

### Are dog bites a public health concern?

Dog bites are among the top 12 non-fatal injuries in the world.<sup>1</sup> Some estimate that there is a 50 percent chance of being bitten by a domestic animal during a lifetime, of which dog bites account for 80–90 percent,<sup>2</sup> and about half of all dog bite injuries are actually reported to medical services.<sup>3</sup> According to the Centers for Disease Control and Prevention (CDC), about 4.5 million Americans are bitten by dogs each year, half of these are children.<sup>4</sup> One study estimated that hospitalization costs for dog bites in 1994 were more than \$40.5 million. Another study analyzed 20 years of fatality data from 1979–1998 and found that there were an average of 16 fatalities per year over that time.<sup>2</sup> In 2012, more than 27,000 people underwent reconstructive surgery as a result of being bitten by dogs.<sup>4</sup> Although dog bite injuries are frequent, they are preventable.<sup>4</sup> Box 1 provides some important safety tips for children.

### Assessment of dog bites using inpatient and emergency hospital data

Dog bite injury estimates have been produced using a variety of sources,<sup>5</sup> including household surveys such as the Injury Control and Risk Survey (ICARIS) by the CDC,<sup>2</sup> hospital-based studies, school-based surveys, police reports, local animal shelter monitoring, and emergency departments.<sup>5</sup> To enumerate the case incidence of dog bite injuries at population level, Arizona Hospital Discharge Data (HDD) data for 2008 to 2012, a five-year time-period, was utilized. Cases were identified based on the national incidence study by using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* code similar to Weiss et al<sup>5</sup> and Day et al<sup>6</sup> as indicated in Box 2 for both emergency department visits (EDs) and inpatient hospitalizations (IP). The Arizona Department of Health

#### Highlights

- There were **34,151 ED visits** and **2,358 inpatient hospitalizations** during 2008–2012 for dog-bite related injuries.
- While ED visits declined three percent, inpatient hospitalizations increased by **139 percent**.
- The total charges during this time-period was **\$55 million** with a median cost of \$17,000 for an inpatient hospitalization and \$1,150 for an ED visit.
- **More than 70%** of the dog bite injuries were in homes.

#### Box 1

##### Safety tips:

- Pick a dog breed that matches your lifestyle especially if you have children.
- Do not approach an unfamiliar dog.
- Do not run from a dog or scream.
- Remain motionless (e.g., "be still like a tree") when approached by an unfamiliar dog.
- If knocked over by a dog, roll into a ball and be still.
- Do not play with a dog unless supervised by an adult.
- Immediately report stray dogs or dogs displaying unusual behavior to an adult.
- Avoid direct eye contact with a dog.
- Do not disturb a dog that is sleeping, eating, or caring for puppies.
- Do not pet a dog without allowing it to see and sniff you first.
- If bitten, immediately report the bite to an adult.

<sup>1</sup> Sacks JJ, Kresnow M, Houston B. Dog bites: how big a problem? *Inj Prev*, 1996; 2: 52–54.

<sup>2</sup> Gilchrist J, Sacks JJ, White D, Kresnow MJ. Dog bites: still a problem. *Inj Prev*, 2008;14:296–301.

<sup>3</sup> Morgan M, Palmer J. Dog bites. *BMJ*, 2007;334: 413–417.

<sup>4</sup> Centers for Disease Control and Prevention. Dog bites. Available at: <http://www.cdc.gov/homeandrecreationalsafety/dog-bites/index.html>. Accessed on March 11, 2014.

<sup>5</sup> Weiss HB, Friedman DI, Coben JH. Incidence of dog bite injuries treated in emergency departments. *JAMA*, 1998;279(1):51–53.

<sup>6</sup> Day H, Roesler JS, Kinde M. Hospital-Treated Dog Bites in Minnesota, 1998–2005. *Minn Med.*, July 2007.

Services (ADHS) collects hospital discharge records for inpatient and emergency department visits from all Arizona licensed hospitals. All Arizona licensed hospitals (i.e. regulated by the Arizona Department of Health Services), are required to report. However, hospitals such as Veteran's Administration, Department of Defense, and those located on tribal land are not included in the reporting.

The description of case identification is given in Box 2. Numerators are case incidents and all reported discharges for the calendar year serve as denominators. Rates were expressed per 100,000 discharges for any given year.

#### Box 2

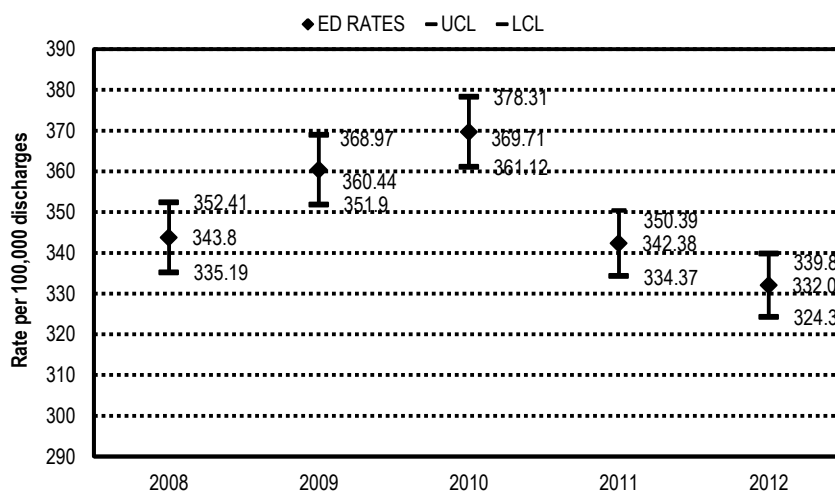
**Dog bites:** Cases were classified as dog-bite injuries if they had an external cause-of-injury code (E code) of E906.0 (dog bite).

### Dog bites in Arizona

During 2008-2012 there were a total of 34,151 ED visits and 2,358 inpatient hospitalizations for dog bites in Arizona. Figure 1 and Figure 2 display the rates of hospital-treated dog bites for the 2008-2012 time-period for both inpatient and ED visits. The overall ED discharge rate for dog bites was 349.29 (95% CI, 345.59-353) during 2008-2012 and inpatient hospitalization rate for Arizona for the same time-period was 59.8 (95% CI, 57.39-63.21) per 100,000 discharges. While the rate of inpatient hospitalizations during 2008-2012 for dog bites increased (139% from 2008), ED discharge rates declined (3.41% from 2008).

Table 1 compares the characteristics of ED and inpatient hospitalizations for dog bites in Arizona during 2008-2012.

**Figure 1. Emergency Department Rates for Dog bites 2008-2012 with 95% Confidence Intervals**



**Figure 2. Inpatient Hospitalization Rates for Dog bites 2008-2012 with 95% Confidence Intervals**

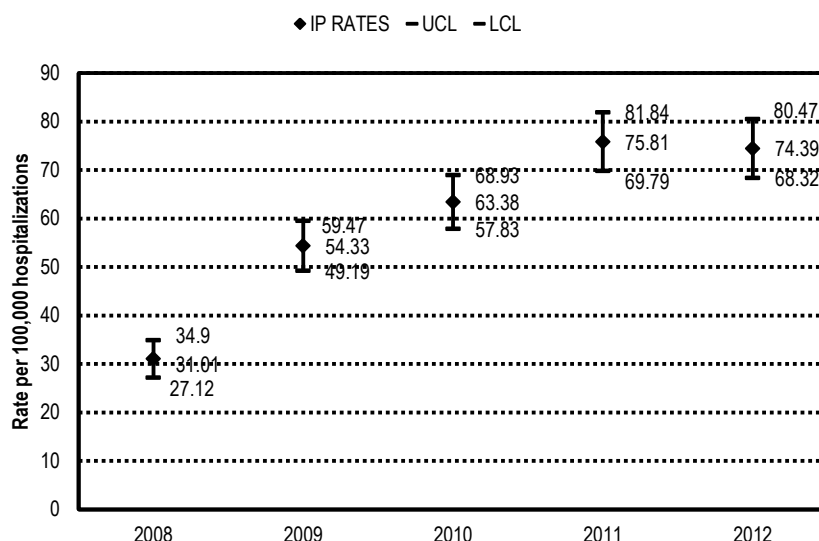


Table 1. Characteristics of ED and Inpatient Hospitalizations for dog bites in Arizona 2008-2012

Characteristics	Total (N = 36,509)	
	Emergency Department discharges (ED) (N = 34,151)	Inpatient Hospitalizations (IP) (N = 2,358)
Gender (Male)	17,927 (52.5%)	1,174 (49.79%)
Age in years		
Less than 1 year	179 (0.52%)	17 (0.72%)
1- 4 years	4,299 (12.59%)	229 (9.71%)
5-14 years	7,537 (22.07%)	245 (10.39%)
15-24 years	4,862 (14.24%)	229 (9.71%)
25-34 years	4,401 (12.89%)	235 (9.97%)
35-44 years	3,891 (11.39%)	337 (14.29%)
45-54 years	3,987 (11.67%)	409 (17.35%)
55-64 years	2,625 (7.69%)	317 (13.44%)
65-74 years	1,461 (4.28%)	184 (7.8%)
75-84 years	684 (2%)	110 (4.66%)
85+ years	225 (0.66%)	46 (1.95%)
Multiple site of injuries		
Single site	29,712 (87%)	1,858 (78.8%)
Two sites	3,961 (11.6%)	374 (15.86%)
Three or more sites	478 (1.4%)	126 (5.35%)
Insurance Status		
Medicaid	12,212 (35.76%)	735 (31.17%)
Private payers	9,437 (27.63%)	752 (31.89%)
Self-pay	5,301 (15.52%)	249 (10.56%)
Indian Health Services	228 (0.67%)	42 (1.78%)
Commercial Indemnity	2,268 (6.64%)	76 (3.22%)
Other	4,705 (13.78%)	504 (21.37%)
Race and Ethnicity		
American Indian or Alaskan Native	1,193 (3.49%)	124 (5.26%)
Asian	287 (0.84%)	7 (0.3%)
African American or Black	1,241 (3.63%)	77 (3.27%)
Hispanic or Latino	9,096 (26.64%)	411 (17.43%)
Native Hawaiian or Pacific Islander	92 (0.27%)	7 (0.3%)
White	21,768 (63.74%)	1,703 (72.22%)
Two or more races	24 (0.07%)	0 (0%)
Unknown/Refused	151 (1.32%)	29 (1.23%)
Median cost in dollars (IQR)	\$1,149 (\$1,039)	\$16,882 (\$15,653)
Median length of stay in days (IQR)	0 (0)	2 (2)

Children less than 14 years represented almost one-third of all dog-bite related injuries. Further, children 5-14 years represented 22 percent of all dog bite-related ED visits in this age and were twice as likely to have an ED visit than an inpatient hospitalization. Majority of injuries were single site injuries and the median

cost in dollars for an ED visit was \$1,149 as compared to \$16,882 for an inpatient hospitalization during 2008-2012. Slightly more than one-third of all dog bite-related ED visits were paid for by Medicaid.

Table 2. Dog bite Case Incidents by County

County	Emergency Department (ED) discharges		Inpatient hospitalization rates (IP)	
	2008-2012 <sup>¶</sup>		2008-2012 <sup>¶</sup>	
	Cases	Rates	Cases	Rates
Apache County	339	417.76 (373.29 - 462.23)	10	49.89 (23.92 - 91.75)
Cochise County	989	401.87 (376.82 - 426.92)	30	37.51 (25.3 - 53.54)
Coconino County	580	343.17 (315.24 - 371.1)	36	65.73 (44.26 - 87.2)
Gila County	366	332.01 (298 - 366.03)	22	55.08 (34.52 - 83.39)
Graham County	259	307.31 (269.89 - 344.74)	17	61.58 (35.87 - 98.59)
Greenlee County	20	228.6 (139.63 - 353.05)	1	21.95 (0.56 - 122.32)
La Paz County	97	278.46 (223.04 - 333.87)	4	33.2 (9.05 - 85)
Maricopa County	20,071	366.95 (361.88 - 372.03)	1,636	71.57 (68.1 - 75.03)
Mohave County	1,622	386.8 (367.98 - 405.62)	63	50.26 (37.85 - 62.68)
Navajo County	455	334.45 (303.71 - 365.18)	37	67.5 (45.75 - 89.25)
Pima County	5,175	370.94 (360.83 - 381.04)	263	44.83 (39.41 - 50.25)
Pinal County	1,664	341.64 (325.23 - 358.06)	144	63.97 (53.53 - 74.42)
Santa Cruz County	249	379.46 (332.33 - 426.6)	5	21.8 (7.08 - 50.86)
Yavapai County	1,479	367.84 (349.1 - 386.59)	56	46.16 (34.07 - 58.25)
Yuma County	780	312.75 (290.8 - 334.7)	34	32.44 (21.54 - 43.35)
Unknown	6	NA	0	NA
<b>State</b>	<b>34,151</b>	<b>349.29 (345.59 - 353)</b>	<b>2,358</b>	<b>59.8 (57.39 - 62.21)</b>

<sup>¶</sup>Rates are per 100,000 hospital discharges in Arizona during 2008-2012. Rates based on numerators (i.e. case incidents) of less than 10 use Poisson distribution and should be interpreted cautiously.

Other than Coconino, Gila, Graham, Greenlee, La Paz, Navajo, Pinal and Yuma, all other counties had higher rates of dog bite-related ED visits as compared to the state rate. Cochise, Pima, and Yuma had lower inpatient hospitalization rates for dog-bites as compared to the state. Appendix A and B present the discharge rate maps by Primary Care Areas (PCAs).

### Place, type, and severity of injury in Arizona

The top three place of injury that represented more than 80 percent of dog-bite related injuries for both ED visits and inpatient hospitalization were home accidents (73%), street and highway accidents (~8%), and accidents occurring in places for recreation and sport (~3%). Table 3a and table 3b provide top 10 principal diagnosis involving dog-bites for ED visits and inpatient hospitalization. While majority of the ED visits involved some type of 'open wound without mention of any complications,' more than half of the inpatient diagnoses involved some type of 'cellulitis' and/or an 'open wound' diagnoses. Thus, ED visits could be regarded as less severe while the inpatient hospitalizations as more severe and traumatic. Appendix A and Appendix B provide hospital discharge rates for dog-bite related injuries by Primary Care Area (PCA).

Table 3a. Top 10 Principal Diagnoses for ED visits involving dog-bites

Top 10 Principal Diagnoses	Emergency Department (ED) discharges 2008-2012	
	Cases	Percent
1. Open wound of hand except finger(s) alone, without mention of complication	4,881	14.29%
2. Open wound of knee, leg [except thigh], and ankle, without mention of complication	3,601	10.54%
3. Open wound of forearm, without mention of complication	3,374	9.88%
4. Open wound of finger(s), without mention of complication	2,854	8.36%
5. Open wound of lip, without mention of complication	2,473	7.24%
6. Open wound of cheek, without mention of complication	1,669	4.89%
7. Open wound of hip and thigh, without mention of complication	1,278	3.74%
8. Open wound of face, unspecified site, without mention of complication	789	2.31%
9. Open wound of wrist, without mention of complication	746	2.18%
10. Open wound of nose, unspecified site, without mention of complication	595	1.74%

Table 3b. Top 10 Principal Diagnoses for Inpatient hospitalizations involving dog-bites

Top 10 Principal Diagnoses)	Inpatient Hospitalizations (IP) 2008-2012	
	Cases	Percent
1. Cellulitis and abscess of hand, except fingers and thumb	340	14.42%
2. Open wound of hand except finger(s) alone, complicated	148	6.28%
3. Cellulitis and abscess of leg, except foot	140	5.94%
4. Cellulitis and abscess of upper arm and forearm	138	5.85%
5. Cellulitis and abscess of face	102	4.33%
6. Cellulitis and abscess of finger, unspecified	87	3.69%
7. Open wound of finger(s), complicated	65	2.76%
8. Open wound of forearm, complicated	63	2.67%
9. Open fracture of distal phalanx or phalanges of hand	59	2.5%
10. Open fracture of middle or proximal phalanx or phalanges of hand	59	2.5%

Approximately, one-third of the principal procedures in dog-bite related injuries in ED visits related to “closure of skin and subcutaneous tissue of other sites” followed by approximately 25 percent receiving immunizations (shots for tetanus). On the contrary, principal procedures in the inpatient hospitalizations varied considerably that not only included “closure of skin and subcutaneous tissue of other sites,” but also included “excisional debridement,” “incisions with drainage of skin and subcutaneous tissue,” “arthrotomy of hand and fingers,” “attachment of pedicle or flap graft to other sites,” “myectomy,” “open reduction of fracture” etc.

### Implications of findings and future steps

Although the trend in dog-bite related injuries for ED visits declined by three percent in Arizona during 2008-2012, the burden of dog-bite related injuries has increased as evident from inpatient hospitalizations (139%). The median cost for an inpatient hospitalization was about \$17,000 and the total charges during this time-period was approximately \$55 million. Further, approximately one-fifth of the inpatient hospitalizations were in children under 15 years of age and the majority of these injuries were at home. While the statistics reveal the acute impact of the dogbites, they do not reflect the long-term impacts such as limited range of motion, scarring and disfigurement, impaired circulation, and psychological impact.

While this brief highlights the importance of dog-bite related injuries in Arizona, it is difficult to estimate the ‘true incidence’ due to variability in reporting and also because hospitals such as Veteran’s Administration, Department of Defense, and those located on tribal land are not included. While rates are typically estimated using population denominators, rates computed here utilize total number of discharges because discharges are not unique.

Further, lack of state-wide information on dog breeds prohibits any analysis of injuries by dog types. However, one recent study examined the type of injuries by dog-bites.<sup>7</sup> Apart from the safety tips included in Box 1, some of the strategies recommended in the literature involve: (1) promoting responsible dog ownership (including training, socializing, and neutering of dogs); (2) increasing knowledge about how to behave around a dog (eg, do not run from a dog, be still like a tree when approached by an unfamiliar dog); (3) supporting animal control efforts (e.g., stray management, low-cost neutering, licensing, dealing with irresponsible owners); (4) regulatory/legislative measures (e.g., targeting dogs of any breed that has exhibited harmful behavior such as unprovoked attacks on persons or animals, requiring insurance, placing primary responsibility for a dog’s behavior on the owner).<sup>2</sup>

**Suggested citation:** Hussaini SK. Who let the dogs out? Dogbites in Arizona. *Research Brief*, 2014.

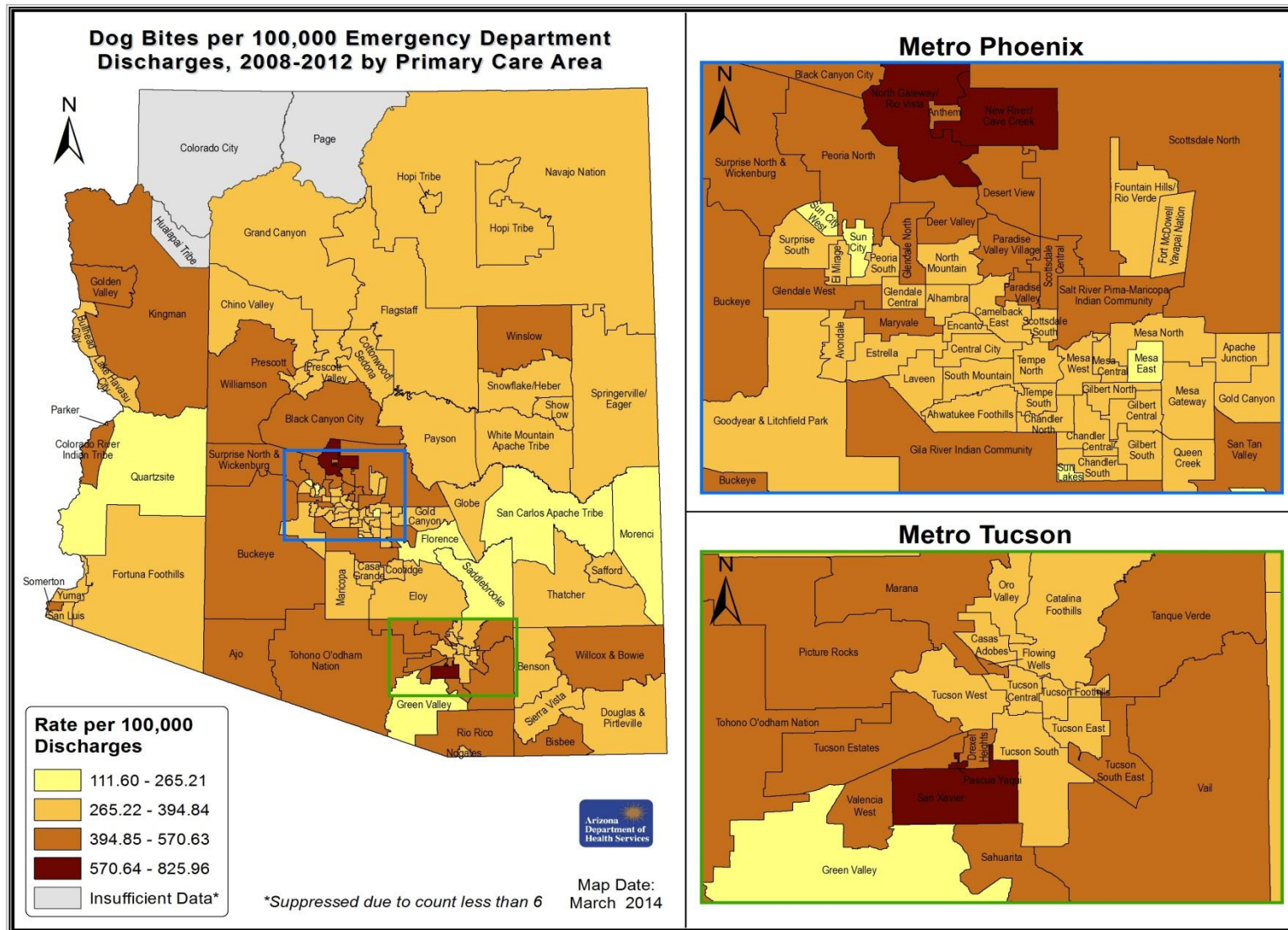
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<sup>7</sup> Pfortmueller CA, Efeoglou A, Furrer H, Exadaktylos AK. Dog Bite Injuries: Primary and Secondary Emergency Department Presentations—A Retrospective Cohort Study. *TheScientificWorldJournal*, August, 2013;1-6.

<sup>2</sup> Gilchrist J, Sacks JJ, White D, Kresnow MJ. Dog bites: still a problem. *Inj Prev*, 2008;14:296-301.



## Appendix A



## Appendix B

