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Dog Bite Prevention: A New Screening Tool

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Abstract

Objectives—To determine what children know about preventing dog bites and parental desires for dog bite prevention education.

Study design—This cross-sectional study sampled 5-15 year olds and their parents/guardians presenting to a pediatric emergency department with non-urgent complaints or dog bites. Pairs completed surveys and knowledge-based simulated scenario tests developed from American Academy of Pediatrics (AAP) and Center for Disease Control and Prevention (CDC) dog bite prevention recommendations. Regression analyses modeled knowledge test scores and probability of passing; a passing score was ≥11/14 questions.

Results—Of 300 parent/child pairs, 43% of children failed the knowledge test. Older children had higher odds of passing the knowledge test than younger children, as did children with white parents versus non-white parents. No associations were found between knowledge scores and other sociodemographic or experiential factors. Over 70% of children had never received dog bite prevention education, although 88% of parents desired it.

Conclusion—Dog bites are preventable injures disproportionately affecting children. Dog bite prevention knowledge in our sample was poor, particularly among younger children and children with non-white parents. Formal dog bite prevention education is warranted and welcomed by a majority of parents.

Keywords

dog bite; injury prevention; education; knowledge; emergency department

Dog bites are a major public health issue and contribute to the burden of injuries seen nationwide.[1] According to the Center for Disease Control and Prevention (CDC), in the

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United States (US) alone, an estimated 4.5 million dog bites occur each year.[2] Of these annual dog bite victims, 885,000 seek medical care,[2] nearly 370,000 are seen in emergency departments (EDs),[3] and an average of 16 fatalities occur.[4] Children are highly vulnerable to dog bites and make up a large percentage of dog bite victims; and despite reported decreases in dog bite incidence seen the last decade, children are still more likely to seek medical attention for their injuries,[2] and account for approximately 70% of all bite-related fatalities.[5] In the US, younger children, aged 5-9, are disproportionately at risk, with the highest incidence among all children[2,6] and a large portion of their injuries to the head, face or neck.[3,6]

Consequences from dog bite injuries can be temporary or lasting, including pain, disfigurement, infection, time lost from school or employment, fear and anxiety. According to the American Society of Plastic Surgeons statistical data, there were over 30,000 reconstructive procedures for dog bite injuries in 2009.[7] Infections due to bacterial pathogens have long been described in dog bite wounds and are estimated to occur in approximately 16% of cases.[8] A United Nation's Children's Fund and the Alliance for Safe Children study reported animal bites to children as the number two cause for seeking medical care or time lost from school and work.[9] Evidence of post-traumatic stress disorder a month after injury has been seen in over half of children who have been bitten by a dog.[10]

These injuries place a significant financial strain on the US medical system. The annual cost for dog bites is estimated at $120 million for emergency services alone, of which children and adolescents account for over 50% and governmental sources pay more than a quarter of the sums.[11] Combining direct and indirect medical expenditures, dog bites cost nearly $250 million each year.[12]

Despite these statistics, and the inclusion of reduced dog bite incidence as a goal of the CDC's "Healthy People 2010",[13] dog bite prevention research has been largely ignored. Most literature on dog bites to date is limited to descriptive data of injury incidence, patterns, and treatments. Additionally, althoughmany studies suggest that safety education is an important factor in the prevention of other types of childhood injury,[14-18] dog bite prevention education is often not addressed by health care providers or researchers.

To begin the process of developing evidence-based dog bite prevention interventions, we conducted a cross-sectional study to explore gaps in child dog bite prevention knowledge and identify sociodemographic and experiential factors that could assist with targeting prevention education towards those most at-risk. We hypothesized that the majority of children and parents presenting to our ED have little knowledge about dog bite prevention, and that lack of knowledge is consistent across age, sex, socioeconomic status, race/ethnicity, prior dog bite history, dog ownership, safe-dog practices and parent-child communication frequency.

METHODS

This was a cross-sectional survey study conducted in the ED of an urban, inner city, Level 1 pediatric trauma center with over 90,000 pediatric visits. The ED treats over 300 patients with dog bites each year. This study was approved by the hospital institutional review board.

The survey instrument was designed in two parts. The first captured sociodemographic and experiential information, of which two versions were developed – one for adults (parents or legal guardians) and one for the children. The adult survey included questions about parent age, sex, race and level of education; household income; dog ownership; and the perceived need and/or desire for formal dog bite prevention education. The child survey included questions about child age, sex, and perceived feelings of safety around dogs. Both surveys

included questions about previous dog bites, prior dog bite prevention education, and frequency of parent-child communication about safe practices around dogs. The second part of the survey was developed from consistent dog bite prevention recommendations advocated by the American Academy of Pediatrics (AAP), CDC, Humane Society of United States and American Veterinary Medical Association. Fourteen questions (7 text and 7 text with accompanying picture) were posed as scenarios which depicted a dog in various situations, such as standing behind a fence, being tied up, eating or nursing puppies. The participant (child or adult) was asked how he or she would interact with the dog in each scenario by answering “Yes” or “No” to the text portion of the question (Appendix for complete knowledge test; available at www.jpeds.com).

Survey implementation occurred between April 2008 and January 2009, during which the principal investigator (PI) or a clinical research coordinator (CRC) enrolled a convenience sample of potential participants. Participants were eligible if the child was aged 5-15 years, had been triaged with any non-urgent complaint or any dog bite, and were accompanied by a parent or legal guardian; potential participants were identified using a computerized patient tracking system. Participants were excluded if they were non-English speaking, had previously been enrolled in this study, or were unable to complete the study because of severe illness, injury, or developmental delay. Informed consent was obtained for all parent/legal guardian participants; assent was obtained for all child participants who were aged 11 years or older.

Initially the parent/guardian and child independently completed their respective sociodemographic and experiential survey questions. Depending on the reading ability of the child, child surveys were either individually read and answered by the child, or read to the child by the PI or CRC with documentation of the child’s answer. Next the child and their parent/guardian separately answered the 14 knowledge-based simulated scenario questions. This portion of the survey was given in the same manner, and the questions in the same order, to each participant. Althoughparents/guardians and children were not physically separated when answering questions, parents/guardians were asked to write down their answers without communicating with their children; children answered the questions either written or verbally to the PI or CRCs without having knowledge of their parent’s/guardian’s answers. Parents/guardians were not allowed to help their children with the surveys. All survey administration occurred during the ED visit, and at the end of their involvement in the study participants received the AAP dog bite prevention pamphlet to aid in dog-bite prevention education/awareness.

Parent/guardian and child knowledge scores were calculated by summing correct answers to the 14 simulated scenario questions; this total constituted a range 0-14 (0 having no knowledge and 14 having the highest knowledge). Missing values were coded as zero (incorrect). Because a dog bite can be catastrophic, a relatively high passing threshold of ≥11/14 questions correct (78.5%) was selected.

Statistical Analysis

Data were described using means and standard deviations or frequencies and percentages as appropriate. Comparison of categorical variables between groups used chi-square or Fisher’s exact test. To explore factors associated with knowledge, generalized linear models were fit to the knowledge score, andlogistic regression was used to model the odds of passing. All analyses were conducted using SPSS 17.0 for Windows (SPSS Inc, Chicago, IL).

RESULTS

Thee-hundred pairs completed the study. The majority, 90% (271/300), of parent/guardian participants were female, with a mean age of 35.2 (standard deviation [SD] 8.2) years. Of these individuals, 51% (146/300) were white, 57% (170/300) had greater than a high school education, and 62% (186/300) had a household income above $20,000. For child participants, mean age was 8.7 (SD 3.7) years, 69% (206/300) were aged 5-9, and 51% (154/300) were female. Eleven percent of children presented to the ED for a current dog bite; the remaining children presented for other non-urgent complaints. Prior dog bites in the child was reported by 23% (68/300) of parents/guardians and previous or current dog ownership was reported by 72% of participants (218/300).

The mean child knowledge score was 10 (SD 2.5) with a passing score achieved by 57% (170/300). Child age, parental age and parental race/ethnicity were noted to predict the odds of the child passing the knowledge test in a univariable analysis (Table I). No significant relationship was found between child passing the knowledge test and other sociodemographic and experiential factors (such as child/parent sex, level of parental education, household income, dog ownership, previous dog bites in the family, reported prior dog bite prevention education, or parent-child communication about safe practices around dogs [data not shown]).

Multivariable logistic regression revealed that older children had higher odds of passing the knowledge test than younger children, as did children with white parents versus non-white parents. Multivariable linear modeling showed that with every increased year of age, children gained 0.25 in total score, and children with white parents had an overall score 0.97 points higher than children with non-white parents (Table II).

The mean parent/guardian knowledge score was 13 (SD 1.6) with the majority (92%) achieving a passing grade. Multivariable logistic and linear modeling suggested that only age was a significant predictor of score: older parents had higher odds of passing the knowledge test and with every increased year of age, parents gained 0.005 in total score (Table II).

Among parents/guardians, 27% (81/300) stated that they or their children had received prior dog bite prevention education; 88% (256/300) reported that they and their children would benefit from this type of prevention education. Few (26%, 82/300) stated they knew where to go to receive this education. The pediatrician’s office and the ED were reported as the “right place” to receive this dog bite prevention education by 87% (242/300) and 82% (242/300) of parents, respectively.

DISCUSSION

Despite high incidence, high annual cost, and a disproportionate burden among children, dog bite prevention education and research to date has been limited. Many US national organizations advocate consistent dog bite prevention recommendations, however large scale dissemination of these messages is rare, and it is unknown whether children have gleaned the necessary knowledge to maximize the effectiveness of the recommendations. The results of our study help to answer this question by determining what a sample of children know about dog bite prevention. Further, we identify factors associated with this knowledge and describe parental desires and acceptance regarding this type of prevention education.

Our results show a notable lack of awareness and knowledge regarding dog bite prevention among children, as nearly half of child participants failed a dog bite prevention knowledge

test based on well-accepted dog bite prevention recommendations. Moreover, based on parent/guardian responses, less than one third of children had ever received formal dog bite prevention education. Others have shown that children who are educated on safe-dog interactions act more safely around dogs,[19,20] and a recent Cochrane review of dog bite interventions found that although there is no direct evidence linking dog bite education to decreased dog bite rates, "educating children who are less than 10 years … could improve their knowledge, attitude and behavior towards dogs."[21] Given this potential for education to prevent unsafe behavior combined with the magnitude of the child knowledge deficits and lack of formal education found in our study, we propose that universal dog bite prevention interventions have the potential to prevent these injuries and alleviate the unnecessary burden of dog bites on the US health care system.

Additionally, our findings contribute to knowledge about dog bite risk factors. We demonstrated that younger children and those with non-white parents/guardians may be at higher risk of a dog bite as they tended to have lower dog bite prevention knowledge scores. Thus, it is not surprising that younger children are highly vulnerable to dog bites, possibly because their prevention knowledge is significantly lower than older children. The trends associated with race noted in our results, while not previously recognized in epidemiologic studies,[2,22] may still imply a potential disparity in injury risk. Research to understand the possible association between these sociodemographic factors and dog bite prevention knowledge is necessary to elaborate any causes and consequences of this disparity. Further, whether knowledge differences actually translate to differences in injury risk and outcome requires exploration, thus we echo the Cochrane review statement of needing "high quality studies that measure dog bite rates as an outcome."[21]

Interestingly, some experiential factors which one might assume would have an effect on dog bite prevention knowledge - such as current or prior dog ownership, previous dog bite in the family, prior dog bite education and parent-child communication about safe practices around dogs - did not reveal significant correlation in our analysis. Possible reasons for these findings are: (1) dog ownership does not necessarily equate to knowledge of how to prevent dog bites, evidenced by the fact that the majority of dog bites to children are by familiar dogs;[23] (2) having an experience of a dog bite does not mean that the victim or their family member has subsequently learned how to prevent dog bites; and (3) reports from children regarding their prior education and/or parent-child communication about dog bite prevention are not generalizable as it is difficult to know the specific type of education experienced, and/or if appropriate dog bite prevention messages have been communicated.

Lastly, our results suggest that dog bite prevention interventions would be well received. Even thoughnearly 90% of parents/guardians recognized the need and indicated a desire for their families to be educated about how to minimize the risk of dog bites, over 70% didn't know where to they could go to learn this information. The majority indicated that both the pediatrician's office and the ED would be good settings in which to conduct this intervention. Identifying the ED as a place for public health prevention programs is consistent with trends in disease screening,[24,25] injury prevention[25-27] and brief intervention research;[25,28] thus EDs should consider providing dog bite prevention information and education.

It is important to interpret the results of our study within the context of its limitations. First, this study was conducted in a convenience sample of patients in a single busy pediatric ED that is the region's only major pediatric trauma. Although the study sample had similar demographics to our overall ED population, it is possible that this sample does not reflect the local population or other ED populations, and/or that certain groups may seek non-urgent care in the ED more frequently. Thus generalizability might be questioned and we

would encourage validation of our findings in other settings. Second, though the test questions used in our study were based on dog bite prevention recommendations espoused by several national organizations, questions have not been validated and it is unclear if participants would respond to real situations in a similar manner as stated in response to hypothetical scenarios. Additionally, althoughdog bite recommendations are typically stated in the negative tense (e.g. “Do not pet a dog that is behind a fence”, and “Do not pet a dog that is eating”), the correct answers for all of the pictoral questions were “No”, which might lead some test-takers to reconsider their answer. Further research on dog bite prevention knowledge would benefit from validation and careful assessment of any knowledge test used. Third, because this test was the first of its kind, an arbitrary cut-off for passing the test was made and it is expected that a lower passing threshold would result in fewer children failing the test. Even though we didnotvalidate this cut-off, we replicated all of our analysis using a linear regression with the continuous test result as the dependent variable, and no differences were observed between the two modeling strategies, suggesting the choice of cut-off did not adversely affect interpretation of our results. Lastly, it is unknown whether knowledge of dog bite prevention actually decreases the number or severity of dog bites. Althoughdog bite prevention education recommendations are consistent, we are not aware of any studies that explore an association between prevention knowledge and dog bite incidence. Evidence demonstrating a benefit of prevention interventions on reducing the incidence of injury would be persuasive in translating our recommendations for dog bite prevention intervention into practice.

Despite alarming injury statistics, children aged 5-15 in our sample population often lacked the knowledge to minimize the risk of dog bites and few had received formal dog bite prevention education. In this study, younger children and children with non-white parents had a greater knowledge deficit than older children and children with white parents. We conclude that this may place younger children and those with non-white parents at greater risk of dog bites. The vast majority of parents in our study recognized the need for dog bite prevention education and indicated health care settings as appropriate venues for providing it. Our findings reinforce that dog bite prevention education should be included in injury prevention discussions with children and parents. Further research on this topic will be helpful in addressing this problem and discovering other strategies and interventions to reduce dog bite injuries and outcomes in children.

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ABBREVIATIONS

AAP	American Academy of Pediatrics
CDC	Center for Disease Control and Prevention
CI	Confidence interval
CRC	Clinical research coordinator
ED	Emergency department
OR	Odds ratio
PI	Principal investigator
SD	Standard deviation
US	United States

Table I

Univariable predictors of child passing the knowledge test.

	Odds ratio	95% confidence interval	p-value
Child age	1.14	1.06 – 1.24	0.001
Parent age	1.03	1.00 – 1.06	0.053
Parent race (white vs. non-white)	1.76	1.11 – 2.79	0.017

Table II

Multivariable predictors of the child or parent passing the knowledge test, and predicting their respective knowledge scores.

	Logistic regression model			Generalized linear model		
	Odds ratio	**95% confidence interval**	**p-value**	**Parameter estimate**	**95% confidence interval**	**p-value**
Child test predictors						
Child age	1.15	1.06 – 1.25	0.001	0.25	0.16 to 0.33	<0.001
Parent race (white vs. non-white)	1.88	1.17 – 3.02	0.009	0.97	0.43 to 1.51	<0.001
Parent test predictors						
Parent age	1.07	1.01 – 1.15	0.035	0.005	0.001 to 0.009	0.013

Table III

Correct responses to the knowledge test.

		Parent		Child	
Written scenarios	**Correct response**				
You are at a friend's house and their dog is tied in the yard; do you pet the dog?	No	268	89.3%	207	69.0%
Your cousin's dog is playing with a toy; do you run up and take the toy?	No	294	98.0%	277	92.3%
A mommy dog is nursing her puppies; do you try to pet her or the puppies?	No	296	98.7%	248	82.7%
Your uncle gets a new dog; do you ask him before petting the dog?	Yes	268	89.3%	261	87.0%
Walking home from the bus stop, a strange dog comes near you and starts barking; do you run away?	No	251	83.7%	140	46.7%
A dog you have never seen before is sniffing a tree in the neighbor's yard; do you reach out and try to grab the dog?	No	298	99.3%	282	94.0%
A dog you don't know runs up to you; do you stand very still and wait for the dog to walk away?	Yes	266	88.7%	226	75.3%
Pictorial scenarios: Should you pet this dog?					
Black dog sitting in front of a dog house	No	265	88.3%	211	70.3%
Black dog lying on a bed with toys	No	245	81.7%	230	76.7%
Golden dog lying on a bed with toys	No	191	63.7%	137	45.7%
Black dog standing behind a fence	No	294	98.0%	231	77.0%
Golden dog standing behind a fence	No	253	84.3%	182	60.7%
Golden dog eating	No	285	95.0%	224	74.7%
Black dog eating	No	296	98.7%	253	84.3%