

Mental Health after Unintentional Injury in a Pediatric Managed-Medicare Population

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Objectives The purpose of this study was to compare the rates of mental health diagnoses and psychotropic prescriptions pre- and posthospitalization for injury in a managed-Medicare population. We hypothesized that children have increased rates of mental health diagnoses and psychotropic prescriptions after injury.

Study design We investigated children ($n = 2208$) ≤ 18 years of age treated at a pediatric trauma center from 2005 to 2015 who were enrolled in a managed-Medicare program at hospital admission and for at least 1 health-care visit in the preceding year. We used Poisson regression models to estimate rates of mental health diagnoses and psychotropic prescriptions that occurred in the 12 months pre- and postinjury.

Results The rate of mental health diagnoses preinjury was 95.9 per 1000 person-years, which increased to 156.7 per 1000 postinjury (rate ratio [RR] 1.63, 95% CI 1.39-1.92). Children ages 0-4 years with burns were more likely to have mental health diagnoses postinjury (race and ethnicity adjusted RR [aRR] 8.56, 95% CI 3.30-22.2). Children with head injuries were also more likely to have mental health diagnoses postinjury: ages 0-4 years (aRR 3.87, 95% CI 1.31-11.5); ages 5-9 (aRR 3.11, 95% CI 1.27-7.59); ages 10-14 (aRR 2.17, 95% CI 1.27-3.73); and ages 15-18 (aRR 5.37, 95% CI 2.12-13.6). The rate of psychotropic prescriptions preinjury was 121.7 per 1000 person-years and increased to 310.9 per 1000 postinjury (RR 2.55, 95% CI 2.26-2.89).

Conclusions We identified increased mental health diagnoses and psychotropic prescriptions in children following hospitalization for injury. (*J Pediatr* 2018;■■■:■■■-■■■).

In 2013, 73.6 million children lived in the US and nearly 8 million suffered from an unintentional nonfatal injury.^{1,2} The impact of injury on children's mental health is important but may be overlooked. Most pediatric research relating injury to mental health has been conducted in populations suffering from traumatic brain injury (TBI). Post-traumatic stress disorder is known to follow TBI, with symptoms directly related to severity of injury.³⁻⁵ One study found that 26% of children without pre-existing mental health diagnoses experienced mental illness in the 3 years following a mild TBI.⁶ Another study demonstrated increased utilization of mental health services for children following TBI, peaking 12 months postinjury.⁷ Other studies showed that family functioning, injury severity, and history of mental illness best predicted development of new mental health disorders in children following TBI.^{8,9}

Despite high rates of mental health diagnoses following TBI, investigators found that more than half of families of children with TBI reported not receiving mental health services, family counseling, or cognitive therapy following injury.¹⁰ Another study found that up to 20% of caregivers of children with TBI reported unmet medical needs, either because healthcare services were not recommended by a doctor, were not provided by a school, or were too costly. Payer status further compounds the lack of appropriate treatment for uninsured and publicly insured patients. Guardians of children on Medicare were 1.8 times more likely to report having unmet needs compared with those children covered by commercial health insurance.¹¹

There is limited research investigating mental health following non-TBI injury. Several studies demonstrated post-traumatic stress disorder after orthopedic injuries.^{3,4} Studies evaluating the relationship between children with burns and mental health have contradicting findings.¹²⁻¹⁴ Few studies have looked explicitly at mental health after injury in the Medicare population. Establishing programmatic efforts for this population requires determining whether mental health diagnoses and psychotropic medication use are altered by injury. The purpose of this study was to compare the rates of mental health diagnoses and psychotropic prescriptions

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aRR	Adjusted RR
ADHD	Attention-deficit/hyperactivity disorder
EMR	Electronic medical record
GCS	Glasgow coma score
ICD-9	International Classification of Diseases, Ninth Revision
ISS	Injury severity score
RR	Rate ratio
TBI	Traumatic brain injury

pre- and posthospitalization for unintentional, nonfatal injury in a managed-Medicaid pediatric population, hypothesizing rate increases after injury.

Methods

Study Design

We performed a 10-year retrospective cohort study of children who were admitted to Nationwide Children's Hospital, a free-standing, American College of Surgeons level I pediatric trauma center, for traumatic injuries and who were enrolled in the Partners for Kids managed-Medicaid program, a state-level accountable care organization.

Inclusion Criteria

The study included children ages 0-18 years enrolled in the trauma registry who were treated for unintentional injuries between June 1, 2005 and May 31, 2015 and who survived to discharge. Of these, only children covered by the hospital's managed-Medicaid program at hospital admission and for at least 1 healthcare visit in the preceding 12 months were included, ensuring the injury event was not the patient's first interaction with the healthcare system and maximizing the likelihood that patient data was current in the system's electronic medical record (EMR) at the time surrounding the injury.

Exclusion Criteria

The trauma registry excludes children admitted for injuries obtained during medical care and injuries such as venomous animals/plants, cellulitis without surgical intervention, poisonings, or asphyxia from a foreign body. The current study further excluded children: discharged home from the emergency department without being admitted to the hospital; treated for intentional injuries (ie, suicide attempt, self-mutilation, or child abuse injuries); not verified in the EMR by name, date of birth, admission date, and medical record number; who died during hospitalization; with multiple injury events after an initial recorded injury.

Data Sources

The hospital's trauma registry was used to identify injured children who were hospitalized within 30 days of injury. Trauma registry data elements consisted of patient demographics, mechanism of injury, trauma type, Glasgow coma score (GCS) upon emergency department arrival, abbreviated injury score, overall injury severity score (ISS), and hospital disposition.

Using medical record numbers, names, and dates of birth from the trauma registry, children were identified in the hospital's EMR and managed-Medicaid billing database. When children could not be identified within the databases, direct EMR review was performed. Those that could not be identified by direct review were excluded. The managed-Medicaid billing database was used to verify that each patient was insured at

admission and for at least 1 healthcare visit in the 12 months preinjury. The databases were then used to identify *International Classification of Diseases, Ninth Revision* (ICD-9) diagnoses and prescribed medications associated with each healthcare visit that occurred in the 12 months pre- and postinjury. This period allowed adequate time to observe each patient's healthcare status and was consistent with previous research.^{9,15,16}

Data Analyses

Patient demographics and clinical characteristics were summarized by count and percentage for the cohort. Mechanisms of injury, trauma type, injury severity, hospital length of stay, and hospital discharge disposition were described. Injury severity was measured using body region abbreviated injury score, as well as GCS, ISS, and hospital discharge disposition. A GCS score of 15 is normal whereas 3-14 indicates some level of brain injury. Scores of 4-8 indicate a comatose patient, and a score of 3 indicates complete unresponsiveness. The ISS rates the patient's overall injury severity. A score of 1-8 indicates minor severity, 9-15 moderate severity, and >15 severe severity. Hospital discharge dispositions included home without services or other (another acute care hospital, jail/institutional care/mental care, rehabilitation center, or unknown location).

ICD-9 diagnosis codes for mental health disorders were categorized into 14 overarching categories (**Appendix 1**; available at www.jpeds.com): adjustment disorders, anxiety disorders, attention-deficit/hyperactivity disorders (ADHDs), bipolar disorders, disruptive behavior disorders, eating disorders, learning/cognitive disorders, nonbipolar depressive disorders, pervasive developmental disorders, psychotic disorders, sleep disorders, somatoform disorders, substance use disorders, and other disorders. If patients had multiple diagnoses, they were coded as having each diagnosis. Each diagnosis was counted just once, even if a patient had multiple visits for that diagnosis. Similarly, psychotropic prescriptions in the hospital's formulary were grouped into 8 categories (**Appendix 2**; available at www.jpeds.com): ADHD, anti-anxiety, anticonvulsant, antidepressant, antipsychotic, bipolar, hypnotics/sedatives, and stimulants. If patients had multiple medications prescribed, they were coded as having each prescribed medication. Anticonvulsants prescribed to patients with seizure disorder or intracranial hemorrhage ICD-9 diagnosis codes were excluded, as it was unclear if these were intended for management of neurologic or mental health disorders (**Appendix 3**; available at www.jpeds.com).

Rates of children with mental health diagnoses or psychotropic prescriptions pre- and postinjury were calculated as the number of children (overall and by category) for the number of days under observation pre- and postinjury (person-years). The observation period included the time from the first healthcare visit in the 12 months preinjury to the last visit in the 12 months postinjury. Poisson regression was used to estimate the rate and 95% CI of children with mental health diagnoses or psychotropic prescriptions in either time period, as well as the rate ratio (RR) and CI between time

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