Identification of Physical Abuse Cases in Hospitalized Children: Accuracy of *International Classification of Diseases* Codes

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Objective Hospital discharge databases are being increasingly used to track the incidence of child physical abuse in the United States. These databases use *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) codes to categorize illnesses and injuries in hospitalized patients. We assessed the accuracy of the assignment of these codes for cases of child physical abuse.

Study design Participants were all children (N = 133) evaluated by a child abuse pediatrician (CAP) for suspicion of abuse at Yale-New Haven Children's Hospital from January 1, 2007-December 31, 2010. These children included both those judged to have injuries from abuse and those judged to have injuries accidental/medical in nature. We compared the ICD-9-CM codes entered in the hospital discharge database for each child with the decisions made by the CAPs, as documented in their child abuse registry. The CAPs' decisions were considered to be the gold standard. Sensitivity and specificity were calculated. Medical records were reviewed for cases in which the ICD-9-CM codes disagreed with the CAP's decision.

Results In 133 cases of suspected child physical abuse, the sensitivity and specificity of ICD-9-CM codes for abuse were 76.7 % (CI 61.4%, 88.2%) and 100% (CI 96.0%, 100%), respectively. Analysis of the 10 cases of abuse not receiving ICD-9-CM codes for abuse revealed that errors in physician documentation (n = 5) and in coding (n = 5) contributed to the reduction in sensitivity.

Conclusions Despite high specificity in identifying child physical abuse, the sensitivity of ICD-9-CM codes is 77%, indicating that these codes underestimate the occurrence of abuse. *(J Pediatr 2013;162:80-5).*

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n 2010, the US Department of Health and Human Services estimated that there were 695 000 victims of child maltreatment, with 17.6% of these cases classified as physical abuse.[1] These data, compiled by the National Child Abuse and Neglect Data System using reports generated by Child Protective Services agencies across the nation, do not provide information about the types or severity of the abusive injuries. Therefore, alternative methods of quantifying and tracking injuries due to abuse are needed.

Hospital discharge databases (HDDs) are powerful sources of information for tracking child physical abuse. HDDs are routinely maintained by hospitals for billing and payment purposes, contain data about victims of abuse with injuries serious enough to require hospitalization, and document the types of injuries in abused patients who have been evaluated by medical professionals. Hospital databases that contain *International Classification of Disease* (ICD) codes, such as the Kids' Inpatient Database and the Nationwide Inpatient Sample maintained by the Agency for Healthcare Research and Quality, are currently used in studies to estimate the occurrence of hospitalizations due to abusive injuries.[2-10]

In the United States, hospital coders review medical records and use ICD codes to categorize the illnesses and injuries of all hospitalized patients. Child physical abuse is coded by specific diagnosis codes as well as codes for external causes (E-codes) that are used to categorize intent and mechanism of an injury.[11]

Only 2 previous studies have examined the accuracy of the use of child maltreatment codes in children hospitalized with injuries. These studies, however, did not focus specifically on physical abuse and only compared the accuracy of the documentation in the medical record with the ICD codes.[12,13] In addition, 2 important changes have occurred in hospital coding over the last 20 years: (1) E-codes are being used more frequently to document cause of injury; and (2) the majority of states now mandate inclusion of E-codes in HDDs.[14]

CAP	Child abuse pediatrician
E-codes	Codes for external causes
HDD	Hospital discharge database
ICD	*International Classification of Disease*
ICD-9-CM	*International Classification of Diseases, 9th Revision, Clinical Modification*
ICD-10-CM	*International Classification of Diseases, 10th Revision, Clinical Modification*
TBI	Traumatic brain injury

With the increasing availability of cause of injury data and the use of ICD-based databases in estimating the occurrence of physical abuse, there is a need for a more thorough examination of how accurately hospital discharge data reflect the conclusions of the physicians who evaluate children with injuries concerning for physical abuse.[2,3,5-10] The purpose of this study, thus, was to determine how accurately ICD codes reflect the decisions made by child abuse pediatricians (CAPs) asked to assess the likelihood of physical abuse and to describe the nature of the cases of physical abuse that are coded incorrectly.

Methods

Subjects included all children who were admitted to Yale-New Haven Children's Hospital from January 1, 2007 to December 31, 2010 and evaluated by the child abuse consultation service during their admission. Subjects were identified through an electronic child abuse registry maintained by the hospital's 2 CAPs. The registry contains demographic information about the suspected victims of child abuse and decisions made regarding the likelihood of physical abuse in each case.

To decide the likelihood that a child's injuries were attributable to physical abuse, the CAP who evaluated the patient used a 7-point likelihood scale ranging from definite abuse to definite accident/medical cause.[15] In the present study, "abuse" was defined as a rating of 1 (definite abuse) or 2 (likely abuse); "unknown" included ratings of 3 (questionable abuse), 4 (unknown cause), or 5 (questionable accident/medical cause); and "accident/medical cause" included 6 (likely accident/medical cause) or 7 (definite accident/medical cause). Cases of suspected medical child abuse, sexual abuse, or neglect were excluded unless there was also a suspicion of physical abuse.

The CAP completed a form with the abuse rating scale after the patient was discharged from the hospital. When completing the form, the CAP reflected his or her clinical impression and decision-making about the likelihood of abuse at the time of the child's hospitalization and not upon a reevaluation of the case.

Identifying Injuries Coded as Child Physical Abuse
The HDD contains demographic information and *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) diagnosis codes and E-codes for all patients discharged from the hospital. The ICD-9-CM codes were obtained for all patients in the CAPs' electronic registry. Based on the ICD-9-CM codes and E-codes for each patient, the injuries contained in the discharge database were classified into 4 categories (**Table I**): (1) physical abuse; (2) accident/medical cause; (3) unknown cause; or (4) no injury code. Children who received codes for both physical abuse and an accidental/medical cause were classified as victims of physical abuse, as these abuse codes are what are used epidemiologically to identify cases when using hospital discharge data.

Table I. ICD-9-CM codes for abuse, accident, and unknown causes

Child physical abuse codes
    Diagnosis code for child physical abuse (995.50, 995.54)
    Diagnosis code for shaken infant syndrome (995.55)
    Diagnosis code for other child abuse and neglect (995.59)
    E-code for a fight, brawl, or assault (E960.0, E961-E966, E968.0-E968.9)
    E-code for perpetrator of child and adult abuse (E967.0-967.9)
Accident/medical cause codes
    Diagnosis codes for birth injury or medical cause such as, but not limited to:
        286.0 Congenital factor VIII disorder
        733.15 Pathologic fracture of other specified part of femur
        767.0 Cerebral hemorrhage at birth
        967.2 Fracture of clavicle due to birth trauma
    E-code for an accidental injury (E800-E848, E850-869, E880-E889, E910-E929)
Unknown cause codes
    E-code for an injury with unknown, unspecified, questionable, probable, or suspected intent (E980-E989)

Note: Children receiving an accident, medical cause, and/or unknown cause code, and a physical abuse code were considered coded as physical abuse.

Analysis of Sensitivity and Specificity
The decision made by the CAPs about whether a child's injuries were due to physical abuse or not was considered the gold standard in this study. We first compared the decision made by the CAP (abuse, unknown cause, or accident/medical cause) with the ICD code assigned to the patient (abuse, unknown cause, accident/medical cause, and no injury code).

For the purpose of calculating sensitivity and specificity, we categorized the CAPs' decisions into two categories: abuse or not abuse. In order to be conservative in labeling a case as abuse, cases classified as unknown in cause were categorized in the "not abuse" group. Cases in the HDD that had no injury code were also classified as not abuse. Comparison between the CAPs' likelihood rating and the code(s) contained in the discharge database was made to determine sensitivity and specificity in the coding of child physical abuse. Sensitivity and specificity and 95% exact binomial CIs were calculated using SAS v. 9.2 (SAS Institute Inc, Cary, North Carolina).

Review of Discordant Cases
Medical records were reviewed for all cases in which the ICD code assigned differed from the classification of cause of injury by the CAPs. Pertinent information from consultation notes by the CAP, other physicians' notes, and the discharge summary was abstracted by a primary reviewer and used to identify and classify the reasons for discordance between the CAP's decision and the codes in the discharge database. A second reviewer then independently reviewed the abstracted information from the medical records of the incorrectly coded cases. Any disagreement between reviewers was resolved through discussion or input from a third reviewer.

Completeness of the Child Abuse Registry
To determine the completeness of the CAP's child abuse registry, we queried the HDD for all children (less than 18 years