Child Abuse & Neglect 99 (2020) 104264

Contents lists available at ScienceDirect

Child Abuse & Neglect

journal homepage: www.elsevier.com/locate/chiabuneg

A longitudinal analysis of the spatial spread of police-investigated physical child abuse

Andrew Grogan-Kaylor[a], Julie Ma[b], Shawna J. Lee[a], Sacha Klein[c,*]

[a] University of Michigan, School of Social Work, United States
[b] University of Michigan Flint, Department of Social Work, United States
[c] Michigan State University, School of Social Work, United States

ARTICLE INFO

Keywords:
Police-investigated physical child abuse
Neighborhoods
Child maltreatment
Longitudinal spatial model

ABSTRACT

Background: Research has shown that problematic behaviors, such as violence and drug use, may spread through shared physical space and social norms, lending rise to the notion of contagion theories of human behavior.
Objective: This study examines whether physical child abuse spreads across time and space in a pattern reflective of a contagion model.
Participants and Setting: This study uses 15 years of data from a large U.S. city police department. Data points are geo-located police-investigated physical child abuse incidents that occurred from 2001 to 2015.
Methods: Police department data are combined with U.S. Census estimates of the number of child residents in each of the Census Tract comprising the study site to derive annual rates of police-investigated physical child abuse cases per 1000 children residing in each Census tract. A panel data spatial regression model is used to analyze the association between this dependent variable, the rate of police-investigated physical child abuse cases in surrounding Census tracts, and time. The analysis statistically controls for multiple covariates commonly associated with Census tract-level estimates of child maltreatment, specifically household median income, residential instability, racial composition, population density, and the concentration of child residents.
Results: The rate of physical child abuse in a Census tract is positively associated with the rate of physical child abuse in the surrounding Census tracts, net of the covariates and the effect of time ($\beta = 0.461$, $p < .001$).
Conclusion: This finding provides preliminary evidence that physical child abuse, like some other problematic human behaviors, may spread spatially.

1. Introduction

Child maltreatment is a major public health crisis in the U.S. In 2017, state Child Protection Services (CPS) agencies responded to maltreatment allegations regarding approximately 3.5 million children. More than 17 % were found to be substantiated victims of maltreatment, and 17 % of children with substantiated cases of maltreatment experienced physical child abuse (U.S. Department of Health and Human Services; USDHHS, 2017). Research suggests that the annual statistics grossly underestimate the likelihood that any individual child will experience maltreatment. Using synthetic cohort analysis of a national data source, researchers estimated

* Corresponding author at: School of Social Work, Michigan State University, 246 Baker Hall, 655 Auditorium Road, East Lansing MI, 48824, United States.
E-mail address: kleinsa@msu.edu (S. Klein).

https://doi.org/10.1016/j.chiabu.2019.104264
Received 20 August 2018; Received in revised form 23 October 2019; Accepted 5 November 2019
Available online 12 December 2019
0145-2134/

that 12.5 % of all U.S. children would experience a confirmed case of maltreatment by 18 years of age (Wildeman et al., 2014). The public health implications of child maltreatment are clear. The Adverse Childhood Experiences Study (ACES) shows that adults who were maltreated as children are more likely than non-maltreated adults to perpetrate or be victimized by intimate partner violence (Whitfield, Anda, Dube, & Felitti, 2003), to be obese (Williamson, Thompson, Anda, Dietz, & Felitti, 2002), and to have lower levels of health-related quality of life (Corso, Edwards, Fang, & Mercy, 2008). In comparison to other industrialized countries, the U.S. stands out as having an exceptionally high rate of child death due to maltreatment—which is most often the result of neglect and physical child abuse—nearly double the rate of the next highest country, New Zealand (United Nation's Children's Fund; UNICEF, 2003).

A long tradition of research in the field of child maltreatment has examined how ecological factors such as neighborhood contexts contribute to the etiology of child maltreatment. Prior studies have identified concentrated economic disadvantage, crime, and social disorganization as neighborhood-level risks of child maltreatment (Coulton, Crampton, Irwin, Spilsbury, & Korbin, 2007; Morris et al., 2018). Yet, the question of whether child maltreatment is contagious such that child abuse incidents in a neighborhood may influence abusive acts towards children in nearby neighborhoods has not been examined. In this study, we propose that spatial spread processes (Fagan, Wilkinson, & Davies, 2007) may explain some of the variations in neighborhood physical child abuse (PCA) rates over time. To examine the hypothesis that spatial spread (i.e., the tendency of human behaviors to diffuse across time and space, sometimes described as a "contagion" effect) is a unique factor that contributes to child maltreatment rates, we conduct a longitudinal spatial analysis of a highly novel data source in the field of child maltreatment—publicly available police-investigated child maltreatment data from a large city in the Midwestern United States. This study examines neighborhood rates of police-investigated PCA over 15 years to determine whether there is evidence for "spatial spread" or diffusion of police-investigated PCA, from adjoining Census tracts to a Census tract, over time.

1.1. Ecological models of the etiology of maltreatment

Most studies of the etiology of maltreatment have focused on the microanalysis of individual (e.g., parental substance use) and family-level (e.g., domestic violence) characteristics that drive parents' abusive and neglectful behavior. However, the ecological or "person-in-environment" framework suggests that risk for child maltreatment is complex, and explained by proximal factors (e.g., "microsystems") that may affect dynamics of the parent-child relationship and household characteristics, as well as by factors in the broader environmental contexts in which families live (e.g., "exosystems" and "macrosystems"; Belsky, 1993).

Indeed, studies employing an ecological framework have shown that child maltreatment rates are higher in neighborhoods, typically operationalized as Census tracts, Census block groups, or zip codes, with higher rates of poverty (Drake & Pandey, 1996; Freisthler, 2004), unemployment (Merritt, 2009; Molnar, Buka, Brennan, Holton, & Earls, 2003), residential instability, and housing stress (e.g., large concentrations of vacant homes) (Klein & Merritt, 2014), or factor scores or scales inclusive of some or all of these variables (Coulton et al., 2007; Coulton, Korbin, & Su, 1999). There is some evidence that child maltreatment rates may be higher in neighborhoods that are sparsely populated (Freisthler, 2004; Freisthler, Midinak, & Gruenewald, 2004), have high levels of "child care burden" or a lack of informal resources (e.g., adult residents) for child supervision (Coulton, Korbin, Su, & Chow, 1995, 1999; Klein & Merritt, 2014; Klein, 2011; Merritt, 2009), and are racially diverse or have high concentrations of some minority groups (Freisthler, 2013; Klein, 2011; Klein & Merritt, 2014).

1.2. Spatial co-location and spread of violence

We focus on the notion of geographical proximity of neighborhoods (in this study, operationalized by Census tracts) and spatial spread or diffusion of physical child abuse as a factor that may explain fluctuations in police-investigated PCA over time. The concept of spatial spread states that (a) analogous to the spread of infectious diseases, social behaviors are also vulnerable to spread (or diffusion) in neighborhoods—a phenomena that may be pronounced in urban areas, where there are densely packed social relationships and networks, and (b) social behaviors and beliefs can spread through interactions by people in proximal social structures (Fagan et al., 2007). In this study, we focus on demonstrating statistical evidence for the first part of this concept, (a) diffusion across neighborhoods, specifically, showing that rates of police-investigated PCA in adjoining neighborhoods (Census tracts) are associated with the spread of police-investigated PCA to a neighborhood (Census tract) over time.

As outlined by Fagan et al. (2007), spatial spread (or contagion) of behavior may occur via direct exposure to violence and aggression, and such exposure thus normalizes the occurrence of those behaviors (Bond & Bushman, 2017). In other words, the occurrence of the behavior "creates an environment where future occurrences are more likely to occur" (Degarmo, 2011, p. 589). Over time, increased exposure elevates the likelihood that the behavior will occur and contributes to the "spread" of the behavior to adjoining geographical locations. Fagan et al. (2007) document trends suggesting that youth homicide rates can be linked through spatial spread and contagion processes.

In addition to youth violence (Fagan et al., 2007), spatial co-location and geographical spread processes have been observed to occur in several other domains of human behavior. One study examined the spatial co-location of crime in a Canadian city and found that certain forms of criminal activity tended to co-occur (Andresen & Jenion, 2008). Another study used police data to examine the spatio-temporal movement of different forms of homicide in an urban area, and their longitudinal analysis showed both clustering (spatial co-location) of homicides as well as spatial spread, which they call diffusion, of gang motivated homicide over 10 years (Zeoli, Grady, Pizarro, & Melde, 2015). Gruenewald et al. (2013) demonstrated how methamphetamine use showed signs of growth and spatial spread in low-income areas, with evidence that laws to reduce methamphetamine use were effective at reducing