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Hospitalizations for pediatric dog bite injuries in the United States☆,☆☆

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ABSTRACT

Background: Dog bites are a common cause of pediatric trauma requiring hospital admission. We aim to describe pediatric bite victims, associated injuries and interventions.
Methods: Children (≤18 years old) were identified with an ICD-9 diagnosis of dog bite in the Kids' Inpatient Database for the years 2006, 2009 and 2012. National estimates were obtained using case weighting. Multivariable logistic regression was performed.
Results: We identified 6323 admissions for a dog bite with mean age of 6.63 years. Patients were predominately male (56.9%), non-Hispanic white (61.9%), resided in the South (35.1%), and in an urban environment (59.9%). Almost one third underwent a surgical procedure. Open wounds of the head, neck and trunk were the most common injury and decreased in prevalence with increasing age. Open wounds of the extremities were the second most common and the prevalence increased with increasing age. Children aged 1–4 and 5–10 years were both more than three times more likely to be admitted than those more than age 11.
Conclusions: Dog bite injuries are common for pediatric patients. Children less than age 11 are at greatest risk, particularly in the summer. Dog safety training should be focused on elementary and middle school children close to the start of summer vacation.
Level of evidence: III.

1. Introduction

Dog bites are a source of preventable morbidity in pediatric populations with an estimated 50% of children being victimized in their lifetime [1] and with more than 50% of the annual deaths associated with dog bites occurring in children less than the age of 10 [2,3]. In the United States, approximately 2.5 million children are bitten by dogs annually [4]. With more than one-third of American households owning at least one dog, most children are bitten at home and by dogs with whom they are familiar [4–7]. Not only do pediatric dog bites have the potential to cause long-term physical and psychological consequences, but, there is also a significant associated financial burden [8,9]. It is estimated that more than $164 million is spent on healthcare charges for dog bite injuries in the U.S. annually [10] and homeowner liability claims for dog bites and dog-related injuries accounted for $700 million in 2017 alone [11].

The majority of existing research about bites focuses on the breed of dog involved. Other studies have shown that younger children are at a higher risk for dog bite injuries, and these injuries are more likely to involve the face, head, and neck region [4,7,8,12,13]. Many have found the risk of dog bite to be greater in boys compared to girls [8,13,14]. Only one study has found that females were most likely to incur dog bite injuries, and this paper also identified a bimodal age distribution with children aged 0–2 and 6–12 years being most at risk [4]. Attention-deficit hyperactivity disorder (ADHD), particularly in males, has been shown to be associated with a 21% increase in odds of presenting to an ED with a dog bite injury, but this potentially contributing factor hasn't been fully explored.

Previous studies have not detailed the types of medical and surgical interventions most often required for dog bite injuries in a pediatric population.

This study seeks to establish a comprehensive national perspective on the pediatric population that is hospitalized after a dog bite, and it will analyze the associated injury patterns, seasonal variations and types of interventions. We hypothesize that the injury patterns associated with dog bites will differ based on the age of the victim with younger victims suffering more head and neck trauma while older victims would have higher rates of extremity injury. Additionally, we hypothesize that toddlers and those in early childhood will be significantly more likely than adolescents to be the victims of a dog bite.

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2. Methods

2.1. Data source

A cross-sectional analysis was performed for the Kids' Inpatient Database (KID) for the years 2006, 2009 and 2012. The KID is produced by the Agency for Healthcare Research and Quality (AHRQ) as part of the Healthcare Cost and Utilization Project (HCUP) and is the largest publicly available all-payer national sampling of pediatric inpatient discharges. It is produced triennially and consists of more than 3700 hospitals and 6 million weighted discharges per iteration [15]. The 2012 KID was the last to use an International Classification of Diseases, Ninth Revision (ICD-9) coding system and the 2016 KID (the most recent) used an ICD-10 system. Owing to concerns regarding the consistency of coding and classification between the ICD-9 and ICD-10 systems, we chose to exclude the 2016 KID.

The study was reviewed by the Institutional Review Board at the University of Massachusetts Medical School and deemed exempt. In compliance with the KID data use agreement, we did not report information where the number of observations is ≤10, and where there is potential to identify individuals.

2.2. Case selection

Using ICD-9 external course of injury codes, cases were identified associated with a dog bite (E906.0) in either of the primary or secondary diagnoses in children aged ≤18 years old. Cases were limited to those hospitalizations which were nonelective. We utilized both ICD-9 and single-level Clinical Classifications Software (CCS) codes, developed as part of the HCUP [16], to identify procedures, injuries, and comorbidities (Appendix A).

Exclusion criteria included ICD-9 coding abnormalities and missing data. Coding abnormalities were identified within the ICD-9 codes using a built-in feature of STATA 15.0 statistical software (2017; College Station, TX). Cases were excluded if there were data missing from critical variables including age, gender, race, primary payer, mortality, total hospital charges (THC), and median income quartile by zip code. Overall, 18.2% of cases were excluded, predominantly for lack of a race (69.3%) and income quartile data (14.4%).

2.3. Independent and dependent variables

We assessed the following patient characteristics and hospital course variables—gender, race, payer, median income quartile by zip code, length of stay (LOS), and THC (standardized to 2018 U.S. dollars) [17]. Age was assessed both continuously and categorically via five age-groups, defined by the National Institute of Child Health and Human Development (NICHD): infancy (<12 months), toddler (12 months–2 years), early childhood (3–5 years), middle childhood (6–11 years), and early adolescence (12–18 years) [18]. Patient setting was defined as urban (central and fringe counties of ≥1 million population), suburban (counties in metro areas of 250 k –<1 million and counties 50 k–<250 k), and rural (micropolitan or noncore counties). Health insurance payer was consolidated into private, government (Medicaid, Medicare), and other. Four geographic hospital regions were defined, consistent with the U.S. Census Bureau definitions [19]. A major surgical procedure, which is an HCUP-defined variable, was defined if ICD-9 codes indicating a major therapeutic or diagnostic procedure were present [20]. We considered the use of an arterial line, ventilator, hemodialysis, central line or extracorporeal membrane oxygenation (ECMO) as an intensive care unit (ICU) admission. Diagnoses of ADHD, conduct disorder and disruptive behavior disorders, as defined by CCS code 652, were examined as a single-variable and evaluated in a binary fashion.

2.4. Statistical analysis

The analysis was conducted using chi-square for bivariable analysis of categorical variables and Student's t-test for continuous variables. Standard deviations (Std. Dev) were calculated where appropriate. Descriptive statistics examined included frequency counts. All statistical tests were two-tailed with a p-value threshold of 0.05 as a marker for statistical significance. National estimates were generated for all U.S. inpatient discharges for dog bites using provided weights and the svy function in STATA. Multivariate logistic regression was performed to examine the association between age, gender, race, patient setting, median income quartile by zip code, payer, and season, with the risk of hospitalization for a dog bite. An additional model was also assessed including ADHD, conduct or disruptive disorders. Models were evaluated for specification errors as well as the goodness of fit using the Hosmer–Lemeshow test. All statistical analyses were performed using STATA 15.0.

3. Results

We identified 6323 admissions for a dog bite with a mean age of 6.63 years (Std Dev. 6.36). Nationwide there were almost six hospitalizations daily in the study period. Patients were predominately male (56.9%), non-Hispanic white (61.9%), aged 6–11 years old (32.3%), resided in the South (35.1%), in an urban environment (59.9%), were in the lowest income quartile (29.7%) and were government-insured (47.7%). The summer was the most common season for hospitalization for dog bites (Table 1). Mortality was low in the study at 0.07%, and the mean total hospital charge for children hospitalized with dog bites was $21,194. The mean length of stay was 2.5 days. The prevalence of attention deficit, conduct, or disruptive behavior disorders was 2.45%.

3.1. Injuries associated with dog bites

The most common injuries overall were open wounds of the head, neck, and trunk (55.9%), open wounds of the extremities (39.7%), and fracture (8.7%). A less common injury, but with the potential for severe, lasting sequelae, was nerve or spinal cord injury at 1.8% (Table 2).

Several injury patterns showed a relationship with age. Open wounds to the head, neck, and trunk decreased in prevalence with increasing age (70.3% in infants aged <1 year to 24.2% in those aged 12–18 years) as did skull or facial fractures (13.1% to 1.1%). Conversely, open wounds of the extremities rose from 16.5% in those children aged younger than 1 year to 68.0% in those aged 12 years and older. Upper extremity fractures increased from less than 1% in those aged younger than 1 year of age to almost 7% in those aged 12 years or older.

3.2. Procedures associated with the management of dog bite injuries

Almost one-third of children bitten by a dog required a major surgical intervention (Table 1). When analyzing the need for major surgical procedure by age group, the highest prevalence was in those aged 6–11 years at 36.3%. The most common procedure associated with a dog bite injury overall was suturing of the skin and subcutaneous tissues (Table 2). Wound debridement was the second most common procedure performed at 16.2%. Additionally, 8.7% of children required a procedure on the eye. Other notable interventions were procedures of the mouth (8.3%), incision and drainage (6.0%), and skin grafts (4.2%). Computed Tomography (CT) scan use in this study was low at less than 1%. There were no significant trends regarding the type of procedure performed by age group.

3.3. Logistic regression analysis of dog bites in children

We performed multivariable logistic regression to assess factors associated with the risk of hospitalization for a dog bite (Table 3). Males

Table 1
Patient characteristics.

	n (%)
Total	6323
Age in years, mean (± Std. Dev)	6.63 (±6.36)
Age Groups	
Infant, <1 year old	182 (3.0)
Toddler, 1–2 years	1599 (26.6)
Early childhood, 3–5 years	1365 (22.7)
Middle childhood, 6–11 years	1942 (32.3)
Early adolescence, 12–18 years	924 (15.4)
Male	3595 (56.9)
Race	
Non-Hispanic White	3913 (61.9)
Black	755 (11.9)
Hispanic	1222 (19.3)
Asian or Pacific Islander	81 (1.28)
Native American	96 (1.10)
Other	282 (4.46)
Hospital Region	
Northeast	1613 (25.5)
Midwest	1045 (16.5)
South	2221 (35.1)
West	1328 (21.0)
Weekend Admission	1903 (30.1)
Season	
Spring (Mar, Apr, May)	1532 (26.0)
Summer (Jun, Jul, Aug)	1802 (30.6)
Fall (Sept, Oct, Nov)	1321 (22.4)
Winter (Dec, Jan, Feb)	1240 (21.0)
Length of Stay, mean in days (± Std. Dev)	2.51 (±3.54)
Died during hospitalization	NR (0.07)
Adjusted Hospital Charges, mean n USD$ (± Std. Dev)	$21,194 (±$43,845)
Type of Primary Insurance	
Private	2647 (41.9)
Government	3019 (47.7)
Other	657 (10.4)
Income Quartile by Zip code	
1st	1879 (29.7)
2nd	1557 (24.6)
3rd	1547 (24.5)
4th	1339 (21.2)
Patient Setting	
Urban	3787 (59.9)
Suburban	1635 (25.9)
Rural	850 (13.4)
Mean New Injury Severity Score (± Std. Dev)	2.50 (±4.2)
ICU Admission	82 (1.3)
Major Surgical Procedure	2004 (31.7)
ADHD and Related Conduct/Disruptive disorders	155 (2.45)

were at higher odds than females to be hospitalized for a dog bite. Black, Hispanic, and Asian or Pacific Island children were at decreased odds of a hospitalization for a dog bite, compared to non-Hispanic white children, by 55%, 42%, and 64% respectively. Toddlers (adjusted OR, aOR, 3.74), children aged 3–5 years (aOR 5.08) and 6–11-year-olds (aOR 4.46) all had higher odds than those in early adolescence to be admitted for a dog bite. Compared to children residing in the Northeast, children in the South had lower odds, but there was no difference for children in the Midwest or West. There were higher odds of admission for a dog bite in the summer than in the spring (aOR 1.47) and lower odds in the fall and winter by 11% and 19% respectively. Children residing in urban environments had higher odds than those living in rural communities.

4. Discussion

This study demonstrates important age-related differences in the pattern of injuries associated with a hospitalization for dog bites in children. We found that hospitalizations for a pediatric dog bite directly cost the U.S. healthcare system more than $44 million annually, and this does not account for any additional emergency department or outpatient therapy, either medically or psychologically. Furthermore, particular age groups are at increased odds of being hospitalized for a dog bite and this represents a potential opportunity for targeted educational intervention.

4.1. Gender, age groups, and ADHD

We found that the injured population was predominately aged 6–11 years old and that the dog bite most often took place during the summer months which supports existing literature [4,12,21]. The population in this study was predominantly male, and after adjusting for potential confounders, we found that males were at increased odds of a hospitalization. Our findings are supported by one recent study using national emergency department visits [14] but in contrast to another using the National Trauma Data Bank [4]. Further research will be needed to further elucidate any gender differences.

Prior research has examined links between the prevalence of dog bites and age. However, this is the first study to our knowledge to directly assess the odds of a hospitalization for a dog bite by age-group after adjusting for confounders. We have found that those in early childhood (3–5 years) had the highest odds and that toddlers (1–2 years) and those in the middle of childhood (6–11 years) also had increased odds of hospitalization for a dog bite when compared to those in early adolescence. Children aged 3–5 years may have less parental supervision than toddlers. These children are less likely to appropriately judge potential dangers, to be aware of their provocative behaviors, or to interpret warning signs exhibited by a dog. Parental presence at the time of injury has shown to be less than 50% [7], and the age of the child has been shown to predict the severity of the dog bite injury [4]. With the majority of dog bites occurring in the home setting [7], and with the dog belonging to the family or a neighbor [6], increased parental supervision of children interacting with dogs has the potential to make a significant public health impact. This impact is likely to be further magnified when the breed of the dog is factored in — known high frequency and high severity offending breeds such as pit bulls [22] might require even greater restriction to reduce the risk.

We investigated the potential role that ADHD, and related conduct and disruptive behavior disorders play in children being bitten by dogs. Previous research has suggested that in a mixed adult and child population, males with such externalizing behavior disorders had higher odds of being evaluated in the ED for a dog bite [14]. The prevalence of ADHD and related conduct or disruptive disorders in our study was 2.45%. When adding the disorder to the logistic regression presented in Table 3, we found that children with a coexisting diagnosis of ADHD and related conduct or disruptive disorders had decreased odds of being hospitalized (Appendix B). A further subanalysis by gender showed similar findings. This contrasts with prior work that has suggested that children with externalizing behavior disorders have an increased risk of injury from dog bites [14,23–26]. The reasons for this discrepancy are unclear, but it is possibly related to our use of an inpatient database which might result in underreporting.

4.2. Injuries associated with dog bites

Previous research has demonstrated that younger children are more likely to suffer injuries to the head and neck region whereas older children are more likely to suffer injuries to the extremities [27–32]. These studies are limited to single-centers. Our work corroborates those findings and provides a more specific age-association of injuries based on national data. We had hypothesized that younger children's upper body and head would be at the head or muzzle height for a dog, and thus injured more commonly. As expected, we discovered a higher proportion of skull fractures, open wounds to head, neck and trunk as well as a higher number of procedures on the eyes, ears, and nose in younger children. In contrast, we saw a higher proportion of injuries to the extremities as age increased indicating that the older children were more likely to be able to defend themselves or were reaching out to

Table 2
Injuries and procedures associated with dog bites in children.

	Infant, <1-year-old	Toddler, 1–2 years	Early childhood, 3–5 years	Middle childhood, 6–11 years	Early adolescence, 12–18 years	Total	p-value
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	
Injuries							
Any fracture	28 (15.7)	127 (7.9)	109 (8.0)	173 (8.9)	88 (9.5)	526 (8.7)	0.05
Skull or Face Fracture	24 (13.1)	82 (5.1)	73 (5.4)	47 (2.4)	10 (1.1)	236 (3.9)	<0.01
Upper Limb Fracture	NR	34 (2.1)	28 (2.0)	104 (5.4)	66 (7.2)	234 (3.9)	<0.01
Lower Limb Fracture	NR	NR	NR	19 (1.0)	10 (1.1)	43 (0.7)	0.38
Intracranial Injury	16 (8.7)	15 (1.0)	NR	NR	NR	45 (0.8)	<0.01
Open Wound of Head, Neck, Trunk	128 (70.3)	1099 (68.7)	967 (70.9)	1003 (51.6)	223 (24.2)	3420 (56.9)	<0.01
Open Wound of Extremities	30 (16.5)	374 (23.4)	347 (25.4)	940 (48.4)	628 (68.0)	2318 (38.6)	<0.01
Contusion	16 (9.0)	122 (7.6)	114 (8.3)	123 (6.4)	71 (7.7)	446 (7.4)	0.41
Nerve or Spinal cord injury	NR	30 (1.9)	23.00 (1.7)	40 (2.1)	15 (1.6)	109 (1.8)	0.82
Cellulitis	74 (40.9)	723 (45.2)	525 (38.5)	693 (35.7)	386 (41.7)	2401 (39.9)	<0.01
Procedures							
Major Surgical Procedure	61 (33.6)	399 (25.0)	436 (31.9)	705 (36.3)	300 (32.5)	1901 (31.6)	<0.01
Suture of Skin And Subcutaneous Tissue	47 (26.2)	475 (29.7)	469 (34.4)	614 (31.6)	151 (16.3)	1756 (29.2)	<0.01
Debridement of Wound	14 (7.6)	212 (13.3)	207 (15.2)	394 (20.3)	149 (16.2)	976 (16.2)	<0.01
Incision and Drainage	NR	114 (7.1)	67 (4.9)	106 (5.5)	65 (7.0)	361 (6.0)	0.20
Skin Graft	NR	35 (2.2)	59 (4.3)	124 (6.4)	29 (3.1)	251 (4.2)	<0.01
Plastics Procedure on Nose	11 (6.0)	98 (6.1)	91 (6.7)	88 (4.5)	25 (2.7)	313 (5.2)	0.01
Procedure on Ear	14 (7.6)	76 (4.8)	70 (5.1)	116 (6.0)	NR	280 (4.7)	<0.01
Other Repair or Reconstruction of Skin or Subcutaneous Tissue	NR	25 (1.6)	40 (2.9)	47 (2.4)	NR	127 (2.1)	0.04
Wound Irrigation	NR	43 (2.7)	39 (2.8)	69 (3.5)	25 (2.8)	176 (2.9)	0.29
Injection of Antibiotics	NR	47 (2.9)	44 (3.3)	84 (4.3)	50 (5.4)	227 (3.8)	0.07
Any procedure on the Eye	24 (13.1)	180 (11.3)	177 (13.0)	129 (6.6)	14 (1.5)	524 (8.7)	<0.01
Mouth Procedure or Repair	NR	125 (7.8)	151 (11.1)	158 (8.2)	53 (5.7)	496 (8.3)	<0.01
Any Computed Tomography (CT) Scan	NR	NR	NR	NR	NR	17 (0.7)	0.09

NR = Not Reported in compliance with the HCUP data use agreement.

touch the offending dog. Our finding that 8.7% of our population had any form of a fracture is similar to that of a recent study that found 8.9% [6]. Educational initiatives to reduce dog bite injuries should utilize age-specific injury patterns as part of the approach.

4.3. Procedures associated with dog bites

The finding in this study that 31.6% of children required a major surgical procedure is consistent with one recent single-center study [7]. Unsurprisingly, procedures on soft tissue, such as suturing and debridement, were the most common. Additionally, 4% of our population required skin grafting which is slightly higher than the 2% found in one single-institution study [6]. The current body of literature is predominantly focused around single-center studies, and thus our finding likely represents an average of national procedures by balancing tertiary trauma and referral centers with local community hospitals.

The utility of imaging for the assessment of pediatric dog bites is unclear, particularly in the setting of attempting to reduce radiation exposure in young children. One recent single-institution abstract found 3.6% of children underwent a maxillofacial CT scan [33]; however, our work found a low overall CT (of any form) use rate of 0.7%. Additionally, the work above found an overutilization of imaging studies as part of the initial evaluation [33]. A good physical exam should guide management prior to any mandated radiographic imaging.

4.4. Educational interventions

We identified a demographic of children who are at increased odds of hospitalization for dog bite injuries. An educational intervention in this population has the potential to make a significant public health impact. A 2012 study found that 70% of children had never received dog bite education and that 88% of their parents wished the children had been educated [34]. A follow up to this study implemented a video-based education intervention and found a passing score for dog safety increase from 90% to 53%, after viewing the video. Owing to the increased odds of being bitten by a dog in the summer, a targeted educational initiative in communities in the weeks preceding the start of summer vacation for children aged 1–11 and their parents might reduce the morbidity associated with pediatric dog bites.

Table 3
Logistic regression evaluating dog bite hospitalizations.

	Odds Ratio	95% C.I.	p-value
Males	1.14	(1.06, 1.22)	<0.01
Race			
Non-Hispanic White	Reference		
Black	0.45	(0.40, 0.51)	<0.01
Hispanic	0.58	(0.52, 0.66)	<0.01
Asian or Pacific Islander	0.36	(0.27, 0.47)	<0.01
Native American	0.97	(0.69, 1.36)	0.86
Other	0.60	(0.51, 0.71)	<0.01
Age Group			
Infant, <1 year old	0.03	(0.02, 0.04)	<0.01
Toddler, 1–2 years	3.74	(3.32, 4.21)	<0.01
Early childhood, 3–5 years	5.08	(4.52, 5.72)	<0.01
Middle childhood, 6–11 years	4.46	(4.01, 4.96)	<0.01
Early adolescence, 12–18 years	Reference		
Hospital Region			
Northeast	Reference		
Midwest	0.90	(0.79, 1.04)	0.15
South	0.79	(0.69, 0.91)	<0.01
West	0.89	(0.76, 1.04)	0.13
Season			
Spring	Reference		
Summer	1.47	(1.34, 1.61)	<0.01
Fall	0.89	(0.81, 0.98)	0.02
Winter	0.81	(0.73, 0.90)	<0.01
Patient Setting			
Urban	1.38	(1.21, 1.58)	0.00
Suburban	1.12	(0.98, 1.27)	0.09
Rural	Reference		
Income Quartile			
1st	1.09	(0.97, 1.23)	0.15
2nd	1.09	(0.98, 1.22)	0.11
3rd	1.10	(0.99, 1.22)	0.07
4th	Reference		
Payer			
Private	Reference		
Government	1.17	(1.08, 1.27)	<0.01
Other	1.57	(1.39, 1.77)	<0.01
Weekend	1.32	(1.23, 1.42)	<0.01

4.5. Study strengths and limitations

The biggest strength of this study is the utilization of the largest national all-payer administrative dataset of children <20 years of age within the United States, the Kids Inpatient Database. The KID consists of more than 3500 participating hospitals and is therefore significantly larger than other potential data sources such as the National Epidemiologic Injury Surveillance System (>100 participating hospitals), and the Pediatric Health Information System (PHIS, >45 participating hospitals). The size of the KID allows one to generate a national impression of the disease states or trauma-related injuries that would be difficult to study at a single institution.

There are several limitations to this study. These include the use of ICD-9 codes in an administrative database, the potential for misclassification, the role of missing data, and the lack of a longitudinal design. Administrative datasets, like the KID and PHIS, rely on the use of ICD-9 (or ICD-10 codes in more recent iterations) but whether or not the diagnosis was present on admission or developed during the admission is difficult to determine. There is a chance of misclassification by the medical reviewers during data entry. However, these datasets have been used across a broad spectrum of disease states, involve hospitals in almost every state, and are considered reliable. We excluded cases where there were missing data to be able to describe the population being affected by dog bites accurately. Finally, the KID was not designed as a longitudinal dataset, or a patient-level database, and therefore is missing information on whether or not the same patient had multiple hospitalizations for the same reason, to track readmissions, or to look at medication use or laboratory values. The KID is an inpatient only dataset and so does not account for any child who was seen in the emergency department and discharged.

5. Conclusions

Dog bite injuries are common in pediatric patients and result in more than 40 hospitalizations per week nationally. Children aged 3 to 5 years have the greatest odds of being hospitalized for a dog bite and are at particularly high risk during the summer. Dog safety training should be focused on elementary and middle school children and their families close to the start of summer vacation to reduce the morbidity associated with pediatric dog bites.

Appendix A

Diagnosis	ICD-9 Code
Intensive Care Admission	*ICD-9 Procedure* 89.61, 96.70, 96.71, 96.72, 38.97, 39.65 *CCS Procedure* 55
Nerve or Spinal cord injury	950, 950.0, 950.1, 950.2, 950.3, 950.9, 951, 951.0, 951.1, 951.2, 951.3, 951.4, 951.5, 951.6, 951.7, 951.8, 951.9, 952, 952.0, 952.00, 952.01, 952.02, 952.03, 952.04, 952.05, 952.06, 952.07, 952.08, 952.09, 952.1, 952.10, 952.11, 952.12, 952.13, 952.14, 952.16, 952.17, 952.18, 952.19, 952.2, 952.3, 952.4, 952.8, 952.9, 953, 953.0, 953.1, 953.2, 953.3, 953.4, 953.5, 953.8, 953.9, 954, 954.0, 954.1, 954.8, 954.9, 952.9, 955, 955.0, 955.1, 955.2, 955.3, 955.4, 955.5, 955.6, 955.7, 955.8, 955.9, 956, 956.0, 956.1, 956.2, 956.3, 956.4, 956.5, 956.8, 956.9, 957, 957.0, 957.1, 957.8, 957.9
Open Injury to the Eye	871, 871.0, 871.1, 871.2, 871.3, 871.4, 871.5, 871.6, 871.7, 871.8, 871.9
Cellulitis	682.0, 682.1, 682.2, 682.3, 682.4, 682.5, 682.6, 682.7, 682.8, 682.9

Diagnosis	CCS Code
Skull or Face Fracture	CCS 228
Upper Limb Fracture	CCS 229
Lower Limb Fracture	CCS 230
Other Fracture	CCS 231
Intracranial Injury	CCS 233
Open Wound of Head, Neck, Trunk	CCS 235
Open Wound of Extremities	CCS 236
Contusion	CCS 239
Attention-deficit, conduct, and disruptive behavior disorders	CCS 652

	ICD-9 Procedure Code
Central Line	38.97
Arterial Line	89.61
Any ventilator use	96.70, 96.71, 96.72
Other Repair or Reconstruction of Skin or Subcutaneous Tissue	86.89
Wound Irrigation	96.59
Injection of antibiotics	99.21
Mouth Procedure or Repair	27.51, 27.59

	CCS Procedure Code
Therapeutic procedures on eyelids; conjunctiva; cornea	19
Other intraocular therapeutic procedures	20
Procedure on Ear	26
Plastics Procedure on Nose	28
Other therapeutic procedures on muscles and tendons	160
Incision and Drainage of Wound	168
Incision and drainage; skin and subcutaneous tissue	168
Debridement of wound	169
Suture of subcutaneous wound or skin	171
Skin Graft	172
Other nonoperating room therapeutic procedures on skin and breast	174
Other extraocular muscle and orbit therapeutic procedures	221

Appendix B. Logistic regression evaluating dog bites in children incorporating ADHD diagnoses

	Odds Ratio	95% C.I.	p-value
Males	1.14	(1.07, 1.23)	<0.01
Race			
White	Reference		
Black	0.45	(0.40, 0.51)	<0.01
Hispanic	0.58	(0.51, 0.65)	<0.01
Asian or Pacific Islander	0.35	(0.26, 0.47)	<0.01
Native American	0.97	(0.69, 1.36)	0.84
Other	0.60	(0.50, 0.71)	<0.01
Age Group			
Infant, <1 year old	0.03	(0.02, 0.04)	<0.01
Toddler, 1–2 years	3.66	(3.25, 4.12)	<0.01
Early childhood, 3–5 years	4.98	(4.43, 5.61)	<0.01
Middle childhood, 6–11 years	4.46	(4.01, 4.96)	<0.01
Early adolescence, 12–18 years	Reference		
Hospital Region			
Northeast	Reference		
Midwest	0.91	(0.79, 1.04)	0.17
South	0.79	(0.69, 0.91)	<0.01
West			
Season			
Spring	Reference		
Summer	1.47	(1.33, 1.61)	<0.01
Fall	0.89	(0.81, 0.98)	0.02
Winter	0.81	(0.73, 0.90)	<0.01
Patient Setting			
Urban	1.38	(1.21, 1.58)	<0.01
Suburban	1.12	(0.99, 1.28)	0.08
Rural	Reference		
Income Quartile			
1st	1.09	(0.97, 1.23)	0.15
2nd	1.10	(0.98, 1.23)	0.11
3rd	1.10	(0.99, 1.22)	0.07
4th	Reference		
Payer			
Private	Reference		
Government	1.18	(1.08, 1.28)	<0.01
Other	1.57	(1.39, 1.77)	<0.01
Weekend	1.31	(1.22, 1.41)	<0.01
ADHD, Conduct, Disruptive Disorders	0.67	(0.54, 0.84)	<0.01

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