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WHAT'S KNOWN ON THIS SUBJECT: Although the impact of changes in the economy on child physical abuse rates is not well understood, there is concern that increased numbers of children may have been victims of physical abuse as a result of the recent economic recession.



WHAT THIS STUDY ADDS: Results of this study demonstrate that the rate of admissions for physical abuse to pediatric hospitals has increased during the past 10 years and suggest an association between that increase and the housing mortgage crisis.

abstract

OBJECTIVE: To examine the relationship between local macroeconomic indicators and physical abuse admission rates to pediatric hospitals over time.

METHODS: Retrospective study of children admitted to 38 hospitals in the Pediatric Hospital Information System database. Hospital data were linked to unemployment, mortgage delinquency, and foreclosure data for the associated metropolitan statistical areas. Primary outcomes were admission rates for (1) physical abuse in children <6 years old, (2) non-birth, non-motor vehicle crash-related traumatic brain injury (TBI) in infants <1 year old (which carry high risk for abuse), and (3) all-cause injuries. Poisson fixed-effects regression estimated trends in admission rates and associations between those rates and trends in unemployment, mortgage delinquency, and foreclosure.

RESULTS: Between 2000 and 2009, rates of physical abuse and high-risk TBI admissions increased by 0.79% and 3.1% per year, respectively ($P \leq .02$), whereas all-cause injury rates declined by 0.80% per year ($P < .001$). Abuse and high-risk TBI admission rates were associated with the current mortgage delinquency rate and with the change in delinquency and foreclosure rates from the previous year ($P \leq .03$). Neither abuse nor high-risk TBI rates were associated with the current unemployment rate. The all-cause injury rate was negatively associated with unemployment, delinquency, and foreclosure rates ($P \leq .007$).

CONCLUSIONS: Multicenter hospital data show an increase in pediatric admissions for physical abuse and high-risk TBI during a time of declining all-cause injury rate. Abuse and high-risk TBI admission rates increased in relationship to local mortgage delinquency and foreclosure trends. *Pediatrics* 2012;130:e358–e364

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KEY WORDS

child safety, maltreatment, abuse, head trauma, head injuries

ABBREVIATIONS

CI—confidence interval
CPS—Child Protective Services
ICD-9-CM—International Classification of Diseases, Ninth Revision, Clinical Modification
MSA—metropolitan statistical area
NCANDS—National Child Abuse and Neglect Data System
PHIS—Pediatric Health Information System
TBI—traumatic brain injury

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Although child physical abuse remains a critical issue in the United States with >120 000 children determined to be victims of physical abuse by Child Protective Services (CPS) in 2010, data from the National Child Abuse and Neglect Data System (NCANDS) suggest that the number of cases has been declining over the past 15 years.^{1–8} The thriving US economy was hypothesized as 1 of the factors contributing to the dramatic decrease in cases of physical abuse that began in the late 1990s and continued into the mid-2000s.⁹

Despite these encouraging numbers, the onset of the recession in late 2007 has raised concerns that rates of physical abuse might begin to rise again. These concerns have been supported by 2 recent studies and numerous anecdotal reports in the popular press of increased rates of injuries from severe forms of physical abuse during the recession, including abusive head trauma in some regions of the country.^{10–14} National data from NCANDS, however, indicate that trends in physical abuse rates did not change and continued to decrease during the recession.^{5,6} The conflicting reports regarding rates of physical abuse during the economic recession have raised questions about child maltreatment trends as well as questions regarding the relationship of macroeconomic indicators with child maltreatment rates.

Although research has established a strong relationship between poverty and child maltreatment, less is known about the impact of changes in the economy on maltreatment trends.^{15–19} Results from studies of changes in unemployment rates and child maltreatment rates have been mixed.^{20–24} Even less is known about the impact of the residential foreclosure crisis, an economic stressor that marked the recent recession, on child maltreatment rates.

Given concerns about the accuracy of reported trends in national child physical

abuse rates, emerging reports of increasing cases of physical abuse in medical settings, and uncertainty about how economic circumstances of this recession may have impacted communities, this study sought to examine the relationship between local macroeconomic indicators and child abuse trends by using a database of children's hospital administrative data. Hospital administrative data serve as an alternative source of data that is unrelated to CPS-derived data sources and is one that captures the most severe, albeit small proportion of severe physical abuse cases reported to CPS. The primary aims of the study were to (1) describe the trend in physical abuse admissions to pediatric hospitals from 2000 to 2009 in relationship to other injury admissions, and (2) examine the relationship between local macroeconomic indicators and the rate of pediatric hospital admissions for such injuries over time.

METHODS

Study Design and Data Sources

We used hospital discharge data from the Pediatric Health Information System (PHIS), an administrative database maintained by Child Health Corporation of America (Shawnee Mission, KS). Forty-three hospitals that are located in 17 of the 20 major metropolitan areas submit patient-level data to PHIS. These hospitals represent 85% of freestanding children's hospitals in the U.S. that are registered with the National Association of Children's Hospitals and Related Institutions (Alexandria, VA). Maintaining and validating the quality of the PHIS data are a joint effort between Child Health Corporation of America, participating hospitals, and Thomson Reuters, the data warehouse vendor for PHIS. Validity and reliability checks of the data are performed and data are included in the database only when classified errors occur in <2% of

a hospital's quarterly data. Patients admitted to 38 of the 43 PHIS hospitals between January 1, 2000 and December 31, 2009 were included in the study. Three hospitals were excluded because of incomplete data, as were a hospital that briefly closed and another that moved. Hospital data were linked to macroeconomic data for the associated metropolitan statistical area (MSA).²⁵ Data were combined for 2 sets of 2 hospitals located in the same MSA. Unemployment data were obtained from the US Bureau of Labor Statistics' Local Area Unemployment Statistics Database,²⁶ and mortgage foreclosure and 90-day mortgage delinquency data were obtained from CoreLogic, a real estate data and analytics company that collects property address level data from public records at county recorder's offices, courthouse filings, tax assessors, sheriff's offices, newspaper filings, proprietary sources, and selected vendors for the number of new and outstanding unique notices of default, as well as for notices of trustee sales (McLean, VA). CoreLogic's broad coverage includes >140 million properties and 99% of the US population.²⁷ This study was determined as exempt from institutional review board approval, because it did not meet the definition of human subjects research.

Study Measures

The primary outcomes were the monthly rate of admissions for (1) physical abuse and (2) high-risk traumatic brain injury (TBI) at each hospital. Physical abuse admissions included children <6 years of age with *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) discharge diagnosis codes (995.54–995.55, 995.50, 995.59) or E-codes (E960–E967, E968.0–E968.3, E968.5–E968.9) for child physical abuse or assault. The group was limited to children <6 years old, because the majority of hospitalized victims of physical abuse are young children, and because of concern that some older

assault victims may be victims of peer violence. The high-risk TBI admissions included infants <12 months of age with ICD-9-CM discharge diagnosis codes for TBI (800.1–800.4, 800.6–800.9, 801.1–801.4, 801.6–801.9, 803.1–803.4, 803.6–803.9, 804.1–804.4, 804.6–804.9, 851.0–851.9, 852.0–852.5, 853.00–853.1). Children whose hospitalizations were related to birth or a motor vehicle-related accident were excluded from both groups, because they were not at risk for injuries related to child abuse occurring in the home environment. The high-risk TBI group of infants has a high likelihood of having been victims of abuse with approximately 1/3 receiving a diagnosis code of abuse in prior studies. Therefore, this group provides a mechanism for trending admissions for injuries from physical abuse that does not depend on assignment of an ICD-9-CM code or E-code for abuse.^{28,29} The rates of physical abuse and high-risk TBI admissions per 1000 all-cause hospital admissions were calculated by using the rolling 12-month average for all-cause hospital admissions to account for seasonal fluctuations in admission numbers.

The all-cause injury admission rate was determined to assess whether changes in abuse and high-risk TBI admission trends were related to trends in all-cause injury admission patterns to the hospitals. All hospitalizations with a principal discharge diagnosis of injury (ICD-9-CM 800–959) were included. The primary predictor variables were time and the macroeconomic indicators of monthly unemployment rate, mortgage foreclosure rate, and 90-day mortgage delinquency rate for the MSA associated with each hospital.

Statistical Analysis

Trends in admission rates for physical abuse and high-risk TBI were described by using locally weighted scatter plot smoothing.³⁰ By using the hospital and month as the unit of observation, we

estimated rates of physical abuse per hospital admission and their association with macroeconomic indicators during the 10-year study period by means of Poisson regression, where the number of child abuse cases was the outcome and the rolling 12-month average number of all-cause hospital admissions was the offset. The initial model included only time (by monthly increments) as an independent variable. Then, 3 separate models were used to test the association between abuse and the macroeconomic indicators adjusting for time. Sensitivity analysis explored the association between abuse and the macroeconomic indicators lagged 1 year and the change in macroeconomic indicators over the previous year. The methods were repeated by using high-risk TBI and all-cause injury admissions as the outcomes. The analyses were repeated by using robust variance estimates and then using a negative binomial model. Because similar point estimates were obtained from all 3 models and the significance remained unchanged, only the results from the original model are reported. Statistical analyses were performed by using Stata 11.1 (StataCorp, College Station, TX).

RESULTS

During the 10-year study period, 11 822 (0.28%) of the 4 188 216 hospital admissions were for physical abuse in children <6 years of age. Between 2000 and 2009, the rate of physical abuse admissions per 1000 all-cause hospital admissions across the 38 hospitals rose with a distinct peak in 2008 (Fig 1). During this period, hospitals experienced a 0.79% (95% confidence interval [CI] 0.13%–1.44%) increase in the rate of child abuse admissions per year ($P = .02$). At the same time, the rate of admission for high-risk TBI increased 3.1% (95% CI 2.36%–3.87%) per year ($P < .001$). In contrast, the rate of admissions for all-cause injuries decreased by 0.80% (95% CI 0.70%–0.91%) per year ($P < .001$).

Within MSAs during the 10-year study period, admission rates for physical abuse and high-risk TBI cases were associated with the current 90-day delinquency rate and with the change in 90-day delinquency over the previous year (Table 1). For each 1 percentage point increase in 90-day delinquency from the previous year, there was an associated 3.09% increase in the child abuse admission rate ($P = .005$) and a 4.84% increase in the high-risk TBI admission rate ($P < .001$). Examining the rate of mortgages in foreclosure yielded similar results except that the association between the current foreclosure rate and the abuse admission rate only approached, but did not reach, statistical significance ($P = .06$). The 1-year lagged 90-day delinquency and foreclosure rates were not significantly associated with abuse and high-risk TBI admission rates. In contrast, there was no association of the unemployment rate with the abuse admission rate. There was also no association between the current unemployment rate and the high-risk TBI admission rate, and only a weak association between the 1-year change in unemployment and the high-risk TBI admission rate ($P = .04$).

The association between the abuse admission rate and percentage point changes in 90-day delinquency and foreclosure rates must be examined in relation to the magnitude of change in these macroeconomic indicators that occurred in some MSAs during the recession. Between 2008 and 2009, the median change in 90-day delinquency was 1.25 percentage points (range, 0.40%–9.28%), and the median change in foreclosure was 0.30 percentage points (range, 0.17%–5.63%). Focusing on the impact of the change in the 90-day delinquency rate from 2008 to 2009, the estimated 3.09% increase in abuse admission rate for each 1 percentage point change in 90-day delinquency from the previous year translates into a 3.86%

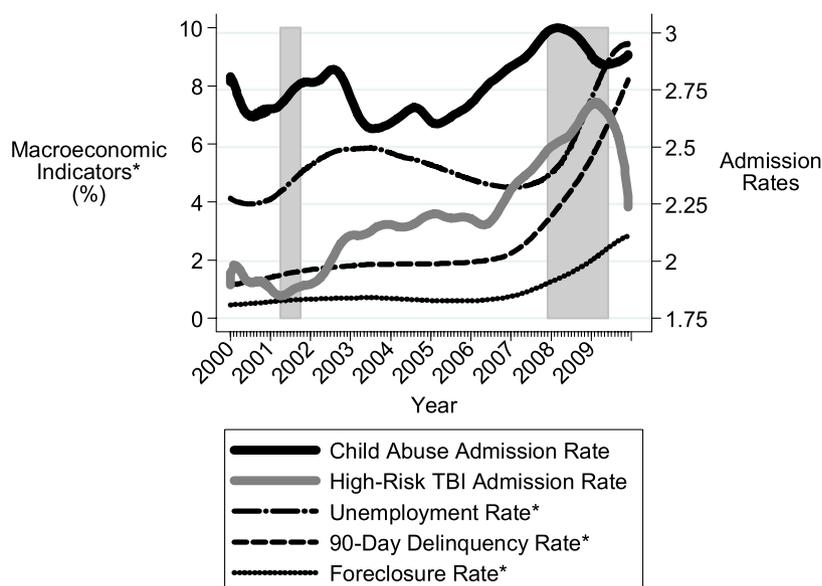


FIGURE 1

Trends in pediatric injury admission rates and economic indicators between 2000 and 2009. Locally weighted scatter plot smoothing of the rates of physical abuse admissions in children <6 years of age per 1000 all-cause hospital admissions and high-risk TBI admissions per 1000 all-cause hospital admissions were created. The percentage of unemployment, percentage of 90-day delinquency, and percentage of foreclosure in the MSAs in which the hospitals were located were also graphed. The periods of recession from March 2001 to November 2001 and December 2007 to June 2009 are marked by the shaded areas.

increase in the abuse admission rate for areas experiencing a 1.25 percentage point increase in 90-day delinquency and a 28.68% increase in the abuse admission rate for areas experiencing a 9.28% point increase in 90-day delinquency.

In contrast to the rates of admissions for physical abuse and high-risk TBI, the rate of admission for all-cause injuries was negatively associated with the current and 1-year lagged 90-day delinquency, foreclosure, and unemployment rates,

but not with the change in those rates over the previous year. For each 1% increase in the current rates of 90-day delinquency, foreclosure, and unemployment, there were 0.44%, 0.56%, and 0.43% decreases in the all-cause injury rate, respectively (all $P \leq .01$).

DISCUSSION

This study revealed that rates of hospital admissions for physical abuse and high-risk TBI have increased at children's

hospitals across the country over the past 10 years. Within geographic regions, macroeconomic housing trends, in particular, 90-day delinquency rate and active mortgage foreclosures, were associated with both diagnosed physical abuse admissions as well as high-risk TBI admissions that carry a high suspicion for abuse.

The major finding of the study was the relationship between child physical abuse admissions and housing security

TABLE 1 Relationship Between Economic Indicators and Hospital Admissions for Injuries Within MSAs

Economic Indicator	% Change in Admission Rate for Each 1% Point Change in Economic Indicator (95% CI)					
	Child Abuse	<i>P</i>	High-Risk TBI	<i>P</i>	All-Cause Injury	<i>P</i>
% 90-day delinquency						
Current	1.38 (0.16 to 2.62)	.03	1.83 (0.62 to 3.06)	.003	-0.44 (-0.68 to -0.29)	<.001
1 y previous	1.41 (-0.78 to 3.64)	.2	0.76 (-1.43 to 3.12)	.5	-1.71 (-2.01 to -1.41)	<.001
Change over previous year	3.09 (0.93 to 5.30)	.005	4.84 (2.66 to 7.07)	<.001	-0.13 (-0.47 to 0.21)	.4
% Foreclosure						
Current	2.55 (-0.15 to 5.33)	.06	4.10 (1.6 to 6.63)	.001	-0.56 (-0.96 to -0.05)	.007
1 y previous	1.41 (-3.65 to 6.73)	.6	3.85 (-0.95 to 8.90)	.1	-2.62 (-1.97 to -3.27)	<.001
Change over previous year	6.50 (1.69 to 11.55)	.008	10.21 (5.56 to 15.06)	<.001	0.21 (-0.49 to 0.91)	.6
% Unemployment						
Current	-0.23 (-1.52 to 1.07)	.7	1.23 (-0.18 to 2.66)	.09	-0.43 (-0.64 to -0.22)	<.001
1 y previous	-0.78 (-2.83 to 1.32)	.5	-0.64 (-2.95 to 1.72)	.6	-2.68 (-3.32 to -2.03)	<.001
Change over previous year	0.31 (-1.23 to 1.88)	.7	1.80 (0.11 to 3.52)	.04	0.19 (-0.51 to 0.89)	.6

Poisson regression analyses were performed by using the economic indicators for the MSAs in which the hospitals were located. Time was included in the model as a continuous variable based on month of admission. The rolling 12-month average number of all-cause hospital admissions to each hospital was used as the offset.

issues, a result that was not replicated consistently for unemployment. These results suggest that housing concerns were a significant source of stress within communities and a harbinger for community maltreatment rates. This is not surprising given the magnitude of foreclosure and housing crisis that marked the recent recession.^{31–33} The widespread housing crisis affected many families across the nation with nearly 45% of families with children reporting difficulties with stable housing.³⁴ Our results mirror reports from a recent study linking foreclosure activity in communities to increases in hospital visits for mental health complaints, preventable conditions, and stress-related physical complaints in adults.³⁵ Until this study, the impact of foreclosure on children has been limited to commentary on access to education and physical health of children^{33,36} and speculations on the negative outcomes of housing pressures on children's safety.

A clear relationship between unemployment and physical abuse was not found in our study or in a recent study of abusive head trauma.¹¹ One possible explanation for the lack of a relationship is that unemployment statistics, which do not include the underemployed or the discouraged workers who stop looking for a job, may not adequately measure economic hardship.¹¹ Another possibility is that the availability of unemployment benefits and other social services may have mitigated against the worst shocks of unemployment for families. Housing insecurity as manifested by foreclosure may represent a serious result of unemployment and a time at which families have exhausted their resources and safety net benefits. As such, unemployment may not adequately capture the impact of this recession in the context of child physical abuse.

Our findings should be considered in light of the limitations of our data. First, although more recent studies support

the use of administrative ICD-9-CM codes for detecting maltreatment, older studies have presented concerns regarding the sensitivity of the codes to detect cases of abuse.^{37–40} Therefore, the increases we observed may reflect more vigilant diagnosis or coding of abusive injuries. An increase in admissions for high-risk TBI, however, was also noted, a finding that is unlikely due to changes in diagnosis or coding of abuse. Admissions for high-risk TBI, which included only children with identified intracranial injury, occurred during a time in which use of head imaging among children with a history of head trauma has been decreasing and thus is unlikely due to increased detection.^{41–43} Second, our findings may not be generalizable across all communities or to future recessions, because the elements of individual recessions can be different over time. The findings therefore warrant further examination through community-specific evaluations of hospital utilization for child abuse injuries, in particular, with respect to economic downturns. Third, the study findings may reflect a trend of increasing referral of complicated pediatric trauma cases toward children's hospitals in recent years. However, the all-cause injury admission rate among the hospitals in our study declined slightly, which contrasts with the trend that would have occurred if there had been an increase of referrals. A similar trend of decreased trauma admissions has been noted in adults during times of increased unemployment⁴⁴ and may be due in part to decreased driving; multiple studies have demonstrated lower motor vehicle crash fatalities during times of higher unemployment.^{45–47} Finally, our analysis treated the relationship between macroeconomic indicators and child abuse admission rates as constant throughout the 10-year period, but Fig 1 shows that the relationship was not constant. In particular, after peaking in 2008, the rates of admissions for physical abuse

and high-risk TBI decrease in 2009, despite the continued increase in 90-day delinquency and foreclosure rates. The reason for the decrease in the admission rates in 2009 is unclear. Further research is needed to determine if this downward trend continues or reverses. One possibility to explore is whether communities become less sensitive to economic stressors after prolonged exposure.

Although additional studies are needed to confirm and further characterize the relationship between local macroeconomic indicators and child abuse, the findings from this study introduce an opportunity to consider macroeconomic indicators as potential proxies for child maltreatment. By tracking changes in macroeconomic indicators at the state and community levels, these efforts could help identify communities with heightened risk for child abuse and thus inform better prevention programs and allocation of resources to meet the needs of families.

Furthermore, the results of this study combined with regional studies of increases in hospital admissions for inflicted head injuries raise concern that rates of serious physical abuse in young children may be increasing in the United States.^{10,11} The observed increase in child physical abuse parallels data from a comparison of national survey data that reported a nonstatistically significant trend toward higher rates of physical abuse among victims aged 2 to 17 years for 2008 in comparison with 2003.⁴⁸

The increase in child physical abuse, however, differs from other data sources that have reported a decrease in some forms of violence against youth. Surveys including the Minnesota Student Survey and the National Crime Victimization Survey have reported decreases in adolescent exposure to violence in the 1990s and 2000s.^{49,50} Results from the National Incidence Studies of Child Abuse and Neglect, which include CPS data and survey data from non-CPS agencies, also demonstrated a decline

in child physical abuse rates between the third study in 1996 and the fourth study in 2005–2006.^{16,51} In addition, NCANDS, the most cited source on yearly national maltreatment trends, has reported that child physical abuse rates continue to decline for >15 years. One possible explanation for this divergence is that the trends in the type of severe physical abuse among young children captured by hospital data differ from the trends in the broader range of physical abuse that is reported in NCANDS, National Incidence Studies of Child Abuse and Neglect, and survey data of adolescent victimization.

Alternatively, it is possible that the divergence of our findings from other reports of child abuse trends may call into question the accuracy of these

sources of data. For example, NCANDS data rely on cases of abuse that are substantiated by state and local CPS agencies and might not capture the full spectrum of actual abuse.^{16,51–55} CPS data are also sensitive to changes in administrative protocols, regulations, and data-reporting practices at the state and local levels.^{56,57} Of note, 4 states had decreases in their rates of maltreatment of at least 25% in 2007 that were associated with administrative or data-reporting changes.⁵⁷ Finally, many CPS agencies have created systems to differentially respond to families in need through alternative pathways based on level of risk for future maltreatment and reporting mechanisms separate from the primary system that substantiates cases.^{58,59} Nationally,

the percentage of investigated cases that are substantiated has declined steadily over the past decade,^{1–7} which may be due in part to changing thresholds in the definition of substantiated abuse that are linked to alternative pathways.

CONCLUSIONS

Ultimately, the challenge raised by this study is how best to monitor the safety and well-being of children at a population level and respond to the needs of families during times of economic hardship. Although this study cannot confirm a causal pathway between macroeconomic conditions and child abuse rates, it suggests the need to examine how society's response to economic hardship can mitigate the risk to children.

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