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# Child Abuse & Neglect

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Research article

## Child maltreatment in U.S. emergency departments: Imaging and admissions



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### ABSTRACT

**Objective:** We report imaging and admission ratios for children with definitive and suggestive maltreatment in a national sample of emergency departments (EDs).

**Methods:** Using the 2012 Nationwide Emergency Department Sample (NEDS), we generated national estimates of ED visits for children < 10 years with both definitive and suggestive maltreatment. Outcomes were admission/transfer ratios for children < 10 years and screening ratios by skeletal surveys and head computed tomography (CT) for children < 2 years with suspected physical abuse. We compared hospitals with low, medium, and high pediatric ED volumes using multivariable logistic regression.

**Results:** The 2012 national estimate of U.S. ED visits (children < 10 years) with definitive maltreatment is 14,457 (95% CI: 11,987–16,928). Suggestive child maltreatment was seen in an additional 103,392 (95% CI: 90,803–115,981) pediatric ED visits. After controlling for patient case mix, high volume hospitals had a significantly higher adjusted odds ratio (AOR) of admission/transfer among definitive cases (AOR = 1.74, 95% CI: 1.08–2.81), and medium volume hospitals had a higher odds of admission/transfer among suggestive cases (AOR = 1.24, 95% CI: 1.02–1.50) when compared with low volume hospitals. In hospitals with reliable reporting of imaging procedures, high volume hospitals reported skeletal surveys (age < 2 years) significantly more often than low volume hospitals, AOR = 3.32 (95% CI: 1.25–8.84); the AORs for head CT did not differ by hospital volume.

**Conclusions:** Low volume hospitals were less likely to screen by skeletal survey, but head CT ratios were not affected by ED volume. Low volume hospitals were also less likely to admit or transfer.

### 1. Introduction

In 2013, approximately 679,000 children in the United States were confirmed victims of child abuse and neglect (9.1 per 1000 child population) (U.S. Department of Health and Human Services, 2015). Using annual estimates from Child Protective Services (CPS), researchers have produced prevalence estimates, which indicate that over 12% of U.S. children will experience a CPS confirmed case of maltreatment by the age of 18 (Wildeman et al., 2014). Despite drops in CPS cases over time (1997–2009), abuse-

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related hospitalizations have been steady, and there have been increases in injury severity over this time period (Farst, Ambadwar, King, Bird, & Robbins, 2013). A 2015 study using a local trauma registry reported a rate of child abuse-related mortality that was over 6 times that for accidental trauma (Estroff, Foglia, & Fuchs, 2015).

Although some maltreated children present to the emergency department (ED) with serious injuries, others may present with subtle or occult injuries and a variety of chief complaints. A number of studies have shown that child maltreatment is a recurring condition (Deans, Thackeray et al., 2013; Deans, Thackeray, Groner, Cooper, & Minneci, 2014; Putnam-Hornstein, Cleves, Licht, & Needell, 2013; Putnam-Hornstein, Simon, Eastman, & Magruder, 2015); therefore, early recognition provides the opportunity for harm prevention. Putnam-Hornstein et al. followed a group of infants who remained home after a substantiated allegation of abuse, and over 60% were re-reported within 5 years (Putnam-Hornstein et al., 2015). Currently, medical personnel (who are required by law to contact authorities) report 8–9% of the maltreatment cases to CPS each year (U.S. Department of Health and Human Services, 2015), with higher rates of substantiated cases than non-mandated reporters (King, Lawson, & Putnam-Hornstein, 2013). Early recognition of child maltreatment allows for interventions which may mitigate the emotional and developmental effects of abuse (Cohen, 2005; Cohen, Mannarino, Kliethermes, & Murray, 2012; Wethington et al., 2008).

Medical evaluation of child maltreatment has received careful consideration in recent medical literature (Christian & Committee On Child Abuse and Neglect, 2015; Wood et al., 2014; Wood, Fakeye et al., 2015; Wood, Pecker, Russo, Henretig, & Christian, 2012), including a proposed research agenda (Dubowitz, Christian, Hymel, & Kellogg, 2014) prepared for an Institute of Medicine report (IOM Institute of Medicine) and NRC (National Research Council), 2014). When maltreatment is suspected, medical evaluation recommendations consist of a variety of screening practices, including imaging (Christian & Committee On Child Abuse and Neglect, 2015). High risk children are at times best protected by hospitalization (Christian & Committee On Child Abuse and Neglect, 2015).

Previous research has described the variation in maltreatment screening practices for occult fractures in young children when physical abuse is suspected (Wood, Feudtner et al., 2012; Wood et al., 2010; Woodman et al., 2008; Woodman et al., 2008). Wood et al. documented socioeconomic and racial bias in skeletal survey practices among children with non-motor vehicle crash (non-MVC) traumatic brain injury (TBI) using data from 40 children's hospitals (Wood et al., 2010). They reported considerable variation in skeletal screening practices across the hospitals (Wood, Feudtner et al., 2012). More recently, this group considered skeletal screening in children with documented maltreatment and non-MVC TBIs and femur fractures in a sample of 366 hospitals (Wood, French, Song, & Feudtner, 2015). They concluded that only 50% of children received surveys for occult fractures in a cohort of patients for whom screening should be universal.

For this study, we have utilized a nationally representative ED database to document hospital admission and maltreatment screening variation across hospital EDs in the U.S, and we have included a much wider range of suspicious diagnoses and injury events than described by previous researchers. We have utilized a list of International Classification of Disease, 9th Revision, Clinical Modification (ICD-9) diagnosis codes and external cause of injury codes (E codes) suggestive of maltreatment based upon the work of a team of child maltreatment experts (Schnitzer, Slusher, Kruse, & Tarleton, 2011). When devising their suggestive code list, the authors used a statewide database of discharges from hospitals and EDs to investigate cases. Suggestive cases were those where > 66% of the reviewed cases could be classified as maltreatment-related, either abuse or neglect, after medical record review by the team. This suggestive list of ICD-9 codes has previously been used to describe maltreatment in children, 0–3 years (King, Farst, Jaeger, Onukwube, & Robbins, 2015).

The purpose of this study was to examine variation in the evaluation of maltreatment in both documented and suggestive cases of maltreatment. Our outcome measures are (1) hospital admission or transfer and (2) physical abuse screening by skeletal surveys and head CT. We sought to determine if emergency department pediatric volumes affected imaging evaluations and the disposition from the ED of these children. Variations in maltreatment evaluation may be indicative of disparities in care. Emergency department pediatric volume is used as a measure of institutional experience and resource availability to address possible maltreatment. This study is the first to provide national emergency department estimates by diagnosis for definitive and suggestive cases of maltreatment for children under the age of 10 years.

## 2. Methods

### 2.1. Study design and setting

We retrospectively reviewed the 2012 Nationwide Emergency Department Sample (NEDS). This Healthcare Cost and Utilization Project database includes records from 950 U. S. non-rehabilitation hospitals. Because NEDS is a 20% stratified sample, when weighted it produces nationally representative estimates of ED visits (Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project, 2015). Research using this publicly available deidentified dataset was deemed exempt by our institutional review board.

### 2.2. Child maltreatment definitions

We limited the analysis to children under age 10 years when describing maltreatment (abuse and neglect) (Schnitzer et al., 2011) and when examining the variation in hospitalization. When looking at occult injury imaging, we focused on children under 2 years. Definitive cases of maltreatment were defined using the abuse diagnosis ICD-9 diagnosis codes 995.50–995.59 and the perpetrator external cause of injury codes (E codes), E967.0–E967.9. If any of these codes were among the fifteen diagnosis and four E codes available in NEDS, then maltreatment was defined as definitive rather than suggestive. To define suggestive cases, we utilized the

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