

# Association between socioeconomic status and risk of hospitalization due to child maltreatment in the USA

Sehryr Imran,<sup>1</sup> Chad Cross,<sup>2,3</sup> Samrat U Das<sup>4</sup>

<sup>1</sup>Department of Pediatrics, Children's Mercy, Kansas City, Missouri, USA

<sup>2</sup>Department of Radiation Oncology, UNLV School of Medicine, Las Vegas, Nevada, USA

<sup>3</sup>Department of Environmental and Occupational Health, UNLV School of Community Health Sciences, Las Vegas, Nevada, USA

<sup>4</sup>Department of Pediatrics, Duke University School of Medicine, Durham, North Carolina, USA

## Correspondence to

Dr Samrat U Das, Department of Pediatrics, Duke University School of Medicine, Durham NC 27710, USA; samrat.das@duke.edu

The work has been presented in abstract form at the Western Medical Research conference, January 25–27, 2018, Carmel, California, and as platform presentation at the Pediatric Academic Society Meeting, May 5–8, 2018, Toronto, Canada.

Accepted 6 September 2018



© American Federation for Medical Research 2018. No commercial re-use. See rights and permissions. Published by BMJ.

**To cite:** Imran S, Cross C, Das SU. *J Investig Med* Epub ahead of print: [please include Day Month Year]. doi:10.1136/jim-2018-000858

## ABSTRACT

Child maltreatment remains a significant problem in the USA. There is a dearth of literature examining the association of socioeconomic status (SES) and incidence of child maltreatment among hospitalized children across the entire USA. Our aim was to study the association between SES and incidence and mortality from child maltreatment among hospitalized children in the USA. We used 2013–2014 data from the Nationwide Inpatient Sample, a discharge database representative of all hospitals in the USA. International Classification of Diseases-9 codes for general child maltreatment were used to identify patients discharged with a primary diagnosis of child maltreatment. Trends in the incidence and outcomes of child maltreatment were compared with SES based on quartiles (Qx) of median household income. In 2013–2014, there were a total of about 2.3 million pediatric discharges. Out of these, a total of 8985 had a primary diagnosis of child maltreatment. Approximately 40 per cent of the cases were from families with the lowest SES (Q1). In-hospital mortality was 2.4 per cent in Q1 (lowest SES) compared with 0.4 per cent in Q4 (highest SES). We conclude that children from lower SES households have a higher incidence of child maltreatment and have worse outcomes, including significantly higher in-hospital mortality among hospitalized children. This trend was generally consistent across all age groups and ethnicities. To our knowledge, this is the first report studying the association between SES and children with child maltreatment among hospitalized children across the entire USA.

## INTRODUCTION

Child maltreatment is any act or a series of acts of commission or omission by a parent or other caregiver that results in harm, potential for harm or threat of harm to a child. National estimates of child maltreatment victims in 2016 (676,000) show an increase of 3.0 per cent from 2012. In 2016, 1750 children died of abuse and neglect, at a rate of 2.36 per 100,000 children in the national population.<sup>1</sup> Child maltreatment remains a significant problem in the USA, and poverty is a recognized risk factor for abuse. While individual poverty is a well-known risk factor for child maltreatment, the role of

## Significance of this study

### What is already known about this subject?

- ▶ Individual poverty is a well-known risk factor for child maltreatment.
- ▶ Association between socioeconomic status and risk of child maltreatment has been demonstrated based on local, neighborhood and state-level studies.
- ▶ Among hospitalized children, association between socioeconomic status and certain categories of child maltreatment like abusive head trauma and firearm-related injuries have been studied.

### What are the new findings?

- ▶ First report studying the association between socioeconomic status and general child maltreatment (includes all categories) among hospitalized children across the entire USA.
- ▶ Mortality rates from child maltreatment among hospitalized children is also associated with socioeconomic status.
- ▶ The economic impact of child maltreatment hospitalization is significant.

### How might these results change the focus of research or clinical practice?

- ▶ More research needs to be done to look into other factors like education level of caregivers, geographic locations, social and cultural factors to be able to identify unique risk factors.
- ▶ We also need to look at the trends in more recent years.
- ▶ Data for 2015–2017 will be available in 2018 for further studies.
- ▶ The results from this article need to be brought to the attention of the policymakers so that appropriate policies can be developed for screening and prevention of child maltreatment.
- ▶ More may need to be done to target poverty.

community-level poverty on non-fatal child maltreatment is becoming better understood.<sup>2–5</sup> An association between socioeconomic status (SES) and risk of child maltreatment has been

demonstrated based on local-, neighborhood- and state-level studies.<sup>3–7</sup> Among hospitalized children, associations between SES and certain categories of child maltreatment, such as abusive head trauma and firearm-related injuries, have been studied.<sup>8,9</sup> However, there are no studies examining the association of SES and risk of general child maltreatment (includes all categories of child maltreatment) among hospitalized children at a nationwide level in the USA. There are no studies looking at the association of SES and mortality rates from child maltreatment among hospitalized children across the entire USA. Authors wanted to understand the association between SES based on median household income and risk of hospitalization and mortality from child maltreatment across the entire USA. Additionally, authors wanted to estimate the economic burden exerted by child maltreatment hospitalizations.

## METHODOLOGY

We examined discharge data between 2013 and 2014 at all US hospitals including children's hospitals and academic institutions. The only hospitals excluded were rehabilitation hospitals. The sampling frame had data from >95 per cent of US hospitals. Data were collected from the National In-Patient Sample (NIS) database, a component of the US Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project (HCUP). NIS is a self-weighted, stratified, systematic, random sample of discharges from all US hospitals. Beginning with the 2012 data year, the NIS approximates a 20 per cent stratified sample of all discharges from US hospitals.<sup>10</sup> NIS is the largest publicly available all-payer inpatient healthcare database in the USA. Unweighted, it contains data from >7 million hospital stays each year. Weighted, it estimates >35 million hospitalizations nationally.<sup>10</sup>

In this study, pediatric patients were defined as patients under 18 years of age. Subgroups were based on age: 0–3 years, 4–8 years, 9–13 years and 14–18 years. International Classification of Diseases (ICD-9) codes for general child maltreatment were used to identify patients discharged with diagnosis of child maltreatment; specifically, we utilized ICD-9 codes 995.50, 995.51, 995.52, 995.53, 995.54, 995.55 and 995.59. For SES, we used quartiles (Qx) based on median household income of the patient's zip code of residence (divisions defined by HCUP in 2013 are tabulated in [table 1](#)), as defined and provided by HCUP in the NIS data set. For 2014, each quartile endpoint was increased by approximately \$2000. Additionally, for the purposes of our study, we used two additional variables in our examination

as provided by HCUP in the existing database. Total charges include all charges generally excluding professional fees and non-covered charges, and length of stay represents the difference between admission and discharge dates.

For comparisons across quartiles, incidence rates were calculated per 100,000 (100K) discharge population. Mortality rates were also calculated per 100 K discharge population. Data management and statistical analyses were performed using IBM SPSS V.24. We obtained frequency counts and cross-tabulations of interest, along with appropriate  $\chi^2$  tests, using complex sample weighting using the discharge weight variable provided in the NIS data. Statistical analyses were performed using weighted data to determine national-level estimates.

## RESULTS

There were a total of 2,309,184 pediatric discharges in the data that we studied. Out of these, 8985 had a diagnosis of general child maltreatment. [Figure 1](#) compares the incidence (per 100K discharges) and in-hospital mortality related to child maltreatment among hospitalized children in different division quartiles based on median household income.

There was a trend of lower incidence in patients from higher SES based on median household income that was statistically significant (all  $p < 0.01$ ) across quartiles. Similar trends were observed for mortality rates ( $p < 0.01$ ) among hospitalized children ([figure 1](#)). The trend of decreased incidence with increasing SES based on median household income was generally consistent and significant ( $p < 0.01$ ) across different age groups, ethnicities, sex and payer category ([table 2](#)). Interestingly, though the trends were significant across quartiles in total, there are some demonstrable exceptions. For ages 4–8 and 14–18, an increase was seen from Q2 to Q3. This was also observed for Hispanics and for Medicaid and self-pay patients.

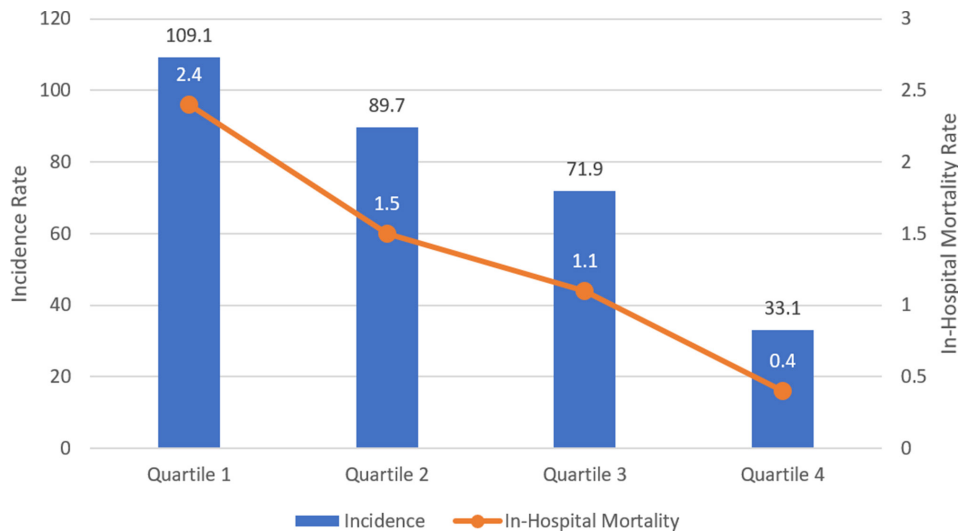
There were no particular trends in hospital length of stay due to child maltreatment among hospitalized children across the different quartiles. The average total cost for the inpatient stay ranged from a minimum of \$17,459 to a maximum of \$164,181 across all groups. These costs were limited to direct costs.

## DISCUSSION

As per a Department of Health and Human Services report in 2016, the problem of child maltreatment is significant in the USA and continues to increase.<sup>1</sup> Individual poverty is a well-known risk factor for child maltreatment based on local-level and state-level studies. Among hospitalized children, association between SES and certain categories of child maltreatment like abusive head trauma and injury due to firearm has been shown. This is the first report studying the associations between SES and general child maltreatment (includes all the different categories of child maltreatment) among hospitalized children across the entire USA. There are some limitations to this study. We used ICD-9 codes for general child maltreatment and did not look at individual injury types using E codes. While there have been studies showing that ICD-9 codes may not capture all cases of child maltreatment, those studies were based on a few children's hospitals and there were variations in the

**Table 1** Quartiles of socioeconomic status based on median household income

Quartile	2013 range (\$)	2014 range (\$)	Value description
Q1	1–37,999	1–39,999	0–25th percentile (25th percentile is 150 per cent of poverty level for the USA)
Q2	38,000–47,999	40,000–50,999	26th–50th percentile (median household income for the USA)
Q3	48,000–63,999	51,000–65,999	51st–75th percentile
Q4	>64,000	>66,000	76th–100th percentile



**Figure 1** Incidence (per 100,000 discharges) and in-hospital mortality from child maltreatment compared with income quartiles among hospitalized children in the USA.

results among the different hospitals.<sup>11–13</sup> The specificity for using ICD-9 codes to detect cases of child maltreatment was 96 per cent and sensitivity was 77 per cent.<sup>12</sup> The lower sensitivity of ICD-9 codes to capture all child maltreatment cases was related to coding errors or omissions by the coders and errors in physician documentation.<sup>12</sup> Electronic medical record (EMR) was implemented in most hospitals during our study time period as a requirement of affordable care act, making physicians responsible for majority of the coding. Hence, use of ICD-9 codes for general child maltreatment in our study might be more accurate in capturing cases of child maltreatment compared with

studies that were conducted before wide-scale implementation of EMR. Even in those reports, authors do acknowledge the utility of ICD-9 codes for surveillance of child maltreatment.<sup>11</sup> Moreover, our study also showed a trend of decreased mortality from child maltreatment among hospitalized with improving SES based on median household income. This makes the results more reliable and decreases the chances of observer bias as mortality is more objective data. Additionally, this is the first nationwide study looking at general child maltreatment from discharge data of all US hospitals using newly structured NIS data (NIS sampling restructured in 2012) giving us improved estimates.<sup>10</sup> The economic impact of child maltreatment hospitalization is significant. Our estimate included only the direct costs of hospitalization due to child maltreatment. If we consider the indirect and opportunistic costs of rehabilitating these children back into the community, the economic burden would be enormous. In conclusion, we acknowledge the limitation of use of ICD-9 codes to detect all cases of child maltreatment. However, our study is the first such attempt to study association between SES and incidence of child maltreatment among hospitalized children in the USA. The results are significant especially considering the fact that mortality rates were also associated with SES based on median household income. Our future studies would include looking at individual injury types using E codes and using ICD-10 codes to study 2015–2017 data that would be available from HCUP in 2018. Using ICD-10 codes will likely result in improved accuracy of detection of child maltreatment cases among hospitalized children.<sup>12</sup> Finally, we want to make sure our results are interpreted appropriately by healthcare providers and policymakers. Our results do not imply that we stop looking for child maltreatment in the wealthiest population. Rather, our results make a case to advocate on behalf of impoverished children. Interestingly, in some comparisons shown in table 2, we did find that there were slight increases from Q2 to Q3. It is unclear why this occurred. It could potentially be explained as a statistical artifact in that estimates of rates depend both on denominator size for a given category of interest (eg,

**Table 2** Incidence rates of child maltreatment among hospitalized children per 100K by income quartile across different age groups, ethnicities, and sex and payer categories

Category	Income quartile			
	1	2	3	4
Overall	109.1	89.7	71.9	33.2
Age (years)				
0–3	103.5	84.0	59.7	26.6
4–8	166.8	150.4	163.8	42.5
9–13	174.0	160.3	137.2	86.9
14–18	90.1	70.4	92.7	53.7
Race				
White	106.5	95.1	66.9	29.2
African-American	135.3	120.6	117.1	93.7
Hispanic	77.2	67.0	68.8	36.6
Other	91.7	61.1	37.4	18.1
Sex				
Female	101.9	82.5	78.3	35.5
Male	116.1	96.8	65.8	31.0
Primary payer				
Medicaid	133.3	130.3	133.9	86.2
Private insurance	42.2	34.6	22.6	14.7
Self-pay	112.0	35.5	71.5	20.6
Other	127.3	146.6	86.6	78.5

race) and on weighted estimation of available cases for such subgroups. Certainly slightly higher rates in Q3 should be explored in some detail, potentially using additional data sources or expanding the years under investigation.

More research needs to be done to examine other factors like education level of caregivers, geographic locations, social and cultural factors to be able to identify unique risk factors. This would help develop appropriate policies for screening and prevention of child maltreatment in the USA. Though we do observe trends in maltreatment across the quartiles, fully explaining why this occurs is not straightforward. It could be that ability to pay is related to access to care, and that more severe evidence of maltreatment is hence diagnosable in lower SES quartile families who seek treatment for injuries that are more severe, which leads to a higher probability of inpatient stays and hence higher rate estimates. It could also be that there is a relationship between perceived wealth and stress, which leads to more maltreatment in some groups. Also of interest is the potential for rates of diagnosis of maltreatment and of injuries in children to be related to the SES of the child and family. Research has suggested that appropriate injury diagnosis of low-income and minority children may be a function of over-evaluation in some groups, which may lead to an implicit confounding effect in relating SES to maltreatment or injury.<sup>14</sup> This clearly is difficult to evaluate using secondary data such as NIS where patient information is simply provided as diagnosis and procedures and we must assume that all procedures were done correctly and without such biases. The fact that mortality rates were also associated with SES minimizes the chances of such biases as mortality rate is more objective data. Further work on this phenomenon with patient-level data should be examined closely in future work in an attempt to parse these observations.

**Contributors** SI was the lead author on this research. CC provided analytical expertise and interpretation. SUD was the senior and corresponding author and helped supervise this research. All authors discussed the results and contributed to the final manuscript.

**Funding** This study was supported by a research grant provided by the University of Nevada, Reno School of Medicine Resident Research Pathway Program.

**Competing interests** None declared.

**Patient consent** Not required.

**Ethics approval** University of Nevada Reno-A category #4 exemption was obtained from Institutional Review Board of University of Nevada, Reno, to conduct this research study [UNR IRB: 1048508-1].

**Provenance and peer review** Not commissioned; externally peer reviewed.

## REFERENCES

- 1 U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, *et al.* 2017. Child Maltreatment 2016 <http://www.acf.hhs.gov/programs/cb/research-data-technology/statistics-research/child-maltreatment> (accessed 8 Aug 2018).
- 2 Kellogg ND. American Academy of Pediatrics Committee on Child Abuse and Neglect. Evaluation of suspected child physical abuse. *Pediatrics* 2007;119:1232–41.
- 3 Mersky JP, Berger LM, Reynolds AJ, *et al.* Risk factors for child and adolescent maltreatment: a longitudinal investigation of a cohort of inner-city youth. *Child Maltreat* 2009;14:73–88.
- 4 Leventhal JM, Gaither JR. Incidence of serious injuries due to physical abuse in the United States: 1997 to 2009. *Pediatrics* 2012;130:e847–e852.
- 5 Lane WG, Dubowitz H, Langenberg P, *et al.* Epidemiology of abusive abdominal trauma hospitalizations in United States children. *Child Abuse Negl* 2012;36:142–8.
- 6 Farrell CA, Flegler EW, Monuteaux MC, *et al.* Community poverty and child abuse fatalities in the United States. *Pediatrics* 2017;139:e20161616.
- 7 Maguire-Jack K, Font SA. Community and individual risk factors for physical child abuse and child neglect: variations by poverty status. *Child Maltreat* 2017;22:215–26.
- 8 Wood JN, Medina SP, Feudtner C, *et al.* Local macroeconomic trends and hospital admissions for child abuse, 2000–2009. *Pediatrics* 2012;130:e358–e364.
- 9 Cassidy LD, Lambropoulos D, Enters J, *et al.* Health disparities analysis of critically ill pediatric trauma patients in Milwaukee, Wisconsin. *J Am Coll Surg* 2013;217:233–9.
- 10 HCUP Methods Series Calculating National Inpatient Sample (NIS). Variations for data years 2012 and later: 2014. [https://www.hcup-us.ahrq.gov/reports/methods/2015\\_09.jsp](https://www.hcup-us.ahrq.gov/reports/methods/2015_09.jsp) (accessed on 8 Aug 2018).
- 11 Schnitzer PG, Slusher PL, Kruse RL, *et al.* Identification of ICD codes suggestive of child maltreatment. *Child Abuse Negl* 2011;35:3–17.
- 12 Hooft A, Ronda J, Schaeffer P, *et al.* Identification of physical abuse cases in hospitalized children: accuracy of International Classification of Diseases codes. *J Pediatr* 2013;162:80–5.
- 13 Hooft AM, Asnes AG, Livingston N, *et al.* The accuracy of ICD codes: identifying physical abuse in 4 children's hospitals. *Acad Pediatr* 2015;15:444–50.
- 14 Wood JN, Hall M, Schilling S, *et al.* Disparities in the evaluation and diagnosis of abuse among infants with traumatic brain injury. *Pediatrics* 2010;126:408–14.