

The epidemiology of dog bite injuries in Greece: preliminary results of a surveillance scheme

Dougas G, Katerelos P, Chatzianastasiou S, Mellou K

National Public Health Organization, Athens, Greece

Abstract

Background: Dog bite injuries commonly fall under the radar of the public health surveillance systems. Nevertheless, these incidents may result in emotional distress, disfigurement, functional deficit, or exposure to zoonotic agents and therefore may have a considerable impact on public health.

Methods: A pilot surveillance scheme was launched in Greece to assess the epidemiology of dog bite injuries. Physicians in hospital-based emergency room departments and primary health care centers were required to report bite cases via a reporting form. The collected data were analyzed cross-sectionally.

Results: From January to June 2023, 1,656 dog bite victims attended the healthcare settings in Greece. The rate was estimated at 15.8 cases per 100,000 population. The frequency of healthcare visits varied significantly among the regions ($p < 0.0001$), ranging from 0.9 to 45.2 per 100,000 inhabitants. The median number (interquartile range in brackets) of visits concerning dog bite victims for the examined period per reporting hospital was nine (2, 21) and per reporting health center three (1, 10), respectively. The ownerless-to-owned dogs ratio was almost equal (1.04). According to the Abbreviated Injury Scale, 67.3 % of the injuries were classified as minor, 27.7 % as moderate, 4.9 % as serious, and 0.1 % as critical. The lower limb was the most frequently affected anatomical site (50.6 %). Head/neck injuries were associated with younger patients ($p < 0.0001$). Macroscopic tissue loss occurred in 11.9 % of the cases, with the majority presenting areas of damaged or missing skin (50.9 %); partially or completely amputated hand digits occurred in nine of these cases (8.5 %). Among dog bite victims, 2.8 % were hospitalized (inpatients), and 1 % were referred to other hospitals.

Conclusions: Dog bite surveillance offers important epidemiological information on the respective traumatic impact. HIPPOKRATIA 2023, 27 (2):82-88.

Keywords: Public health, bites, dog, wound, injury

Corresponding author: Georgios Dougas, National Public Health Organization, 3-5 Agrafon str., 15123 Athens, Greece, email: g.dougas@eody.gov.gr

Introduction

Dog (*Canis familiaris*) is the most prevalent carnivore species worldwide, with an estimated population of 700 million and rising and a human-to-owned dog ratio ranging from 6 to 10^{1,2}. This animal species is closely bonded with humans as it historically represents a working or companion animal. Contact with dogs rewards people with companionship, joy, comfort, and unconditional love. The benefits of keeping a dog as a companion animal are mainly psychological and may extend to physical health³. At least 70 % of dogs are not closely supervised by humans and are considered ownerless⁴; nevertheless, they usually live in inhabited areas due to easier access to food and shelter¹. The dogs' rights and welfare are unanimously recognized by the majority of nations and supported by laws and international treaties⁵. The harmonious coexistence of humans with every form of life on the planet is among the prerequisites for environmental sustainability and ecological balance. However, the proximity of humans and dogs in the same habitats sets the conditions for the infliction of accidental bite

injuries. Dogs are the species most frequently involved in animal bite incidents affecting humans⁶⁻⁸. The dog bites may result in functional impairment or disfigurement⁹ and are accompanied by the experience of physical pain and emotional distress¹⁰. Furthermore, exposure to dogs is associated with the transmission of zoonotic agents or the inoculation of commensal bacteria originating from the normal flora of the animal's oral cavity or from the victim's own skin^{10,11}. According to WHO, dogs are almost exclusively responsible for the transmission of rabies in humans, with an annual estimate of more than 50,000 cases worldwide¹². Nevertheless, dog bite incidents are not adequately monitored by conventional public health surveillance schemes^{11,13}. Epidemiological data concerning the injuries inflicted by dogs were not systematically collected in Greece preventing a concise overview of this important public health issue. In order to manage this impediment and assess the impact of dog-related trauma, a dedicated monitoring system was determined. This study presents the preliminary results of the surveillance scheme recording the visits of dog bite

victims in healthcare settings with the primary objective of providing insight into the epidemiology of dog bite incidents in Greece.

Material and Methods

The National Public Health Organization (NPHO) launched a surveillance scheme monitoring animal bite cases in Greece in January 2023. Physicians of public hospital emergency departments and primary health care centers were required to fill out a reporting form for any animal bite victim. Guidance was provided for the reporting form to be forwarded to NPHO within three days of the victim's attendance.

This study was approved by the Bioethical Committee of the Greek National Public Health Organization (NPHO Ref. no 15478/2023) and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Case selection criteria

The study included those individuals who sought medical care due to dog bites during the first semester of 2023. The attendance of a dog bite victim in a healthcare setting was designated as a case.

Recorded data

The recorded data included the gender, age, and residency of the victim, the date and location of the incident, the ownership status of the dog that inflicted the bite, and information about the injury and the hospitalization of the patient. The affected anatomical site of the victim was classified as upper limb, lower limb, torso, head/neck, or multiple sites. The magnitude of inflicted trauma was ranked by the treating physicians according to the Abbreviated Injury Scale (AIS) as minor (1), moderate (2), serious (3), severe (4), critical (5), and un-survivable (6)¹⁴. A macroscopically perceptible damaged or missing tissue at the site of the bite was recorded as tissue loss; after reviewing the collected data, the deficits were classified as i) skin, ii) skin and underlying tissue, and iii) partial or complete loss of one or more hand digits.

Statistical analysis

The case frequency was calculated on a semester basis (January to June 2023). According to the Nomenclature of Territorial Units for Statistics (NUTS), we utilized NUTS-2 level units (regions) for the spatial analysis. The population referred to the permanent residents, and the data were extracted from the publicly available records of the 2021 national census¹⁵. The cases were stratified in age groups by increments of 10 years, similar to the ranking used in the Greek census for estimating incidence rates by age group based on the reference population. An EpiData database (The EpiData Association, Odense Denmark) was used for the data entry, and the analysis was performed with the IBM SPSS Statistics for Windows, Version 20.0. (IBM Corp., Armonk, NY, USA). Data cleaning was performed by applying logical checks. The results included a description of

the demographic characteristics of the victims, and of the anatomical site and the severity of the respective injuries, and the case frequency by gender, age group, region, and month. Descriptive statistics are presented as number and percentage in brackets for categorical variables, or median and interquartile range (IQR) in brackets for quantitative variables. The rate results were presented using 95 % confidence intervals (95 % CI) (based on the standard normal distribution after normality checks were performed). The chi-squared test was used to test the hypotheses of rate equalities. Differences in variance across means of different population groups were tested with one-way analysis of variance (ANOVA). Continuous and count data were tested with normality checks (Shapiro-Wilk) and were presented accordingly. The alpha level was set to 5 %.

Results

Descriptive epidemiology

From January to June 2023, 1,656 dog-bite incidents were reported in Greece. One thousand ninety-four cases were notified by the primary health section (health centers) and 809 from hospitals. Cases were reported by 138 health centers and 56 hospitals, representing the 42.9 % and 76.7% of the total hospitals and health centers of the country, respectively. The median number of visits of dog bite victims per reporting hospital for the examined period was 9 (2, 21) whereas per reporting health center was 3 (1, 10). Six hundred eighty-three incidents (41.3 %) were caused by ownerless dogs, whereas 658 (39.7 %) by owned dogs (rate ownerless-to-owned: 1.04; unknown ownership: 315 incidents, 19.0 %). The victims had a median age of 45 (IQR: 25, 61) years and a male-to-female ratio 1: 4. Dog-bite incidents occurred more frequently in April (20.3 %), in the region of Central Macedonia (23.2 %), and in individuals of the age group of 50-59 years (17.5 %) (Table 1). The majority of the victims were permanent residents (1441; 87.0 %), with the rest being tourists (50; 3.0 %), migrant workers (24; 1.4 %), various immigrants (9; 0.5 %), whereas for 132 cases (8.0 %) this information was not available. Among incidents involving ownerless dogs, in 221 (32.4 %) cases the attack was caused by more than one dog, in 235 (43.4 %) cases a single dog was reported, and the information was missing in 227 (33.2 %) cases.

The mostly affected anatomical site was the lower limb (50.6 %) and the majority of the injuries (67.3 %) were of minor (1) severity according to the AIS score. Macroscopic loss of tissue due to the bite was reported in 197 cases (11.9 %), however for 411 (24.8 %) this information was missing; the described tissue deficit concerned most frequently the upper extremity, specifically metacarpus (24; 24.2 %), arm/forearm (13; 13.1 %), and hand digits (9; 9.1 %). In the majority of cases, the lost tissue comprised only skin (54; 50.9 %); however, in nine cases (0.5 %) the victims presented with partially or completely amputated hand digits. Among victims, 2.8 % stayed as inpatients and 1 % were referred to other hospitals. The characteristics of the respective injuries are presented in Table 2.

Table 1: Demographic characteristics of dog-bite injury victims in Greece during the period January-June 2023.

		Dog bite cases	Population	Rate per 100,000	95 % CI lower and upper limit		χ^2 test	p value
Gender	Female	618	5,356,510	11.5	10.7	12.5	61.420	<0.00001
	Male	889	5,125,977	17.3	16.2	18.5		
	Total	1,246	10,482,487					
Age group (years)	0-9	54	878,491	6.1	4.6	8.0	63.829	<0.001
	10 – 19	160	1,068,216	15.0	12.8	17.5		
	20 – 29	164	1,053,304	15.6	13.3	18.2		
	30 – 39	144	1,256,393	11.5	9.7	13.5		
	40 – 49	168	1,596,028	10.5	9.0	12.2		
	50 – 59	218	1,543,340	14.1	12.3	16.1		
	60 – 69	168	1,324,635	12.7	10.8	14.8		
	70 – 79	105	996,037	10.5	8.6	12.8		
	80 and over	65	766,043	8.5	6.5	10.8		
	Total	1,246	10,482,487					
Region	Attica	344	3,814,064	9.0	8.1	10.0	700.831	<0.001
	Central Greece	87	508,254	17.1	13.7	21.1		
	Central Macedonia	384	1,795,669	21.4	19.3	23.6		
	Crete	33	624,408	5.3	3.6	7.4		
	East Macedonia & Thrace	254	562,201	45.2	39.8	51.1		
	Epirus	123	319,991	38.4	32.0	45.9		
	Ionian Islands	17	204,532	8.3	4.8	13.3		
	North Aegean	8	194,943	4.1	1.7	8.1		
	Peloponnese	83	539,535	15.4	12.3	19.1		
	South Aegean	3	327,820	0.9	0.2	2.7		
	Thessaly	116	688,255	16.9	13.9	20.2		
	West Greece	154	648,220	23.8	20.2	27.8		
	West Macedonia	50	254,595	19.6	14.6	25.9		
	Total	1,656	10,482,487					
Month	January	235	10,482,487	2.2	1.9	2.5	31.443	<0.0001
	February	232	10,482,488	2.2	1.9	2.5		
	March	311	10,482,489	3.0	2.6	3.3		
	April	336	10,482,490	3.2	2.8	3.6		
	May	287	10,482,491	2.7	2.4	3.1		
	June	260	10,482,492	2.5	2.2	2.8		
	Total	1,661	10,482,493					

CI: confidence interval.

Table 2: Clinical data of dog-bite injury victims in Greece during the period January-June 2023.

		n	%
Anatomical site of the injury	Head/neck	67	4.6
	Lower limb	744	50.6
	Multiple sites	54	3.7
	Torso	69	4.7
	Upper limb	537	36.5
	Total	1,471	100
Abbreviated Injury Scale score	Minor	1,075	67.3
	Moderate	442	27.7
	Serious	79	4.9
	Critical	1	0.1
	Total	1,597	100
Bleeding	No	370	24.3
	Yes	1,152	75.7
	Total	1,522	100
Multiple bites	No	842	63.2
	Yes	491	36.8
	Total	1,333	100
Macroscopic loss of tissue	No	1,048	84.2
	Yes	197	15.8
	Total	1,245	100
Anatomic site with macroscopic loss of tissue	Arm /forearm	13	12.1
	Auricle	1	0.9
	Digits	9	8.4
	Facial, cheeks, lips	5	4.7
	Gluteal region	2	1.9
	Lower limb	46	43.0
	Metacarpus	26	24.3
	Multiple sites	3	2.8
	Neurocranium	1	0.9
	Torso	1	0.9
	Total	107	100
Description of tissue deficit	Skin	54	50.9
	Skin/underlying tissue	43	40.6
	Hand digit (partial or complete loss)	9	8.5
	Total	106	100
Hospitalization	No	1,098	94.7
	Referred to other hospital	16	1.4
	Yes	46	4.0
	Total	860	100

n: number.

Rates estimation - inferential analysis

The total rate of bites per 100,000 population from January to June 2023 was 15.8 (95 % CI: 15.1, 16.6). A chi-square test of independence determined that regions differed in the frequency of incidents, with the highest recorded in East Macedonia and Thrace (32.4) and Epirus (26.3), and the lowest in the islands and Attica, $\chi^2(12) = 700.831$, $p < 0.001$ (Figure 1, Table 1). The dog-bite victims were more likely to be male individuals (male to female odds ratio 1.5) concerning the gender distribution of the Greek population, $\chi^2(1) = 61.420$, $p < 0.00001$. Based on the Greek population's known age distribution, the presentations' frequency varied significantly among age groups, with the highest rates in the 20-29 and 10-19 years-old groups, $\chi^2(8) = 63.829$, $p < 0.001$. The bite rate presented a monthly variation, with most of the incidents occurring in April $\chi^2(5) = 31.443$, $p < 0.0001$. The rate results regarding gender, region, age groups, and month, with 95 % CI, are presented in Table 1. The anatomical site of the injury was associated with the age of the victims, $F(4) = 12.904$, $p < 0.0001$. Head or neck bites tended to occur in younger individuals (avg: 24.8 years) compared with injuries located at the torso (avg: 38.4 years), multiples sites (avg: 42.1 years), lower limbs (avg: 44.6 years), and upper limbs (avg: 47.5 years). Younger individuals tended to present with less severe wounds; an AIS score of 1 (minor) had patients with an average age of 42 years, whereas scores of 2 (moderate) and 3 (serious) had victims with an average age of 48 and 48.6 years, respectively, $F(2) = 10.567$, $p < 0.0001$. The anatomical site of the bites differed between ownerless and owned dogs; the ownerless tended to bite more often on the lower limbs, whereas the owned dogs bit the head/neck and upper extremities, $\chi^2(4) = 138.377$, $p < 0.0001$. The ownerless dogs bit more often younger individuals, especially the 10-19 years-old group (63.0 % of cases due to ownerless dogs),

whereas the owned dogs tended to inflict injuries to older people, with the 70-79 years-old group mainly affected (65.5 % of cases due to owned dogs), $\chi^2(8) = 29.249$, $p < 0.0001$.

Discussion

A newly established surveillance scheme provided epidemiological information for the injuries caused by dogs in Greece.

The collection of data from the emergency departments of the hospitals has been proposed as a practical means of monitoring the animal-associated injuries on a permanent basis, especially of the most severe cases⁶. In this study, we included the primary health care centers for a comprehensive overview of all cases, regardless of the severity of the inflicted wound. Indeed, most of the cases in this study sought medical assistance to primary healthcare units.

In most reports¹⁶⁻¹⁸, the majority of dog-bite victims are children, from five to 14 years old, whereas our findings indicated that the 20-29 years-old group was mostly affected, with the 10-19 years-old closely following. This discrepancy could be associated with the variation of the distribution of age groups among the populations of different countries and the rate of dog ownership per household; the bite accidents in children are mostly attributed to owned dogs usually belonging or known to the family^{6,19,20}.

In accordance with previous studies, our findings indicated a predominance of male patients¹⁶⁻¹⁸, with the majority of victims presented with single bites¹⁰, and the head/neck injuries occurring more often in younger patients²⁰⁻²². Previous reports present mixed results, suggesting that the wounds are located mostly at the upper extremities^{20,21} or involve mainly the lower limbs²³; in this

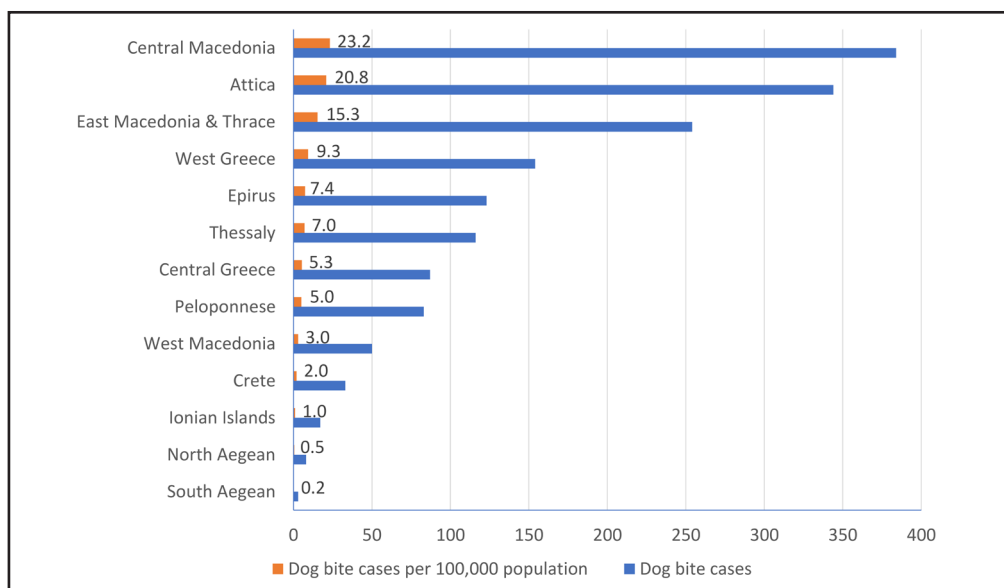


Figure 1: Rate of dog bite cases by region of Greece during the period January-June 2023.

survey the injuries tended to occur in the lower limbs. Our data indicated that the ownerless dogs bit more often the lower limbs; the discrepancy with previous reports might be explained by an increased proportion of stray dogs in Greece; however, official data for the dog population in Greece, stratified by region and ownership status, were not available in our study. The hospitalization rate recorded in this survey is consistent with previously published data¹⁷; Loder²⁰ reported that the older patients were more likely to stay in the hospital as inpatients; however, our data did not indicate any trend in hospitalizations related to age.

The peak of the rate of attendance in April could be explained by the Easter holidays; during this period, Greek citizens massively leave urban residential areas for a short recreation break in the countryside. Holidays, combined with warm temperatures and spending time outdoors, are associated with a higher likelihood of getting involved in dog bite accidents^{17,18,20,21}.

We used the AIS ranking system to document the severity of the wounds; however, there is no consensus on a standard scale to reflect the complexity of animal bite wounds. Some authors suggest that a modified classification scheme should be devised explicitly for this type of injuries²⁴.

The present study is cross-sectional; only information obtained during the patient's attendance was recorded. In order to reduce complexity and achieve higher participation, information regarding the administration of antimicrobial prophylaxis was omitted from reporting. Moreover, the patients were not followed; therefore, information regarding possible post-injury infection development, the performance of any surgical intervention, the time of hospital stay, the recovery time, and the functional, cosmetic, or psychological sequelae was not collected. Functional impairment, sensory loss, fractures, or disfigurement requiring complex reconstructive surgeries have been described after dog bites^{18,21}. Post-injury infection rates 5-20 % have been reported most commonly involving skin and subcutaneous tissue, whereas osteomyelitis, arthritis, septicemia, and endocarditis were less frequently observed^{17,21,22,25}. If rabies emerges in an area, dog-bite victims may require the administration of post-exposure prophylaxis (pep). Due to the re-emergence of rabies in Greece in 2012, pep was administered to a significant number of individuals, most commonly bitten by ownerless dogs in high-risk areas²⁶. Longitudinal studies that follow the patients and include a multitude of information are indispensable for the overall assessment of the impact of dog bites on the physical and mental health of the victims. An analysis of the medical care costs, including treatments and pep administrations, hospital stays, and surgical procedures, would provide an even more comprehensive insight into the financial aspect of dog bites^{27,28}. The extra strain that the management of bite cases puts on the hospitals and the indirect costs, such as lost salaries, transportation costs, etc., should also be considered.

The findings of this study highlight the importance

of integrating dog-bite monitoring into conventional surveillance systems to obtain a comprehensive overview of the afflicted injuries. Surveillance of dog bite incidents may contribute to the development of prevention programs based on national and local epidemiology and better prepare healthcare settings to address the medical needs of the victims.

Limitations of this study

The dog bite surveillance spanned only six months, lacking the representation of an entire calendar year. Nevertheless, a sizeable number of cases contributed to the validity of the results for the examined period. Spring and Summer, hot weather, and vacations are reportedly associated with increased bites due to people spending more time outdoors with a higher likelihood of interacting with dogs^{18,20,21,24}. The examined period included months with temperatures ranging from cold to warm; however, the months associated with summer holidays were not studied. The season of the year may also affect the victims' demographic characteristics as more tourists visit the country during summer holidays. Nevertheless, the study period included the spring and the 2023 Easter holidays (April), with a high rate of domestic tourism and increased stay of urban dwellers outdoors in rural areas.

Population of dogs in Greece stratified by region and ownership status could provide case frequency rates concerning the subpopulation of each group and the odds ratios by region and ownership status; however, this information is currently unavailable. Estimating the dog population, especially of ownerless animals, presents many challenges as official data are not systematically collected²⁹.

Underreporting of dog bites could lead to underestimation of the case frequency. The lack of reported cases from a fraction of hospitals and health centers cannot be directly attributed to reporting failure or to the absence of dog-injured victims. Nevertheless, a regional bias among the non-reporting healthcare settings was not detected. Moreover, not all bite victims seek medical care in hospitals and primary health units, and therefore, the total bite cases might be underrepresented¹⁶.

A systematic dog bite surveillance can be a valuable tool for the epidemiological mapping of respective injuries and for designing interventions and prevention programs.

Conflict of interest

The authors declare no competing interests relevant to the content of this article.

Acknowledgements

We sincerely thank the physicians and infection control nurses in Greece's healthcare settings for their collaboration, which enabled this study. The dataset is deposited at <https://doi.org/10.5281/zenodo.10684439> (supplementary database January-June 2023). Access to the dataset is granted upon reasonable request and is decided by the authors.

References

- Smith LM, Hartmann S, Munteanu AM, Dalla Villa P, Quinnell RJ, Collins LM. The Effectiveness of Dog Population Management: A Systematic Review. *Animals (Basel)*. 2019; 9: 1020.
- Carvelli A, Scaramozzino P, Iacoponi F, Condoleo R, Della Marta U. Size, demography, ownership profiles, and identification rate of the owned dog population in central Italy. *PLoS One*. 2020; 15: e0240551.
- Matchock RL. Pet ownership and physical health. *Curr Opin Psychiatry*. 2015; 28: 386-392.
- Hughes J, Macdonald DW. A review of the interactions between free-roaming domestic dogs and wildlife. *Biol Conserv*. 2013; 157: 341-351.
- Martinez J, von Nolting C. Review: "Animal welfare" - A European concept. *Animal*. 2023; 17 Suppl 4: 100839.
- Bregman B, Slavinski S. Using emergency department data to conduct dog and animal bite surveillance in New York City, 2003-2006. *Public Health Rep*. 2012; 127: 195-201.
- Williams BM, Purcell L, Kayange L, Gallaher J, Charles A. Characteristic and outcomes of human and animal bites in Malawi. *Injury*. 2021; 52: 2188-2193.
- Hurt JB, Maday KR. Management and treatment of animal bites. *JAAPA*. 2018; 31: 27-31.
- Abuabara A. A review of facial injuries due to dog bites. *Med Oral Patol Oral Cir Bucal*. 2006; 11: E348-E350.
- Hon KL, Fu CC, Chor CM, Tang PS, Leung TF, Man CY, et al. Issues associated with dog bite injuries in children and adolescents assessed at the emergency department. *Pediatr Emerg Care*. 2007; 23: 445-449.
- Spille J, Schulz J, Spille DC, Naujokat H, Wieker H, Wiltfang J, et al. Microbiological Characteristics and Surgical Management of Animal-Bite-Related Oral & Maxillofacial Injuries: A Single Center's Experience. *Antibiotics (Basel)*. 2021; 10: 998.
- World Health Organization. WHO Expert Consultation on Rabies: WHO TRS N°1012. Available at: <https://www.who.int/publications/i/item/WHO-TRS-1012>, date accessed: 30/6/2023.
- Whitehouse ER, Person MK, Brown CM, Slavinski S, Rao AK, Blanton JD. Evaluating Surveillance for and Estimating Administration of Rabies Postexposure Prophylaxis in the United States, 2012-2018. *PLoS Negl Trop Dis*. 2021; 15: e0009878.
- Hsu SY, Wu SC, Rau CS, Hsieh TM, Liu HT, Huang CY, et al. Impact of Adapting the Abbreviated Injury Scale (AIS)-2005 from AIS-1998 on Injury Severity Scores and Clinical Outcome. *Int J Environ Res Public Health*. 2019; 16: 5033.
- Hellenic Statistical Authority. Census Results of Population and Housing. ELSTAT 2021. Available at: https://elstat-outsource.rs.statistics.gr/census_results_2022_en.pdf, date accessed: 30/6/2023.
- Holzer KJ, Vaughn MG, Murugan V. Dog bite injuries in the USA: prevalence, correlates and recent trends. *Inj Prev*. 2019; 25: 187-190.
- Holmquist L, Elixhauser A. Emergency Department Visits and Inpatient Stays Involving Dog Bites, 2008. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs [Internet]. Agency for Healthcare Research and Quality (US). Available at: <https://www.ncbi.nlm.nih.gov/books/NBK52650/>, date accessed: 30/6/2023.
- MacBean CE, Taylor DM, Ashby K. Animal and human bite injuries in Victoria, 1998-2004. *Med J Aust*. 2007; 186: 38-40.
- Reisner IR, Nance ML, Zeller JS, Houseknecht EM, Kassam-Adams N, Wiebe DJ. Behavioural characteristics associated with dog bites to children presenting to an urban trauma centre. *Inj Prev*. 2011; 17: 348-353.
- Loder RT. The demographics of dog bites in the United States. *Heliyon*. 2019; 5: e01360.
- Morzycycki A, Simpson A, Williams J. Dog bites in the emergency department: a descriptive analysis. *CJEM*. 2019; 21: 63-70.
- Ellis R, Ellis C. Dog and cat bites. *Am Fam Physician*. 2014; 90: 239-243.
- Nkomo M, Mahomed Z, Laher AE. An Audit of Patients with Dog-bite Wounds Presenting to a Tertiary Level Hospital Emergency Department in South Africa. *Cureus*. 2020; 12: e6558.
- Singhal R, Sikka N, Namdev R. Animal bite injuries in pediatric population: a systematic review. *J Oral Med Oral Surg*. 2022; 28: 37.
- Bula-Rudas FJ, Olcott JL. Human and Animal Bites. *Pediatr Rev*. 2018; 39: 490-500.
- Dougas G, Konte V, Mitrou K, Georgakopoulou T, Baka A, Liou A, et al. Surveillance of Rabies Postexposure Prophylaxis in Greece: 4 Years Experience. *Vector Borne Zoonotic Dis*. 2019; 19: 295-301.
- Ortiz DD, Lezcano FO. Dog and Cat Bites: Rapid Evidence Review. *Am Fam Physician*. 2023; 108: 501-505.
- Amparo ACB, Jayme SI, Roces MCR, Quizon MCL, Mercado MLL, Dela Cruz MPZ, et al. The evaluation of Animal Bite Treatment Centers in the Philippines from a patient perspective. *PLoS One*. 2018; 13: e0200873.
- Warembourg C, Berger-González M, Alvarez D, Maximiano Sousa F, López Hernández A, Roquel P, et al. Estimation of free-roaming domestic dog population size: Investigation of three methods including an Unmanned Aerial Vehicle (UAV) based approach. *PLoS One*. 2020; 15: e0225022.