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The human–canine environment: A risk factor for non-play bites?

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Abstract

Few dog bite risk factor studies have been conducted. This veterinary clinic-based retrospective cohort study was aimed at identifying human–canine environmental risk factors for non-play bites in Kingston, Jamaica (660) and San Francisco (SF), USA (452). Data were analysed using modified Poisson regression with confounders selected using directed acyclic graphs (DAGs) and the change-in-estimate procedure.

Dogs acquired for companionship were more likely (RR = 1.66; 95% CI 1.02–2.70) to bite than those acquired for protection. Routinely allowing a dog into the presence of visitors was also positively associated with it biting. A dog sleeping in a family member's bedroom was a risk factor for biting in Kingston (RR = 2.54; 95% CI 1.43–4.54) but not in SF, while being able to leave the yard unaccompanied was a risk factor for biting in SF (RR = 3.40; 95% CI 1.98–5.85) but not in Kingston. Overall, dogs which were less restricted in their interactions with humans were at elevated risk for biting. An observed association with dog bites in one cultural setting might not exist in another.

Keywords: Kingston; Jamaica; San Francisco; USA; Non-play; Dog; Bite; Risk factor

Introduction

Dog bites to humans are a worldwide problem (Chomel and Trotignon, 1992; Bhanganada et al., 1993; Thompson, 1997; Kumar, 1999; Chen et al., 2000; Ozanne-Smith et al., 2001; Frangakis and Petridou, 2003; Horisberger et al., 2004; Van Eeckhout and Wylock, 2005; Morgan and Palmer, 2007). In the United States there are 300–1000 bites per 100,000 persons per year (Beaver, 1997; Cornwell, 1997), and reports from Switzerland and Belgium have indicated national bite rates of 180 (Horisberger et al., 2004) and 900 (Gisle et al., 2002) per 100,000 per year, respectively. These figures are striking given that some studies suggest that far less than 50% of dog bites are reported (Beck and Jones, 1985; Chomel and Trotignon, 1992; Kahn et al., 2003; De Keuster et al., 2006).

Research has largely focused on (1) the circumstances of incidents (Beck et al., 1975; Beck and Jones, 1985; Szpakowski et al., 1989; Mathews and Lattal, 1994; Thompson, 1997; Guy et al., 2001a; Frangakis and Petridou, 2003; Horisberger et al., 2004), (2) the characteristics of both biting dogs (Beck and Jones, 1985; Szpakowski et al., 1989; Gershman et al., 1994; Mathews and Lattal, 1994; Cornwell, 1997; Thompson, 1997; Guy et al., 2001b; Horisberger et al., 2004) and persons bitten (Beck and Jones, 1985; Bhanganada et al., 1993; Mathews and Lattal, 1994; Cornwell, 1997; Thompson, 1997; Savino et al., 2002; Horisberger et al., 2004), (3) the estimation of public health costs (Bhanganada et al., 1993; Weiss et al., 1998), (4) the pathological sequelae to attacks (Fishbein and Robinson, 1993; Mendez Gallart et al., 2002; Peters et al., 2004; Van Eeckhout and Wylock, 2005), and (5) wound care for the victims (Van Eeckhout and Wylock, 2005; Morgan and Palmer, 2007).

Unfortunately, few investigators have employed a formal reference series in their studies (Gershman et al., 1994; Chen et al., 2000; Guy et al., 2001c; Drobatz and

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Smith, 2003; Reisner et al., 2005), and thus research to date has been of limited value in accurately identifying risk factors. In addition, because hospital based data formed the basis for inferences for all except a few studies, it is questionable whether these results are applicable to the general dog population. An analysis of a case series of 227 biting dogs obtained from a veterinary clientele has reported that 73%, 17.9% and 21.5% animals had bitten an adult (>18 years), a teenager (13–18 years), and children (⩽12 years), respectively, at least once (Guy et al., 2001a). This stands in contrast to hospital data which suggest that children are over represented among dog bite victims (Ozanne-Smith et al., 2001). A consequence of the limited scope of dog bite research is the paucity of epidemiological evidence supporting the belief that a dog's tendency to bite depends on an interaction of genetics (including sex), early experiences, later socialization and training, reproductive status, quality of ownership, supervision, and the potential victim's behaviour (American Veterinary Medical Association, 2001).

We conducted a retrospective cohort study in San Francisco (SF), USA, and Kingston, Jamaica (JA) to identify human–canine environmental risk factors for non-play bites to humans. Work by a few authors has suggested that both human–canine attitudes and interactions in the Caribbean differ considerably from those in the continental United States with some studies from Caribbean territories reporting that 56–70% of dogs are kept entirely outdoors (Fielding and Mather, 2001; Davis et al., 2007; Ortega-Pacheco et al., 2007). In the US, this figure is 15–20% (American Pet Products Manufacturers Association, 2005–2006). In selecting divergent cultures with respect to attitudes to human–canine relationships, we hoped to identify, if present, heterogeneity by country.

Materials and methods

Study protocol

The study was approved by the Human Subjects Review Committee at the University of California, Davis, USA.

Study participants

Study participants were clients in the waiting rooms of eight veterinary clinics participating from May 30th to August 9th 2003, in Kingston and from three veterinary clinics in SF from 20th October 2003 to 10th January 2004. Both sets of clinics were located within areas ⩽5 square miles in their respective cities. All clinics were privately owned with caseloads of >90% companion animal (dogs and cats). Clients were eligible to participate only if they had a dog present at the time of the interview, had owned the dog for ⩾24 h, lived 7 days a week in the same home as the dog, and were ⩾18 years of age.

Data collection

Respondents were approached, following clinic registration but prior to being seen. The same interviewer administered the questionnaire to over 99% of respondents and dog-related information pertained only to the dog present. Whenever more than one dog was present, their names were ranked alphabetically and the first ranked chosen for participation.

Exposure assessment

For biters and non-biters the exposure period pertained only to the time period up to the incident and interview respectively. Exposure information included respondents characteristics, canine characteristics, factors related to owner-dog habitual interactions, and factors related to the dogs' living environment (Fig. 1 and Table 1). Except for three age-time-related questions, all responses were categorical.

Identical data collection protocols were employed in both cities and 1120 (667 in Kingston and 453 in SF) interviews were conducted with 41 (11 in Kingston and 30 in SF) persons electing not to participate. One San Franciscan and seven Kingstonian questionnaires were disqualified due to participant ineligibility.

In constructing the final data set, the functional forms of "age at acquisition", "current age" and "length of ownership" were determined using fractional polynomials (Royston et al., 1999). To create the variable "Dog breed size" we used breed weights listed in dog breed standards (Hart and Hart, 1988; American Kennel Club, 1997). "I don't know" responses were considered missing data.

Outcome determination

Outcome categories were based on answers to the following questions: (1) "Not during play, in the last two years, did the dog ever hold onto or catch a part of any person's body with its teeth and cause a wound?", (2) "Not during play, in the last two years, did the dog ever hold onto or catch a part of any person's body or clothes with its teeth but not cause a wound?" and (3) "During play, in the last two years, did the dog ever hold onto or catch a part of any person's body with its teeth and cause a wound?" A dog was considered a non-play biter (hereafter a "biter") if the respondent said "yes" to either or both of questions 1 and 2 above, and a non-biter if the respondent said "no" to all three questions. We were primarily concerned with factors motivating a dog to attack and bite and assumed that the factors under consideration would motivate the attack but not determine whether injury occurred. When possible, it was noted whether the victim was a family member and/or lived in the same home as the dog though no distinction was made in later multivariable analyses. Dogs that had bitten during play were excluded from analysis.

Statistical methods

We used directed acyclic graphs (DAGs) to create a causal diagram (Fig. 1) defining a hypothesized causal web for dog bites. This master DAG provided the basis for confounder selection (Greenland et al., 1999), and a necessary set of confounders was identified for each exposure of interest (Fig. 2 and Table 2). Relationships in the causal diagrams were determined by subject matter considerations inclusive of results of previous studies. A modified Poisson regression (Zou, 2004) was used to analyze the data in SAS/STAT version 8.2. For each exposure of interest, variables included in the relevant DAG-based subset were used in analysis (Table 2). We employed the change-in-estimate procedure (Greenland, 1989) using forward selection to select confounders from each DAG-based subset with a ⩾10% change in the estimated relative risk (RR) required for retention in the model. For each exposure of interest, we excluded all observations that had missing values for any of the variables in the DAG-based subset of potential confounders (Table 2). Differences in RR between cities were investigated by including an interaction term comprised of the exposure of interest and city in the model. The term was retained in the model if statistically significant at the 5% level. Otherwise pooled RRs were calculated. Relative risks and their associated 95% confidence intervals (95% CIs) were calculated using the "estimate" syntax in Proc Genmod (Table 2) (Spiegelman and Hertzmark, 2005).