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Factors Associated with Child Protective Services Referrals in Young Children with Isolated Skull Fractures

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Dr. Breeden-Carino's, Dr. Brink's, Dr. Christian's, Dr. Harper's, Dr. Henry's, Dr. Ruiz-Maldonado's, and Dr. Wood's employers have received payment for expert testimony when subpoenaed to testify in cases of suspected child maltreatment. Dr. Christian, Dr. Lindberg, Dr. Frasier, and Dr. Frazier provide medical legal expert testimony in child abuse cases.

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Abstract:

Objective

Many young children with isolated skull fractures are referred to child protective services (CPS) despite being assessed to have a low likelihood of abuse. We sought to identify factors associated with CPS referrals in this population and to quantify hospital-level variation.

Methods

We performed a multicenter retrospective cross-sectional study of children <2 years with skull fractures with or without a small underlying intracranial hemorrhage (ICH) and no additional injuries undergoing a child abuse pediatrics (CAP) subspecialty evaluation. We explored associations between demographic factors, clinical characteristics, psychosocial risk factors, and hospital site with CPS referral status. We performed multivariable logistic regression, adjusting for transfer status and all significant covariates from unadjusted analyses. We utilized marginal standardization to calculate the estimated probability of CPS referrals at each site, adjusting for all factors in the final model.

Results

Of 528 children, 303 (57.4%) were referred to CPS, with 86.5% referred prior to CAP consultation. In multivariable logistic regression, presence of psychosocial risk factors (OR 4.00; 95% CI 2.25, 7.11), in-person CAP consult (OR 3.93; 1.61, 9.62), inflicted or no trauma history provided (OR 6.15; 3.30, 11.45), absence of ICH (OR 2.03; 1.26, 3.27), and site were significantly associated with CPS referral. After adjustment for case-mix, the percentage of children referred to CPS ranged from 34.6% to 76.4% across sites.

Conclusions

We found a two-fold variation in CPS referrals based on site. Most referrals occurred prior to CAP involvement. These findings support the need for increased guidance regarding indications for referral.

What's New:

A significant proportion of children with isolated skull fractures received child protective services referrals, often despite low concern for abuse by child abuse experts. The two-fold variation in referral practices by hospital suggests room for improvement in care standardization.

Introduction:

Skull fractures are the most common fracture in infancy and often occur in children <2 years old [1,2]. While most result from accidental trauma, they can also be inflicted [1,2]. Evaluation of skull fractures involves careful consideration of the history provided, developmental abilities of the child, physical examination findings, fracture morphology, and, when appropriate, imaging to assess for additional injuries. Identification of the subset of children with skull fractures that are attributable to abuse is important to guide clinical care and appropriate referrals to child protective services (CPS).

The decision of whether to refer to CPS can be challenging, particularly in children with isolated skull fractures without additional identified injuries. Little is known about the frequency and predictors of referrals to CPS in young children with isolated skull fractures. Prior research has mainly focused on the yield of evaluations for additional abusive injuries in children with skull fractures to assist clinicians in differentiating abusive from accidental presentations [3-8]. These studies have shown that psychosocial risk factors, additional injuries identified on exam, unwitnessed mechanisms of injury, younger age, and complex fractures are associated with social work or child protection team referral as well as CPS referrals [3-6,9]. To our knowledge, no published research has explored the factors associated with CPS referrals across a multicenter sample of children with isolated skull fractures.

Although referrals to CPS are mandated for children who are suspected victims of abuse, they can be a significant source of financial and emotional stress for families due to legal costs, potential family separation, and stigmatization [10-12]. Understanding factors associated with CPS referrals, the timing of referrals, and variation in referral rates across hospitals will clarify current practices and may highlight opportunities for standardization of care. Identification of children

with low concern for physical abuse and for whom CPS referrals could be reasonably deferred could improve future care.

We leveraged a multicenter child physical abuse dataset to identify factors in current practice that are associated with CPS referrals amongst children <2 years with isolated skull fractures who are undergoing subspecialty child abuse evaluations. We additionally sought to quantify hospital-level variation in these referrals. We hypothesized there would be significant hospital-level variation in CPS referrals. As a secondary objective, we described timing of referral to CPS in relation to Child Abuse Pediatrics specialist (CAP) involvement and CAP level of concern for abuse amongst cases referred to CPS. We hypothesized that CAPs would have low levels of concern for abuse in the majority (>70%) of children with isolated skull fractures.

Methods:

Data Source

This was a retrospective cross-sectional study using CAPNET, a multicenter research network that collects detailed demographic and clinical information for children <10 years old who have undergone medical evaluations due to a recent concern for physical abuse [13]. CAPNET includes children with documented recommendations by a CAP in the electronic medical record (EMR) at a participating CAPNET site. Children can be evaluated in a variety of settings, including outpatient clinics, emergency departments (EDs), inpatient wards, and intensive care units with either in-person or telephonic CAP consultation [13]. Each CAPNET site's institutional review board (IRB) provided approval under either exempt or expedited mechanisms for CAPNET's data procedures and use of data for research.

Study Population

We included children <2 years with isolated skull fractures who underwent evaluation by CAPs for physical abuse concerns between February 2021 and May 2023 across 10 CAPNET sites (Figure 1). We excluded children with the following concurrent injuries: non-skull fractures, high-risk bruising, burns, spinal injuries, intra-abdominal injuries, and intracranial injury not limited to a small focal intracranial hemorrhage (ICH) under the site of the skull fracture. Notably, CAPNET includes only definitive injuries therefore equivocal injuries would not be included in this definition. We included children with small, underlying ICH as these could likely be attributed to the contact mechanism of trauma causing the skull fracture itself as opposed to more extensive hemorrhages or hemorrhages not near the fracture [14,15]. The TEN-4-FACESp clinical decision rule to improve recognition of bruising concerning for physical abuse was utilized to define high risk bruising [OBJ:OBJ]. TEN-4-FACESp considers bruising in any location in infants <4.99 months to be high risk, however we excluded scalp bruising from this definition as a scalp bruise may occur as part of the clinical presentation of patients with skull fractures. We additionally limited our population to children who underwent evaluation with a skeletal survey, as the American Academy of Pediatrics recommends that children <2 years [OBJ:OBJ]. This ensured that the study population included only those children with sufficient concern for abuse that a provider ordered. Children were excluded if they were not neurologically well appearing, defined as having obvious neurologic symptoms (loss of consciousness, concern for seizures, altered mental status, focal neurologic signs, Glascow Coma Score (GCS) 12 or less, or requiring intubation) or those who had cardiorespiratory collapse. Children referred for medical evaluation by CPS or law enforcement were also excluded. Only initial presentations to CAPNET were included, as prior presentations for abuse concerns may impact referral decisions.

Outcomes

Our primary outcome of interest was referral to CPS. We additionally described timing of referral to CPS in relation to CAP involvement and CAP level of concern for abuse amongst those referred to CPS.

Covariates

Demographic factors: We divided age into 3 categories (<6 months, 6 to <12 months, and 12 to <24 months), reflecting developmental differences in mobility. We additionally considered factors that may be associated with disproportionality in CPS referrals, specifically race/ethnicity and socioeconomic status (SES) [18-21]. Race is identified in CAPNET from EMR based on family identification of patient race. CAPNET records ethnicity as Hispanic/Latino, not Hispanic/Latino, or unknown. As 38% of children who identified as other or unknown race in our sample also identified as Hispanic/Latino, we combined race and ethnicity into one variable. Children who identified as any race and Hispanic/Latino ethnicity were categorized as Hispanic/Latino. The following categories were then utilized: White, Black, Hispanic/Latino, Multiple Races, Other, and Unknown. Race/ethnicity categories with 10 or fewer subjects (Asian, American Indian or Alaskan Native, and Native Hawaiian or Other Pacific Islander) were combined into the "Other" category for data analysis [22]. These categories were created recognizing that documented race and ethnicity in the EMR may not reflect self-identification and the lived experience for families [23]. We utilized insurance type as a proxy for SES, with the following categories: Private/Military, Public/No insurance, and Unknown. If a child had both Private/Military and public insurance, they were categorized as Private/Military.

Patient characteristics: Trauma history was captured from the history provided by caregivers on arrival to clinical care and categorized as "accidental" versus "not accidental/no trauma history". Not accidental and absent trauma histories were combined into one category as either could raise a provider's level of concern for abuse, as absent histories of accidental trauma contribute to unexplained injuries which may increase concern for abuse [24,25]. Additionally, only two children presented with histories of inflicted trauma. Mobility was categorized as "not yet rolling", "rolling and crawling", "cruising and beyond", and "unknown". Children described as "normal/not specified" were categorized based on standard developmental milestones for their age per the Centers for Disease Control and Prevention [26]. We hypothesized that as children became mobile, there would be perceived increased likelihood of self-initiated, rather than inflicted, injury [26]. Skull fracture characteristics included number of fractures, laterality (unilateral vs bilateral), location, and simple vs complex fractures. Skull fracture location was categorized as parietal only vs occipital, frontal, temporal, or basilar (with or without a parietal fracture) as prior research has shown that linear parietal fractures are the most common morphology of pediatric skull fracture and may be interpreted as lower risk [27-29]. Simple skull fractures were defined as single, linear, unilateral skull fractures. Fractures that were bilateral, multiple, depressed, diastatic, comminuted, ping-pong, or crossing suture lines were classified as a complex fracture [30]. The presence of a small underlying ICH was defined in CAPNET as ICH "limited to a small focal injury directly beneath a skull fracture" [31]. CAP level of concern for physical abuse is defined in CAPNET using a previously published 7-point Likelihood of Abuse Rating Scale ranging from "definitely not inflicted injury" to "definite inflicted injury" [13,32]. No or low concern for abuse was defined as scores from 1-3 ("definitely not abuse" to "mildly

concerning for abuse") and intermediate to high concern for abuse was defined as scores from 4-7 ("intermediately concerning for abuse" to "definitely abuse").

Clinical care characteristics: We included transfer status as hospitals referring patients to CAPNET sites may have made CPS referrals prior to transfer. Setting of consult was defined as "In person" versus "Not in person" CAP consult. Highest level of care required was defined as "ED/Outpatient", "Inpatient/Observation", and "ICU" level of care. CAPNET site was also considered.

Presence of identified psychosocial risk factor(s): Psychosocial risk factors included documentation of one or more of the following: prior CPS involvement for the child/caregiver, current or prior foster care or out of home placement for the child, presence of intimate partner violence in the home, or presence of caregiver mental health concerns, substance use, or criminal history.

Statistical Analysis

Descriptive statistics were utilized to report frequencies and proportions for categorical variables. We utilized chi-square or Fisher's exact tests (if cell size < 5) to explore associations between demographic factors, patient characteristics, clinical care characteristics, and presence of identified psychosocial risk factors with CPS referral status. We performed multivariable logistic regression, adjusting for transfer status and all significant covariates ($p < 0.05$) from unadjusted analyses ($p < 0.05$). Wald test was utilized to assess for overall contribution of individual variables to the model. Although not significant in unadjusted analyses, we included transfer status in the model as, in our clinical experience, many children are referred to CPS prior to transfer from an outside hospital. For our primary model, unknown values remained in the

model as separate subcategories. To assess the impact of this decision, we additionally performed a sensitivity analysis after removing all cases with unknowns.

We utilized marginal standardization to calculate the estimated probability of CPS referrals at each site, adjusting for all factors in the final model. This probability is the mean estimated probability of CPS referral by CAPNET site assuming all children in our sample had presented to each CAPNET site. For ease of interpretation, we converted probabilities to percentages, describing them as adjusted percentages [22].

As a secondary exploration, we utilized chi-square tests to determine associations between presence of ICH, admission status, and CPS referrals. A mediation analysis was performed by calculating all pair-wise associations between presence of a small ICH, admission status, and CPS referral. We determined whether admission status attenuated the relationship between a small ICH and CPS referral. Data analysis was performed using Stata 18.0 (Stata Corp, College Station, TX) and R software version 4.4.0 (R Core Team, 2024).

Results:

Study Population

We identified 528 children <2 years with skull fractures with or without small focal ICH without additional injuries who met our inclusion criteria (Figure 1). The majority were <12 months (497, 94.1%), with 48.7% (257) <6 months (Table 1). Nearly half identified as White (259, 49.1%). A total of 126 (23.9%) identified as Hispanic/Latino and 69 (13.1%) identified as Black. Most children had public or no insurance (339, 64.2%).

Most children had accidental mechanisms of injury reported at presentation (398, 75.4%). Skull fractures were primarily unilateral (447, 84.7%), single (438, 83.0%), and parietal (433,

82.0%) without identified small focal ICH (324, 61.4%). Most children were assessed as having no or low level of concern for abuse by a CAP (466, 88.3%). Many (42.2%) were transferred from another facility; 374 had an in-person CAP consult (70.8%), and 291 (55.1%) received general inpatient or observation level care. Most children had no documented psychosocial risk factors (390, 73.9%).

Factors Associated with CPS Referrals

In unadjusted analyses, older age, public or no insurance status, presence of psychosocial risk factors, in-person CAP consult, inflicted or no trauma history provided, higher level of mobility, absence of a small underlying ICH, and intermediate to high level of concern for abuse by a CAP were associated with CPS referral (Table 1). There was a significant association between CAPNET site and CPS referral status. CPS referrals were not associated with race/ethnicity, transfer status, level of care required, or skull fracture characteristics.

In multivariable logistic regression, all significant covariates from unadjusted analyses as well as transfer status were included (Table 2). After adjustment for these factors, presence of psychosocial risk factors (OR 4.00, 95% CI 2.25, 7.11), in-person CAP consult (OR 3.93, 95% CI 1.61, 9.62), inflicted or no trauma history provided (OR 6.15, 95% CI 3.30, 11.45), absence of a small underlying ICH (OR 2.03, 95% CI 1.26, 3.27), and CAPNET site remained significantly associated with CPS referral. After adjustment, transfer status became significantly associated (OR 2.03, 95% CI 1.25, 3.30). Age, insurance status, and mobility were no longer significant. Removing all cases with unknowns as part of our sensitivity analysis did not meaningfully alter the observed associations (supplemental tables 1 and 2).

Variation in referrals based on CAPNET site

In unadjusted analyses, the percentage of patients referred to CPS at each CAPNET site ranged from 19.7% to 86.1% (Table 1). After adjustment for case-mix, the percentage of children referred to CPS ranged from 34.6% to 76.4% (Figure 2). There was statistically significant variation in CPS referral rates across CAPNET sites in both unadjusted and adjusted analyses (P<0.001).

CPS referrals prior to CAP involvement

Of the 528 children, 303 (57.4%) were referred to CPS, with 263 of these 303 children (86.8%) receiving referrals prior to CAP consultation. Of the 265 children who did not receive CPS referrals prior to CAP involvement, 40 (15.1%) were referred to CPS after CAP involvement. Of the 263 children who were referred to CPS prior to CAP involvement, 218 (82.9%) children were assessed as no (61.2%) or low (21.7%) concern for abuse by CAPs.

Exploratory analysis: Presence of ICH, referral status, and admission status

In the primary analysis, presence of an underlying ICH was unexpectedly associated with decreased rates of CPS referrals. An exploratory analysis was performed to further explore this unexpected association; specifically, to explore whether differences in rates of hospital admission and timing of CPS consult may be mediating the association. Of the 204 children with small focal underlying ICHs, 90 (44.1%) were referred to CPS prior to CAP involvement. In contrast, 173 of 324 (53.4%) children without ICH were referred to CPS prior to CAP involvement (p= 0.038). Additionally, 187 of 324 (57.7%) children without ICH were admitted to the hospital compared to 178 of 204 (87.3%) of those with ICH (p= <0.001). In the mediation analysis, absence of a small ICH was univariably associated with CPS referral (OR 1.63, 95% CI 1.15, 2.33) and admission status (OR 0.20, 95% CI 0.12, 0.31). Admission status was not associated

with CPS referral (OR 0.95, 95% CI 0.65, 1.38), suggesting no mediation. In a multivariable model, with only admission status and small ICH as covariates, admission status was not significant, and the effect of the absence of a small ICH was similar to the univariate association (adjusted OR 1.69, 95% CI 1.17, 2.47).

Discussion:

In our study of children <2 years with isolated skull fractures with or without small focal ICH, we found that 57.4% were referred to CPS. We identified multiple factors associated with CPS referrals in current practice. Despite adjustment for these factors, CAPNET sites demonstrated more than two-fold variation in CPS referral rates.

CPS referrals have high potential for impacting children and families, but despite evidence of high variability between centers in the evaluation of skull fractures, there is limited guidance about which injuries should prompt a CPS referral. Because isolated skull fractures in infants are common and are often associated with low level of concern for abuse by CAP experts, they would benefit from clear practice guidelines.

We identified a combination of demographic factors, patient characteristics, and clinical care characteristics associated with CPS referrals. In unadjusted analyses, older age, uninsured/public insurance status, presence of psychosocial risk factors, in-person CAP consult, inflicted or no trauma history provided, higher level of mobility, absence of a small underlying ICH, and intermediate to high level of concern for abuse by a CAP were associated with CPS referral. After adjusting for all significantly associated factors from unadjusted analyses as well as transfer status, we found that presence of psychosocial risk factors, in-person CAP consult,

inflicted or no trauma history provided, not having a small underlying ICH, and CAPNET site remained significantly associated with CPS referral. After adjustment, transfer status became significantly associated. These findings are consistent with prior single-center studies that found psychosocial risk factors and unwitnessed mechanisms of injury to be associated with CPS referrals [3-6,9]. Notably, after adjustment for presence of known psychosocial risk factors, the association between insurance status and CPS referrals was no longer significant, suggesting a complex relationship between SES, psychosocial risk factor screening, and CPS referrals that warrant exploration in future studies.

CPS referrals varied by CAPNET site. There was a wide range in the number of children who met inclusion criteria at each site, ranging from 13 to 109, as well as the proportion of those children referred to CPS, ranging from 19.7% to 86.1%. All children in this study had a CAP consultation, therefore site-level differences in CAP consultation rates may contribute to these wide ranges of children who met inclusion criteria and referral rates. After adjustment for case-mix, the adjusted percentage of children referred to CPS ranged from 34.6% to 76.4%. The large variation in CPS referral rates supports opportunities to better standardize evaluations and CPS referrals for children with isolated skull fractures.

Prior studies found younger age and complex skull fractures to be associated with CPS referrals [3-6,9]. Notably, the definition of complex skull fracture differed in each study. No association between skull fracture complexity and CPS referral was seen in our study population [3-6,9]. We found that older age and higher level of mobility were associated with increased CPS referral rates, although these findings did not remain significant in adjusted analyses. While prior studies found that younger age was associated with increased CPS referrals, we hypothesized that older age and higher level of mobility was associated with increased referral rates due to

increased risk of unwitnessed injury as children are newly independently mobile. Additionally, our study included children <2 years, whereas prior studies have included different age ranges (<3 years, <12 months, or <5 years) [3-6,9]. The higher rates of reporting of potentially unwitnessed injuries does not necessarily equate to reporting of abusive injuries, as unwitnessed does not equal abused.

Of those receiving CPS referrals, 86.5% were referred prior to CAP involvement, and 82.9% were subsequently assessed as having no or low concern for abuse by CAPs. Additionally, of the children who did not receive CPS referrals prior to CAP involvement, only 15.1% went on to receive CPS referrals after evaluation by a CAP. These findings suggest that earlier CAP involvement may decrease CPS referral rates in children with isolated skull fractures. These results align with prior work that demonstrates CAPs commonly diagnose injuries as accidental or not abusive in origin [13,33].

The presence of an underlying small ICH was associated with decreased likelihood of CPS referral. We found that children without ICH were significantly more likely to receive CPS referrals prior to CAP involvement than children with ICH, suggesting providers may have been more likely to engage CAPs earlier in the process when children had ICH present. Additionally, patients without ICH were less likely to be hospitalized, allowing for potentially less time for CAP involvement in these cases. Admission status did not attenuate the relationship between presence of ICH and CPS referral in formal mediation analysis. These findings provide additional insight into future work exploring how earlier CAP involvement impacts CPS referrals, including the relationship between admission status, ICH presence, and CPS referral status. As 42.2% of our population was transferred into a CAPNET site, earlier CAP involvement may be challenging in some cases.

Limitations

Our study has several limitations. As we utilized retrospective data based on chart abstraction, we were unable to assess all factors involved in the complex decision to refer to CPS. Additionally, as our study was cross-sectional, we were able to test for associations but not able to assess causation. Given that CAPNET data are limited to patients undergoing subspecialty physical abuse evaluations, this may impact the generalizability of our findings as there may be children with skull fractures who are never assessed by a CAP. This may impact the variability we measured between centers if some centers might be less likely to undertake CAP consultation for patients who are also not referred to CPS. Additionally, there may be differences in practice of skeletal survey utilization across sites which may lead to differences in populations eligible for the study. There may be differences in which children have documented psychosocial histories that were not accounted for in our study. While we could adjust for case-mix among children evaluated by CAPs, we were not able to adjust for differences in CAP involvement across sites.

Conclusions:

This study of children <2 years with isolated skull fractures found that 57.4% of children received CPS referrals with 86.5% occurring prior to CAP involvement. Our finding of more than 2-fold differences in rates of referrals to CAPNET sites despite adjustment for case mix highlights an opportunity to inform standardization of care. The majority (82.9%) of children referred to CPS prior to CAP involvement were later assessed to have no or low concern for abuse by the CAP. Future work should assess the impact of earlier involvement of CAPs on CPS referral rates.

Tables/Figures:

Table 1: Demographics and Factors Associated with CPS Referrals, unadjusted

	Total (Column %)[1]	**CPS Referral Made (Row %)[1,2]**		**p-value**
		Yes	**No**	
Total	528	303 (57.4)	225 (42.6)	-
Race/Ethnicity	-	-	-	0.231
White	259 (49.1)	137 (52.9)	122 (47.1)	-
Black	69 (13.1)	46 (66.7)	23 (33.3)	-
Hispanic/Latino	126 (23.9)	75 (59.5)	51 (40.5)	-
Multiple races	19 (3.6)	14 (73.7)	5 (26.3)	-
Other	18 (3.4)	10 (55.6)	8 (44.4)	-
Unknown	37 (7.0)	21 (56.8)	16 (43.2)	-
Age	-	-	-	0.002
<6 months	257 (48.7)	129 (50.2)	128 (49.8)	-
6-11.99 months	240 (45.5)	153 (63.8)	87 (36.3)	-
12-23.99 months	31 (5.9)	22 (71.0)	9 (29.0)	-
Insurance Status	-	-	-	<0.001
Private/Military	183 (34.7)	76 (41.5)	107 (58.5)	-
Public/None	339 (64.2)	225 (66.4)	114 (33.6)	-
Unknown	6 (1.1)	2 (33.3)	4 (66.7)	-
Psychosocial Risk Factor(s) Present	-	-	-	<0.001
Yes	138 (26.1)	111 (80.4)	27 (19.6)	-
No	390 (73.9)	192 (49.2)	198 (50.8)	-
Transfer Status	-	-	-	0.996
Yes	223 (42.2)	128 (57.4)	95 (42.6)	-

No	305 (57.8)	175 (57.4)	130 (42.6)	-
CAP Consult Setting	-	-	-	<0.001
In person	374 (70.8)	265 (70.9)	109 (29.1)	-
Not in person	154 (29.2)	38 (24.7)	116 (75.3)	-
History of Trauma Reported	-	-	-	<0.001
Accidental	398 (75.4)	199 (50.0)	199 (50.0)	-
Inflicted/None	130 (24.6)	104 (80.0)	26 (20.0)	-
Mobility	-	-	-	<0.001
Not Yet Rolling	167 (31.6)	83 (49.7)	84 (50.3)	-
Rolling and Crawling	192 (36.4)	125 (65.1)	67 (34.9)	-
Cruising and Beyond	124 (23.5)	84 (67.7)	40 (32.3)	-
Unknown/Not Specified	45 (8.5)	11 (24.4)	34 (75.6)	-
Highest Level of Care Required	-	-	-	0.972
Outpatient/ED	179 (33.9)	104 (58.1)	75 (41.9)	-
Inpatient/Observation	291 (55.1)	166 (57.0)	125 (43.0)	-
ICU	58 (11.0)	33 (56.9)	25 (43.1)	-
Skull Fracture Characteristics	-	-	-	-
Number of Fractures	-	-	-	0.352
1	438 (83.0)	253 (57.8)	185 (42.2)	-
2	73 (13.8)	38 (52.1)	35 (48.0)	-
3	17 (3.2)	12 (70.6)	5 (29.4)	-
Laterality	-	-	-	0.274
Unilateral	447 (84.7)	261 (58.4)	186 (41.6)	-
Bilateral	81 (15.3)	42 (51.9)	39 (48.2)	-
Location	-	-	-	0.425
Parietal only	433 (82.0)	245 (56.6)	188 (43.4)	-
Occipital, Temporal, Frontal, Basilar +/- Parietal	95 (18.0)	58 (61.1)	37 (39.0)	-
Skull Fracture Complexity	-	-	-	0.649
Simple- Linear, single, and unilateral only	360 (68.2)	209 (58.1)	151 (41.9)	-
Complex- Depressed, diastatic, crossing suture lines, comminuted, ping-pong, multiple, or bilateral	168 (31.8)	94 (56.0)	74 (44.1)	-
Presence of Small Underlying ICH	-	-	-	0.006

Yes	204 (38.6)	102 (50.0)	102 (50.0)	-
No	324 (61.4)	201 (62.0)	123 (38.0)	-
Level of Concern for Abuse	-	-	-	<0.001
No/Low	466 (88.3)	241 (51.7)	225 (48.3)	-
Intermediate/High	62 (11.7)	62 (100)	0 (0)	-
CAPNET Site	-	-	-	<0.001
1	45 (8.5)	30 (66.7)	15 (33.3)	-
2	66 (12.5)	13 (19.7)	53 (80.3)	-
3	86 (16.3)	56 (65.1)	30 (34.9)	-
4	109 (20.6)	89 (81.7)	20 (18.4)	-
5	18 (3.4)	6 (33.3)	12 (66.7)	-
6	13 (2.5)	5 (38.5)	8 (61.5)	-
7	66 (12.5)	40 (60.6)	26 (39.4)	-
8	35 (6.6)	15 (42.9)	20 (57.1)	-
9	36 (6.8)	31 (86.1)	5 (13.9)	-
10	54 (10.2)	18 (33.3)	36 (66.7)	-

1. Values may add to more than 100% due to rounding.
2. Chi square utilized if cell sizes were 5 or greater, Fisher's exact testing utilized if any cell size was less than 5.
3. ICH= intracranial hemorrhage; CAP= child abuse pediatrics specialist; CPS= child protective services

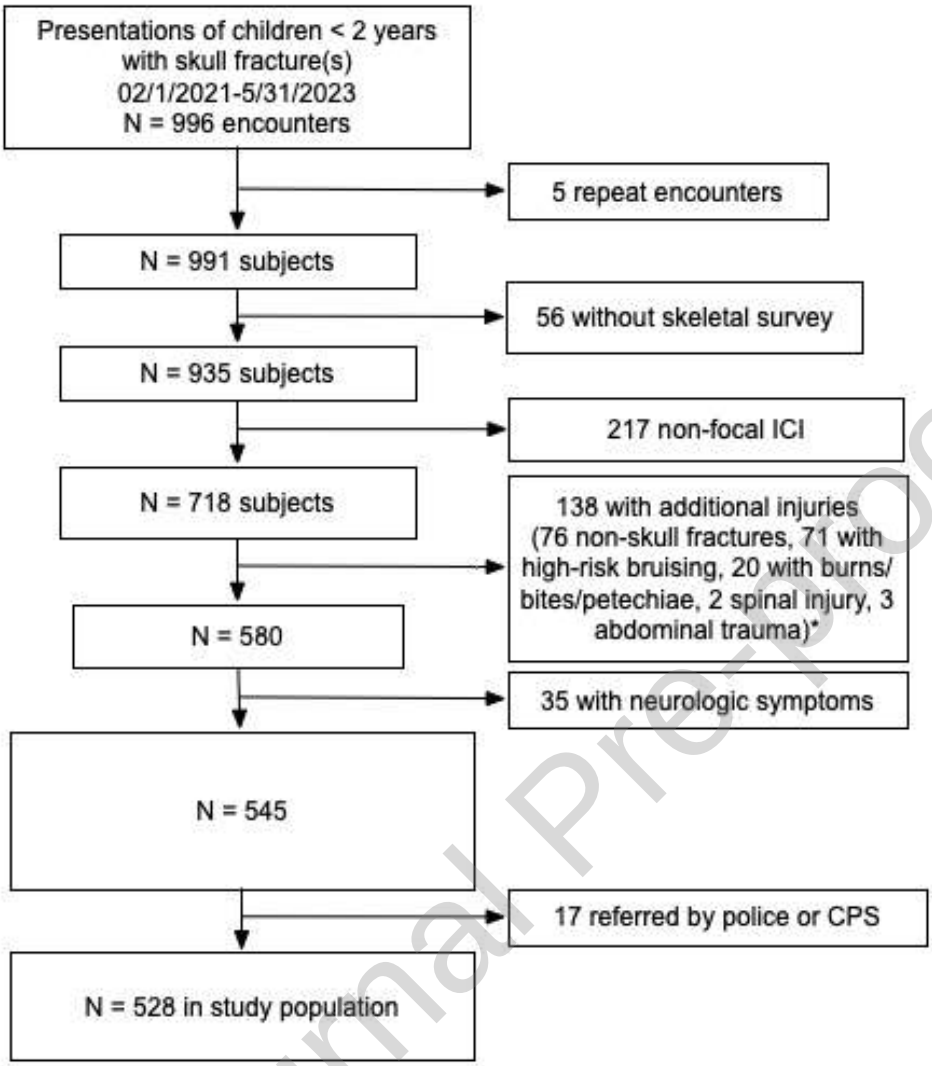
Table 2: Demographics and Clinical Factors Associated with CPS Referrals, Adjusted

	Odds Ratio (95% CI)	**95% CI**	**p-value[1]**
Age	-	-	0.17
<6 months	Ref.	-	
6-11.99 months	0.67	0.34, 1.30	
12-23.99 months	1.58	0.44, 5.73	
Insurance Status	-	-	0.279
Private/Military	Ref.	-	
Public/None	1.48	0.91, 2.37	
Unknown	1.05	0.13, 8.59	
Documented Psychosocial Risk Factor(s)	-	-	<0.001
Yes	4.00	2.25, 7.11	
No	Ref.	-	
Transfer Status	-	-	0.004
Yes	2.03	1.25, 3.30	
No	Ref.	-	
CAP Consult Setting	-	-	0.003
In person	3.93	1.61, 9.62	
Not in person	Ref.	-	

History of Trauma Reported	-	-	<0.001
Accidental	Ref.	-	
Inflicted/None	6.15	3.30, 11.45	
Mobility	-	-	0.432
Not Yet Rolling	Ref.	-	
Rolling and Crawling	1.64	0.85, 3.16	
Cruising and Beyond	1.19	0.49, 2.93	
Unknown/Not Specified	1.28	0.49, 3.35	
Presence of Small Underlying ICH	-	-	0.004
Yes	Ref.	-	
No	2.03	1.26, 3.27	
CAPNET Site	-	-	<0.001
1	Ref.	-	
2	0.53	0.15, 1.81	
3	1.22	0.50, 3.00	
4	3.38	1.33, 8.59	
5	0.53	0.12, 2.41	
6	1.05	0.19, 5.77	
7	0.77	0.29, 2.01	
8	0.31	0.11, 0.93	
9	3.71	1.05, 13.03	
10	1.00	0.30, 3.14	

1. P-values calculated using Wald test.
2. ICH= intracranial hemorrhage; CAP= child abuse pediatrics specialist, CPS= child protective services
3. All significant covariates ($p < 0.05$) from unadjusted analyses and transfer status were included in model.

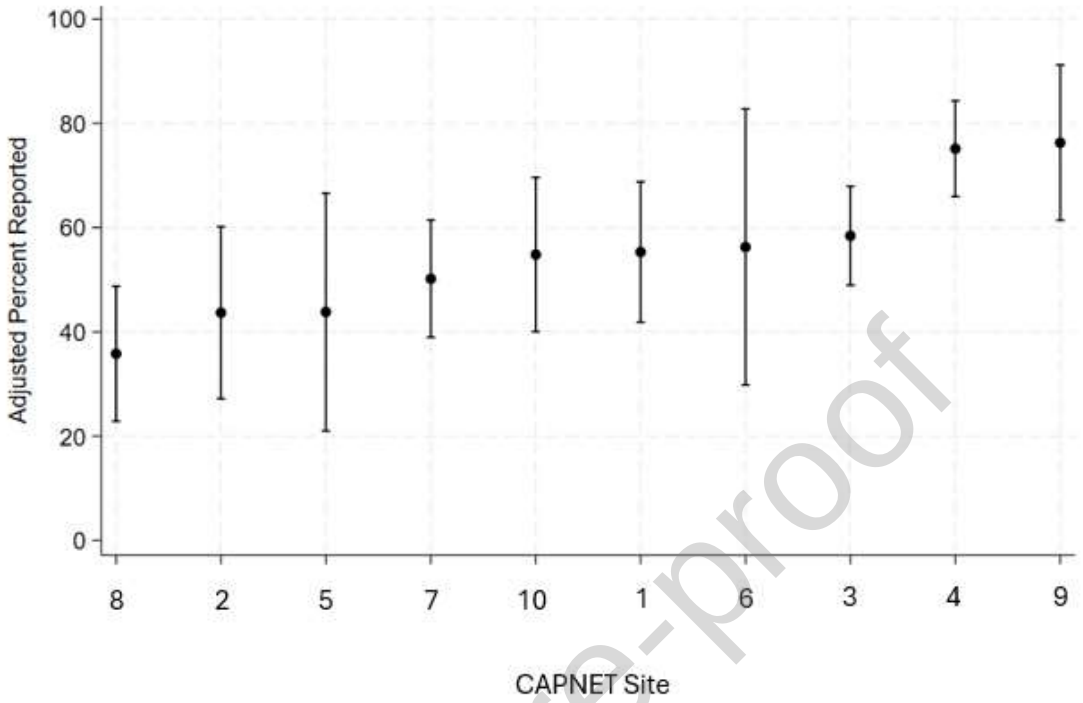
Figure 1: Flowchart of inclusion and exclusion criteria



*Sums to greater than 138 as children may have multiple injuries.

Note: ICI= intracranial injury; CPS= child protective services

Figure 2: Adjusted Percentage of Referrals by CAPNET site. Generated from marginal standardization following a logistic regression model that includes adjustment for age, transfer status, insurance status, trauma history provided, setting of consult, mobility status, presence of underlying intracranial hemorrhage, psychosocial risk factors, and CAPNET site. .



1. Sites organized by increasing adjusted percentage.

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Conflicts of interest:

Dr. Breeden-Carino's, Dr. Brink's, Dr. Christian's, Dr. Harper's, Dr. Henry's, Dr. Ruiz-Maldonado's, and Dr. Wood's employers have received payment for expert testimony when subpoenaed to testify in cases of suspected child maltreatment. Dr. Christian, Dr. Lindberg, Dr. Frasier, and Dr. Frazier provide medical legal expert testimony in child abuse cases.

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What's New:

A significant proportion of children with isolated skull fractures received child protective services referrals, often despite low concern for abuse by child abuse experts. The two-fold variation in referral practices by hospital suggests room for improvement in care standardization.