Using a Geographic Information System to Guide a Community-Based Smoke Detector Campaign

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Abstract

Smoke detectors are proven effective in providing early warning to occupants in residential fires. We used a geographic information system (GIS) to identify areas of greatest need to guide a community smoke detector campaign in Hartford, Connecticut. Computerized fire incident data for all residential fires from 1992 to 1994 were collected from the Hartford Fire Department. PC ArcView was used to geocode street addresses and to categorize census tracts into quartiles by the frequency of house fires occurring within them. Population, income, and housing data by census tract came from the 1990 US census. There were 942 house fires resulting in 41 civilian injuries, 9 civilian deaths, and 282 firefighter injuries. We identified four census tracts with the highest frequency of house fires in homes without functional smoke detectors. In census tracts with a high frequency of house fires a large proportion of those homes either had no smoke detectors or had smoke detectors that were nonfunctioning. Several standard GIS functions were important in the analysis and display of data. We geocoded the street address of over 900 house fires, which allowed us to view the spatial distribution and identify high-risk areas. Each point carried additional data on the characteristics of each fire. We were able to group house fires by census tract and relate them to other geographic information such as population, economic, and housing data. In November 1997, a community fire safety coalition installed more than 75 new smoke detectors, and tested and replaced batteries for existing detectors in one high-risk census tract. This approach is useful for other communities interested in conducting targeted smoke detector campaigns.

Keywords: injury, house fire, smoke detectors

Introduction

Each year in the United States an estimated 5,000 people die and an additional 30,000 are hospitalized due to residential fires (1). Inhalation of carbon monoxide and smoke causes the majority of these deaths (2). Smoke detectors are proven effective in providing early warning to occupants in residential fires (3,4). Many organizations, including local fire and health departments, conduct smoke detector promotion campaigns, often targeting high-risk areas such as low-income neighborhoods with high proportions of children and/or elderly residents (5). Recent studies have noted the increased use of smoke detectors in these areas (6,7) and one program found that most homes in the

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target area already had a detector (8). The purpose of this study was to demonstrate the usefulness of a geographic information system (GIS) in analyzing a variety of data so as to identify areas in greatest need of a community smoke detector campaign to be run in Hartford, Connecticut.

Methods

Computerized fire incident data for all residential fires from 1992 to 1994 were collected from the Hartford Fire Department. Data included temporal characteristics (hour, day, month, year), extent of flame and smoke damage, type of residence (height, construction type), injured persons, method of alarm, response time, street address, cause, room of origin, and smoke detector use (present and working; present and not working; not present; unknown). PC ArcView (a GIS computer program) was used to geocode street addresses and to categorize census tracts into quartiles by the frequency of house fires occurring within them.

The street addresses of schools, firehouses, community centers, and churches were obtained from a standard telephone directory for Hartford, and were geocoded. Population, income, and housing data by census tract came from the 1990 US census.

Results

There were 942 house fires resulting in 41 civilian injuries, 9 civilian deaths, and 282 firefighter injuries. House fires were more likely to occur in more densely populated census tracts (Figure 1). Figure 2 identifies four census tracts with the highest frequency of house fires in homes without smoke detectors. Figure 3 identifies one of the census tracts with the highest frequency of house fires in homes with smoke detectors present but not working. Finally, Figure 4 identifies the location of potential collaborators in a smoke detector promotion campaign within this census tract.

On November 22, 1997, 35 volunteers from across the state gathered at Fire Station House #7 in the north end of Hartford to install smoke detectors in Project Get Alarmed. More than 75 smoke detectors were distributed door to door by firefighters, police officers, teenage volunteers from Explorer posts of both departments, as well as volunteers from Connecticut Children's Medical Center and Connecticut SAFEKIDS. Depending on families' needs, volunteers tested detectors, replaced batteries, or installed new smoke detectors. Along with the families that were affected directly, numerous people were reached through the extensive media coverage the event gained that day. Similar activities are scheduled to reach the other high-risk areas within the city.

Discussion

Interrelated approaches including control of ignition sources, early warning and minimizing losses during fires, and provision of care after fires are required for the reduction of injuries from house fires. Smoke detectors and home sprinklers are proven strategies for early warning and rapid suppression of residential fires, but they have not been universally adopted. Approximately 80% of fire-related deaths occur in homes without working smoke detectors (9).

The results of our project indicate that in census tracts with a high frequency of

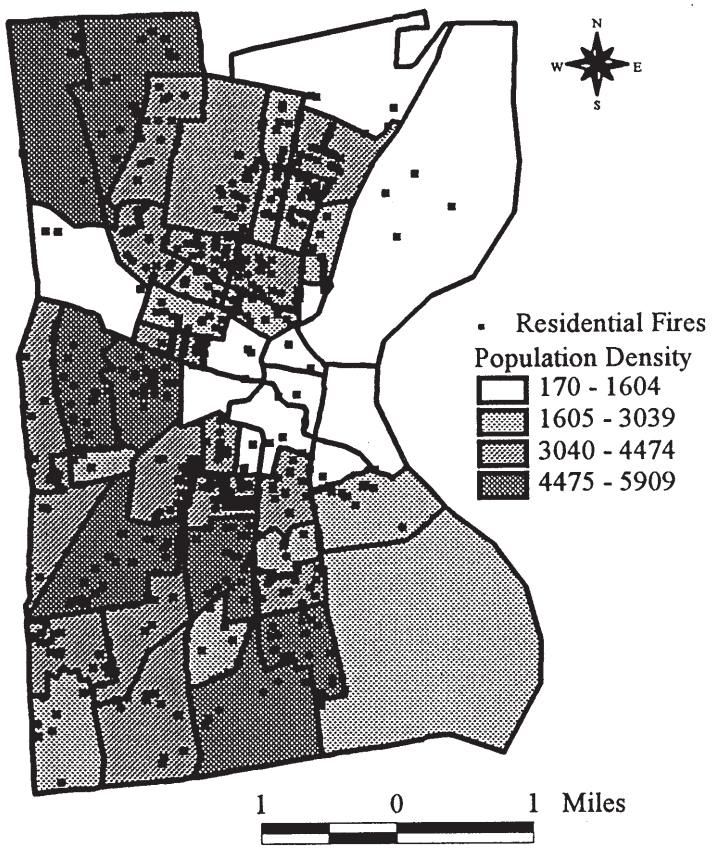

Figure 1 Residential fires, 1992–1994 (n=942), and population density by census tract, Hartford, CT.

house fires, a large proportion of those homes either had no smoke detectors or had smoke detectors that were nonfunctioning (presumably because of an absent or dead battery). Several standard GIS functions were important in the analysis and display of data. For example, we were able to quickly and easily geocode the street addresses of over 900 house fires, which allowed us to view the spatial distribution and identify high-risk areas. Each point on the map (indicating where the house fire occurred) carried additional data on the characteristics of each fire. Another GIS function performed easily was the grouping of house fires by census tracts and relating them to other geographic information such as population, economic, and housing data. Finally, we were able to show specific geographic areas in need of new smoke detectors and/or battery replacements, as well as the location of fire department stations, community agencies, churches, and schools that can be recruited to participate in a fire safety campaign. This approach is useful for other high-risk communities interested in conducting smoke detector campaigns.

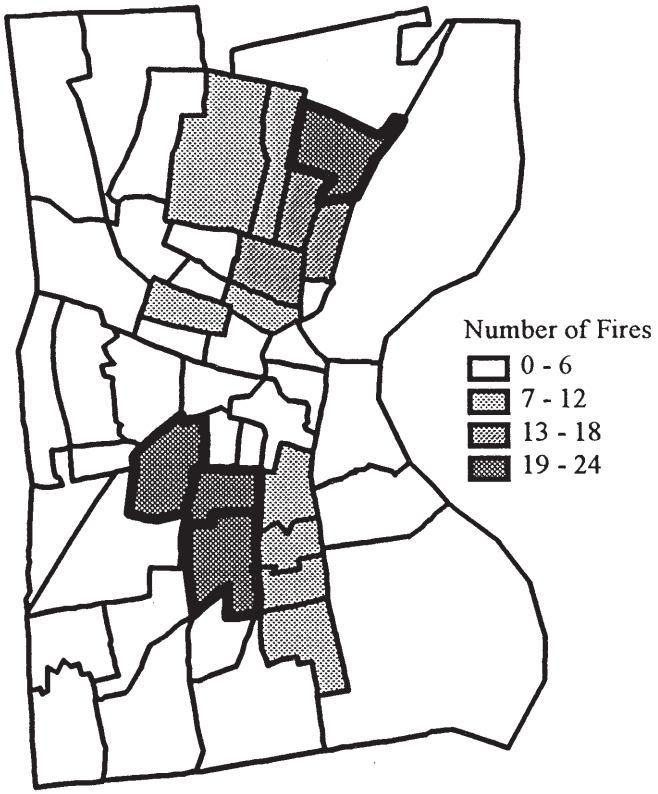

Figure 2 Residential fires, smoke detectors not present (n=286), by frequency and census tract, Hartford, CT.

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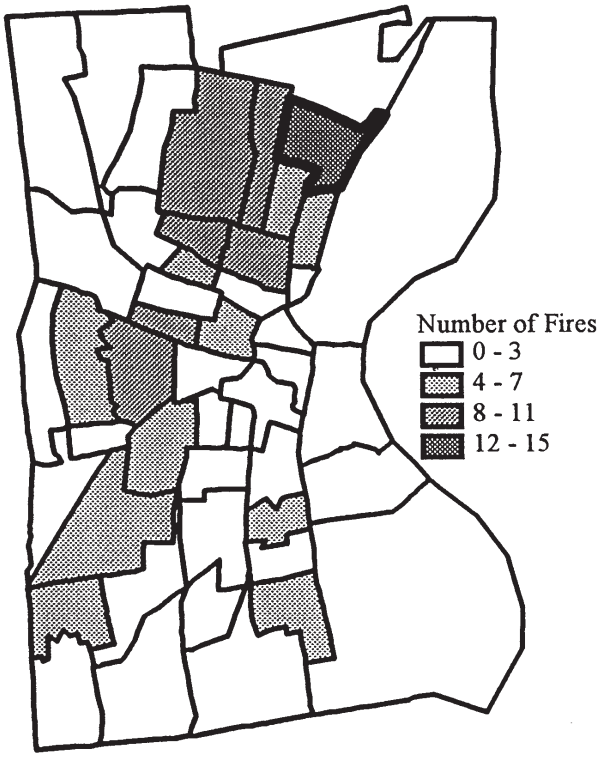

Figure 3 Residential fires, smoke detectors present but not working (n=151), by frequency and census tract, Hartford, CT.

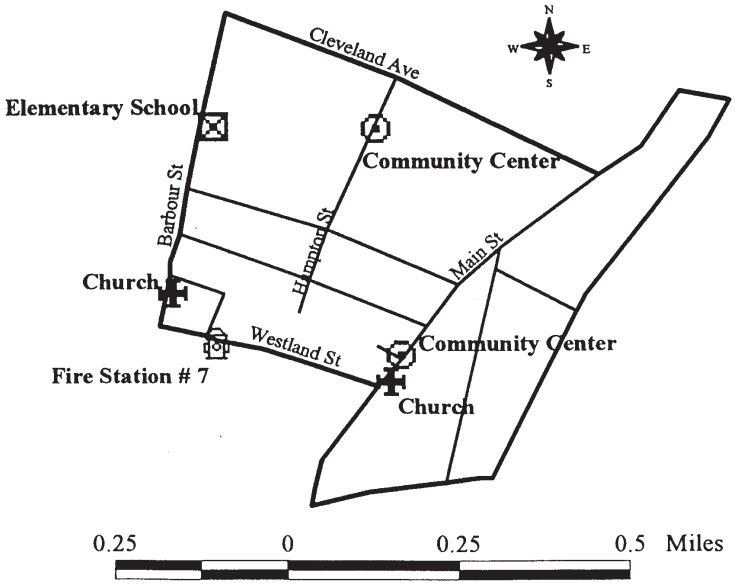

Figure 4 Potential collaborators for a targeted smoke detector campaign, census tract 10.

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