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### Epidemiology of dog bite, a potential source of rabies in Guilan, north of Iran

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#### ABSTRACT

**Objective:** To determine epidemiological aspects of dog bite in Guilan Province, north of Iran.

**Methods:** An analytical cross-sectional study was conducted on 1643 cases of dog bites who presented at rabies vaccination centers in Guilan, Iran from June 2011 to May 2012. Data including demographic characteristics of dog bite cases, characteristics of biting dog, treatment and preventive measures carried out, and dog bite incident circumstances were collected. Independent *t*-test, ANOVA, Fisher exact test and *chi*-square test were used.

**Results:** Dog bite incidences in men and women were 179.4 and 55 in 100000 populations, respectively. Incidences in urban and rural were 72.8, and 181.9 in 100000 population, respectively. The highest percentage of victims (20.1%) was in 20-29 years old age group. Majority of dogs (92%) were owned. Victims in the highest percentage (26.6%) were dog owners. Most of dog bites were occurred in houses (58.5%). Entering to the dog's guarding territory was the most common circumstances (27.6%). Injuries most commonly involved the lower extremities (51%). Rabies vaccine, rabies immunoglobulin, tetanus vaccine and tetanus immunoglobulin were administered for 100%, 23.2%, 74.8%, and 9.1%, respectively. There were significant differences between men and women in term of area and place of bite incidence and dog ownership ( $P < 0.05$ ). Mean age differences among categories of dog ownership, dog bite circumstance, and bitten site of body were significant ( $P < 0.05$ ).

**Conclusions:** Designing comprehensive educational programs to reduce dog bite incidence based on gender and age of target groups can be useful.

### 1. Introduction

Dog bite is the most common type of animal bites worldwide and it is considered as a public health problem because dog bites relate to physical and mental traumas, wound infection and the risk of rabies transmission[1,2].

The relationship between human and dog dates back to the time when human decided to keep the tamed dogs for hunting, guarding and having companion. However, the tamed dogs still

keep some wild instincts including attack human which dog bites is a permanent risk[3]. Dog bites are prevalent in all countries. About 4.5 million American people are bitten by dog each year that one in five of them need medical attention[4]. About 300 thousands cases of emergency department in USA were due to dog bites and related injuries. This rate was 103.9 visits for each 100000 people. About 9500 cases of hospitalizations were due to dog bites with a rate of 3.1 cases per 100000 people[5]. Based on latest published report in Iran, the overall incidence of animal bites was 173.2 in 100000 populations, out of which 85% had been injured by dogs[6].

Despite most dog bite injuries are minor or moderate, in many countries dog bite injuries are considered as a threat of human life because the risk of rabies transmission. According to the World Health Organization report, each year more than 55000 people die due to rabies worldwide. Dogs are the main host and transmitter of

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rabies to humans. Each year, more than 15 million people worldwide are vaccinated against rabies after dog bites. Rabies due to dog bites threatens more than three billion people in Asia and Africa and most at risk individuals live in rural and low income areas[1].

Despite rabies is endemic in Iran and is prevalent event in domestic animals number of human cases, rabies is very low about four or five cases, yearly. In Iran, all cases of dog bites should be vaccinated against rabies regardless characteristics of injury, biting dog, and circumstance of dog bite. This imposes a financial burden on health system, and for this reasons, reducing dog bites are very important for Iranian health system[6]. Designing and implementing some programs to reduce dog bites incidence are essential. There are few data on dog bite epidemiology in Iran and all of previous studies were conducted on animal bites and reported some victims' characteristics. This study aimed to determine epidemiological aspect of dog bite injuries in Guilan Province, north of Iran.

## 2. Materials and methods

### 2.1. Setting and subjects

This study was a cross-sectional study conducted on cases of dog bites who presented at rabies vaccination centers (RVCs) in Guilan Province, north of Iran from June 2011 to May 2012. According to the reports of Iran census in 2011, the population of this province was 2480874[7]. At the time of this study, Guilan Province had 16 districts and in each of them, there was one RVC. Among them, 8 RVCs were selected based on their health workers ability and willing to participate to this study. Population of 8 selected districts was 1545131, 952363 people residence in urban area and rest in rural area and 740176 people were men and the rest were women[7]. All of cases of dog bites attending selected RVCs during the study period were entered to the study. Participation in this study was optional and informed consent was taken from participants. Ethical approval was obtained from Ethical Committee of Guilan University of Medical Sciences.

### 2.2. Measures

For data collection, regarding to research objectives, a questionnaire was designed based on previous studies conducted on cases of dog bites or animal bites in Iran and other countries as well as interviewed with dog bite victims and some public health and veterinary specialists. The questionnaire was used in a pilot study conducted on 30 cases of dog bites and then problems were resolved by expert team. The questionnaire included four parts. The first part contained the demographic characteristics of victims. The second part included some questions about the biting dogs. The third one consisted of treatment and preventive measures carried out at the RVCs and the last part involved information about circumstances of dog bite incident. Questionnaires were filled out by trained RVC health workers in a direct interview with victims or a person who accompany them.

### 2.3. Statistical analysis

Data were analyzed using IBM SPSS 21. Continuous data were shown as mean  $\pm$  SD and categorical data were shown as number

(percentage). Descriptive statistics, independent *t*-test, ANOVA, least significant difference *post-hoc* test, Fisher exact test, and *chi*-square test were used. A *P* value less than 0.05 was considered significant.

## 3. Results

### 3.1. Dog bite incidence

During study period, 1771 cases of dog bite who presented at 8 selected RVCs including 1328 (75%) men, 443 (25%) women, 693 (39.1%) cases lived in urban and 1078 (60.9%) in rural area. Dog bite incidence was 114.6 in 100000 populations in a year. Incidences in men and women were 179.4 and 55 in 100000 population, respectively. Also dog bite incidences in urban and rural residences were 72.8 and 181.9 in 100000 population, respectively.

### 3.2. Demographic characteristics of dog bite cases

Among 1771 cases who presented at 8 selected RVCs, 1643 cases (92.8%) accepted to be interviewed. Median and mean of age were 33 and  $35.15 \pm 17.98$ , respectively (range 2-88). The highest percentage (20.1%) of subjects belonged to the 20-29 years old age group. Most commonly, in men 21.8% were in 20-29 age group, and in women with equal percentage (18.3%) were in 40-49 and 50-59 age groups. In men, frequency of workers was more than other job categories (25.9%) and most of women were housewives (69.9%). The highest percentages of subjects (46.9%) was primary or secondary school education (Table 1).

**Table 1**

Demographic characteristics of the dog bitten victims, Guilan, Iran [*n* (%)].

Variables		Male	Female	Both gender
Age	0-9	88 (7.1)	39 (9.5)	127 (7.7)
	10-19	179 (14.5)	49 (12.0)	228 (13.9)
	20-29	269 (21.8)	61 (14.9)	330 (20.1)
	30-39	237 (19.2)	58 (14.2)	295 (18.0)
	40-49	191 (15.5)	75 (18.3)	266 (16.2)
	50-59	153 (12.4)	75 (18.3)	228 (13.9)
	60	117 (9.5)	52 (12.7)	169 (10.3)
Job	Housewife	0	286 (69.9)	286 (17.4)
	Employee	88 (7.1)	9 (2.2)	97 (5.9)
	Worker	319 (25.9)	7 (1.7)	326 (19.8)
	Farmer	248 (20.1)	1 (0.2)	249 (15.2)
	Self-employed	168 (13.6)	10 (2.4)	178 (10.8)
	School or university student	210 (17)	74 (18.1)	284 (17.3)
	Unemployed	35 (2.8)	7 (1.7)	42 (2.6)
	Driver	50 (4.1)	0	50 (3.0)
	Others	116 (9.4)	15 (3.7)	131 (8.0)
Educational level	Under school age	45 (3.6)	15 (3.7)	60 (3.7)
	Illiterate	124 (10)	110 (26.9)	234 (14.2)
	Primary or secondary school	597 (48.4)	173 (42.3)	770 (46.9)
	High school	327 (26.5)	86 (21.0)	413 (25.1)
Residential area	University	141 (11.4)	25 (6.1)	166 (10.1)
	Urban	493 (40)	152 (37.2)	645 (39.3)
	Rural	741 (60)	257 (62.8)	998 (60.7)

History of dog bite was mentioned by 151 victims (9.2%) and 107 of them (70.9%) received rabies vaccine in previous bite. Only 810 cases (49.3%) were aware that they should receive the rabies vaccine after dog bite. A total of 477 cases (29%) referred to RVCs after attending rural or urban health centers for receiving tetanus vaccine or wound treatments, 171 cases (10.4%) and 71 cases (4.7%) referred to RVCs after attending private clinics and hospitals for receiving wound treatment, respectively, 102 cases (6.2%) attended RVCs because their family or friends recommended to them, 6 cases

(0.4%) attended RVCs after receiving advice from pharmacies, schools, or veterinarian clinics staffs.

### 3.3. Biting dog characteristics

Owned dogs comprised 92% of all biting dogs. Majority of biting dogs (73.9%) were male. Victims in the highest percentage (26.6%) were owner of dog. Of all the victims that were bitten by their own dogs, only 22.6% knew their dog's breed and only 35.8% claimed that their dogs had received rabies vaccine at least once dose. Most of owner (67.2%) mentioned that they keep dogs for guarding their house (Table 2).

### 3.4. Dog bite incidence characteristics

Most dog bites were occurred in rural area (75.0%) and in house (58.5%). The pick time of bite occurrence was 12 p.m to 18 p.m. Entering to the dog's guarding territory was the most common circumstances (27.6%). Most of the victims (94.6%) had one bitten site of the body. Injuries most common involved the lower extremities (51.0%) (Table 2). Majority of the injuries (78.3%) were superficial. Mean of number of wound in each case was  $1.74 \pm 1.16$ .

### 3.5. Treatment and preventive measures carried out at the RVCs

Eighty five cases (5.2%) attended RVCs within 48 h or more delay. For all of cases, anti rabies vaccine was administrated on their first visit to the RVCs (Day 0). Rabies immunoglobulin, tetanus vaccine,

and tetanus immunoglobulin were administrated for 23.2%, 74.8%, and 9.1% of cases, respectively. Thirty one cases (1.8%) were hospitalized due to dog bite injuries. There were no cases of rabies and dog bites related fatalities.

### 3.6. Gender and age differences in circumstance and incidence characteristics of dog bite

There were significant differences between men and women in terms of area and place of dog bite incidence ( $P = 0.029$ ,  $P = 0.0001$ , respectively). Dog owners in the highest percentage in men were victims but in women were neighbors that this difference was significant ( $P = 0.0001$ ). There were no significant differences between the two genders in terms of bitten site of the body and circumstances of dog bite incidence ( $P > 0.05$ ).

Subjects who had superficial injuries were significantly younger than subjects who had deep injuries ( $P = 0.0001$ ). Mean age differences in different categories of area and place of dog bite incidence were no significant ( $P > 0.05$ ). Subjects who were bitten by their own dogs were significantly older than individuals who were bitten by stray dogs ( $P = 0.008$ ), which belonged to their family ( $P = 0.0001$ ), relative or friend ( $P = 0.0001$ ) and neighbor ( $P = 0.003$ ). Also cases that were bitten by their family dog were significantly younger than cases who were bitten by stray dogs ( $P = 0.0001$ ), their relative or friend's dogs ( $P = 0.001$ ), neighbor's dogs ( $P = 0.0001$ ), work place's dogs ( $P = 0.0001$ ), and other dogs ( $P = 0.0001$ ). Subjects who were bitten by their relative or friend dogs were significantly younger than cases who were bitten by their neighbor's dogs ( $P = 0.008$ ), or work place's dogs ( $P = 0.027$ ), and other dogs ( $P = 0.034$ ). Among other dog categories, mean age of cases were

**Table 3**  
gender and age differences in circumstance and incidence characters of dog bite.

Variables		Gender		P value	Age (mean $\pm$ SD)	P value
		Men	Women			
Area	Urban	291 (23.6)	119 (29.1)	0.029	34.06 $\pm$ 18.34	0.163
	Rural	943 (76.5)	290 (70.9)			
Place	House yard/ Inside of house	649 (52.6)	312 (76.3)	0.0001	35.80 $\pm$ 18.74	0.058
	Street, alley	283 (22.9)	70 (17.1)			
	Work place	222 (18.0)	11 (2.7)			
	Other	80 (6.5)	16 (3.9)			
Ownership of dog	Stray	99 (8.0)	32 (7.8)	0.0001	35.11 $\pm$ 17.87	0.0001
	Victim	309 (25.0)	93 (22.7)			
	Family	115 (9.3)	89 (21.8)			
	Friend, relative	260 (21.1)	54 (13.2)			
	Neighbor	246 (19.9)	118 (28.9)			
	Work place	127 (10.3)	7 (1.7)			
	Other	78 (6.3)	16 (3.9)			
Circumstance	Feeding	106 (8.6)	37 (9.0)	0.064	35.55 $\pm$ 19.94	0.0001
	Playing or petting	140 (11.3)	51 (12.5)			
	Fastening or opening the dog's leash	113 (9.2)	28 (6.8)			
	Teasing	110 (8.9)	25 (6.1)			
	Without any interactions with dog	190 (15.4)	64 (15.6)			
	Entering to the dog's guarding territory	319 (25.9)	134 (32.8)			
	Passing form side of dog's guarding territory	165 (13.4)	41 (10)			
	Others	91 (7.4)	29 (7.1)			
Bitten site of body	Lower extremity	698 (52.5)	201 (46.5)	0.196	37.02 $\pm$ 18.29	0.012
	Upper extremity	529 (39.8)	194 (44.9)			
	Abdominal and trunk	85 (6.4)	31 (7.2)			
	Head, face, and neck	17 (1.3)	6 (1.4)			

not significantly different.

Mean age of cases that were bitten during playing with dog, petting or teasing the dog were significantly lower than cases in all of the other categories ( $P < 0.05$ ). Also mean age of individuals that were bitten when they were fastening or opening the dog's leash was significantly higher than others ( $P < 0.05$ ). Among other circumstance categories, mean age of cases were not significantly different. Cases who had injuries in their upper extremity were significantly older than cases who had injuries in their lower extremity ( $P = 0.011$ ) or head, face, and neck ( $P = 0.007$ ) (Table 3).

**Table 2**

Biting dog and dog bite incidence characteristics.

Variables		n (%)
Owning	Owned	1 512 (92.0)
	Stray	131 (8.0)
Gender	Male	1 214 (73.9)
	Female	223 (13.6)
	Neutered	2 (0.1)
	Unidentified	204 (12.4)
Dog ownership	Victim	402 (26.6)
	Family	203 (13.4)
	Friend, relative	314 (20.8)
	Neighbor	364 (24.1)
	Work place	134 (8.9)
	Other	94 (6.2)
Main reason for owning dog (among victim who were dog owner)	As pet	58 (14.4)
	House guarding	270 (67.2)
	Work place guarding	59 (14.7)
	Hunting or herding	15 (3.7)
Area of dog bite incidence	Urban	410 (25.0)
	Rural	1 233 (75.0)
Place of dog bite incidence	House	961 (58.5)
	Street, alley	353 (21.5)
	Work place	233 (14.2)
	Other	96 (5.8)
Time	0-6	58 (3.5)
	6-12	497 (30.2)
	12-18	635 (38.6)
	18-24	453 (27.6)
Circumstance	Feeding	143 (8.7)
	Playing or petting	191 (11.6)
	Fastening or opening the dog's leash	141 (8.6)
	Teasing	135 (8.2)
	Without any interactions with dog	254 (15.5)
	Entering to the dog's guarding territory	453 (27.0)
	Passing form side of dog's guarding territory	206 (12.5)
	Others	120 (7.3)
Bitted site of body	Lower extremity	899 (51.0)
	Upper extremity	723 (41.0)
	Abdominal and trunk	116 (6.6)
	Head, face and neck	23 (1.3)
	Genital	2 (0.1)

#### 4. Discussion

Based on our findings, dog bites are more frequent in men, rural area, and people in 20-29 years age group. Male especially in 20-29 years age group present more outdoor for many reasons such as work. Therefore they encounter with stray or owned dogs in various situations. In Iran, in rural area dog population is more than urban area. In previous studies conducted on animal bite cases in Iran more than 70% were men and resident in rural area[8-13]. Also in studies conducted on dog bite cases in other countries majority of cases were male[2,14-22]. Similarly with Saghafipour *et al.*[8] and Eslamifar

*et al.*[9] studies, the highest percentage of animal bites occurred in age range of 20-29 years old. Dadypour *et al.*[10] and Rezaeinasab *et al.*[12] studies reported that the highest percentage of animal bite cases was in 10-19 years old age group followed by 20-29 years old age group. Mean age in Amiri study was 29.5 years[11]. In Alavi study, the highest percentage of animal bite cases were in 16-25 years old age group[13]. In Ostanello study, the highest incidence of dog bites was reported in the age range of 20-29 years[2]. In Gautret study, the mean age was 32 years (median 29 years) and the highest percentage of cases were in 15-29 age group[14]. In Cassell study, 0-14 age group had the highest percentage[16]. In Tenzin study, median age of all dog bite cases was 17.5 years[17]. In Pfortmueller study, median age was 36 years[21]. In Kent study, most common age group was 6-10 years[20].

Based on our findings, majority of biting dogs were owned, male, and house guard. The highest percent of cases were bitten by their own dogs, in the rural area, in house, at 12-18 p.m, while entering the dog's guarding territory. Frequency of women bitten in urban and house yard or inside house was significantly higher than men. Dog owners in the highest percentage in men were victims but in women were neighbors that this difference was significant. Owned dog are responsible for majority of dog bites worldwide[23]. In Dadypour's study, among cases of dog bites, 96.5% were bitten by owned dogs[10]. In a study conducted in Italy, 74% of dog bitten were the family members of dog owner[2]. In Iran, dog population size in rural is larger than urban and most of them are guarding dogs, unleashed and male[24].

Women in rural area of Iran have more connection with their neighbors than men and they go to their neighbors' houses frequently, also many men are bitten in public places and work places. It is common that dogs show territorial aggression when unfamiliar people are entering the house they reside in[25].

Based on our findings, most of dog bite cases had been injured in lower extremities. In other studies in Iran conducted on animal bite cases, lower extremities were most injured body site[9-13]. Also in some studies in other countries, lower extremities were most often injured[2,14,15,17,22,26]. In this study, many people were bitten when they were entering to dogs guarding territory and it is expected that most of them be bitten in their lower extremities.

Subjects who were bitten by their won dog were significantly older than individuals who were bitten by stray dog which belonged to their family, relative or friend and neighbor. Also cases that were bitten by their family dog were significantly younger than cases that were bitten by stray dog, their relative or friend's dog, neighbor's dog, work place's dog, and other dogs. Subjects who were bitten by their relative or friend dog were significantly younger than cases that were bitten by their neighbor's dog, or work place's dogs, and other dogs. This is reasonable because children are not dog owner, also they are rarely present at work places and many of them are bitten by their families' dogs.

Subjects who had superficial injuries and who were bitten during playing with dog, petting or teasing the dog were significantly younger than subjects who had deep injuries and cases in all of the other circumstance categories. Also individuals that were bitten when they were fastening or opening the dog's leash were significantly



older than others. Cases that had injuries in their upper extremity were significantly older than cases that had injuries in their lower extremity or head, face, and neck.

Playing with, petting, and teasing dogs are common in children and usually lead to minor injuries[16]. Fastening or opening the dog's leash usually is done by dog owner and children don't do it.

In conclusion, the findings of this study have identified target groups for intervention for reducing dog bite incidence. Designing comprehensive educational program for reducing based on gender and age of target groups is necessary. Providing prevention strategies should be included educational programs on dog behavior, laws for regulating aggressive dogs, enhanced dog control programs, and educational programs regarding responsible dog ownership. Moreover, authorities' emphasis on the dog socialization before entering them into house or workplace may be an effective step to prevent dog bites.

### Conflict of interest statement

We declare that we have no conflict of interest.

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