

## Level 1 Trauma Center Studies Characterizing Dog Bite Injuries Across Major U.S. Geographical Regions (2011-2018)

### Summary

Table 1. From 2011 to 2018, 10 peer-reviewed retrospective medical studies from Level 1 trauma centers spanning the Northwest, Northeast, Southeast, South, Southwest and West Coast regions all report similar findings. Pit bulls are inflicting a higher prevalence of injuries than all other breeds of dogs. The majority of these studies also report that pit bulls are inflicting a higher severity of injuries, requiring a higher number of operative interventions -- up to five times higher -- than other dog breeds. Table 2. Three studies from this period -- all from Level 1 trauma centers in the Denver metro area -- show varying results, possibly due to Denver and the surrounding metropolitan regions enforcing pit bull bans over the last 2.5 decades.

### Selection Criteria

Criteria for inclusion in this series of studies requires being a multi-year study of Level 1 trauma center dog bite patients, published from 2011 to 2018, the inclusion of dog breed information, and the scientific research conducted by medical doctors.

**Table 1: Major U.S. Geographical Regions**

Years	Region	Breed & Injury Prevalence	Severity Information	Ref
Published: <b>September 2018</b> Study period: 2010-2016	<b>West</b> - Level 1 trauma center - Fresno, CA	95 patients studied -- orthopaedic injuries requiring specialized treatment only. Pit bulls inflicted the highest prevalence of injuries, 50% (47), followed by law enforcement dogs, 22% (21), of total studied. Breed was known in 84% (80) of all cases.	Pit bulls were responsible for 78% of all amputation injuries. Of those bitten by pit bulls, 51% had a bony injury. Bites from law enforcement dogs resulted in 24% bony injuries. 66% of pit bull bite patients (31/47) sustained an amputation or bony injury.	1
<p><b>Conclusions:</b> “Thirty-nine percent of all dog bite-related emergency department visits at our facility resulted in an injury requiring orthopaedic treatment. Pit bull terrier bites were responsible for a significantly higher number of orthopaedic injuries and resulted in an amputation and/or bony injury in 66% of patients treated, whereas bites from law enforcement dogs and other breeds were less associated with severe injuries.”</p>				

Published: <b>August 2018</b> Study periods: 2011-2016 2010-2016	<b>South</b> - Two institutions, pediatric and adult, Arkansas' only Level 1 trauma centers	740 patients studied, 574 children and 166 adults. Pit bulls inflicted the highest prevalence of injuries to children, 28.1% (55), when breed was known. Breed was recorded in 34% (195/574) of pediatric cases and 58.6% (17/29) of pediatric cases that required operative intervention.	Of the 31 adult trauma cases in which a breed was recorded, 42% (13/31), pit bulls were represented in 69% of cases. Of all child and adult cases combined that required operative intervention, pit bulls were represented in 62.5% of cases.	2
<b>Findings:</b> "Our study corroborates much of the previous literature, supporting the notion that pit bull bites are severe enough to require operative intervention more frequently than the bites of other dog breeds ... Indeed, when looking at cases that required operative interventions, pit bulls were disproportionately represented in 62.5% of cases."				
Published: <b>October 2017</b> Study period: 2012-2014	<b>Northeast</b> - Pediatric Level 1 trauma center - Westchester, NY	108 pediatric patients studied. 17 dog breeds identified in 56 cases, 52%. Pit bulls inflicted the highest prevalence of injuries, 48.2% (27), when breed was known and 25% of total studied.	47.8% of pit bull injuries required operative repair, which was 3 times more than other breeds. Of the 9 patients with extended hospitalization, 66.7% were caused by a pit bull.	3
<b>Findings:</b> "Of the 56 cases that had an identified dog breed, pit bulls accounted for 48.2% of the dog bites ... More importantly, 47.8% of pit bull injuries required operative repair, which was 3 times more than other breeds."  "Of the 9 patients with extended hospitalization, 6 (66.7%) were caused by a pit bull that confirms our theory that this breed results in the most devastating injuries at our center. The penetrating and crushing nature of these bites can lead to lifelong deformities."				
Published: <b>April 2017</b> Study period: 4 years	<b>Southeast</b> - Pediatric Level 1 trauma center - Atlanta, GA	1616 pediatric patients studied. 46 dog breeds identified in 509 cases, 31.3%. Pit bulls inflicted the highest prevalence of injuries, 38.5% (196), when breed was known and 12% of total studied.	Pit bull bites were implicated in 50% of all surgeries performed and over 2.5 times as likely to bite in multiple anatomic locations as compared to other breeds. A pit bull inflicted the only fatality.	4
<b>Findings:</b> "Pit bull bites were implicated in half of all surgeries performed and over 2.5 times as likely to bite in multiple anatomic locations as compared to other breeds."  "Our data were consistent with others, in that an operative intervention was more than 3 times as likely to be associated with a pit bull injury than with any other breed."				

Published: <b>July/Aug 2016</b>  Study period: 2003-2013	<b>Northwest</b> - Regional Level 1 trauma center - Seattle, WA	342 patients studied. Breed identified in 270 cases, 79%. Pit bulls inflicted the highest prevalence of injuries 27% (92) of total studied and 25% (22.7) of all ocular injuries. Among dogs unknown to patients, pit bulls inflicted 60% of all injuries and 63% of ocular injuries.	5 patients (1.5%) ages <7 sustained facial fractures. 3 sustained orbital fractures inflicted by a doberman, husky and labrador, 1 sustained a nasal bone fracture by a pit bull, and 1 sustained a depressed skull fracture by a German shepherd.	5
<b>Findings:</b> “Importantly, this study is the first to accurately establish that pit bulls are the breed most commonly associated with ocular injuries (25%). Most alarming is the observation that when attacks come from unfamiliar dogs, the pit bull was responsible for 60% and 63% of all injuries and ocular injuries, respectively.”				
Published: <b>May 2015</b>  Study period: 2006-2013	<b>Southeast</b> - Level 1 trauma center - Knoxville, TN	20 patients studied -- head, neck and facial injuries only treated by oral and maxillofacial surgery. Breed identified in 16 cases, 80%. Pit bulls inflicted the highest prevalence of injuries, 56% (9), when breed was known and 45% of total studied.	Pit bulls were more frequently associated with injuries than other dog breeds (9/20). Two cases involved multiple dogs, all of which were pit bulls. A pit bull inflicted the only fatality.	6
<b>Results:</b> “The medical records from 20 patients were included and reviewed. More than one half (60%) of the patients were younger than 12 years old. The dog was owned by the patient or a relative in 58% of the cases. The children sustained injuries requiring hospital admission and repair in an operating room setting more often than did the adults. Pit bulls were more frequently associated with injuries than other breeds (9 of 20).”				
Published: <b>February 2015</b>  Study period: 2007-2013	<b>Southwest</b> - Pediatric Level 1 trauma center - Phoenix, AZ	282 pediatric patients studied. Breed identified in 213 cases, 75.5%. Pit bulls inflicted the highest prevalence of injuries, 39% (83), when breed was known and 29.4% of total studied.	Among the 11 patients with the highest AIS (3–5), pit bulls were responsible in 45.5% of cases. Pit bulls also accounted for 38% of all head, neck or facial bites.	7
<b>Findings:</b> “Pit bulls were most frequently responsible, accounting for 39% (83/213) of incidents in which dog breed was documented ... Among the 11 patients with the highest AIS (3–5), Pit bulls were responsible in 45.5% of cases, followed by mixed breeds in 18.2% (2/11) of cases. Pit bulls were also responsible for 38% of all head, neck or face bites.”  “Dog familiarity did not confer safety, and in this series, pit bulls were most frequently responsible. These findings have great relevance for child safety.”				

Published: <b>Jan/Feb 2015</b> Study period: 2012-2013	<b>West</b> - Level 1 trauma center - Sacramento, CA	334 patients studied. Breed identified in 211 cases, 63%. Pit bulls inflicted the highest prevalence of injuries, 54% (114), when breed was known and 34% of total studied. Pit bulls also inflicted the highest prevalence of head and neck injuries, 48% (32/67), when breed was known and 32% of total studied.	Bites from pit bull terriers were more severe than other dog breeds with a mean DBCI of 3.2 compared to 2.3, had a significantly higher rate of consultation (94%) and had 5 times the rate of operative repair when compared to other breeds.	8
<b>Results:</b> “Of the more than 8 different breeds identified, one-third were caused by pit bull terriers and resulted in the highest rate of consultation (94%) and had 5 times the relative rate of surgical intervention. Unlike all other breeds, pit bull terriers were relatively more likely to attack an unknown individual (+31%), and without provocation (+48%).”				
Published: <b>Nov/Dec 2011</b> Study period: 2005-2009	<b>Southeast</b> - Level 1 trauma center - Charleston, WV	40 pediatric patients studied -- facial, head and neck injuries only. Breed identified in 30 cases, 75%. Pit bulls inflicted the highest prevalence of injuries, 40% (12), when breed was known and 30% of total studied.	The skull and orbital fractures were caused by a pit bull bite, which is characterized as a “vice-grip” which crushes, avulses and strangles, potentially making it a more dangerous breed.	9
<b>Findings:</b> “Bites from large-breed dogs, especially pit bull-type dogs and rottweilers are more likely to result in more severe injuries, subsequent medical care and report, which may over-represent those breeds among biting dogs -- in other words, creating reporting bias. However the severity of injury necessitating medical attention should not be overlooked when considering the breed of dog generating more severe injuries.”				
Published: <b>April 2011</b> Study period: 1994-2009	<b>South</b> - Level 1 trauma center - San Antonio, TX	228 patients studied. Breed identified in 82 cases, 36%. Pit bulls inflicted the highest prevalence of injuries, 35% (29), when breed was known. There were three dog bite fatalities; pit bulls inflicted all three deaths.	Attacks by pit bulls were associated with a higher median Injury Severity Scale score, a higher risk of an admission Glasgow Coma Scale score of 8 or lower, higher median hospital charges, and a higher risk of death.	10
<b>Conclusions:</b> “Attacks by pit bulls are associated with higher morbidity rates, higher hospital charges, and a higher risk of death than are attacks by other breeds of dogs. Strict regulation of pit bulls may substantially reduce the US mortality rates related to dog bites.”				

## Level 1 Trauma Center Studies Characterizing Dog Bite Injuries In Denver, Colorado Region (2011-2018)

### Summary

In October 1989, the city and county of Denver adopted a pit bull ban. Notably, in 1994, one of the first epidemiological studies of “breeds of biting dogs” was carried out in the county of Denver, despite the absence of pit bull terriers due to the ban ([Which Breeds Bite? A Case-Control Study of Risk Factors](#)).<sup>a</sup> As a result, pit bulls did not appear in the case-control study’s “biting” or “nonbiting” breed findings.

From 2011 to 2018, one of three Level 1 trauma center studies in the Denver metro area showed that pit bulls continue to have a high prevalence of facial injuries (Gurunluoglu, 2014). Another study, also limited to facial injuries, states that while the prevalence of pit bull injuries was low during their study period (2003-2008), the severity of pit bull injury included, “the patient who suffered the most extensive injuries and the longest hospitalization of our entire population” (Chen, 2013).

### **Table 2: Denver Level 1 Trauma Centers**

*Children’s Hospital Colorado in Denver and the Denver Health Level 1 Trauma Center are regional Level 1 trauma centers that serve Denver and the 7-state Rocky Mountain region.*

Years	Region	Breed & Injury Prevalence	Severity Information	Ref
Published: <b>January 2017</b> Study period: 2000-2015	<b>West -</b> Regional Pediatric Level 1 trauma center - Denver, CO	17 pediatric patients studied -- neurosurgical consultation for head and neck injuries only. Akitas and German shepherds inflicted the highest prevalence of wounds (3 each) followed by American bulldogs, labradors, large mixed-breed dogs and pit bulls (2 each).	All attacks requiring neurosurgical consultation were committed by large-breed dogs. Neurological deficits, all of which were considered catastrophic, developed in 3 patients involving an akita (1), American bulldog (1) and unknown breed (1).	11
<p><b>Findings:</b> “In this study, large-breed dogs were responsible for all attacks on children requiring neurosurgical consultation. Most dogs were family pets with no history of prior aggression, and most of the attacks occurred at home.”</p> <p>“Parental supervision, though important, may not be enough, given that the majority of attacks in this series occurred in the presence of an adult, even those with catastrophic neurological injury.”</p>				

Published: <b>May 2014</b> Study period: 2006-2012	<b>West -</b> Regional Level 1 trauma center - Denver, CO	75 patients studied, 98 total wounds -- facial dog bite injuries treated by plastic surgery only. Pit bulls and German shepherds inflicted the highest prevalence of wounds, 11.6% each (11/95), when breed was known and 11.22% each of total wounds.	Over half of all wounds inflicted by pit bulls and German shepherds required reconstruction procedures (7/11 each). Combined, the two breeds accounted for 37% (14/38) of all reconstruction procedures performed.	12
<b>Findings:</b> “Ninety-eight wounds in the head and neck region were repaired. Twelve different breeds were identified. There was no significant association between the type of dog breed and the number of bite injuries ... There was no statistically significant association between wounds needing reconstruction versus direct repair according to dog breed.”				
Published: <b>September 2013</b> Study period: 2003-2008	<b>West -</b> Regional Pediatric Level 1 trauma center - Denver, CO	537 pediatric patients studied -- facial dog bite injuries only. Breed identified in 366 cases, 68.2%. Mixed breed inflicted the highest prevalence of injuries, 23% (84), when breed was known and 16% of total studied.	There were 11 victims of pit bull bites from 2003 to 2008, including the patient who suffered the most extensive injuries and the longest hospitalization of our entire population.	13
<b>Findings:</b> “Pit bulls were banned in Denver because of several gruesome maulings and fatalities that occurred between 1984 and 1989. Our study found 11 victims of pit bull bites from 2003 to 2008, including the patient who suffered the most extensive injuries and the longest hospitalization of our entire population, indicating that despite legislation, pit bull bites continue to be a public health concern.”				

### **Citations**

- 1.) Brice J, Lindvall E, Hoekzema N, Husak L, [Dogs and Orthopaedic Injuries: Is There a Correlation to Breed?](#), *J Orthop Trauma*, 2018 Sep;32(9):e372-e375.
- 2.) Smith AM, Carlson J, Bartels AB, McLeod CB and Golinko MS, [Characteristics of Dog Bites in Arkansas](#), *South Med J*, 2018 Aug;111(8):494-500.
- 3.) Kaveh Alizadeh, MD, MSc, FACS, Ali Shayesteh, MD, and Min Li Xu, MD, [An Algorithmic Approach to Operative Management of Complex Pediatric Dog Bites: 3-Year Review of a Level I Regional Referral Pediatric Trauma Hospital](#), *Plastic and Reconstructive Surgery - Global Open*, October 2017.
- 4.) Golinko MS, Arslanian B, Williams JK, [Characteristics of 1616 Consecutive Dog Bite Injuries at a Single Institution](#), *Clinical Pediatrics (Phila)*, April 2017;56:316-325 [July 2016, Epub].
- 5.) Prendes MA, Jian-Amadi A, Chang SH and Shaftel SS, [Ocular Trauma From Dog Bites: Characterization, Associations, and Treatment Patterns at a Regional Level I Trauma Center Over 11 Years](#), *Ophthalmic Plast Reconstr Surg*, 2016 Jul-Aug;32(4):279-83 [June 2015, Epub].

- 6.) Foster MD and Hudson JW, [Contemporary Update on the Treatment of Dog Bite: Injuries to the Oral and Maxillofacial Region](#), *J Oral Maxillofac Surg*, May 2015 Volume 73, Issue 5, Pages 935–942.
- 7.) Garvey EM, Twitchell DK, Ragar R, Egan JC and Jamshidi R, [Morbidity of pediatric dog bites: A case series at a level one pediatric trauma center](#), *J Pediatr Surg*, February 2015;50:343-6.
- 8.) O'Brien DC, Andre TB, Robinson AD, Squires LD and Tollefson TT, [Dog bites of the head and neck: an evaluation of a common pediatric trauma and associated treatment](#), *Am J Otolaryngol*, 2015 Jan-Feb; 36(1): 32–38. [2014 Sep 28, Epub].
- 9.) Horswell BB and Chahine CJ, [Dog Bites of the Face, Head and Neck in Children](#), *W V Med J*, Nov-Dec 2011.
- 10.) Bini JK, Cohn SM, Acosta SM, McFarland MJ, Muir MT, Michalek JE; TRISAT Clinical Trials Group, [Mortality, Mauling, and Maiming by Vicious Dogs](#), *Ann Surg*, April 2011;253:791-797.
- 11.) Kumar R, Deleyiannis FW, Wilkinson C and, O'Neill BR, [Neurosurgical sequelae of domestic dog attacks in children](#), *J Neurosurg Pediatr*, January 2017:24-31 [Epub 2016 Oct 21].
- 12.) Gurunluoglu R, Glasgow M, Arton J and Bronsert M, [Retrospective analysis of facial dog bite injuries at a Level I trauma center in the Denver metro area](#), *J Trauma Acute Care Surg*, 2014 May;76(5):1294-300.
- 13.) Chen HH, Neumeier AT, Davies BW and Durairaj VD, [Analysis of Pediatric Facial Dog Bites](#), *Craniofacial Trauma Reconstr*, September 2013;6:225-232.

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<sup>a</sup> Gershman KA1, Sacks JJ, and Wright JC, [Which Dogs Bite? A Case Control Study of Risk Factors](#), *Pediatrics*, 1994 Jun;93(6 Pt 1):913-7.