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RESEARCH ARTICLE

Neighborhood Risks and Child Maltreatment Investigations: A Comparison Across Urban and Rural Contexts

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Abstract

Neighborhoods have a profound influence on the likelihood of child maltreatment. Understanding the context in which parents live is critical for exploring risk and protective factors for abuse and neglect. Rural child maltreatment is understudied, and the extent to which neighborhood factors relate to maltreatment in rural areas is unknown. The current study sought to understand whether certain neighborhood-level characteristics that were found to be associated with hospital-based child maltreatment reports in a single urban Midwestern county in the USA held true in official statewide child maltreatment data across urban and rural contexts. Statewide zip code-level data for all child maltreatment investigations in the State of Michigan in 2019 were used to examine child maltreatment. In multivariate models, poverty rate was related to higher levels of official child maltreatment investigations in rural areas, but unlike the prior study, not in urban areas. Residential stability was related to lower levels of hospital-based maltreatment reports and official child maltreatment investigations in urban areas. A greater proportion of residents with at least a bachelor's degree and a greater proportion of individuals who speak a language other than English were both related to lower levels of maltreatment across both measures and contexts.

Keywords Neighborhood risks · Child maltreatment · Children

Introduction

Child maltreatment is a significant problem in the USA. In federal fiscal year 2020, there were 3.9 million referrals to child protective services agencies for concerns about child abuse and neglect involving 7.1 million children (USDHHS, 2022).

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Further, it is estimated that one in eight US children will become substantiated victims of child maltreatment before their 18th birthday (Wildeman et al., 2014). The consequences of child maltreatment are far-reaching—children who are victims of child maltreatment are more likely to experience difficulties in physical and behavioral health (Lanier et al., 2010; Maclean et al., 2019), academic performance (Ryan et al., 2018), social skills (Ohene et al., 2006), and relationships (Elliott et al., 2005). These deleterious impacts extend into adulthood, with an increased likelihood of involvement with criminal justice systems (Widom, 2017), socioeconomic challenges (Bunting et al., 2018), mental health difficulties (Kisely et al., 2018), and early death (Segal et al., 2021). Targeting child maltreatment prevention strategies requires an understanding of the factors that contribute to maltreatment risk, including family and community factors measured at the neighborhood level. The current study focused on understanding whether certain neighborhood characteristics are related to child maltreatment and the extent to which these relationships differ between rural and urban contexts. The study harnessed a statewide dataset of maltreatment investigations in the State of Michigan.

Neighborhoods and Child Maltreatment

While much of the prior work investigating the etiology of child maltreatment focused on individual parent characteristics, in the past few decades, there has been a proliferation of research seeking to understand the impact of neighborhood-level factors on child maltreatment (Coulton et al., 2007; Freisthler et al., 2006; Maguire-Jack, 2014). A recent study by Bressler and colleagues (2019) found relationships between a variety of neighborhood characteristics and child maltreatment in Franklin County, OH, USA. Specifically, the authors found that poverty rate was associated with a higher likelihood of a hospital-based maltreatment report, while percent of residents with a bachelor's degree, percent of residents who speak a language other than English, and percent of residents living in the same home as the prior year were associated with a lower likelihood (Bressler et al., 2019).

Neighborhood Poverty and Child Maltreatment

Across a variety of studies, neighborhood poverty has been found to be related to child maltreatment within urban contexts (Bressler et al., 2019; Coulton et al., 2007; Drake & Jonson-Reid, 2013; Drake & Pandey, 1996; Freisthler et al., 2006; Kim et al., 2020; Maguire-Jack, 2014; Maguire-Jack et al., 2021; McLeigh et al., 2018). Neighborhood poverty is believed to be related to child maltreatment because of the lack of employment opportunities hindering the ability to meet children's basic needs and the stress associated with living in a disadvantaged community may increase the use of harsh parenting (Maguire-Jack, 2014). There is a paucity of research on neighborhood factors in rural areas, but in the one study specifically examining it, it was found that county-level rates of poverty were related to higher rates of child abuse (Weissman et al., 2003).

Education Level and Child Maltreatment

Many studies examining neighborhood-level educational attainment group it with other measures of socioeconomic status for an overall neighborhood disadvantage factor using factor analysis. These studies have found their overall disadvantage factor to be related to maltreatment in urban areas (Maguire-Jack, 2014). One prior study examining rural areas focused on educational attainment, but focused on the percent of residents who did not have a high school degree (Weissman et al., 2003). Neighborhood education level might be related to child maltreatment for several reasons. First, education level and employment are linked, and the extent to which parents have a career in which they feel fulfilled and fairly compensated may reduce stress. Additionally, the monetary resources from their employment help parents to meet their children's basic needs.

Languages Spoken and Child Maltreatment

As previously noted, Bressler and colleagues (2019) found the proportion of residents within a neighborhood speaking a language other than English (instead of, or in addition to, English) to be related to lower levels of hospital-based child maltreatment reports. The authors reported that this may be due to higher education levels and professional status or cultural differences in parenting. We were unable to identify other studies specifically examining this variable, but suspect that it could also be related to a prior finding that the percent of residents who are Latinx within urban communities is related to lower rates of maltreatment (Molnar et al., 2003). We are not aware of any rural studies examining this variable.

Residential Instability and Child Maltreatment

Frequent moves of neighborhood residents may hinder the creation of meaningful relationships between neighbors, making it more difficult for social and instrumental support exchanges to occur. This variable is found to be related to maltreatment in a variety of urban studies (Coulton et al., 1995; Deccio et al., 1994; Ernst, 2000, 2001; Fromm, 2004). Residential instability has not been investigated in relation to child maltreatment in rural areas.

Sources of Child Maltreatment Data

Child maltreatment is a complex problem that is difficult to measure (Waldfogel, 2000). Self-report data may be unreliable because of social desirability bias and recall bias. Official sources of data are limited by the decision-makers involved. In order for child maltreatment to be counted in any form of official data, it has to be noticed by someone who feels compelled to report it to the proper authorities, and then, the authorities must recognize it as such. A primary objective of

the current study is to understand whether the relationships identified hold true with another source of child maltreatment information. Prior studies focused on hospital-based child maltreatment reports (Bressler et al., 2019) demonstrate that these reports are more likely to be related to physical or sexual abuse, which can be readily identified by a physician and less likely to be related to neglect, a more prevalent form of child maltreatment. Physicians have more episodic contact with children, and hospital-based maltreatment reports are subject to the training, experience, and biases of the individual physicians making the report, which contribute to the decision to report maltreatment. For the purposes of this study, we chose to examine neighborhood characteristics of child maltreatment using the child welfare reports in the Michigan Statewide Automated Child Welfare Information System (MiSACWIS). A benefit of this data source compared to hospital-based child maltreatment reports is that it includes reports from all sources, not just physicians; and includes allegations of neglect, which may be more readily identified by an individual with regular contact with children. The official MiSACWIS data also includes investigated child maltreatment reports and those that do not rise to the level of statutory child abuse or neglect are excluded. The trade-off with these data compared to hospital-based reports is that the official child maltreatment data are subject to the decision-making of multiple individuals, including the reporters deciding to notify child welfare, but also the child welfare worker making the decision to investigate. The training, experience, and biases of all individuals involved within these decision points may impact the likelihood that maltreatment is recorded within these data. No single source of child maltreatment data is a perfect measure, and the limitations within existing measures of child maltreatment require that research findings be triangulated with multiple sources of data. In order to understand the extent to which maltreatment measurement differences affect relationships found between neighborhood factors and maltreatment, the current study sought to replicate the key independent variables used within the study from Bressler and colleagues (2019) and estimate the associations with maltreatment using administrative data.

Rural and Urban Child Maltreatment

The second objective of this study was to understand whether the relationships between neighborhood factors and child maltreatment vary by urban and rural contexts. Across the USA, rural maltreatment rates outpace urban rates, when population size is taken into consideration. In rural counties, approximately 60/1,000 children are investigated for suspected child maltreatment compared to 40/1,000 children in urban counties (Maguire-Jack & Kim, 2021). Rural maltreatment is much less understood compared to urban maltreatment (Maguire-Jack et al., 2020), and the neighborhood-level risk factors may differ from such factors in urban areas, due to differences in demographics, culture, and geography (Maguire-Jack et al., 2022). Poverty rates in rural areas are higher than in urban areas, with 16.1% of rural residents falling below the federal poverty level in 2018 compared to 12.6% urban residents (USDA, 2020). In 2017, the percentage of adult employment as a share of

all adults in rural areas was 53.4% compared to 60.5% in urban areas (USDA, 2019). In urban areas, poverty and residential instability are positively correlated (Osgood & Chambers, 2000). However, in rural areas, these two are negatively correlated, with *higher* rates of poverty being associated with *lower* rates of residential instability (Osgood & Chambers, 2000).

One prior study to our knowledge has examined neighborhood-level predictors of child maltreatment in rural areas (Weissman et al., 2003). This study found that county-level rates of child poverty, single-parent families, marriage, divorce, unemployment, high school education attainment, elder abuse, median family income, rates of births and deaths, and number of physicians and other helping professionals were all related to child abuse in rural Iowa counties (Weissman et al., 2003). A key extension of the current study is that this prior study exclusively examined rural areas, rather than making comparisons of the same factors across rural and urban contexts.

Contributions of the Current Study

The current study examined the following research questions: (1) Are the neighborhood risk factors found to be related to hospital-based child maltreatment reports in Franklin County, OH, USA, also related to child maltreatment investigations in Michigan? (2) Are these relationships the same in rural and urban areas in Michigan? We hypothesize that neighborhood poverty and residential instability will be related to higher rates of child maltreatment investigations and percent of residents who speak a language other than English and percent of residents with a bachelor's degree will be related to lower rates of maltreatment in the urban zip codes within our sample. We also hypothesize that poverty rate will be related to higher rates of child maltreatment investigation in rural zip codes. Given the lack of research on rural neighborhood factors and child maltreatment, we do not have a priori hypotheses related to the other relationships investigated in our second research question.

Although other studies have examined the relationships between neighborhood factors and child maltreatment, these have primarily been conducted in urban settings and utilizing either self-reported child maltreatment or administrative data (Coulton et al., 2007; Freisthler et al., 2006; Maguire-Jack, 2014). The study from Bressler and colleagues (2019) is the first study to specifically examine neighborhood characteristics and child maltreatment using hospital reports of maltreatment. This study also relied upon unique neighborhood measures not examined within other studies. While many other studies have examined poverty and residential instability, Bressler and colleagues (2019) examined percent of residents speaking languages other than English and percent of residents with a bachelor's degree. The extent to which these characteristics would be significantly related to official child maltreatment records is unknown. Given important differences outlined above between the data sources, a direct comparison across these two data sources is needed. Additionally, very few studies have examined the relationship between neighborhood characteristics and child maltreatment in rural areas (Maguire-Jack et al., 2020). The current study is only one of a few studies seeking to explicitly

explore the connection between neighborhood characteristics and child maltreatment and the first to directly compare the same neighborhood factors across urban and rural zip codes.

Methods

Data

The current study utilized two sources of information. The first was the 2016–2020 5-year estimates from the American Community Survey (ACS) for zip codes across the State of Michigan (U.S. Census Bureau, 2021). The second source of data was the MiSACWIS, the state administrative child welfare information system, which included individual-level data on each child maltreatment investigation in the year 2019 in the State of Michigan. The study was approved by the MDHHS Institutional Review Board as well as the Institutional Review Board of the lead author's institution.

Measures

Neighborhood Variables

The variables from the ACS included those from the prior article by Bressler and colleagues (2019). At the zip code level, we investigated the median age, poverty rate, disability rate, percent of residents with a high school education or higher, percent of residents with a bachelor's degree or higher, labor force participation rate, unemployment rate, percent of residents who are Latinx, homeownership rate, occupied housing rate, average household size, percent of households with children, percent of individuals with health insurance, percent of residents that spoke a language other than English (primary or in addition to English), percent of residents who were married, percent of residents who were over the age of 18, percent of residents who were White, percent of residents who were foreign-born, and percent of residents who were living in the same residence as the prior year.

Rural Definition

To understand differences between urban and rural areas, we also pulled the urban and rural data file from the 2010 decennial census, which identifies the number of urban clusters within zip codes (U.S. Census Bureau, 2010). We calculated the number of urban clusters divided by the total number of clusters in each zip code to determine the percent of each zip code that was considered urban. We considered zip codes containing no urban clusters to be rural and those with 100% urban clusters to be urban. We excluded zip codes that were not included in either of those extremes.

Maltreatment Variable

From the MiSACWIS data, we calculated the number of child maltreatment investigations by zip code. We then divided by the number of children under the age of 18 who were living in the zip code and multiplied by 1,000 to determine the number of investigations per 1,000 children.

Analyses

We first examined standard summary statistics of the dataset by each context type (rural versus urban), including the mean, standard deviation, and range. We then ran the correlations between all study variables, by context type. Finally, we ran multivariate Poisson regressions using robust standard errors between the four variables identified in the prior study (Bressler et al., 2019), poverty rate, percent of residents with a bachelor's degree or higher, percent of residents who speak a language other than English, and percent of residents living in the same residence as the prior year; with the child maltreatment investigation rate as the outcome variable. We ran each of these regressions by context type. Poisson regression with robust standard errors is a statistical approach that allows for estimating relationships when the outcome variable is skewed toward the lower end of the distribution and is better able to deal with zero values and very small values compared to a log transformation of the outcome variable (Cameron & Trivedi, 2010; Wooldridge, 2010). For ease of interpretation, we provide incidence rate ratios.

Results

Contexts of Study

The prior study focused on one urban county in the State of Ohio, Franklin County, which includes Columbus, OH, USA. The current study included all zip codes within the State of Michigan. Both states are in the United States Midwest region and are demographically similar. There are 10.1 million people in the State of Michigan compared to 11.8 million in the State of Ohio. In Michigan, 72.4% of residents are White, 13.5% are Black, 5.6% are Latinx, 4.4% are multiracial, and 3.3% are Asian. In Ohio, 75.9% of residents are White, 12.3% are Black, 4.3% are multiracial, and 2.5% are Asian.

Descriptive Statistics

The descriptive statistics for the four zip code types are included in Table 1. The investigation rate in rural areas was higher than in urban areas, with 55 per 1,000 children in rural zip codes compared to 44 per 1,000 in urban zip codes, respectively. The median age also differed between the rural and urban context, with

Table 1 Descriptive statistics by rurality

	Rural $N = 445$ rural zip codes		Urban $N = 156$ urban zip codes	
	Mean (*SD*)	Range	Mean (*SD*)	Range
Investigation rate (per 1,000)	54.967 (48.15)	1.23–545.46	43.56 (76.87)	2.05–893.86
Median age (years)	47.22 (8.10)	21.8–85.1	39.30 (6.35)	23.2–69.2
Poverty rate	13.03 (7.34)	0–63.07	16.96 (12.40)	0–49.51
Disability rate	16.75 (5.54)	0–54.90	14.93 (5.00)	5.39–30.47
High school education or higher (%)	89.69 (5.46)	55.41–100	88.88 (7.21)	54.73–98.73
Bachelor's degree or higher (%)	16.76 (8.76)	0–62.86	30.07 (18.26)	4.65–74.83
Labor force participation rate	54.83 (9.96)	13.9–94.7	61.64 (7.72)	33.9–79.7
Unemployment rate	5.90 (4.40)	0–40.7	7.34 (4.52)	0–24.8
Latinx (%)	2.97 (4.27)	0–44.98	6.08 (9.02)	0–67.67
Home ownership rate	60.08 (18.74)	9.22–100	57.79 (20.39)	0–95.47
Occupied housing rate	70.35 (20.95)	10.69–100	89.72 (9.17)	53.26–100
Average household size	2.40 (0.32)	1.26–3.84	2.41 (0.33)	1.27–3.53
Households with children (%)	22.42 (8.18)	2.19–63.10	24.21 (7.08)	0–49.85
Health insurance (%)	93.28 (4.87)	54.07–100	94.25 (3.03)	81.68–100
Speak a language other than English (%)	3.44 (4.57)	0–41.79	14.77 (13.79)	0–76.67
Married (%)	55.64 (8.93)	3.5–81.1	41.66 (14.23)	10–79.4
Over 18 years of age (%)	80.12 (6.02)	57.58–97.11	78.72 (5.12)	64.59–97.53
White (%)	95.00 (5.96)	47.77–100	65.60 (29.66)	8.57–97.57
Foreign-born (%)	1.55 (2.24)	0–21.8	10.45 (9.48)	0–42.2
Living in same residence as last year (%)	91.41 (4.28)	54.41–100	85.77 (7.57)	41.76–100

rural zip codes' median age approximately 47 years compared to approximately 39 years in urban zip codes. A similar percentage of residents across contexts was over the age of 18, with 80% of residents in rural zip codes and 79% of residents in urban zip codes.

The poverty rates were higher in urban zip codes at 17% compared to 13% of rural zip codes. However, health insurance rates were similar across contexts with about 93–94% of residents insured. The disability rate was higher in rural zip codes, at about 17% compared to 15% in urban zip codes. In terms of education level, the percent of individuals with a high school education or more was similar across context, with about 89–90% of individuals having this level of education. However, the contexts varied considerably when it came to bachelor's degrees or higher, with about 30% of urban zip code residents having this level of education compared to only 17% of rural zip code residents. In terms of employment status, urban zip codes had higher rates of both labor force participation (62%) and unemployment (7%) compared to rural zip codes, which were approximately 55% labor force participation and 6% unemployment.

Urban zip codes were more diverse than rural zip codes, with about 6% Latinx residents compared to 3% in rural zip codes. Approximately 95% of residents

were White in rural zip codes compared to 66% in urban zip codes. Approximately 3% of residents in rural zip codes spoke a language other than English compared to 15% in urban zip codes. Approximately 2% of rural zip code residents were foreign-born compared to 11% in urban zip codes.

In terms of housing, homeownership rates were similar across contexts at 61% of mostly rural zip codes and 58% of mostly urban zip codes. There were considerably more vacant housing units in rural areas. The occupied housing rate in the rural zip codes was 70% compared to 90% in the urban zip codes. However, approximately 91% of rural zip codes had residents who were living in the same residence as the prior year compared to 86% of residents in urban zip codes. Taken together, this suggests that urban residents are more likely to move between homes, but there are fewer vacant housing units overall.

The household sizes were very similar across contexts, with about 2.4 persons per household; however, urban zip codes had a slightly greater percentage of households with children, at 24% compared to about 22% in rural areas. A greater percentage of rural residents were married, approximately 56% of residents within rural zip codes compared to 42% of residents in urban zip codes.

Correlations Among Study Variables

Tables 2 and 3 display the correlations among the study variables. A few factors were positively correlated with higher rates of maltreatment investigations across all contexts. These included poverty rate, disability rate, and percent of residents over the age of 18. Several factors were negatively correlated with rates of investigations across all contexts, including higher percent of residents with a high school education or higher, higher percent with a bachelor's degree or higher, greater labor force

Table 2 Correlation matrix for rural zip codes ($N = 445$)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
1.Maltreat.	1																			
2.Med. age	**.26**	1																		
3.Poverty	**.20**	**-.19**	1																	
4.Disability	**.22**	**.41**	**.15**	1																
5.HS education	**-.12**	**.18**	**-.38**	**-.19**	1															
6.Bachelor's education	**-.18**	**.26**	**-.36**	**-.27**	**.43**	1														
7.Labor force part.	**-.19**	**-.64**	**-.11**	**-.60**	.06	.01	1													
8.Unemployment	.06	.09	**.23**	**.20**	**-.18**	**-.11**	**-.12**	1												
9.Hispanic	-.05	**-.23**	**.14**	**-.14**	**-.34**	-.04	.06	-.03	1											
10.Home ownership	**-.32**	**-.49**	**-.25**	**-.39**	**.18**	**-.12**	**.53**	**-.22**	.00	1										
11.Occupied housing	**-.30**	**-.60**	**-.14**	**-.42**	.06	**-.20**	**.62**	**-.23**	.08	**.94**	1									
12.Avg. HH size	**-.35**	**-.75**	.06	**-.36**	**-.16**	**-.14**	**.47**	-.06	**.24**	**.52**	**.52**	1								
13.HHs with children	**-.33**	**-.82**	.03	**-.42**	**-.10**	**-.12**	**.57**	-.01	**.23**	**.47**	**.54**	**.71**	1							
14.Insured	-.08	**.15**	**-.26**	.07	**.46**	**.21**	**-.11**	.01	**-.15**	**.14**	.00	**-.10**	-.03	1						
15.Language other than English	-.08	**-.18**	**.16**	**-.15**	**-.43**	.00	.01	-.07	**.63**	-.08	-.02	**.24**	**.18**	**-.45**	1					
16.Married	**-.19**	**.22**	**-.39**	-.06	**.25**	**.37**	-.04	-.04	-.07	**.10**	-.05	.00	.00	**.23**	.03	1				
17.Over 18	**.39**	**.81**	**-.14**	**.32**	**.18**	**.18**	**-.44**	.02	**-.27**	**-.40**	**-.45**	**-.76**	**-.84**	.08	**-.23**	.03	1			
18.White	.01	**.10**	**-.22**	-.03	**.25**	.01	**.12**	-.06	**-.36**	**.23**	**.14**	-.03	-.05	.09	**-.33**	**.21**	.04	1		
19.Foreign born	-.04	-.03	**.11**	**-.11**	**-.22**	**.17**	.04	-.01	**.65**	**-.13**	-.07	.04	.03	**-.21**	**.65**	-.05	-.01	**-.36**	1	
20.Same residence	-.04	**.24**	**-.15**	-.05	**.14**	.04	-.04	-.08	**-.11**	**.16**	.06	-.02	**-.16**	**.10**	**-.09**	**.25**	.09	**.20**	**-.11**	1

Bolded values indicate $p < 0.05$

Table 3 Correlation matrix for urban zip codes ($N = 156$)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
1.Maltreat.	1																			
2.Med. age	-.14	1																		
3.Poverty	**.40**	**-.58**	1																	
4.Disability	**.23**	.01	**.59**	1																
5.HS education	**-.19**	**.47**	**-.77**	**-.53**	1															
6.Bachelor's education	**-.29**	**.27**	**-.61**	**-.68**	**.71**	1														
7.Labor force part.	**-.40**	-.12	**-.61**	**-.56**	**.55**	**.46**	1													
8.Unemployment	**.30**	**-.37**	**.81**	**.58**	**-.62**	**-.56**	**-.56**	1												
9.Hispanic	.00	**-.36**	**.25**	.09	**-.58**	**-.25**	.02	.09	1											
10.Home ownership	**-.47**	**.54**	**-.79**	**-.51**	**.51**	**.40**	**.38**	**-.63**	-.15	1										
11.Occupied housing	**-.45**	**.32**	**-.80**	**-.50**	**.56**	**.41**	**.59**	**-.80**	-.08	**.73**	1									
12.Avg. HH size	**-.34**	**-.26**	.02	**-.28**	**-.34**	-.07	-.01	.05	**.24**	**.34**	.10	1								
13.HHs with children	**-.31**	**-.25**	-.12	**-.39**	-.13	.11	**.21**	-.02	**.20**	**.36**	**.20**	**.85**	1							
14.Insured	**-.28**	**.49**	**-.66**	**-.46**	**.76**	**.62**	**.29**	**-.56**	**-.55**	**.57**	**.49**	-.11	-.02	1						
15.Language other than English	**-.17**	**-.29**	.08	**-.33**	**-.36**	.14	-.08	-.10	**.37**	-.02	.09	**.55**	**.46**	**-.19**	1					
16.Married	**-.46**	**.46**	**-.81**	**-.70**	**.54**	**.60**	**.42**	**-.73**	-.13	**.85**	**.72**	**.36**	**.45**	**.59**	**.27**	1				
17.Over 18	**.34**	**.34**	**-.22**	.08	**.48**	**.23**	.03	**-.32**	**-.35**	-.11	.10	**-.81**	**-.82**	**.30**	**-.34**	-.10	1			
18.White	**-.22**	**.36**	**-.71**	**-.81**	**.51**	**.39**	**.45**	**-.78**	-.08	**.72**	**.77**	.05	.15	**.48**	.11	**.77**	**.18**	1		
19.Foreign born	**-.24**	**-.18**	-.12	**-.22**	-.08	**.36**	.08	**-.25**	.14	.07	**.22**	**.45**	.42	.02	**.93**	**.40**	**-.19**	**.20**	1	
20.Same residence	**-.60**	**.50**	**-.42**	-.10	.10	.04	.13	**-.16**	-.04	**.67**	**.30**	**.41**	**.39**	**.26**	.01	**.51**	**-.41**	**.23**	.01	1

Bolded values indicate $p < 0.05$

participation rate, greater homeownership rate, greater occupied housing rate, larger average household size, higher percent of households with children, and higher percent married. Only one factor was not significantly correlated with investigation rates across all contexts: percent of Latinx residents in the zip code.

The remaining factors had differential findings across contexts. No factors were positively correlated with maltreatment investigations in one context but negatively correlated in the other context, but several factors that were statistically significant in urban zip codes were not significant in rural zip codes. Greater unemployment rate was positively correlated with rates of investigations in urban zip codes but was not significant in rural zip codes. Median age, on the other hand, was positively correlated with rates of investigations in rural zip codes but was not significant in urban zip codes. Five factors were negatively correlated with rates of investigations in urban areas but were not significant in rural zip codes: higher percent of residents who have health insurance, higher percent of residents who speak a language other than English, higher percent of residents who are White, higher percent of residents who are foreign-born, and higher percent of residents who are living in the same residence as the prior year.

Multivariate Models

Table 4 includes the findings of the multivariate Poisson regression models. Across contexts, the percent of residents with a bachelor's degree or more and the percent of residents who speak a language other than English were related to a lower rate of child maltreatment investigations. In rural zip codes, the percent of residents in poverty was related to a higher rate of investigations. While it trended in the same direction, it was not significant in urban zip codes. In urban zip codes, the percent of

Table 4 Multivariate Poisson regressions, neighborhood characteristics, and child maltreatment investigation rates at zip code level

	100% rural $N = 445$ rural zip codes Incidence rate ratios (95% confidence interval)	100% urban $N = 156$ urban zip codes Incidence rate ratios (95% confidence interval)
Poverty rate	5.06 (1.72, 14.90)**	2.31 (0.81, 6.57)
Bachelor's degree or higher (%)	0.25 0.08, 0.74)*	0.06 (0.02, 0.16)***
Speak a language other than English (%)	0.12 (0.03, 0.54)**	0.14 (0.07, 0.32)***
Living in same residence as last year (%)	0.61 (0.04, 10.05)	0.01 (0.002, 0.01)***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

residents living in the same residence as the prior year was related to a lower level of investigations, but it was not significant in rural zip codes (though it trended in the same direction).

To investigate the differential findings further, we ran a series of correlations between the four variables. There were notable differences in the correlations between poverty and education level and poverty and percent living within the same residence between the urban and rural contexts. The correlation between poverty and bachelor's degree was − 0.4 in rural zip codes but − 0.6 in urban zip codes. The correlation between poverty and percent living in the same residence was − 0.2 in rural zip codes compared to − 0.4 in urban zip codes. These correlations suggest that the relationships between poverty and other variables are stronger in the urban context compared to the rural context. As such, even if poverty and maltreatment hold a similar relationship across the two contexts, the multicollinearity between poverty and education, and between poverty and residential stability may be masking the relationship.

Discussion

In comparing the findings from the current study to those of the study from Bressler and colleagues (2019), we see that there are six neighborhood characteristics that were found to be related to lower levels of maltreatment across all data sources and contexts, when examined bivariately. These include the percent of residents who are married and percent of residents with at least a high school degree or bachelor's degree, homeownership rate, occupied housing rate, and labor force participation rate. In addition, poverty rate and disability rate are related to higher levels of maltreatment. While percent of residents who are Latinx was not significant in any context or with any source of data, this is not entirely inconsistent with Molnar et al.'s (2003) finding that in Chicago, larger size of Latinx families' social networks corresponded to less child maltreatment. In contrast to the study by Bressler et al. (2019), where larger average family size was related to higher levels of hospital-based child maltreatment reports and the proportion of residents over the age of 18 was related to lower rates, the opposite was

true in the MiSACWIS data. It is not obvious why these factors would differ between the two types of maltreatment measures, as more children per family would logically be related to higher levels of both abuse and neglect, with a greater number of children potentially causing more stress in families (possibly leading to harsher parenting) and more financial strain (possibly leading to inability to meet a child's basic needs). However, this pattern is unclear, given that some studies have suggested that families with one or two children have greater abuse rates that those with three or more children (Sedlak, 1997). Additionally, the directionality on the proportion of residents who are over the age of 18 is not immediately obvious, given that more adults could mean both more supervision of children but also more possible perpetrators. It would seem useful for future research to clarify how the proportion of adults over the age of 18 compares to the number and quality of supports that parents have in their community. Relatedly, it is worth noting that the population of residents over the age of 18 in Franklin County, OH, USA, may be characteristically distinct from that of the State of Michigan. For example, 12% of Franklin County is composed of persons 65 years or older (US Census Bureau, 2021) compared to 18% in the State of Michigan (US Census Bureau, 2021). It may be that in communities with greater proportions of residents over the age of 18 who are much older, there is less available community child support and supervision. More research is needed to understand the causal mechanism linking these factors with maltreatment, to explore why these differences might exist.

Within the Michigan data, unemployment rates were positively correlated with maltreatment investigations in urban zip codes, but not in rural zip codes. Of note, rural zip codes in Michigan have lower rates of both unemployment and labor force participation compared to urban zip codes (Table 1). The lower rates of both labor force participation and unemployment may be due to the greater number of elderly residents in rural areas (Henning-Smith et al., 2018). The labor force participation rate and unemployment rate are both calculated as a function of the number of individuals over the age of 16 who are not institutionalized, and unemployment rate includes only those individuals who are actively looking for work. As such, high rates of elderly populations will have lower rates of both and may operate differently than in urban areas.

There were four factors that were negatively correlated with investigations in the urban Michigan zip codes but were not significant in rural zip codes. These included the percent of residents who are White, speak a language other than English, are foreign-born, and those living in the same residence as the prior year. This is consistent with Bressler et al.'s (2019) finding that speaking a language other than English is protective against child maltreatment, as well as extant findings that residential instability is related to risk for child maltreatment in urban areas (e.g., Coulton et al., 1995; Deccio et al., 1994; Ernst, 2000, 2001; Fromm, 2004). It is noteworthy that all four of these factors had limited variation across rural zip codes, but much more variation across urban zip codes. For example, the percent of residents that spoke a language other than English in urban zip codes ranged from 0 to 76.67% ($SD = 13.79$), while in rural zip codes, it ranged from 0 to 41.79% with a standard deviation of only 4.57 percentage points. It is possible that the lower degree of variation on these factors prevented the detection of effects.

In terms of the multivariate models, across both studies, it was found that the percent of residents with a bachelor's degree or higher and the percent of residents who speak a language other than English were both related to lower levels of child maltreatment. However, while poverty rate was found to be related to higher levels of maltreatment in both the hospital-based maltreatment reports (Bressler et al., 2019) and the rural models presented in this study, the relationship was not significant in the urban zip codes using the MiSACWIS data. While the positive link between poverty rate and maltreatment in rural areas is consistent with previous findings (e.g., Weissman et al., 2003), the insignificant link in urban areas is generally inconsistent with the current evidence base (e.g., Drake & Jonson-Reid, 2013; Freisthler et al., 2006; Kim et al., 2020; Maguire-Jack, 2014; Maguire-Jack et al., 2021). Additionally, while proportion of residents living in the same residence was related to lower rates of hospital-based maltreatment reports in both the study by Bressler et al. (2019) and in our models of urban zip codes, the relationship was not significant for rural zip codes using the MiSACWIS data. Upon further exploration of these variables, it was found that the correlation between poverty rate and percent of residents holding at least a bachelor's degree was significantly higher in urban zip codes (approximately -0.6) than in rural zip codes (approximately -0.4) suggesting that education level is highly correlated with income in the urban zip codes in Michigan, but not necessarily in rural areas. Therefore, the effect of poverty may be masked by the education level variable within the urban models. Similarly, the correlation between poverty and percent of individuals living within the same residence as the prior year was also much lower in urban zip codes (approximately -0.4) compared to rural zip codes (approximately -0.1). This finding suggests that in urban areas, communities with high levels of poverty are more likely to have residential turnover compared to high-poverty communities in rural areas. As such, individuals in rural areas may be less able to move out of disadvantaged communities.

Limitations

There are important limitations to the current study that must be considered. First, this paper relied on investigated reports of child maltreatment in the State of Michigan. Investigated reports relate to child maltreatment that was noticed by someone who felt compelled to make a report to the child welfare agency. The report had to have sufficient contact information to allow for an investigation and sufficient detail that rose to the level of the statutory definition of child maltreatment for an investigation to happen. However, these data were intentionally used for the purposes of triangulating findings from a previous study that relied upon hospital-based child maltreatment reports (Bressler et al., 2019). To further triangulate these findings, this study should be replicated with self-reported child maltreatment information. Relatedly, it would seem important in future work to investigate how neighborhood-level characteristics might be differentially related to specific types of child maltreatment (e.g., physical abuse, neglect, sexual abuse). Second, due to data availability, the study examines a population of children that are demographically similar, but not identical to children in the State of Ohio. It is unclear whether the same findings would have held if we had examined investigated reports of child maltreatment in Franklin County,

OH, USA. Third, due to data availability, the current study relied upon zip code-level investigated child maltreatment. Zip code is a large geographic area that does not necessarily map onto a resident's own perception of their neighborhood. Diversity within large geographic areas is masked. With more granular data, there may have been more significant findings. Future studies should explore these relationships using smaller units of geography. Fourth, the current study focused only on structural characteristics of neighborhoods that can be studied with Census data. Coulton and colleagues (2007) highlight the critical influence of neighborhood processes and social capital in child maltreatment. The inclusion of these important neighborhood process variables may have shown different relationships between the structural characteristics examined here and maltreatment.

Conclusions and Implications

The current study has several important implications for research, policy, and practice. In terms of research, future studies should examine whether the findings within this study apply in other rural and urban contexts, such as the geographic South, West, and Northeast of the USA. Additionally, the present findings underscore the importance of comparing child maltreatment findings by measurement source, and future studies should triangulate the findings of this study using other measures of child maltreatment, such as self-reported information. In terms of policy and practice, the findings suggest several neighborhood-level characteristics that are related to child maltreatment that could be used to target supportive services to prevent child maltreatment. Specifically, neighborhoods with a high percentage of residents who have lower educational attainment, that lack diversity in terms of language spoken, have high residential turnover, and high rates of poverty may benefit from targeted child maltreatment prevention efforts. The present findings also point to the potential importance of leveraging not only universally central, but also geographically distinct, neighborhood-level risk factors when targeting preventative services that are specific to rural or urban families.

Data availability The data used in the current study are not publicly available. They were made available to the lead author through a data sharing agreement with the Michigan Department of Health and Human Services

Declarations

Conflict of Interest The authors declare no competing interests.

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