Bulgarian Journal of Veterinary Medicine, 2023, **26**, No 2, 241–254
ISSN 1311-1477; DOI: 10.15547/bjvm.2021-0024

Original article

SHELTER DISEASE SURVEILLANCE AND SHELTER WELFARE ASSESSMENT IN SHORT TERM HOUSING SHELTERS: A CROSS-SECTIONAL STUDY

Y. A. OZTURAN & I. AKIN

Faculty of Veterinary Medicine, Aydin Adnan Menderes University,
Isikli, Aydin, Turkey

Summary

Ozturan, Y. A. & I. Akin, 2023. Shelter disease surveillance and shelter welfare assessment in short term housing shelters: A cross-sectional study. *Bulg. J. Vet. Med.*, **26**, No 2, 241–254.

Six shelters with 7,468 animals (2,305 cats and 5,163 dogs) were followed and diseases and shelter welfare conditions were recorded for one year. Disease records were obtained and categorised on three headings (surgery, internal medicine, and reproductive diseases and interventions) and subheading categories. Descriptive statistics was used to reveal disease distribution, which can attribute to surveillance data. To evaluate shelter welfare conditions, a protocol was developed and shelters were assessed. Under the surgical disease category, the most encountered disease records were open wounds (502, 59.41% and 175, 31.99%) for dogs and cats. For the internal medicine category, the most encountered were respiratory system diseases both for dogs (917, 33.26%) and cats (351, 58.21%). Under the reproductive disease category, the most common disease in dogs was orchitis (29, 60.42%). In cats, the most encountered disease was metritis (19, 79.16%). Ordinal logistic regression was used for evaluation of associations between diseases and shelter conditions. For dogs, with a one-point increase in shelter score, the odds of encountering reproductive diseases increased by 1.4%, while the odds of cumulative and internal diseases decreased 1.1 and 1.2 times ($P<0.05$) respectively. For cats, with an increase in shelter scores, the odds of encountering reproductive and cumulative diseases increased by 3.4% and 0.2%, respectively ($P<0.05$). Disease surveillance and their relation with shelter conditions may be helpful to design efficient plans in shelters.

Key words: cat, dog, kennel, shelter, surveillance

INTRODUCTION

The role of shelters in terms of maintaining public health has been recognised by civilizations throughout history, including the ancient Greeks, Mayans, Indians, and Babylonians civilisations, and continues to be recognised today for the sustainability of one health (Szucs, 1999). Shelters are mainly responsible for balancing the increasing population of dogs and cats (Turner *et al.*, 2012; Smith *et al.*, 2019). For instance, according to a nonprofit organisation (ASPCA), 6.5 million animals enter shelters in the United States annually; similarly, in Canada, 300,000 cats pass through shelters each year (Turner *et al.*, 2012; Anonymous, 2018). Countries and local authorities are following different guidelines to control the stray animal population, according to socioeconomic and public ethical conundrums (Turner *et al.*, 2012). While some governments (e.g., Italy, Germany, and Turkey) prefer to pursue no-kill policies which can result in overcrowded shelters even if they follow the trap-neuter-release (TNR) method, in some countries (e.g., the UK and USA) where such a policy is not adopted, animals are euthanised, which may elicit negative reactions from the public and organisations. In the framework set by the laws and regulations in Turkey, temporary shelters (rehab centers) and nursing homes are known as animal shelters. According to the official animal rights regulation of Turkey implementing regulation on the protection of animals for animals without owners, in temporary nursing homes, the necessary announcements are made for ten days (Anonymous, 2006). Regarding this, animals that cannot be owned are returned to the community where they were taken with the consent of a veterinarian (7 days after the wound closure following the spaying/neutering procedure with controls, vaccines, and medical interventions). In these environments, in collaboration with charitable groups, municipalities create feeding centres and help feed the animals. Under no conditions are animals left outside the respective municipal limits. Thus, the housing period of shelters in Turkey is relatively shorter than in the other countries (e.g., the UK and USA). The increasing number of stray animals released from the shelters may raise the issue of some infectious disease spread, especially in countries where the TNR method is applied (Taetzsch *et al.,* 2018). In this regard, shelters have a crucial opportunity and mission for disease surveillance. Demands for animal disease surveillance systems have increased, considering the growing international trade framework and concerns about foreign pathogens (Stark *et al.*, 2006). In livestock animals, such tools are quite common in practice (Mariner *et al.*, 2011; Häsler *et al.*, 2012). Similarly, shelters can serve as places where animal numbers can be appropriate to track the distribution of diseases for companion animals.

In addition to population control, management practices such as inadequate shelter conditions or unsatisfactory treatments may play a vital role in the direct or indirect transmission of diseases. The shelter environment can be detrimental to dogs and cats, especially when they are housed for long periods (Wells *et al.*, 2002; Hewson *et al.*, 2007; Dalla Villa *et al.*, 2013). For instance, dogs may perceive the same stressors differently due to individual variability, thus exhibiting different responses when housed in similar conditions (Hiby *et al.*, 2007; Titulaer *et al.*, 2013). Similarly, feline upper respiratory infection in shelters has been related directly to stress and is a concern for relocation (Tanaka *et al.*, 2012). According to the length of duration, shelter conditions may dramatically affect the life span and health of animals. In a study by Arhant *et al.* (2015), the mean housing period in European shelters was found to be 12 months for 1,242 shelter cats. This period might be considered as long; therefore shelters should try to serve good quality of life. For this aim, protocols for welfare assessment are developed (Barnard *et al.,* 2015; Arena *et al.,* 2019; Berteselli *et al.*, 2019). However, established protocols are mostly focused on long-term sheltering. Some of the predictors used in previous studies (Barnard *et al.* 2015; Arena *et al.* 2019; Berteselli *et al.*, 2019) such as emotional states of the animals may not be represented completely in short-term housing policies. These established protocols may not fit in short-term housing in TNR adopted countries, like Turkey. Therefore, a welfare protocol appropriate for animal shelters that use TNR and have short-term housing is desired.

This study aimed to reveal disease distribution and its association with shelter conditions, as well as to develop a new shelter welfare assessment protocol in TNR-adopted shelters.

MATERIALS AND METHODS

Study design and disease records

A total of 6 shelters and 7,468 animals (2,305 cats and 5,163 dogs) were included in the study. No specific inclusion criteria for shelters were defined. Shelters were chosen randomly from the western coast of Turkey. Before the first visit, shelter veterinarians were informed of the project by phone and face-to-face interviews for verbal approval. Shelters were visited biweekly during the study period for recording the disease distribution and shelter management assessments. Each shelter was assessed from May 2017 to May 2018. Shelter protocols for all enrolled shelters were the same (the TNR method). All animals in the study remained 30 days in shelters before adoption or release. Animals were diagnosed and treated by shelter veterinarians. Healthy animals underwent spay/neutering before release or adoption. Disease records were categorised as surgical, internal medicine, and reproductive diseases and the categorisation was approved by the veterinary school professionals.

Determination of shelter assessment criteria

Shelter evaluation criteria were selected to assess the five freedoms of welfare identified by the previous studies and the Welfare Quality Consortium and modified to 3 main and 10 subcategories (Blokhuis *et al.*, 2010; Mc Causland, 2014; Barnard *et al.*, 2015; Arena *et al.*, 2019). Different types of measurement and assessment units for the criteria were described in Table 1. The determination of the criteria was also based on the feasibility of measurement and assessment (e.g. practicality under field conditions) considering both time and repeatability. Professionals also implicitly assessed the effectiveness of the protocol's potential practice failures. The primary investigator (PI) was trained by veterinary school specialists for observations. The observations were carried on by the PI. All observations were performed according to previously validated studies (Barnard *et al.*, 2015; Arena *et al.*, 2019; Berteselli *et al.*, 2019). The assessor (PI, veterinarian) remained 2 meters away from the fence in front of the area, with no animal contact. Firstly, the assessor recorded the measures at pen level in the following order: daily feeding, water cleanliness, water amount, pen cleaning frequency, pen physical condition (sharp edges or broken structures within the pen). Secondly, randomly chosen animals were observed to gather thermal comfort information (existence of shivering/panting). As the last step, shelter cleaning, follow-up treatments, health check routines were observed. Additionally, the veterinarian's attendance of higher or continuing education was recorded. Emotional and behavioural assessments were not applied in the protocol since the presence of an unknown observer may affect the behavioural evaluation of animals and the shel-

Table 1. The designed shelter condition assessment protocol

Principle	Evaluation criteria	Scale	Assessment	Assessment method*
Access to food	Daily feeding	1=Yes 0=No	Feeding frequency	Shelter
Access to water	Water cleanliness	1=Yes 0=No	Water container observation	Pen
	Water was *ad libitum*	1=Yes 0=No		
Environmental conformation	Thermal comfort	1=Yes 0=No	Shivering/panting	Individual
	Pen cleanliness	1=Yes 0=No	Cleaning frequency	Pen
	Pen durability and appropriate space	1=Yes 0=No	Pen physical condition	Pen
Diagnosis and treatment consistency	Veterinarian's higher education	1=Yes 0=No	Higher/ continuing education	Interview
	Follow up treatment consistency	1=Yes 0=No	Observation/record log	Shelter
	Health check	1=Yes 0=No	Observation/record log	Shelter

*Assessments were performed according to three separate units: assessment of shelter as a unit, assessment of a pen as a unit, face to face interviews, and assessment of each animal.

tered housing period (30 days) may affect animals' emotional states (Rooney *et al.*, 2007).

Statistical analysis

Statistical analyses were carried out using SPSS 22 (IBM Corp. Armonk, NY, United States) statistical package program. Descriptive statistics was used to reveal disease distribution for each categorical variable (surgical, internal medicine, and reproductive diseases) regarding animal species (dog and cat). A chi-square test was conducted for detecting the difference between diseases and shelter welfare points. Disease categories were used as independent dichotomous categorical variables, coded as 0=sick, 1=healthy. Total shelter welfare scores were used as dependent ordinal categorical variable. Each disease category (surgical, internal medicine, reproductive diseases) was analysed both alone and cumulatively (surgical, internal medicine, reproductive diseases) to reveal categories comparison and overall results. A generalised linear model was carried out for performing ordinal linear regression model for both cats and dogs. Thus, odds ratios (OR) and regression coefficients (b) for all analyses were obtained. Chi-square goodness of fit test was also used to compare the observed disease distribution with the expected probability distribution.

RESULTS

Shelters were evaluated according to the developed welfare criteria and results are presented in Table 2. Descriptive statistics was categorised on three headings (surgery, internal medicine, and reproductive diseases and interventions) and subhead-

Table 2. Shelter assessment criteria and scores of included shelters (2,305 cats and 5,169 dogs)

Principle	Assessment criteria*	Shelter No					
		1	2	3	4	5	6
Access to food	Daily feeding	1	1	1	1	1	1
Access to water	Water cleanliness	1	0	1	0	0	0
	Water was ad libitum	1	1	1	1	1	1
Environmental conformation	Thermal comfort	0	1	0	1	0	0
	Pen cleanliness	1	1	0	1	1	0
	Pen durability and appropriate space	1	1	1	1	0	1
Diagnosis and treatment consistency	Veterinarian's higher education	1	0	0	1	0	0
	Follow up treatment consistency	1	1	1	1	0	0
	Health check	1	0	0	1	1	1
	Total score	8	6	5	8	4	4

*1= presence, 0=absence of criteria.

ing categories and species (Table 3, 4, 5). The association between surgical, internal medicine, reproductive and cumulative disease diseases (surgical, internal medicine, and reproductive diseases) distributions with shelter welfare points of dogs and cats are given in Table 6 and 7.

Descriptive statistics

Reproductive interventions and diseases were the most encountered records (1,561 dogs; 1,154 cats; 36.36%) out of 7,468 observations compared to surgery (1,392; 18.64%) and internal medicine (3,360; 45%) categories for dogs and cats.

From surgical diseases in dogs (Table 3), the most frequent disease was open wound (OW) that required surgical or medical intervention (502; 59.41%) out of 845 surgical diseases. Similarly, in cats (Table 3), open wound that needed surgical or medical intervention (175; 31.99%) was the most common among 547 surgical disease records.

The most prevalent diseases under the internal medicine category (Table 4) for dogs were respiratory system diseases (RSD) (917; 33.26%) out of 2,757 animals. In cats, RSD were also the most frequently seen (351; 58.21%) out of 603 records.

In the reproductive disease category, ovariohysterectomy (OV) (972; 62.27%) and castration (CAS) (541; 34.66%) were the most common operations for dogs. However, the most prevalent disease in observed shelters was orchitis (ORC) (29; 60.42%). Similarly, OV (814, 70.54%) and CAS (316, 27.38%) were the most common operations in cats. The most encountered disease record in cats was metritis (MT) (19; 79.16%) (Table 5).

Association between shelter welfare and diseases

The logistic regression analysis revealed the association between shelter assessment outcomes with disease categories. In dogs, statistically significant associations were obtained between shelter conditions and internal medicine (P=0.005), reproductive

Table 3. Surgical diseases distributions among dogs (n=845) and cats (n=547) according to shelter categories

Species	Shelter No	OW n (%)	OPD n (%)	OCD n (%)	OD n (%)	O n (%)	H n (%)	Total n (%)
Dog	1	33 (41.3)	11 (13.8)	9 (11.3)	14 (17.5)	13 (16.3)	–	80 (100)
	2	28 (51.9)	6 (11.1)	–	20 (37)	–	–	54 (100)
	3	17 (37)	-	7 (15.2)	13 (28.3)	3 (6.5)	6 (13)	46 (100)
	4	55 (53.4)	18 (17.5)	3 (2.9)	27 (26.2)	–	–	103 (100)
	5	27 (52.9)	13 (25.5)	-	10 (19.6)	1 (2)	–	51 (100)
	6	342 (66.9)	38 (7.4)	13 (2.5)	88 (17.2)	30 (5.9)	–	511 (100)
	Total number (%)	502 (59.41)	86 (10.18)	32 (3.79)	172 (20.35)	47 (5.56)	6 (0.71)	845 (100)
Cat	1	23 (39)	3 (5.1)	24 (40.7)	3 (5.1)	2 (3.4)	4 (6.8)	59 (100)
	2	21 (45.7)	15 (32.6)	4 (8.7)	6 (13)	–	–	46 (100)
	3	3 (11.5)	18 (69.2)	3 (11.5)	2 (7.7)	–	–	26 (100)
	4	8 (22.9)	11 (31.4)	1 (2.9)	15 (42.9)	–	–	35 (100)
	5	9 (69.2)	1 (7.7)	1 (7.7)	2 (15.4)	–	–	13 (100)
	6	111 (30.2)	11 (3)	233 (63.3)	–	–	13 (3.5)	368 (100)
	Total number (%)	175 (31.99)	59 (10.79)	266 (48.63)	28 (5.12)	2 (0.36)	17 (3.11)	547 (100)

OW: open wound, OPD: ophthalmological diseases, OCD: oral cavity diseases, OD: orthopaedic diseases, O: otitis, H: hernia.

Table 4. Internal medicine disease distributions among dogs (n=2750) and cats (n=603) according to shelter categories

Species	Shelter No	RSD n (%)	DSD n (%)	INSD n (%)	EGC n (%)	ISD n (%)	Total n (%)
Dog	1	23 (7.8)	218 (74.4)	13 (4.4)	-	38 (13)	292 (100)
	2	84 (47.7)	25 (14.2)	7 (4)	-	60 (34.1)	176 (100)
	3	22 (25.9)	24 (28.2)	29 (34.1)	-	10 (11.8)	85 (100)
	4	45 (14.8)	64 (21)	141 (46.2)	-	53 (17.4)	303 (100)
	5	41 (30.8)	35 (26.3)	50 (37.6)	-	7 (5.3)	133 (100)
	6	702 (39.7)	266 (15)	400 (22.6)	-	400 (22.6)	1768 (100)
	Total number (%)	917(33.26)	632 (v22.92)	640 (23.21)	-	568 (20.61)	2757 (100)
Cat	1	25 (54.3)	-	1 (2.2)	15	5 (10.9)	46 (100)
	2	12 (80)				3 (20)	15 (100)
	3	8 (100)	-	-	-	-	8 (100)
	4	73 (73)	18 (18)	3 (3)	-	6 (6)	100 (100)
	5	7 (26.9)	5 (19.2)	4 (15.4)	-	9 (34.6)	25 (100)
	6	226 (55.3)	-	180 (44)	-	3 (0.7)	409 (100)
	Total number (%)	351 (58.21)	23(3.81)	188 (31.18)	15 (2.49)	26 (4.31)	603 (100)

RSD: respiratory system diseases, DSD: digestive system diseases, INSD: integumentary system diseases, EGC: eosinophilic granuloma complex, ISD: infectious systemic diseases.

Table 5. Reproductive disease and intervention distributions of dogs (n=1561) and cats (n=1154) according to shelter categories.

Species	Shelter No	TVT n (%)	ORC n (%)	MT n (%)	OV n (%)	CAS n (%)	M n (%)	Total n (%)
Dog	1	3 (1.1)	20 (7.6)	-	150 (56.8)	91 (34.5)	-	264 (100)
	2	3 (1.6)	-	-	156 (82.1)	31 (16.3)	-	190(100)
	3	-	-	6 (9.8)	32 (52.5)	23 (37.7)	-	61 (100)
	4	1 (1.3)	-	2 (2.7)	45 (60)	27 (36)	-	75 (100)
	5	-	9 (13.4)	-	39 (58.2)	19 (28.4)	-	67 (100)
	6	4 (0.4)	-	-	550 (60.8)	350 (38.7)	-	904 (100)
	Total number (%)	11 (0.70)	29 (1.86)	8 (0.51)	972 (62.27)	541 (34.66)	-	1561 (100)
Cat	1	-	-	18 (9)	121 (60.5)	61 (30.5)	-	200 (100)
	2	-	-	1 (1.4)	58 (78.4)	15 (20.3)	-	74 (100)
	3	-	-	-	14 (73.7)	5 (26.3)	-	19 (100)
	4	-	-	-	11 (55)	6 (30)	3 (15)	20 (100)
	5	-	2 (2.2)	-	80 (87.9)	9 (9.9)	-	91 (100)
	6	-	-	-	530 (70.7)	220 (29.3)	-	750 (100)
	Total number (%)	-	2 (0.17)	19 (1.65)	814 (70.54)	316 (27.38)	3 (0.26)	1154 (100)

TVT: transmissible venereal tumours, ORC: orchitis, OV: ovariohistectomy, CAS: castration, MT: metritis, M: mammary tumours.

(P<0.001) and cumulative diseases (P=0.025). However, no statistically significant association was found between shelter conditions and surgical diseases (P>0.05) (Table 6). A one-point increase in shelter scores resulted in increase of odds of encountering reproductive diseases by 1.4% (b= −1.457), while, the odds of encountering cumulative diseases, and internal disease decreased 1.1 times (OR: 1.150), and 1.2 times (OR: 1.200), respectively (Table 6).

In cats, a statistically significant association was observed between shelter conditions with reproductive (P<0.001) and cumulative (P=0.009) diseases (Table 7). Nevertheless, there was no statistically significant association between shelter conditions and surgical and internal medicine diseases (P>0.05). A one-point increase in shelter score resulted in (b= –3.484) increase in odds of encountering reproductive diseases by 3.4% and (b= –0.239) increase in odds of encountering cumulative diseases by 0.2% (Table 7).

Table 6. Regression coefficients and P values (Wald-$\chi 2$) from the regression models with disease categories and shelter welfare assessment for dogs (n=5,169).

Variables	Numerical value of variables	b	SE	P value	OR	95% CI for OR
Surgical diseases	0 = sick, 1 = healthy	0.110	0.09	0.213	1.117	0.939−1.328
Internal diseases	0 = sick, 1 = healthy	0.183	0.06	0.005	1.200	1.055−1.365
Reproductive diseases	0 = sick, 1 = healthy	−1.457	0.28	<0.001	0.233	0.134–0.405
Cumulative sickness	0 = sick, 1 = healthy	0.140	0.06	0.025	1.150	1.018−1.299

b: regression coefficient, SE: standard error, CI: confidence interval; OR: odds ratio. Cumulative sickness represents all diseases regardless of specific (surgical, internal medicine, reproductive) criteria.

Table 7. Regression coefficients and P values (Wald-$\chi 2$) from the regression models with disease categories and shelter welfare assessment for cats (n=2,305).

Variables	Numerical value of variables	b	SE	P value	OR	95% CI for OR
Surgical diseases	0 = sick, 1 = healthy	–0.168	0.11	0.138	0.845	0.677−1.055
Internal diseases	0 = sick, 1 = healthy	–0.178	0.11	0.114	0.837	0.671−1.044
Reproductive diseases	0 = sick, 1 = healthy	–3.489	0.62	<0.001	0.031	0.009–0.103
Cumulative sickness	0 = sick, 1 = healthy	–0.239	0.09	0.009	0.787	0.658–0.943

b: regression coefficient, SE: standard error, CI: confidence interval; OR: odds ratio. Cumulative sickness represents all diseases regardless of specific (surgical, internal medicine, reproductive) criteria.

DISCUSSION

This is, to our knowledge, the first survey of data collected from Turkish animal shelters and shelter welfare conditions involving a large number of facilities and animals nationwide. Considering the present study period (1 year) the number of records was evaluated as higher than the authors' expectation. One of the main anticipations of the assessment protocol used in this study was to develop integrated easy, feasible assessment criteria which may help to standardise shelter management. Besides previous study protocols (Botreau *et al.*, 2007; Gourkow *et al.*, 2014; Barnard *et al.*, 2015; Arena *et al.*, 2019; Berteselli *et al.*, 2019) the designed evaluation protocol aimed to consider other factors such as follow-up treatment consistency. Also, some factors such as emotional status and aggressiveness were not considered in the present study, since it was thought that the one-month housing period in shelters may not truly affect the animal's natural emotional status. In future studies, emotional status and aggressiveness may be included in the shelter welfare assessment protocol considering the adaptation time of dogs and cats to short-term housing shelters as a new environment.

Surveillance of small animal diseases in shelters is limited according to animal species and local zones (Ward & Kelmen, 2011; Vizcaino *et al.*, 2016). Shelters have an important role to get info for some infectious diseases in their local area. However, examples of well-established surveillance systems mostly focus on the detection of zoonotic diseases. These are, for instance, CDC (Center for Disease Control and Prevention) on wild animals and Watchdog for dogs (Francke, 1995; Stone & Hautala., 2008) in the United States; SAVSNET on companion animals (Vizcaino *et al.*, 2016) in the United Kingdom; and as a global effort, the Office International des Epizooties (OIE), based on livestock animals and zoonotic diseases (Moore & Lund, 2009). Most of the shelter studies aimed at specific diseases in cats (Luria *et al.,* 2004; Zicola *et al.*, 2009; Carlotti *et al.*, 2010; Gourkow *et al.*, 2014) and dogs (Papini *et al.*, 2004; Tupler *et al.*, 2008; Donnett *et al.*, 2018). None of available papers had aimed at the broad perspective of all disease distributions with main headings (surgical, internal medicine, reproductive, and cumulative diseases) in shelters, as the present study. A large sample size of shelters and including all disease categories, like in the present study, may allow linking the encountered diseases with clinical cases and related epidemics. Also, clinical practitioners and shelter veterinarians may expand their knowledge with locally encountered disease distributions. Considering animal adoption rates from shelters (23% dog, 31% cat) of animal owners in the United States (Anonymous, 2012), the disease distribution in shelters not only seem to be related to shelter animals, but also important for the community (owner, animal, and clinicians), which may be interacting with adopted animals. The present results from shelters would be an advantage for the adoption candidate and the animal, in terms of future health status.

It is well known that shelter conditions may directly affect the lives of shelter animals (Wells *et al.*, 2002), and shelter management practices affect the distribution of diseases (Pesavento & Murphy, 2014). Inadequate shelter management strategies such as stress, immunosuppression, and treatment practices, can establish a biological advantage for potential infectious pathogens (Pesavento & Murphy, 2014). Also, stress-related factors may play a role in humoral and cell-mediated immunity to put cats and dogs at risk for reactivation of latent infectious diseases (Griffin, 1989; Thiry *et al.*, 2009). Shelter cats with high-stress levels have been reported to tend to suffer from upper respiratory system infection, and canine respiratory system diseases have been correlated with shelter-related immunosuppression (Priestnall *et al.*, 2009; Tanaka *et al.*, 2012). For instance, feline herpesvirus infections showed a direct association with stress-related reactivation (Gaskell & Povey, 1977; Bannasch & Foley, 2005; Wagner *et al.*, 2018). Barnard *et al.* (2015), Arena *et al.* (2019) and Berteselli *et al.* (2019) developed simple, objective, and practicable welfare assessment criteria protocols, which may be useful for evaluating diseases in long term housing shelters. Due to the difference in shelter management in Turkey, a new welfare assessment criteria protocol was used in this study. Also, in the present study, statistically significant associations were found between internal medicine (P=0.005), reproductive (P<0.001), and cumulative diseases (P=0.025) with shelter conditions for dogs (Table 6). For cats, statistically significant associations were obtained with reproductive (P<0.001) and cumulative diseases (P=0.009) with shelter conditions (Table 7). While improved shelter conditions illustrated a decrease in encountering internal and cumulative diseases, the odds of encountering reproductive diseases were increased for dogs (Table 6). In cats, increased shelter welfare conditions demonstrated an increase in the odds of encountering reproductive diseases and cumulative diseases (Table 7). This may be related to disease resistance differences between cats and dogs (Day, 2016) and more accurate veterinarian diagnosis or disease categories according to the determined disease headings in the present study. Deductive and inductive approaches are generally preferred in explaining or revealing events for the solution. Most of the studies on diseases in shelters focused on specific diseases (Luria *et al.,* 2004; Papini *et al.*, 2004; Tupler *et al.*, 2008; Zicola *et al.*, 2009; Carlotti *et al.*, 2010; Gourkow *et al.*, 2014; Donnett *et al.*, 2018). Earlier studies carried out with limited disease categories can be classified as inductive researches. For this reason, the present study can be classified as a deductive approach. In this respect, our study tried to convey "all diseases" and aimed to draw attention to "all diseases with shelter welfare conditions". Therefore, a specific comparison and discussion was avoided. However, each specific disease can be found under the titles used in the present study and an assessment can be made accordingly. It should be kept in mind that disease distribution in shelters may vary by regional, climatic, management conditions, and architectural plans. Therefore, it is important to review the standards that can be implemented globally in shelters and to adjust the guidelines to accommodate regional variations. If each shelter checks the health status and disease distribution of their guests and categorises them under the main headings, they can take earlier measures for their comfort and health.

CONCLUSION

The distribution of diseases differed significantly for cats and dogs with shelter management practices (shelter scores). The difference in disease distribution between cats and dogs with the same housing conditions may indicate the need for new shelter welfare assessment protocols separately for dogs and cats. The introduced and used protocol in this study for dogs and cats may be practical for countries that follow TNR and short-term housing. Also, evaluated distributions of diseases in this present study may accelerate and contribute to future surveillance studies.

ACKNOWLEDGEMENTS

This work was funded by the Scientific Research Council of Turkey through research project 2209-A/1919B011700394. Authors would like to thank Kerem Ural, Mehmet Gültekin, Hakkı Bülent Beceriklisoy, Hüsnü Erbay Bardakçıoğlu, and Aykut Göktürk Üner for their contributions to scientific protocol and training. Also, we would like to thank Halil Çapakçıoğlu, Mehmet Baba, Ali Karahallı and Görkem Öner for their support and data collection.

REFERENCES

Anonymous, 2006. Implementing regulation on the protection of animals May 12 2006. Official Gazette of Republic of Turkey (No: 26166); https://www.resmigazete.gov.tr/eskiler/2006/05/20060512-7.htm (13 May 2021 date last accessed) (TUR).

Anonymous, 2012. AVMA. Pet Ownership & Demographics Sourcebook, 2012. American Veterinary Medical Association; Schaumberg, IL, USA.

Anonymous, 2018. ASPCA Pet Statistics; https://www.aspca.org/animal-homelessness/shelter-intake-and-surrender/pet-statistics (13 May 2021 date last accessed).

Arena, L., G. V. Berteselli, F. Lombardo, L. Candeloro, P. Dalla Villa & F. De Massis, 2019. Application of a welfare assessment tool (Shelter Quality Protocol) in 64 Italian long-term dogs' shelters: Welfare hazard analysis. *Animal Welfare*, **28**, 353–363.

Arhant, C., R. Wogritsch & J. Troxler, 2015. Assessment of behavior and physical condition of shelter cats as animal-based indicators of welfare. *Journal of Veterinary Behavior: Clinical Applications and Research*, **10**, 399–406.

Bannasch, M. J., & J. E. Foley, 2005. Epidemiologic evaluation of multiple respiratory pathogens in cats in animal shelters. *Journal of Feline Medicine and Surgery*, **7,** 109–119.

Barnard, S., C. Pedernera, L. Candeloro, N. Ferri, A. Velarde & P. Dalla Villa, 2015. Development of a new welfare assessment protocol for practical application in long-term dog shelters. *The Veterinary Record*, **178**, 18.

Berteselli G. V., Arena L., L. Candeloro, P. Dalla Villa & F. De Massis, 2019. Interobserver agreement and sensitivity to climatic conditions in sheltered dogs' welfare evaluation performed with welfare assessment protocol (Shelter Quality protocol). *Journal of Veterinary Behavior*, **29**, 45–52.

Blokhuis, H. J., I. Veissier , M. Miele & R. B. Jones, 2010. The Welfare Quality project and beyond: safeguarding farm animal well-being. *Acta Agriculturae Scandinavica, Section A Animal Science*, **6**, 129–140.

Botreau, R., I. Veissier, A. Butterworth, M. B. M. Bracke & L. J. Keeling, 2007. Definition of criteria for overall assessment of animal welfare. *Animal Welfare*, **16**, 225–228.

Carlotti, D.N., P. Guinot, E. Meissonnier & P. A. Germain, 2010. Eradication of feline dermatophytosis in a shelter: A field study. *Veterinary Dermatology*, **21**, 259–266.

Dalla Villa, P., S. Barnard, E. Di Fede, M. Podaliri-Vulpiani, C. Siracusa & J. A. Serpell, 2013. Behavioural and physiological responses of shelter dogs to long term confinement.*Veterinaria Italiana*, **49**, 231–241.

Day, M. J., 2016. Cats are not small dogs: Is there an immunological explanation for why cats are less affected by arthropodborne disease than dogs? *Parasites and Vectors*, **9**, 1–9.

Donnett, U., K. Hubbard, K. Woodruff & A. Varela-Stokes, 2018. Prevalence of canine heartworm infection in Mississippi animal shelters. *Veterinary Parasitology*, **259**, 68–73.

Francke,W., 1995. The evolving watchdog: The media's role in government ethics. *The Annals of the American Academy of Political and Social Science*, **537**, 109–121.

Gaskell, R.M. & R. C. Povey, 1977. Experimental induction of feline viral rhinotracheitis virus re-excretion in FVR-recovered cats. *The Veterinary Record*, **100**, 128–133.

Gourkow, N., J. H. Lawson, S. C. Hamon & C. J. C. Phillips, 2014. Descriptive epidemiology of upper respiratory disease and associated risk factors in cats in an animal shelter in coastal western Canada. *Canadian Veterinary Journal*, **54**, 132–138.

Griffin, J. F., 1989. Stress and immunity: a unifying concept. Veterinary *Immunology and Immunopathology*, **20**, 263–312.

Hasler, B., & K. Howe, 2012. Evaluating the role of surveillance in national policies for animal health. *EuroChoices*, **11**, 39–44.

Hewson, C. J., E. F. Hiby & J. W. S. Bradshaw, 2007. Assessing quality of life in companion and kennelled dogs: A critical review. *Animal Welfare*, **16**, 89–95.

Hiby, E. F., N. J. Rooney & J. W. S Bradshaw, 2007. Behavioural and physiological responses of dogs entering re-homing kennels. *Physiology and Behavior*, **89**, 385–391.

Luria, B. J., J. K. Levy, M. R. Lappin, E. B. Breitschwerdt, A. M. Legendre, J. A. Hernandez, S. P. Gorman & I. T. Lee, 2004. Prevalence of infectious diseases in feral cats in Northern Florida. *Journal of Feline Medicine and Surgery*, **6**, 287–296.

Mariner, J. C., S. Hendrickx, D. U. Pfeiffer, S. Costard, L. Knopf, S. Okuthe, D. Chibeu, J. Parmley, M. Musenero, C. Pisang, J. Zingeser, B. Jones, N. A. Syed, B. Bett, M. McLaws, F. Unger, A. Aluma, M. Purvi & C. C. Jost, 2011. Integration of participatory approaches into surveillance systems. *Revue Scientifique et Technique (International Office of Epizootics),* **30**, 653–659.

McCausland, C., 2014. The five freedoms of animal welfare are rights. *Journal of Agricultural and Environmental Ethics*, **27**, 649–662.

Moore, G.E. & E. Lund, 2009. Disease reporting and surveillance: Where do companion animal diseases fit in? *Veterinary Clinics of North America: Small Animal Practice*, **39**, 225–240.

Papini, R., G. Gorini, A. Spaziani & G. Cardini, 2005. Survey on giardiosis in shelter dog populations. *Veterinary Parasitology*, **128**, 333–339.

Pesavento, P. A. & B. G. Murphy, 2014. Common and emerging infectious diseases in the animal shelter. *Veterinary Pathology*, **51**, 478–491.

Priestnall, S. L., J. A. Mitchell & H. W. Brooks, 2009. Quantification of mRNA encoding cytokines and chemokines and assessment of ciliary function in canine tracheal epithelium during infection with canine respiratory coronavirus (CRCoV). *Veterinary Immunology and Immunopathology*, **127**, 38–46.

Rooney, N. J., S. A. Gaines & J. W. S. Bradshaw, 2007. Behavioural and glucocorticoid responses of dogs (*Canis familiaris*) to kennelling: Investigating mitigation of stress by prior habituation. *Physiology & Behavior*, **92**, 847–854.

Sanchez-Vizcaino, F., P. H. Jones, T. Menacere, B. Heayns, M. Wardeh, J. Newman, A. D. Radford, S. Dawson, R. Gaskell, P. J. M. Noble, J. M. Daly, S. Everitt, M. J. Day & K. McConnell, 2016. Small animal disease surveillance: Respiratory disease. The V*Veterinary Record*, **178**, 361–364.

Smith, L. M., S. Hartmann, A. M. Munteanu, P. D. Villa, R. J. Quinnell & L. M. Collins, 2019. The effectiveness of dog population management: A systematic review. *Animals*, **9**, 1020.

Stark, K. D. C., G. Regula, J. Hernandez, L. Knopf, K. Fuchs, R. S. Morris & P. Davies, 2006. Concepts for risk-based surveillance in the field of veterinary medicine and veterinary public health: Review of current approaches. *BMC Health Services Research*, **28**, 6–20.

Stone, A. B., & J. A. Hautala, 2008. Meeting report: Panel on the potential utility and strategies for design and implementation of a National Companion Animal Infectious Disease Surveillance System. *Zoonoses and Public Health*, **55**, 378–384.

Szűcs E, R. Geers, T. Jezierski, E. N. Sossidou & D. M. Broom, 2012. Animal welfare in different human cultures, traditions and religious faiths. *Asian-Australasian Journal of Animal Sciences*, **25**, 1499−1506.

Taetzsch, S. J., A. S. Bertke & K. R. Gruszynski, 2018. Zoonotic disease transmission associated with feral cats in a metropolitan area: A geospatial analysis. *Zoonoses and Public Health*, **65**, 412-419.

Tanaka, A., D. C. Wagner, P. H. Kass, B. M. Lopez & S. Hayama, 2012. Associations among weight loss, stress, and upper respiratory tract infection in shelter cats. *Journal of the American Veterinary Medical Association*, **240**, 570–576.

Thiry, E., D. Addie, S. Belak, C. Boucraut-Baralon, H. Egberink, T. Frymus, T. Gruffydd-Jones, K. Hartmann, M. J. Hosie, A. Lloret, H. Lutz, F. Marsilio, M. G. Pennisi, A. D. Radford, U.Truyen & M. C. Horzinek, 2009. Feline herpesvirus infection: ABCD guidelines on prevention and management. *Journal of Feline Medicine and Surgery*, **11**, 547–555.

Titulaer, M., E. J. Blackwell, M. Mendl & R. A. Casey, 2013. Cross sectional study comparing behavioural, cognitive and physiological indicators of welfare between short and long term kennelled domestic dogs. *Applied Animal Behaviour Science*, **147**, 149–158.

Tupler, T., J. K. Levy, S. J. Sabshin, S. J. Tucker, E. C. Greiner & C. M. Leutenegger, 2012. Enteropathogens identified in cats entering a Florida animal shelter with normal feces or diarrhea. *Journal of the American Veterinary Medical Association*, **241**, 331–337.

Turner P., J. Berry & S. Macdonald, 2012. Animal shelters and animal welfare: raising the bar. *Canadian Veterinary Journal*, **53**, 893-896.

Wagner, D. C., P. H. Kass & K. F. Hurley, 2018. Cage size, movement in and out of housing during daily care, and other environmental and population health risk factors for feline upper respiratory disease in nine North American animal shelters. *PLoS One*, **13**, 1–15.

Ward, M. P., & M. Kelman, 2011. Companion animal disease surveillance: A new solution to an old problem? *Spatial and Spatio-Temporal Epidemiology*, **2**, 147–157.

Wells, D., L. Graham & P. G. Hepper, 2002. The influence of length of time in a rescue shelter on the behaviour of kennelled dogs. *Animal Welfare*, **11**, 317–325.

Zicola, A., C. Saegerman, D. Quatpers, J. Viandier & E. Thiry, 2009. Feline herpesvirus 1 and feline calicivirus infections in a heterogeneous cat population of a rescue shelter. *Journal of Feline Medicine and Surgery*, **11**, 1023–1027.

Paper received 08.03.2021; accepted for publication 09.05.2021

Correspondence:

Yalcin Alper Ozturan,
Faculty of Veterinary Medicine,
Aydin Adnan Menderes University,
Isikli, Aydin, Turkey, 09100,
tel.: +90 506 5037925,
e-mail: alper.ozturan@hotmail.com