Child maltreatment surveillance following the ICD-10-CM transition, 2016-2018

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ABSTRACT

Background Child maltreatment is poorly documented in clinical data. The International Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification (ICD-10-CM) represents the first time that confirmed and suspected child maltreatment can be distinguished in medical coding. The utility of this distinction in practice remains unknown. This study aims to evaluate the application of these codes by patient demographic characteristics and injury type.

Methods We conducted secondary data analysis of emergency department (ED) discharge records of children under 18 years with an ICD-10-CM code for confirmed (T74) or suspected (T76) child maltreatment. Child age, sex, race/ethnicity, insurance status and co-occurring injuries (S00-T88) were compared by maltreatment type (confirmed or suspected).

Results From 2016 to 2018, child maltreatment was documented in 1650 unique ED visits, or 21.7 per 10 000 child ED visits. Suspected maltreatment was documented most frequently (58%). Half of all maltreatment-related visits involved sexual abuse, most often in females and individuals of non-Hispanic white race. Physical abuse was coded in 36% of visits; injuries to the head were predominant. Non-Hispanic black children were more frequently documented with confirmed physical abuse than suspected (38.7% vs 23.7%, p<0.01). The rate of co-occurring injuries documented with confirmed and suspected maltreatment differed by 30% (9.2 vs 12.5 per 10 000 ED visits, respectively).

Conclusions The ability to discriminate confirmed and suspected maltreatment may help mitigate clinical barriers to maltreatment surveillance associated with delayed diagnosis and subsequent intervention. Racial disparities in suspected and confirmed cases were identified which may indicate biased diagnostic behaviours in the ED.

INTRODUCTION

Child maltreatment is a pervasive yet poorly identified public health problem.[1] As demonstrated by the adverse childhood experiences study, childhood adversity has a dose-response relationship with negative behavioural and medical outcomes later in life.[2] Victims of abuse and neglect are at increased risk of experiencing anxiety, depression, eating disorders, gastrointestinal disorders, substance misuse, suicidality and premature death.[3–8] Early recognition and effective prevention are essential to healthy development across the lifespan. Yet, because of its hidden nature, maltreatment can be difficult to predict and identify, creating a barrier to many interventions and surveillance efforts.

The emergency department (ED) is an important setting for maltreatment recognition, documentation and tertiary prevention. Extant literature has demonstrated that victims of child maltreatment are higher utilisers of healthcare services and expenditure compared with non-victims.[9–12] However, it is estimated that just 11% of paediatric ED visits occur in children's hospitals.[13] Thus, many medical professionals treating children with maltreatment-related injuries lack specialised training to identify the related signs and symptoms,[13] resulting in missed opportunities for both intervention and effective surveillance aimed towards quantifying the magnitude of maltreatment.

The clinical burden of child maltreatment has been increasingly surveilled using International Classification of Diseases and Related Health Problems, Clinical Modification (ICD-CM), and external cause of injury e-codes.[14–21] From October 1996 to October 2015, child maltreatment was categorised by ICD-9-CM using seven categories (unspecified maltreatment, emotional abuse, nutritional neglect, sexual abuse, physical abuse, shaken infant syndrome and multiple forms). These categories still inadequately captured the breadth of maltreatment treated in the clinical setting. Arguably, the greatest limitation in using ICD-9-CM for child maltreatment surveillance was the requirement of certitude for a diagnosis of maltreatment to be coded. Studies have demonstrated poor agreement between clinical symptoms of maltreatment and explicit ICD-9-CM documentation in the medical record,[15 20] suggesting that the ICD-9-CM nosology did not allow medical staff to adequately capture maltreatment.

Each ICD-CM iteration improves the specificity of maltreatment diagnoses, and subsequently improves the utility of clinical documentation (table 1) for maltreatment prevention.[22] Beginning in October 2015, ICD-10-CM was adopted in the USA, and for the first time suspected and confirmed maltreatment could be distinguished and documented through medical coding.[22] In addition, the maltreatment classification of nutritional neglect was replaced by the more comprehensive classification of neglect and abandonment. Collectively, these changes in coding have implications for improved clinical documentation and maltreatment surveillance. Inherently, the documentation of maltreatment is dependent on the clinician's familiarity and comfort with these codes, and the

Table 1 Nosology of child maltreatment using ICD-CM

Effective date(s)	ICD-CM version	Description	Code
1 October 1996 to 30 September 2015	Ninth revision	Child abuse and neglect, unspecified	995.50
		Emotional abuse	995.51
		Neglect (nutritional)	995.52
		Sexual abuse	995.53
		Physical abuse	995.54
		Shaken infant syndrome	995.55
		Multiple forms	995.59
1 October 2015 to current	10th revision	Neglect or abandonment, confirmed	T74.0
		Neglect or abandonment, suspected	T76.0
		Physical abuse, confirmed	T74.1
		Physical abuse, suspected	T76.1
		Sexual abuse, confirmed	T74.2
		Sexual abuse, suspected	T76.2
		Psychological abuse, confirmed	T74.3
		Psychological abuse, suspected	T76.3
		Shaken infant syndrome, initial encounter	T74.4
		Unspecified maltreatment, confirmed	T74.9
		Unspecified maltreatment, suspected	T76.9

ICD-CM, International Classification of Disease and Related Health Problems, Clinical Modification.

availability of time to apply them to the electronic chart, a task that is often performed during the final documentation step of billing for the encounter. Yet, we have identified just one study which examines the clinical utility of the new classifications.[23] To address this gap in the literature, this study aims to quantify and compare the characteristics of confirmed and suspected child maltreatment derived from ICD-10-CM codes, using a statewide sample of ED discharge data.

MATERIALS AND METHODS

Population and setting

We conducted secondary data analysis of ED discharge data obtained from the Connecticut Hospital Association (CHA), comprising 27 of 29 EDs in the state. Each record within CHA contains patient demographic information (age, gender, race, ethnicity, insurance status and zip code), procedural codes, treatment costs and up to ten ICD-10-CM codes (including external cause of injury) per visit. Connecticut ED visits involving children under 18 years, who were discharged during the period 2016–2018, were included. Our study population was limited to visits with an ICD-10-CM code for confirmed or suspected child maltreatment. Visits involving children who were not residents of Connecticut were excluded. The study was determined to be exempt by the Connecticut Children's Institutional Review Board.

ICD-CM

ICD-CM has been used since the 19th century to record medical diagnoses and procedures.[24] The 10th revision includes a seven character, alphanumeric system representative of the disease or injury category, related aetiology, anatomic site, severity and vital details.

Measurement

The primary outcome of interest was coding of maltreatment, defined as either confirmed or suspected. Child maltreatment was identified in ED discharge data using ICD-10-CM codes. The first three characters of the code were used to identify the categories of confirmed (T74) and suspected (T76) maltreatment. The type of maltreatment (physical and sexual abuse) was further identified using the remaining subcategories, represented by the fourth character in the code. Injuries co-occurring with documented maltreatment were identified using ICD-10-CM codes for injury and poisonings (S00-T88).

Statistical analysis

Descriptive statistics were calculated using univariate analysis and stratified by coding and maltreatment types. Differences in demographic characteristics were identified using t-test or χ^2 tests, as appropriate. Rates were calculated using the total or stratum specific number of ED visits for individuals under 18 years as the denominator. All analyses were conducted using SAS V.9.4. The level of significance was set at 0.05.

RESULTS

Characteristics of study subjects

There were 761 487 ED visits for children under 18 years from 2016 to 2018. A total of 1650 unique visits (0.2%) included documentation of suspected (n=949) or confirmed (n=698) child maltreatment; three visits included codes for both. Nearly 2% (n=24) of maltreatment-related visits involved more than one type of documented abuse and neglect. Physical (36%) and sexual (50%) abuse were the most common forms of maltreatment. Characteristics of the study population can be found in table 2. Due to low cell counts, results for neglect and psychological abuse are not shown.

Characteristics of visits for confirmed and suspected maltreatment

Visits for confirmed and suspected maltreatment differed significantly by child age ($p<0.01$), and race/ethnicity ($p<0.01$). When compared with suspected maltreatment, documentation of confirmed maltreatment involved children who were older (13 vs 6 years, respectively). The greatest proportion of all maltreatment-related visits involved children of non-Hispanic white race/ethnicity. However, the rates of confirmed maltreatment in children of non-Hispanic black race/ethnicity were more than double that of children in other race/ethnic groups (table 3). Rates of suspected physical abuse were also elevated in non-Hispanic black children, but the difference compared with children in other race/ethnic groups was less pronounced.

Characteristics of visits for physical abuse

Confirmed and suspected physical abuse differed significantly by child age ($p<0.01$) and race/ethnicity ($p<0.01$). The average age of children with confirmed physical abuse was 14 years, compared with 4 years among children with suspected physical abuse. Confirmed physical abuse was most often coded in non-Hispanic black children (38.7%), while suspected physical abuse was most often coded in non-Hispanic white children. Injuries to the head (S00-S09) were most prevalent with confirmed (51%) and suspected (28%) physical abuse coding (table 4). Following this, injuries to the knee and lower leg (S80-S88), and injuries to the neck and thorax (S10-S29) and upper extremities (S40-S69) were most common.

Table 2 Characteristics of confirmed and suspected child maltreatment using ICD-10-CM in Connecticut children aged 0–17 years, 2016–2018

Characteristic	Total confirmed (n=701)	Total suspected (n=952)	P value*	Confirmed physical abuse (n=300)	Suspected physical abuse (n=300)	P value*	Confirmed sexual abuse (n=292)	Suspected sexual abuse (n=538)	P value*
Median age (years)	13.0	6.0	<0.01	14.0	4.0	<0.01	14.0	10.0	<0.01
	n(%)	n(%)		n(%)	n(%)		n(%)	n(%)	
Sex									
Male	229 (32.7)	324 (34.0)	0.56	145 (48.3)	165 (55.0)	0.10	30 (10.3)	96 (17.8)	<0.01
Female	472 (67.3)	628 (66.0)		155 (51.7)	135 (45.0)		262 (89.7)	442 (82.2)	
Race/ethnicity									
Non-Hispanic black	236 (33.7)	238 (25.0)	<0.01	116 (38.7)	71 (23.7)	<0.01	78 (26.7)	138 (25.6)	0.79
Non-Hispanic white	266 (38.0)	361 (37.9)		111 (37.0)	109 (36.3)		121 (41.4)	211 (39.2)	
Hispanic	69 (9.8)	86 (9.0)		31 (10.3)	17 (5.7)		31 (10.6)	59 (11.0)	
Other	130 (18.5)	267 (28.1)		42 (14.0)	103 (34.3)		62 (21.2)	130 (24.2)	
Insurance type									
Public	431 (61.5)	600 (63.0)	0.30	243 (81.0)	241 (80.3)	0.39	106 (36.3)	265 (49.3)	<0.01
Private	81 (11.5)	110 (11.6)		26 (8.7)	31 (10.3)		39 (13.4)	69 (12.8)	
Self-pay	58 (8.3)	56 (5.9)		27 (9.0)	27 (9.0)		19 (6.5)	19 (3.5)	
Other	131 (18.7)	186 (19.5)		4 (1.3)	1 (0.3)		128 (43.8)	185 (34.4)	

Column percentages shown.
*t-test or $\chi 2$ tests, as appropriate.
ICD-10-CM, International Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification.

Characteristics of visits for sexual abuse

Few differences were observed between the documentation of suspected and confirmed sexual abuse. The majority of visits involved females (89% confirmed, 82% suspected), non-Hispanic white race/ethnicity (41% confirmed, 40% suspected) and children in their early/mid-adolescent years (14 years—confirmed; 10 years—suspected). The rate of injury was low with documented sexual abuse (table 5). When noted, the most prevalent injuries were those to the abdomen, lower back, pelvis and external genitals (S30-S39).

DISCUSSION

This study is among the first to evaluate the changes in ICD-10-CM which distinguish confirmed and suspected child maltreatment. Two studies using the Canadian Coding Standards and Canadian Classification of Interventions (ICD-10-CA/CCI) codes evaluated abusive head trauma in children under 3 years of age.[25 26] However ICD-10-CA/CA is most comparable to ICD-9-CM, and many codes cannot be directly converted.[27 28]

A retrospective chart review of a paediatric trauma centre found that ICD-10-CM coding for confirmed and suspected maltreatment was applied inconsistently.[23] Their review of social work notes revealed that only 63% of the children with confirmed abuse and 33% with suspected abuse were identified using diagnostic codes. In addition, 6% of the patients were incorrectly coded for suspected abuse when chart review revealed no supporting evidence. In contrast, this study evaluated the utility of ICD-10-CM codes in a statewide sample of ED discharge records, and found higher rates of coding for suspected child maltreatment when compared with confirmed child maltreatment.

A challenge in using the previously prescribed nosology in ICD-9-CM for child maltreatment surveillance was that it did not allow for the direct comparison between confirmed and suspected child maltreatment without using a series of proxy codes (eg, long bone fractures in infants, or non-congenital sexually transmitted infections in children) suggestive of maltreatment.[15 20] In a prior analysis of maltreatment-related ED visits

Table 3 Rate of confirmed and suspected child maltreatment by sex and race documented in ED discharge data, Connecticut children aged 0–17 years, 2016–2018

	Total confirmed	Total suspected	Confirmed physical abuse	Suspected physical abuse	Confirmed sexual abuse	Suspected sexual abuse
	Rate per 10 000 ED visits	Rate per 10 000 ED visits	Rate per 10 000 ED visits	Rate per 10 000 ED visits	Rate per 10 000 ED visits	Rate per 10 000 ED visits
Characteristic						
Sex						
Male	5.8	8.2	3.7	4.2	0.7	2.4
Female	12.8	17.1	4.2	3.7	7.1	12.0
Race/ethnicity						
Non-Hispanic black	16.6	16.8	8.2	5.0	5.5	9.7
Non-Hispanic white	7.9	10.7	3.3	3.2	3.6	6.2
Hispanic	7.6	9.5	3.4	1.9	3.4	6.5
Other	6.7	13.8	2.2	5.3	3.2	6.7

ED, emergency department.

Table 4 Documented injuries in confirmed and suspected child maltreatment in Connecticut children aged 0–17 years, 2016–2018

		Confirmed physical abuse	Suspected physical abuse	Confirmed sexual abuse	Suspected sexual abuse
ICD-10-CM Code	Description	N (%)	N (%)	N (%)	N (%)
S00-S09	Injuries to the head	154 (51)	85 (28)	4 (1)	9 (2)
S10-S19	Injuries to the neck	24 (8)	6 (2)	3 (1)	7 (1)
S20-S29	Injuries to the thorax	28 (9)	22 (7)	3 (1)	3 (0)
S30-S39	Injuries to the abdomen, lower back, lumbar spine, pelvis and external genitals	12 (4)	28 (9)	8 (3)	16 (3)
S40-S49	Injuries to the shoulder and upper arm	24 (8)	25 (8)	4 (1)	4 (0)
S50-S59	Injuries to the elbow and forearm	24 (8)	22 (7)	2 (0)	1 (0)
S60-S69	Injuries to the wrist, hand and fingers	27 (9)	9 (3)	1 (0)	3 (0)
S70-S79	Injuries to the hip and thigh	17 (6)	15 (5)	1 (0)	5 (1)
S80-S89	Injuries to the knee and lower leg	31 (10)	24 (8)	7 (2)	9 (2)

Column percentages shown.
ICD-10-CM, International Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification.

in Connecticut children aged 0–9 years (2011–2014), we found <1% of visits with confirmed coding using ICD-9-CM .[15] The similarly low rate of maltreatment coding in this study (<1.0%) indicates a continued need for proxy coding in maltreatment surveillance. Under-ascertainment may be due to several factors including missed detection, poor documentation or limitations inherent to the ICD-CM coding system. The inclusion of suspected maltreatment codes did not appear to increase the rate of maltreatment coding from that observed in previous years.[15] It is likely that maltreatment was more accurately classified using ICD-10-CM given the expansion to allow for both suspected and confirmed maltreatment, and the replacement of nutritional neglect with the more comprehensive classification of neglect and abandonment. This may not have been observable in our study because of the lagged effect of physician familiarity and comfort using the new codes, which may be compounded by additional clinical barriers to coding at the level of recognition. Investigators have noted the challenges in distinguishing intentional and unintentional injuries in children.[29 30] In prior years using ICD-9-CM, this uncertainty resulted in both inaccurate coding and underutilisation of maltreatment codes.[18] With the transition to ICD-10-CM, both confirmed and suspected maltreatment can be discerned, potentially alleviating some of the barriers to coding. In order to optimise the coding of maltreatment, providers must know about the available codes and feel empowered to use them. Both of these actions require training. Although many organisations have training curricula on the ICD-10-CM available for both physicians and professional coders, including toolkits, textbooks and webinars, it is unclear whether training specific to the use of suspected maltreatment codes is provided. An important advancement in improving the use of these codes is the development of easily accessible clinical pathways linked to electronic medical record systems. Utilisation of such pathways can standardise clinical evaluation once a concern of abuse or neglect has been identified, and promote the application of maltreatment codes where appropriate. Currently, clinical pathways for child physical abuse have not been universally applied to electronic medical record systems.[31]

Table 5 Rate of injury in visits for confirmed and suspected child maltreatment in Connecticut children aged 0–17 years, 2016–2018

	Total injuries	Rate per 10 000 ED visits
Total confirmed maltreatment	701	9.2
Total suspected maltreatment	952	12.5
Confirmed physical abuse	341	4.5
Suspected physical abuse	236	3.1
Confirmed sexual abuse	33	0.4
Suspected sexual abuse	57	0.8

ED, emergency department.

Using ICD-10-CM, we identified significant differences in child demographic characteristics and injuries sustained based on the type of maltreatment and the level of certainty (confirmed vs suspected). These differences were most noticeable in cases of physical abuse. Children documented with confirmed physical abuse were significantly older. It is known that the most vulnerable victims of maltreatment are young,[1] with limited verbal capacity. Age-related differences identified in this study are likely a result of young children's inability to communicate their experiences of abuse. We also identified stark differences in the rate of child maltreatment coding by child race/ethnicity. In particular, non-Hispanic black children had the highest rates of maltreatment, regardless of documentation type. This result is consistent with literature identifying racial disparities related to physical screening practices for maltreatment.[30 32–34] Given the dual potential for racial bias in child protective service (CPS) reporting, non-Hispanic black child victims of maltreatment may be disproportionately represented in both CPS and ED data.

We identified variations in primary insurance status when comparing confirmed and suspected sexual abuse. In particular, public insurance was coded most often with suspected sexual abuse, and 'other' insurance coded most often with confirmed sexual abuse. This observed differences may be due to state-funded services which help cover the cost of forensic examinations, evidence collection, and additional tests and treatments related to sexual abuse. Victims with confirmed sexual abuse who received these services would be financially covered by the state, and avoid direct billing to their insurance. Consistent with prior studies, sexual abuse was most often coded in females.[14 21]

Visits indicating confirmed and suspected sexual abuse also had few documented injuries, consistent with the literature demonstrating a low percentage of medical symptoms with child sexual abuse.[35 36] Additional studies combining the use of clinical data to identify clusters of symptoms indicative of sexual abuse may help to improve the sensitivity of diagnoses.

LIMITATIONS

This study is not without limitations. First, due to the cross-sectional nature of the data, we were unable to establish a causal relationship between patient demographic characteristics and documented maltreatment type. Second, the ICD-10-CM classification system was developed for the primary purpose of administrative billing, and not surveillance, limiting the level of specificity that can be gleaned from analysing this data. Third, our data were analysed at the visit level, precluding our ability to identify children who visited the ED on multiple occasions during the study period. This limitation may have resulted in an overestimation of calculated rates. Finally, our results and interpretation of the data are dependent on the knowledge, behaviours and biases of the health professionals documenting confirmed and suspected maltreatment.

CONCLUSION

Advances in the ICD-10-CM nosology for child maltreatment equip the healthcare system with opportunities to document maltreatment in the medical record without the barrier of clinical certitude. However, the utility of ICD-10-CM codes for maltreatment surveillance is dependent on consistent coding by medical staff. Given the expansion in available codes with each iteration of the ICD-CM, it is possible that confusion remains about the appropriateness of each code. Low rates of child maltreatment coding in this study suggest that additional effort is necessary to ensure providers are prepared to apply appropriate ICD-10-CM codes in cases where maltreatment is suspected. In addition, given the limitations of health data in understanding child maltreatment, future studies should work to link data sets, including those from within the child welfare system, to provide a more comprehensive picture of child maltreatment. Improving the quality of child maltreatment surveillance in clinical care systems may allow for better understanding of the scope and burden of child maltreatment in the USA and for improved measurement of outcomes in studies of child maltreatment screening and intervention.

What is already known on the subject

- Child maltreatment is poorly surveilled in clinical settings.
- A significant barrier to child maltreatment documentation has been the requirement of certainty in diagnosis.
- The International Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification introduces the first time that confirmed and suspected child maltreatment can be classified separately in medical coding.

What this study adds

- Racial disparities in child maltreatment coding exist which present opportunities for training and education to improve surveillance.
- Assessment of the International Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification child maltreatment classifications will help inform future ICD-CM iterations.

Correction notice The article has been corrected since it is published online. In the first paragraph of the Results, the percentages for physical abuse and sexual abuse have been corrected.

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