-up. This section of the paper will review the history of funding for social research into residential fires, and describe the disciplinary and methodological emphasis of these early efforts.

2.1.1. US federal government role

If there is a primary catalyst for stimulating research into residential fires in the United States, it is the publication of *America Burning*, the 1973 report of the National Commission on Fire Prevention and Control [7]. This report, authored by a Presidentially-appointed panel drawn from broad representation of stakeholders in the fire problem, was unusually effective, leading to a reorganization of the then-federal government's approach to the urban fire problem, and publicly recognizing the dearth of knowledge upon which to design interventions to further reduce the fire problem.

However, this report and the Commission were the product of the Fire Research and Safety Act of 1968 (PL 90–259). The passage of this Act was surely influenced by the surge in fires that occurred in the late-1960s associated with racial unrest, urban economic decline, and notable high-profile fires. In his signing statement, for the Act creating the Commission, President Lyndon Johnson cited the high fire loss statistics for the US, antiquated firefighting techniques, and the need to begin a coordinated federal fire research program [8]. The Commission's preliminary report suggested that fires were comparable in cost to crimes, and therefore “warrants the significant attention of the public and governments at all levels” [9].

Institutionally, the National Fire Prevention and Control Administration (NFPCA) was formed within the Department of Commerce following federal legislation in 1974. The Department was home to the federal government's fire laboratory, the then-National Bureau of Standards [10]. Notable achievements of this agency included development of a national system for collecting fire data from local fire departments, and a well-funded interdisciplinary research program was initiated to better understand dimensions of the fire problem. Within a few years, the NFPCA was reorganized into the United States Fire Administration, and around the same time, its funding was cut, drastically reducing social research into the residential fire problem. A similar initiative to fund scholarly fire research was never repeated at the same scale.

2.1.2. Limitations of early research

As a consequence of federal funding appropriated in the brief span between formation of the NFPCA and its subsequent reorganization and budget reductions, much of the founding work in this area was completed over a short time span, and was understandably exploratory in nature [4].

Because much of this research was done concurrently, there was limited opportunity to learn from previous efforts. Additionally, reliable national data were just becoming available in the United States, with the advent of the National Fire Information Reporting System (NFIRS).

Additionally, analytic and computational techniques at this time predated emergence of personal computers and modern geographic information systems, which greatly limited the ease with which data sources could be integrated. Studies examining geographic dimensions of the fire problem, and the relationship between social, economic, and building stock characteristics were labor intensive and costly, often requiring hand mapping.

Many of these early studies were necessarily descriptive in nature. Some studies used statistical correlations between fires and various characteristics of the population and building stock. More ambitious studies utilized multiple regression to explore the connections between these characteristics and various conceptualizations of fire risk. Some studies were purely explanatory and theoretical, while others were informed by prevailing beliefs or hypotheses of the day.

3. Review of seminal research 1970–2000

These early studies identified the distinct finding that fires were not inevitable, nor were they “acts of god” – rather, they could be prevented. Additionally, the incidence or burden of these fires was not uniformly or randomly distributed – there was systematic variation in the nature and severity of the fire problem across urbanized areas. Ecological approaches to studying fire risk were used to develop meaningful hypotheses [11]. These early ecological approaches to fire risk arose in the urban planning literature, often in association with housing conditions and neighborhood population density. Examples of such works include

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