JBUR 5481 No. of Pages 6
ARTICLE IN PRESS
burns xxx (2018) xxx–xxx

Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.elsevier.com/locate/burns

Families with newborns: Using a cartographic model to identify those who are at risk for fires

Carlee Lehna [a,*], *Stephen Furmanek* [a], *Carol Hanchette* [b]

[a] University of Louisville School of Nursing, Louisville, KY, United States
[b] University of Louisville Department of Geography and Geosciences, Louisville, KY, United States

ARTICLE INFO

Article history:
Accepted 1 February 2018
Available online xxx

Keywords:
Burns
Geographic information systems
Prevention
Infant

ABSTRACT

We assessed whether a home fire safety intervention targeting families with newborn children in Jefferson County, Kentucky, reached those at severe risk using a cartographic model. Demographic and economic factors of 61 families were compared by census tract. Using geographic information systems (GIS), families were assigned a risk level (low, medium, high, or severe) based on the risk model. Families who participated differed from census tracts in that of being minority race (p=0.01). The median risk category of the families was medium risk. Sixty-five tracts were identified as high or severe risk and in need of future intervention. The model yielded a way to prioritize at-risk families. GIS is a useful tool for examining whether prevention interventions reached those in the severe risk category.
© 2018 Published by Elsevier Ltd.

1. Introduction

Burn injuries disproportionately affect children and adolescents [1], and are costly injuries among this vulnerable group. The mean cost of hospitalization and follow-up during recovery of a burn injury among children has been estimated at $83,535 per patient [2]. As infants and children are reliant on their parents, home fire safety (HFS) and burn injury prevention interventions that target either expecting parents or parents of newborns are vital to preventing costly and potentially deadly burns, especially among new parents who do not have experience with children. In a study in British Columbia, Clare et al. found that a fire safety preventions program targeting those at higher risk in the community was effective in reducing the burden and incidence of home fires [3].

Geographic information systems (GIS) are increasingly used to inform prevention and outreach efforts. Two different studies in Alachua County, Florida, used density mapping to identify areas of increased cancer incidence [4] and areas with low access to health care and social resources [5]. Another study used Local Indicators of Spatial Association (LISA), a GIS technique that identifies clusters within geographic data, and multilayered maps to inform cancer screening efforts for South Asians residing in Ontario, Canada [6]. One method, cartographic modeling, was used to synthesize risk factors and produce a risk model for childhood lead poisoning in North Carolina [7].

GIS has been used to identify at-risk areas in fire prevention programs through mapping of children's hospital burn injury discharge data [8]. Higher risk was observed in children from New South Wales, Australia living in rural locations, some areas closer to the coast, and in some metropolitan areas [8]. GIS also has been used to evaluate fire alarm installation programs in North Carolina by using geocoded addresses to merge databases containing intervention targets and reported fires [9]. In Baltimore, GIS was used by researchers in

* *Corresponding author at*: School of Nursing, University of Louisville, 555 S. Floyd St., Louisville, KY, 40202, United States.
E-mail addresses: c0lehn01@louisville.edu (C. Lehna), stephen.furmanek@louisville.edu (S. Furmanek), carol.hanchette@louisville.edu (C. Hanchette).
https://doi.org/10.1016/j.burns.2018.02.002
0305-4179/© 2018 Published by Elsevier Ltd.

collaboration with the city fire department to examine the number of homes in need of home visits for fire alarm installation, to determine total visits, and to use database integration for fire prevention planning [10].

In the current authors' previous research with older adults, a seven-risk factor model (i.e., age greater than 65 years, nonwhite race, below high school education, socioeconomic status, home value, home ownership, and year home built) [11] was tested with large urban sample of older adults who had participated in a comprehensive burn prevention program which included didactic education in either a local community center or the home and home visits [12]. The risk factors of median year built, non-high school education, and percent African American explained the most variance. In the 46 census tracks where this program was implement, 78% were at high or severe risk of burn injuries [12].

Following this model development and evaluation approach, the authors tested a fire risk model to determine the best predictive model for families with newborns. This model included the risks of year home built, home value, poverty status, non-high school education, age less than five years, male sex, black race, and low parental age [13,14]. Median year built, percent of the population that was African American, and non-high school education risk factors explained 60% of model variance [13,14].

The use of geographic prediction models to examine existing fire prevention efforts is underutilized. Research using GIS has examined children's hospital discharge data for burn injuries in Australia [8] and fire alarm installation programs in the United States [9,10]. There is a gap in research concerning the development and use of predictive models to determine where prevention activities should be focused to reach at-risk communities. With limited resources, it is imperative that interventions not only improve HFS knowledge, but also reach those in at-risk communities.

The purpose of this study was to use a geographical risk model to investigate whether a fire prevention intervention [15] had targeted areas at severe risk for home fires in Jefferson County, Kentucky. A secondary purpose was to determine which at-risk census tracts were not targeted and needed future HFS interventions. Cartographic fire risk models were used to examine the impact of HFS knowledge interventions in an older adult population in Jefferson County, Kentucky [11,12]. Using the template developed previously, we examined whether or not this intervention for parents of newborns was successful in reaching those living in areas at high risk for a home fire.

2. Methods

2.1. *Design*

We conducted secondary analysis of existing cross-sectional data from a HFS intervention for families of children with newborns [15–17]. Our goal was to determine which at-risk census track parents from the intervention originated (low, medium, high, or severe) and to determine how many high or severe risk census tracks were left to target.

2.2. *Sample*

2.2.1. *Participant data*

Participants were excluded from this study if they did not live in Jefferson County or did not have a valid address. The mean income, mean year home built, mean home value, minority status, and newborn sex were calculated for all participants for comparison to census data to determine whether the sample was representative of its census track. Minority status and newborn sex were expressed as percentages.

2.2.2. *Census data*

Census tracts were excluded from comparison if they contained no intervention participants. Mean values for participant census tracts were calculated for median year home built, median home value, and median income. The total population of each of the participants' census tracts was obtained. Next, percentages of the population were calculated for those: with less than a high school education; under five years of age and that were male; of minority race; and women aged 15–19 who had given birth in past year.

2.3. *Procedure*

Using a cartographic risk model of Jefferson County made by synthesizing eight risk factors as identified in literature from census tract-level data from the American Community Survey 2008–2012 5-year estimates [14]. Risk factors were year home built, home value, poverty status, low education level, age less than five years, male sex, black race, and low parental age [14]. Census data for each variable were placed into quartiles, and each quartile received a risk category score (see Table 1 for a glossary of terms). Next, risk category scores were summed to produce a total risk score which was split into quartiles based on levels of risk: low, medium, high and severe (see Fig. 1). This model was validated using fire incidence data [14]. Risk levels of interest were high and severe risk. The University of Louisville Institutional Review Board (IRB) approved the use of data from the parent intervention study [15] for this study at the census tract level.

2.3.1. *Census tract risk level assignment*

ArcMap 10.1 software [18] was used. All participants' addresses were geocoded and matched to census tracts by a spatial join (see Table 1). Participants' risk levels were assigned based on the risk level of the census tract in which they resided, i.e., low, medium, high or severe risk (See Table 1). These risk categories were scored on an ordinal scale from 1 to 4, where 1=low and 4=severe. The median risk level of participants was calculated.

2.3.2. *Census tract risk level assignment*

To determine if participants were representative of their census tracts, participant demographics were compared to the demographics of their census tracts. Statistical analysis was performed using R version 3.2.1 [19]. For census data comparisons, t-tests of means (assuming unequal variances) were performed to compare family income, the year home built, and home value. Chi-square tests were used to compare the race of the parents and sex of the newborns.

Download English Version:

https://daneshyari.com/en/article/10215890

Download Persian Version:

https://daneshyari.com/article/10215890

Daneshyari.com