UPDATE: DOG BITE-RELATED FATALITIES IN THE UNITED STATES, 2000-2015:

PREVIOUSLY IDENTIFIED POTENTIALLY PREVENTABLE OWNERSHIP FACTORS CO-OCCUR

INTRODUCTION

A dog bite-related fatality (DBRF) is defined as a human death due to mechanical trauma of a dog bite. DBRFs have been shown to be extremely rare, and to constitute only a tiny percentage of the estimated number of dog bites annually in the United States.[1] Notwithstanding their extreme rarity, a DBRF can attract widespread media and public attention, even giving rise to a moral panic.[2] DBRFs can also lead to breed-specific legislation (BSL), a discriminatory policy regarding companion dogs that has been shown mathematically as unlikely to be effective[3] and as not producing the hoped-for public safety outcomes where it has been implemented.[4,5,6,7,8]

Early studies of DBRFs relied almost exclusively on media reporting for data. In a departure from those earlier studies, Patronek, Sacks, Delise, Cleary, & Marder (2013)[9] utilized extensive sources not previously obtained by researchers and produced the most comprehensive analysis of DBRFs to date. Based on their analysis of all DBRFs known to have occurred in the United States during the ten-year period 2000-2009, Patronek et al. (2013) identified seven potentially preventable factors.

1. Absence of an able-bodied person to intervene.
2. Incidental or no familiar relationship of victims with dogs.
3. Owner failure to neuter dogs.
4. Compromised ability of victims to interact appropriately with dogs.
5. Dogs kept isolated from regular positive human interactions versus family dogs.
6. Owners' prior mismanagement of dogs.
7. Owners' history of abuse or neglect of dogs.

The authors reported that four or more of the above factors co-occurred in 80.5% of the cases investigated. They described the factors as potentially preventable, since all seven describe actions or omissions within the near-term or long-term control of dog owners. Though the casefile included only DBRFs, which are the rarest

and most extreme dog bite-related incidents, the factors identified were consistent with those highlighted by other researchers as to the multi-factorial and potentially preventable dynamics of dog bite-related injuries generally, not just DBRFs. Patronek et al. (2013) proposed their coding as a model for enhancing the quantity and quality of information collected in investigations of dog bite-related incidents, including non-fatal incidents. More comprehensive data, they suggested, can assist both human health care professionals and animal professionals in understanding the multi-factorial nature of dog bite-related injuries, and highlighting husbandry factors that enable prevention.

METHOD

For the present report, data was collected from the same range of sources as were utilized for Patronek et al. (2013). The incidents were analyzed using the same coding form. The same method of analysis was applied to all DBRFs known to have occurred in the United States in the six-year period (2010-2015) that immediately succeeds the years (2000-2009) included in Patronek et al. (2013). The findings for the 6-year period 2010-2015 were then combined with those previously reported for 2000-2009.

A copy of the coding form can be seen in Appendix 1.

RESULTS

Findings for the sixteen-year period (2000-2015) are consistent with those reported by Patronek et al. (2013). Further, no new factors were identified as co-occurring with those previously identified. The definitions for the coding can be found in Patronek et al. (2013).

Dogs continue to be an extremely rare cause of human death. For the sixteen-year period covered in this report, in the United States there was an annual average of one DBRF for every 10.3 million living persons;[10] and one DBRF for every 2.3 million living dogs.[11] By contrast, there was an annual average of one homicide in the United States for every 17,369 living persons; and an annual average of one transportation-related fatality for every 7,007 living persons.[12]

For the sixteen-year period (2000-2015), four or more of the seven potentially preventable factors listed above co-occurred in 75.5% of the cases examined (Table 1).

In 86.9% of the incidents, no able-bodied person was available to intervene (Table 1). The majority (56.7%) of the victims were under sixteen years of age (Table 2). Regardless of age, 83.7% of the victims had either no relationship to the dog, or only an incidental relationship to the dog (Table 1). Lastly, 68.7% of the victims are known or suspected to have had a compromised ability to interact appropriately with the dog (Table 1).

Table 1: Potentially preventable factors analysis, 2000-2015

	Total = 466	
	N	%
1. Absence of an able-bodied person to intervene	405	86.9%
2. Incidental or no familiar relationship of victims with dogs	390	83.7%
3. Owner failure to neuter dogs	363	77.9%
4. Compromised ability of victims to interact appropriately with dogs	320	68.7%
5. Dogs kept isolated from regular positive human interactions versus family dogs	328	70.4%
6. Owners' prior mismanagement of dogs	183	39.3%
7. Owners' history of abuse or neglect of dogs	96	20.6%
Four or more factors	**352**	**75.5%**

70.4% of the dogs involved were maintained as resident dogs, not family dogs, as those terms are defined in Patronek et al. (2013). There was evidence of owner mismanagement of the dogs in 39.3% of the incidents, and of owner abuse or neglect in 20.6% of the cases (Table 1). In 25.5% of the incidents, criminal charges were filed against an owner, parent, or caretaker (Table 2).

Table 2: Coding Results

Years / Factors	2000-2015	2000-2015
DBRFs	29.1/year	(n=466)
	%	N
CO-OCCURRENCE OF PREVENTABLE FACTORS		
4 or more factors (See Table 1)	75.5%	(n=352)
1. AGE OF VICTIM		
Under 90 days	8.4%	(n=39)
90 days-12 months	3.6%	(n=17)
1-4 years	29.4%	(n=137)
5-9 years	13.1%	(n=61)
10-15 years	2.1%	(n=10)
16-69 years	28.1%	(n=131)
70+ years	15.2%	(n=71)
Children < 16	56.7%	(n=264)
Adults	43.3%	(n=202)
2. SEX OF VICTIM		
Male	54.3%	(n=253)
Female	45.7%	(n=213)
3. RELATIONSHIP OF VICTIM TO DOG (Factor 2)		
Owner	7.7%	(n=36)
Familiar	6.9%	(n=32)
Incidental	10.3%	(n=48)
None	73.4%	(n=342)
Unknown	1.7%	(n=8)
4. LENGTH OF TIME DOG OWNED BY PERSON ON DATE OF INCIDENT		
<90 days	9.7%	(n=45)
>90 days	79.6%	(n=371)

Unknown	10.7%	(n=50)
5. BITE OCCURRED IN PRESENCE OF OWNER OR PRIMARY CARETAKER		
Data included in *6. Able-bodied person near enough and able to intervene.*		
6. ABLE-BODIED PERSON NEAR ENOUGH AND ABLE TO INTERVENE (Factor 1)		
Yes	10.9%	(n=51)
No	86.9%	(n=405)
Unknown	2.2%	(n=10)
7. DID VICTIM'S AGE, OR LIMITED MENTAL OR PHYSICAL CAPACITY CREATE INCREASED VULNERABILITY (Factor 4)		
Yes, compromised	50.2%	(n=234)
No	30.5%	(n=142)
Possibly	18.4%	(n=86)
Unknown	0.9%	(n=4)
8. EVIDENCE OF OWNER ABUSE/NEGLECT OF DOG (Factor 7)		
Yes	20.6%	(n=96)
No	66.7%	(n=311)
Unknown	12.7%	(n=59)
9. DID OWNER PREVIOUSLY MISMANAGE THE DOG (Factor 6)		
Yes	39.3%	(n=183)
No	45.3%	(n=211)
Unknown	15.4%	(n=72)
10. CRIMINAL CHARGES FILED AGAINST OWNER/ PARENT/ CARETAKER		
Yes	25.5%	(n=119)
No	73.4%	(n=342)
Unknown	1.1%	(n=5)

11. DID OWNER MAINTAIN DOG AS RESIDENT DOG OR FAMILY DOG (Factor 5)		
Resident dog	70.4%	(n=328)
Family dog	19.7%	(n=92)
Unknown	9.9%	(n=46)
12. HOW DID OWNER HOUSE DOG		
Home	10.9%	(n=51)
Indoors / outdoors	16.7%	(n=78)
Loose in fenced yard	14.6%	(n=68)
Loose unfenced yard	3.2%	(n=15)
Roaming	11.4%	(n=53)
Pen	8.6%	(n=40)
On chain	21.2%	(n=99)
Indoor isolation	6.0%	(n=28)
Unknown	7.3%	(n=34)
13. LOCATION OF INCIDENT WITH RESPECT TO PROPERTY WHERE DOG RESIDED		
Off	23.4%	(n=109)
On	72.7%	(n=339)
Both	3.0%	(n=14)
Unknown	0.9%	(n=4)
13. IF INCIDENT OCCURRED ON PROPERTY WHERE DOG RESIDED, LENGTH OF TIME DOG ON PROPERTY (n = 339)		
<90 days	10.3%	(n=48)
>90 days	62.4%	(n=291)
Unknown	4.3%	(n=20)
N/A	23%	(n=107)
14. NUMBER OF DOGS KNOWN TO HAVE BEEN INVOLVED		
One	56.7%	(n=264)
Two	21.2%	(n=99)
Three	5.8%	(n=27)

Four or more	10.9%	(n=51)
Unknown	5.4%	(n=25)
15. GENDER OF DOG(S) INVOLVED		
Male(s)	55.2%	(n=257)
Female(s)	9.4%	(n=44)
Both	29%	(n=135)
Unknown	6.4%	(n=30)
16. REPRODUCTIVE STATUS OF DOG(S) (Factor 3)		
Intact	76.6%	(n=357)
Altered	8.2%	(n=38)
Both	1.3%	(n=6)
Unknown	13.9%	(n=65)
16. BREEDING STATUS OF ANY INTACT DOGS INVOLVED		
Total (Issues 1-6)	32.4%	(n=151)
Unknown (7)	31.1%	(n=145)
N/A (0)	36.5%	(n=170)
OTHER: BREED IDENTIFICATION		
Reliable evidence of breed	18.2%	(n=85)
At least one source applied single breed descriptor to dog(s)	87.1%	(n=406)
Dog(s) never located	2.8%	(n=13)

*Highlighted factors were used to calculate co-occurrence of potentially preventable factors

**See Appendix 1 for additional explanation of the coding

Breed was not a factor that could be reliably identified for either the ten-year period studied by Patronek et al. (2013), or the six-year period from 2010-2015. For the entire sixteen-year period, reliable genetic evidence or pedigree documentation that a dog was a purebred member of distinct, recognized breed was available in only 18.2% of the incidents (Table 2). Media sources disagreed with each other regarding the presumed breed of the dog in 30.6% of incidents. Media sources disagreed with animal control sources in 31.8% of the cases (Data not shown). In 87.1% of cases, at least one source applied a single breed descriptor to a dog, implying

that the dog was a purebred member of a recognized breed (Table 2). Given that demographic surveys report that almost half of dogs in the United States are mixed-breed dogs,[13] it is highly unlikely that 87.1% of the dogs were purebred members of recognized breeds.

DISCUSSION

Unlike physics or chemistry, no accumulation of data or comprehensive retrospective analysis of DBRFs will yield simple laws governing the complexities of human-canine interaction that apply to all times and all places. Nevertheless, the extreme rarity of DBRFs is evidence that these incidents are highly unrepresentative of human-canine interactions generally: so rare that even reliably identified factors, whether present singly or in combination, cannot be said to be strong predictors. The United States dog population is currently estimated at 70 million or more.[14,15] For every dog maintained as a resident dog that kills a human being, it is reasonable to suppose that an unknown number of dogs similarly kept do not kill, or even injure. For every dog known to have fatally injured a person unfamiliar to it, tens of millions never have and never will. Even though most of the incidents in the casefile show four or more factors co-occurring, it is probable that an unknown number of human-canine relationships may also show the same or similar co-occurrences, yet no one is injured, fatally or otherwise. And for every dog of a known or presumed breed that is implicated in a human death, millions of others assigned the same breed descriptor, irrespective of conditions of their relationship with human beings, are not.

The infrequency of DBRFs – as well as of serious dog bites[16] – can be considered within the context of the nature of the domestic dog (*Canis lupus familiaris*). Dogs, though descended from a common ancestor that they share with the modern wolf, evolved around human beings. Dogs, almost without exception, sustain themselves either from resources that humans have discarded, or from those that humans have specifically devoted to them. Dogs cannot be characterized apart from their relationship to the humans around them. Whether they are owned companions, or unowned and living in loose association with people, dogs have learned to depend on humans. Companion dogs, such as comprise virtually the entire United States population of dogs, are completely dependent on humans, who potentially control every aspect of their lives. Topàl, Miklósi, & Csányi (1997) found that in unfamiliar and problem-solving situations, dogs considered as family members, irrespective of breed or presumed breed, tended to behave socially dependent.[17] A recent review of the literature described the dog's social competence as based in the dog's neurobiology.[18] Even unowned dogs have been shown to look back to a human handler when confronted with a difficult, but solvable food-access puzzle.[19]

Given the proximity of dogs and humans, and the control that humans can exercise, it is not surprising that Patronek et al. (2013), this report, and research into non-fatal dog bite injuries have been remarkably consistent in reporting the co-occurrence of multiple factors in DBRFs and non-fatal dog bite-related injuries.

Further, such studies have discussed co-occurring, potentially preventable factors.[20,21,22] The preventative steps recommended by both human health care professionals and animal professionals to dog owners and parents share many similarities.[23,24]

The seven potentially preventable factors described in Patronek et al. (2013) can be divided into two rough clusters. One such cluster, the four factors numbered above as #3, #5, #6, and #7, describe husbandry issues that can reasonably be expected to have influenced, singly and in combination, the dog's personality over an extended period, and influenced its behavior responses. The cluster of three identified factors numbered #1, #2, and #4, though also potentially preventable and indicative of husbandry practices, describe one or more of the proximate circumstances of the incident. Some ownership practices are subject to governmental regulation in the United States and elsewhere, but comprehensive enforcement may require more resources than the government is able to allocate to animal services. It is particularly difficult to see how most of the factors identified here could be made subject to practically enforceable regulation and thus will ultimately remain dependent upon voluntary compliance of dog owners.[25]

Of the four husbandry factors, owner mismanagement (#6), and owner abuse or neglect (#7) are, or may be, unlawful. However, it is not clear the extent to which enforcement is frequent, consistent, or even possible. An owner's allowing a dog to run loose, an example of mismanagement, is often a violation of state and/or local law. But animal service agencies, if they exist, can have limited resources. If an owner neglects or abuses a dog, such usually goes on out of public view. Addressing mismanagement, neglect and abuse, therefore, should be considered not just as problems of enforcement, but, to the extent that they are remediable, as problems of education and facilitation intended to encourage voluntary compliance with standards of responsible and humane husbandry.

Husbandry practices that determine a dog's condition as a family dog or resident dog (#5) may not be subject to public ordinance, and, in any event, are likely to go on out of public view. To the extent that a community values humane dog keeping, it should employ the resources of both public and private agencies, as well as of those engaged in commercial pet-related occupations, to increase owner interaction with the dog,[26] and to educate, encourage, and facilitate humane practices.

Similarly, the cluster of three circumstantial factors (#1, #2, #4) can be considered as depending upon voluntary compliance, rather than enforcement. Any dog's interaction with infants or small children, as well as with persons who might otherwise be impaired (#4), should be mediated by a person able to interact appropriately with the dog (#1). However, these interactions go on out of public view, and are thus not subject to preemptive regulation, but rather problems of education.

Research has shown that dogs behave less confidently in the presence of strangers, or persons with whom the dogs have had only incidental contact (#2), as compared to their behavior with established owners.[27] While

this study did not report snarling, snapping, or biting behavior, owners should be encouraged to control their dogs' interactions with such persons with these findings in mind (#1).

Breed was not a factor that was reliably identified in this report, or in Patronek et al. (2013). Sources have publicized dozens of breeds of dogs as responsible for DBRFs. The breeds named most frequently have changed over the decades.[28,29] The failure of breed identification based on visual examination, even when offered by those engaged in animal-related occupations, to correspond with breed identification determined by DNA analysis, calls into question the reliability of any dog-bite data based on visual breed identification, or the justification of breed-specific public or private policy.[30,31] The small percentage of incidents where a reliable breed identification is ever available, leads to the conclusion reported by Patronek et al. (2013), and confirmed in this report, that the more widely identified ownership factors can be considered potentially preventable factors with respect to dog bite-related injuries, whereas actual or presumed breed cannot. Community stakeholders, both public and private are advised to address the potentially preventable owner-related factors, rather than undemonstrated factors such as presumed breed.

Blaming breeds can create a false sense of security,[32] as well as obscure the potentially preventable ownership factors that influence if, how, and with what degree of intensity, an individual dog responds to a given stimulus.[33] Dogs kept as pets may show only slight differences in personality dimensions between breed groups and breeds.[34] A dog's behavior is influenced by the closeness of the human-canine relationship.[35]

CONCLUSION

The findings of this report are consistent with those of Patronek et al. (2013), and do not imply recommendations regarding the care, custody and control of dogs different from, or in addition to, those outlined by animal professionals based on investigation of less severe dog bite-related injuries. Consistent, proactive, or anticipatory ownership practices that address the potentially preventable factors identified may also enrich the experience of both dog and owner. A collateral benefit of enriched human-canine relationships may be that dogs who spend their lives in companionable relationships with their owners can learn not just that they may safely rely on familiar persons, but since they share many of their owner's social contacts, are also likely to have opportunities to learn that unfamiliar persons are often benign as well.

Implementation of the recommendations of animal experts depends both on legislating and enforcing practicable standards of ownership, and on encouraging and facilitating recommended ownership practices through multiple sources, both public and private.

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