Association of Pediatric Abusive Head Trauma Rates With Macroeconomic Indicators

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ABSTRACT

OBJECTIVE: We aimed to examine abusive head trauma (AHT) incidence before, during and after the recession of 2007–2009 in 3 US regions and assess the association of economic measures with AHT incidence.

METHODS: Data for children <5 years old diagnosed with AHT between January 1, 2004, and December 31, 2012, in 3 regions were linked to county-level economic data using an ecologic time series analysis. Associations between county-level AHT rates and recession period as well as employment growth, mortgage delinquency, and foreclosure rates were examined using zero-inflated Poisson regression models.

RESULTS: During the 9-year period, 712 children were diagnosed with AHT. The mean rate of AHT per 100,000 child-years increased from 9.8 before the recession to 15.6 during the recession before decreasing to 12.8 after the recession. The AHT rates after the recession were higher than the rates before the recession (incidence rate ratio 1.31, $P = .004$) but lower than rates during the recession (incidence rate ratio 0.78, $P = .005$). There was no association between the AHT rate and employment growth, mortgage delinquency rates, or foreclosure rates.

CONCLUSIONS: In the period after the recession, AHT rate was lower than during the recession period yet higher than the level before the recession, suggesting a lingering effect of the economic stress of the recession on maltreatment risk.

KEYWORDS: child abuse; economic recession; traumatic brain injury

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WHAT'S NEW

Results of this study demonstrate that after rising during the 2007–2009 recession, rates of abusive head trauma decreased slightly in the period after the recession but remained elevated compared to rates before the recession.

ABUSIVE HEAD TRAUMA (AHT) is the leading cause of death from child physical abuse and the most common cause of severe traumatic brain injury in infants.[1–3] Poverty and stress have both been identified as important family-level risk factors for child abuse.[4–8] A strong relationship has also been established between community-level measures of economic stress, such as poverty and housing instability, and rates of child maltreatment.[5,8–10] A recently published study by Eckenrode and colleagues[8] demonstrated a relationship between higher county-level rates of substantiated child maltreatment and higher levels of poverty and income inequality. Increased rates of physical abuse, including AHT, have also been observed after natural disasters.[11,12] The well-documented relationship between economic stress at both the family and community levels and an increased risk for abuse raised concern that rates of

abuse, particularly AHT, would increase during the great recession of 2007–2009.

The great recession, the longest recession since World War II, began in December 2007 and was characterized by significant decline in economic activity across multiple aspects of the economy, including gross domestic product, income, employment, industrial production, and retail sales.[13] The magnitude of the foreclosure and housing crisis distinguished this recession from other recession periods; nearly 45% of families with children reported difficulties with stable housing.[14–17] The National Bureau of Economic Research determined that the great recession ended in June 2009 on the basis of indications that the declining phase of the business cycle had ended and the rising phase had begun. The official end of the great recession did not, however, indicate that economic conditions were favorable or that the economy had returned to normal.

Several publications reported increases in the AHT rate during the great recession. A study by Berger and colleagues[18] reported an increased rate of AHT in a 74-county catchment area during the 17 months of the recession compared with the rate of AHT during the previous 4 years. Another study demonstrated an increase in the number and severity of AHT cases during the recession compared with the period before the recession.[19] Finally, a study using a national sample of emergency department data reported that rates of AHT in children 4 years old or younger were higher during 2007 and 2008 compared with 2006 and 2009, suggesting an increase in AHT during the recession.[20] A recent systematic review of pediatric studies evaluating the impact of the great recession on health behaviors, child physical abuse, mental health, and health-related quality of life concluded that "the evidence to date demonstrates the plausibility of the association between the crisis and violence against children."[21]

There is mixed evidence regarding which specific measures of economic stress in communities, such as mortgage foreclosure and unemployment rates, were associated with abuse rates during the great recession. A study by Wood and colleagues[22] using data from 38 pediatric hospitals demonstrated an association between local mortgage foreclosure rates and rates of admissions for physical abuse and high-risk traumatic brain injury (a proxy for AHT) between 2000 and 2009. Neither the study by Wood and colleagues nor the study by Berger and colleagues[18] found an association between unemployment rates and rates of AHT or physical abuse. A study by Frioux and colleagues,[23] however, found that county-level unemployment rates and foreclosure rates were both associated with the rates of investigated and substantiated child maltreatment reports in Pennsylvania from 1990 to 2010. Thus, while there are data to suggest that rates of physical abuse, including AHT, increased in the United States during the recent recession, the specific economic changes associated with this increase remain unclear. Furthermore, it remains unknown whether the observed increases in AHT rates during the recession have persisted or returned to levels before the recession.

Therefore, the objectives of the study were to evaluate the AHT rate in 3 regions of the United States in the periods before, during, and after the great recession using an ecologic time series analysis, and to assess whether there was a relationship between the AHT rate and several local macroeconomic indicators that have been previously associated with increased rates of various types of child maltreatment.

METHODS

STUDY POPULATION

This study is a continuation of a prior study of children younger than 5 years old residing within a 74-county catchment area who were diagnosed with unequivocal AHT by the child protection teams (CPTs) at 4 level 1 pediatric trauma centers: Children's Hospital of Pittsburgh of UPMC, Seattle Children's Hospital/Harborview Medical Center, Cincinnati Children's Hospital, and Nationwide Children's Hospital.[18] The catchment area included 23 counties in western Pennsylvania, 6 counties in Washington, and 45 counties in Ohio and northern Kentucky. The catchment areas were selected because they had the following: 1) a single regional pediatric level 1 trauma center; 2) an established CPT with stable personnel during the study period; and 3) a local institutional review board that allowed collection of study subjects' county of residence.[18] The hospitals selected to participate in the study all had CPTs with at least one child abuse pediatrician who was at the site for the duration of the entire study. These criteria maximized the possibility that all children in the catchment regions were evaluated at the participating hospital, minimized the possibility that any change in the AHT rate was related to a change in the definition of AHT, and allowed for data analysis.[18] The institutional review boards at the participating hospitals approved this study.

As described by Berger and colleagues,[18] data for the initial sample of 422 subjects residing in the 74-county catchment area and diagnosed with unequivocal AHT by the hospital CPTs were collected from January 2004 to June 2009 by a retrospective medical record review performed at the 4 pediatric hospitals serving the 3 regions. The current analysis includes prospectively collected data for an additional sample of children residing in the same 74-county catchment area who were diagnosed with unequivocal AHT by the CPTs at the same 4 hospitals from July 2009 through December 2012. To optimize ascertainment, data were also collected from the Pennsylvania child abuse registry and from colleagues at 2 nonparticipating pediatric hospitals (Dayton Children's Hospital in Ohio and Mary Bridge Hospital in Washington) located close to one of the participating hospitals.

AHT RATES

Quarterly AHT rates were calculated using the county-level population estimates of residents younger than 5 years old. All population data were obtained from the US Census Bureau; the population data for 2004 to 2010 were provided by the Intercensal Population Estimate, while the 2011 and 2012 population data were obtained from the Annual County Resident Population Estimates.[24,25]