Journal of Veterinary Behavior 30 (2019) 1–8

Contents lists available at ScienceDirect

Journal of Veterinary Behavior

journal homepage: www.journalvetbehavior.com

Canine Research

An investigation using different data gathering methods into the prevalence of behavioral problems in shelter dogs—A pilot study

Simona Normando [a,*], Gianna Di Raimondo [a], Elena Bellaio [b]

[a] Department of Comparative Biomedicine and Food Science, University of Padua, Legnaro, PD, Italy
[b] Veterinary Practitioner, Treviso, Italy

ARTICLE INFO

Article history:
Received 11 December 2017
Received in revised form
9 October 2018
Accepted 9 October 2018
Available online 13 October 2018

Keywords:
dog
behavioral problems
shelter
proxy
direct behavioral observation
behavioral test

ABSTRACT

Behavioral problems in shelter dogs, especially stereotypies, may be an indication of poor management practices within the shelters. To facilitate the inclusion of behavioral problems in an official standardized protocol for shelter assessment, it is necessary to identify a method to gather prevalence data. The method must be both valid and feasible in terms of time and resources. The aim of this pilot study was to investigate the efficacy under these constraints, of different data gathering methods in assessing the prevalence of problem behavior in shelter dogs. The methods used were as follows: a proxy interview (N = 428 dogs), an external inspection of the pens conducted either by nonexpert observers (n° 281, 292, 315, 237 dogs, respectively) or by a veterinary behaviorist (N = 303 dogs) in 3 shelters. Behavioral observation and tests were conducted, and counseling was given on a subsample. The interviewed staff members reported a 58% overall prevalence of behavioral problems, with only 4.44% of these reported to have started during the dog's stay at the shelter. Agreement between what was reported by the shelter staff members and what was recorded by observers inspecting the pens was not high, sensitivity ranging from 0.52 to 0.60 and specificity from 0.64 to 0.74. Stereotypies were underestimated by staff and by observers in comparison with behavioral observation results. Further studies are needed to find a feasible and reliable method to assess the prevalence of behavioral problems in shelter dogs if this variable is to be included in an official shelter quality/standard assessment protocol.

Introduction

In western countries, rescue shelters are the most common organizations to provide care for the unwanted dog population. For example, it has been estimated that 129,743 dogs were relinquished to shelters in the United Kingdom in 2009 (Clark et al., 2012). Shelters vary in the quality of life they offer to the animals in the shelter (Stephen and Ledger, 2005). Running a shelter may also be seen by unscrupulous people as a way to make money without regard for animal welfare (http://www.lav.it/cosa-facciamo/cani-e-gatti/allo-sbaraglio-o-reclusi-a-vita, accessed 30th November 2017), so it is not surprising that public concern regarding animal shelters is growing. Thus, there is a need for authorities to be able to assess whether shelters maintain quality standards ensuring acceptable welfare levels for the animals they house. In a few published scientific studies from protocols assessing shelter standards, the prevalence of behavioral problems, especially abnormal behavior or stereotypies, among resident dogs, is included among indicators of shelter quality (Barnard et al., 2016; De Massis et al, 2014; Kiddie and Collins, 2014). The situations in which dogs develop stereotypies while in the shelter are deemed to be linked to the poor quality of the shelter environment, which the dogs have to cope with and to the inefficacy of stress management procedures if any (e.g., Barnard et al., 2016; Newbury et al., 2010). However, as highlighted by Mason and Latham in their review (2004), the presence of a stereotypy could not always be linked with compromised welfare.

The existence of other behavioral problems, such as fear, in a shelter dog, is likely to decrease his/her quality of life and may be a reflection of an inappropriate environment or one unsuited for purpose and of inadequate behavioral problem treating protocols, hence reflecting shelter quality. The presence of suitable protocols addressing problem behavior in shelters could increase dog welfare

* Address for reprint requests and correspondence: Simona Normando, DVM, PhD, Dipartimento di Biomedicina Comparata e Alimentazione, viale dell'Università 16, Agripolis, Legnaro 35020, PD, Italy. Tel: +39049641231; Fax: +39049641174.
E-mail address: simona.normando@unipd.it (S. Normando).

https://doi.org/10.1016/j.jveb.2018.10.005
1558-7878/

by both directly aiding in preventing them from experiencing negative mental states, such as fear, during their stay in the shelter and indirectly enhancing the dogs' chances of adoption (Normando et al., 2006) and reducing return rate, often due to problem behavior (Diesel et al., 2008; Elliot et al., 2010; Protopopova and Gunter, 2017; Wells and Hepper, 2000).

There is a paucity of published data on the prevalence of behavioral problems in shelter dogs, as most studies tend to focus either on the prevalence of behavioral problems as causes of relinquishment (e.g., Diesel et al., 2010; Patronek et al., 1996) or on the incidence/prevalence of behavioral problems in the first months after adoption (e.g., Wells and Hepper 2000). For example, Orhiel and Fraser (2008) found that 26.67% of the dogs they screened showed moderate-to-severe dog-to-dog aggression.

If the prevalence of behavior problems is to be included when officially assessing shelters, it should be evaluated as objectively as possible. However, as an eventual assessment program is likely to be nationwide and include periodical checks, the methods used should also be feasible in terms of resources, namely the number and qualification of the people involved and the time required for data gathering. Thus, the aim of this pilot study was to investigate the use of some methods (e.g., proxy interview, observers and certified veterinary behaviorist [VB] inspection, behavioral tests, and observations) to assess the prevalence of problem behavior in rescue shelter dogs.

Animals, materials, and methods

The study reported here was conducted in 3 rescue shelters in Northern Italy (details are given in Table 1), run by the same animal protection organization (Lega Nazionale per la Difesa del Cane) and housing a total of 428 dogs (114 females, 314 males, average shelter stay 4.66 years) at the time the study started.

The methods used to assess the prevalence of behavioral problems were as follows:

- Short ad hoc interview with a staff member regarding the dog's behavioral history
- Inspection by different nonexpert people conducted by walking along the aisles of the shelter
- Inspection by a VB conducted by walking along the aisles of the shelter.

Data gathering methods

Proxy interview, standardized test, and quantitative behavioral observations—phase A

Proxy interview

One possible way for the authority in charge to gather data on the prevalence of behavior problems in dogs in a shelter is proxy interview. An interview was carried out with a member of staff (i.e., the senior volunteer who was caring for the animals in both shelter 1 and in shelter 3 and with the dog trainer who was working in shelter 2, both females), gathering the following data for each dog that was housed at the shelter at the time the interview took place: the dog's identification number and name, dog's sex, reproductive status, age (or approximate age), date of arrival at the shelter, whether the dog had any behavioral problem at the point of interview and if so the type, time of onset, and duration of it. As the interviewed staff member was not a VB, the "behavioral problems" we asked about were not defined in terms of clinical behavior, but the staff member was simply asked to state if the dog had what she believed was a behavioral problem and to define it in her own words. The problems were then grouped into the very general nonclinical behavioral categories of having shown overt aggression (irrespective of concomitant fear signs), other problems related to fear/anxiety/separation problems, other problems. Among the "other problems" category, stereotypies (including circling, wall bouncing, pacing, tail chasing, licking/excessive self-grooming as in Stephen and Ledger (2005)) were further analyzed. A brief description of the dog for identification in the other phases of the study and date, name of the shelter, name of person answering were also collected. The interviewer asked the questions without having seen the dogs.

Reliability checks for the proxy interview

To validate the answers given by the respondent, intraobserver (conducting 2 interviews with the same respondent, 1 to 6 months apart) and interobserver (conducting an interview with another volunteer) reliability were evaluated on a subset of the dogs (100 for intraobserver and 98 for interobserver reliability, Table 2), that were still present in the shelter and were not reported as having altered their status (i.e., from not having a problem to having one, or vice versa, or altering the type of problem shown).

Table 1
Details on the 3 rescue shelters

Characteristic	Shelter 1	Shelter 2	Shelter 3
Name and place	"Parco Zoofilo di Frapiero", Frapiero (VE), Italy	"Il Rifugio del Cane", Rovigo (RO), Italy	"Il Rifugio del Cane", Rubano (PD), Italy
Number of dogs at start of study	97	115	216
Number of pens	45 (23 A, 22 B)	34 (25 A, 9 B)	80 (76 A, 4 B)
Size of pens	A: 12 m^2; B: 150 m^2	Varying in size, A between 13 and 30 m^2, B from 70 to 250 m^2	A: between 10 and 15 m^2; B: 26 m^2
Number of dogs per pen	A: 1 or 2 dogs (before introducing them into B); B: up to 8.	A: 1 to 4; B: up to 8	A: 1 to 4; B: up to 6
Details of the pens	A: Indoor and covered outdoor areas (floor: concrete, pebbles); B: Indoor area (approx. 5 × 5 meters) and half covered outside area (floor: concrete, grass).	A and B: Indoor and outdoor areas.	A: Outdoor covered area (floor: concrete, pebbles); B: Indoor area and half covered outside area (floor: concrete, pebbles).
Location of the dog houses*	A: Indoor area; B: Both indoor and outdoor areas	Indoor area.	A: Outdoor area; B: Both outdoor and indoor areas
Activities outside the home pen	Dogs not routinely taken out of their pen	Fenced area, for running free and training; walks outside the shelter	Dogs not routinely taken out of their pen
Staff and volunteers and their main chores	Two volunteers and 2 employees (feeding, cleaning)	40 Volunteers (exercising dogs), 2 employees (feeding, cleaning), a dog trainer (once/twice weekly, addressing behavioral problems, basic commands)	40 Employees/volunteers (feeding, cleaning)
Feeding time	Once daily: 10:30	Twice daily: 07:00 and 16:30	Once daily: 10:30

* The number of dog houses in each pen was suitable for the number of dogs in the pen.

Table 2
Activities performed in the 3 shelters and, between brackets, number of dogs involved

Activity	Shelter 1	Shelter 2	Shelter 3	Number of dogs	Time needed for assessment
Proxy interview	Y (97)	Y (115)	Y (216)	428	1.5′/dog
Intraobserver reliability testing	Y (40)	Y (20)	Y (40)	100	
Interobserver reliability testing	N	Y (49)	Y (49)	98	
Observer 1—man, “blind”	Y (67)	Y (96)	Y (118)	281	3′-4′/pen
Observer 2—woman, “blind”	Y (69)	Y (89)	Y (134)	292	3′-4′/pen
Observer 3: woman, “nonblind”	Y (81)	Y (98)	Y (136)	315	3′-4′/pen
Observer 4: woman, “blind,” standardized approach, video-recorded	Y (64)	Y (98)	Y (75)	237	3.5′/dog
Certified veterinary behaviorist (VB)	Y (66)	Y (110)	Y (127)	303	4′-6′/pen
Video-recorded behavioral observations	N	Y (12)	Y (11)	23	2-2.5 h/pen
Behavioral test	N	Y (17*)	N	17	21-25′/dog
Behavioral clinical consultation by a certified veterinary behaviorist	Y (8)	N	N	8	50′/dog

* Five dogs completed the test, whereas the test was discontinued at the first subtest for 4 dogs, at the second for 1 dog, at the third for 5 dogs, and at the fourth for 2 dogs.

Standardized test and quantitative behavioral observations

To investigate whether the behavioral problems identified by the staff could be detected by a standardized test or by behavioral observations, the following measures were also carried out:

- Behavioral tests, following Valsecchi et al. (2011), were carried out on a subset of dogs (see Table 1 for details). For ethical reasons, the test was interrupted if the dog showed significant fear or aggression (details in the Results section), otherwise all the subtests were conducted. The test was scored both directly by the person conducting it and video-recorded for scoring by one of the VBs, involved in phase C, blind to the condition of the dogs.
- Video-recorded behavioral observations were analyzed using both continuous behavioral and instantaneous (every 30 seconds) scan sampling methods (Martin and Bateson, 1986), on a subset of dogs in 2 shelters (see Table 2 for details). The dogs were videotaped for 1.5 hours on 1 day, half an hour before being fed in the morning, half an hour after being fed in the morning, and half an hour outside meals. We chose to limit observations to 1 day to mimic an inspection, which, even if it includes quantitative behavioral observations on a subsample of dogs, is unlikely to last more than a day. The videos were recorded while the dogs were in their usual pen, and people were not near them. The working ethogram is detailed in Table 3. The person performing the behavioral observation was blind to the results of the proxy interviews and of the activities in phase B and phase C.

Nonexpert observer observing the dogs from outside the enclosures—phase B

An inspection by different veterinary students was conducted to mimic an official inspection of the shelter premises conducted by a nonveterinary behaviorist inspector, who would observe the dogs from outside the pen, without entering it, for time and safety reasons. The inspection by the different observers took place on different days to the proxy interview, and on different days depending on the observer/VB. For agreement calculation, we only included dogs that had already been included in phase A and were still present in the shelter and that were visible and awake when the observer visited the shelter. Before assessment, the observers were given a briefing using standardized oral instructions and a written leaflet containing definitions and scoring forms. To assess the dogs, the nonexpert observer walked around the aisles of the rescue shelter outside the dogs' pens, without entering into them. For each dog, the observer had a form with name, sex, pen number, a short description enabling the observer to identify the dog and a question whether the dog appeared to be aggressive, assertive, diffident, shy, fearful, indifferent, sociable, agitated, stereotyping/showing lick granuloma, asleep, out of sight, other (specify). The Italian terms were defined as for general use in the Italian Language as in Devoto and Oli (1995). The answers were then coded as follows to compare them with the results of phase A: dogs appearing as aggressive as aggressive; dogs appearing as fearful, shy, or diffident as having a fear-related issue; dogs appearing as agitated, stereotyping/showing lick granuloma as having “other behavioral issues.” Hence, dogs categorized as having fear-related issues were those exhibiting the behaviors listed as “fear behaviors” in Table 3, and dogs categorized as aggressive were those exhibiting the behaviors listed as “aggressive behaviors” in Table 3. Dogs were categorized as stereotyping if they exhibited repetitive, invariant behavior without obvious aim or if they exhibited wounds that were likely to have been caused by excessive self-grooming. Dogs were categorized as assertive, if they were confident and exhibited the attitude of a dog that expects to be respected in canine relationships without having to resort to aggression. Dogs were categorized as agitated, if they exhibited a behavior characterized by high intensity and frequent changes in the performed behaviors. Dogs were categorized as indifferent if they exhibited a lack of interest and participation without showing signs of fear. Dogs were categorized as sociable if they appeared to seek out contact with people and other dogs, had a relaxed posture/facial expression during interactions, and did not show any sign of fear and aggression.

To minimize possible confounding variables, the procedure was repeated, on different days, as follows:

1. Observer 1—blind to staff assessment, man, veterinary student, nonstandardized approach (i.e., the observer was not given any instruction on how to approach the pens);
2. Observer 2—blind to staff assessment, woman, veterinary student, nonstandardized approach;
3. Observer 3—nonblind to staff assessment, woman, veterinary student, nonstandardized approach;
4. Observer 4—blind to staff assessment, same woman as observer 2, veterinary student, video-recorded standardized approach (taking around 30 seconds, as in the first phases, taking place before entering the pen, test described by Valsecchi et al., 2011).

Please note that although observers were not experts (e.g., not recognized dog trainers, not VBs) as veterinary medicine university students (fourth and fifth course year), they still had some knowledge of canine behavior (having completed a course in applied ethology), which could be similar to that of a Ministry employee general inspector.

Veterinary behaviorist observing the dogs from outside the enclosures—phase C

A VB, blind to the answers given by the staff member, was asked to visit the shelter and walk outside all enclosures with

Table 3
Working ethogram used for the behavioral observations

Behavioral category	Behavior	Description
Fear behaviors	Crouched posture	The animal shows a rounded top line, especially at the rump, with flexed hindquarters
	Low posture	The animal moves with the legs more flexed than for normal quadrupedal movement or locomotion
	Low tail	The tail is held in tight contact with the perineum and its distal part is either held low or between the hind legs
	Trembling	The dog appears to vibrate or to shake
	Fear facial expressions	Mouth: lips drawn back; Eyes: squinting or completely opened round eyes with visible sclera (whale eye, Aloff, 2005, p.42), gaze is averted; Ears lowered to the side or flattened
	Avoidance/hiding	The animal runs away from a stimulus showing some of the aforementioned fear behaviors and if possible goes into a dog house disappearing from view
Aggressive behaviors	Growling	The dog emits a low-pitched vibrato vocalization
	Show teeth	The dog retracts his/her lips so that the teeth are exposed
	Rigid forward posture	The dog stands with limbs slightly more extended than normal, muscle tension evident, and his/her center of gravity is more in front than normal
	Snap	The dogs lunges with his/her head toward a target and very quickly opens and closes his/her jaws near, but not in contact, with another individual, without the need for the other animal to move to avoid contact
	(Attempt to) bite	Opening and rapid closing of the jaws grasping the flesh of another individual, or failing to grasp because the other individual quickly moves away McDonnell, 2003, p. 133)
Stereotypies (invariant repetitive behaviors with no apparent goal or function)	Pacing	The dog appears to walk repetitively, along an invariant path around the pen without an obvious destination. The animal was deemed to pace if he/she had completed the same route 3 or more times.
	Spinning—tail chasing	The dog quickly revolves around in a circular motion while in a standing position, the body can be significantly bent as if the dog is trying to reach his/her tail (tail chasing), or straight or only slightly bent (spinning)
	Stereotypic barking	The dog vocalizes in a repetitive invariant way and does not appear to be easily distracted from the behavior
	Biting the wire mesh	The dog opens his/her mouth and then closes it around the metal of the wire mesh several times (more than 3 times) and does not appear to be easily distracted from the behavior
	Stereotypic licking of objects	The dog repeatedly (more than 3 times) licks (puts its tongue in contact with and draws it on a surface) in the absence of an apparent reason for doing so
	Stereotypic licking of one's body parts	The dog repeatedly licks (puts its tongue in contact with and draws it on a surface) or nibbles (puts his/her incisors in contact with a surface and slightly opens and closes his/her jaws) a part of his/her own body, in the absence of a medical reason for it (to be later checked)
	Wall-bouncing	The dog repeatedly (more than 3 times) jumps up putting his/her forepaw in contact with the walls of his/her enclosure, in the absence of an apparent reason for it, and does not appear to be easily distracted from the behavior.
	Other stereotypic behavior	Any other invariant repetitive behaviors with no apparent goal or function
Other behaviors		Any other instance in which the dog was visible and did not display the behaviors listed previously (e.g., eating, resting, playing)
Out of sight	Out of sight	Any situation in which the observer could not see the animal

the same procedure and instructions as in phase B. Two VBs, both female, participated: one visited shelters 1 and 3, the other shelter 2. Only dogs that had already been included in phase A and were still present in the shelter when the veterinary behaviorist visited and dogs that were visible and awake were included in agreement calculation. The VB who had not visited shelter 2, who was blind to the staff member's responses, acted as a second scorer for the behavioral test videos (which were video-recorded in shelter 2). The VB who had visited shelter 1 conducted behavioral consultations for 8 of the dogs that were described as having a behavioral problem by the senior volunteer.

Statistical analysis

A chi square test was used to calculate whether there were differences in the prevalence of behavioral problems, as stated by the staff member, among the 3 shelters.

To compare results among different observers regarding their agreement with the staff member, we calculated the number of dogs reported to have at least 1 behavior problem both by the staff member and the observer/VB (+/+), the number of dogs reported to not have a behavior problem both by the staff member and the observer/VB (−/−), the number of dogs reported to not have a behavior problem by the staff member, but to have one (or more) by the observer/VB (−/+),

and the number of dogs reported to have 1 or more behavior problems by the staff member, but to not have a behavior problem by the observer/VB (+/−). A sensitivity value (i.e., ratio of true positives discovered by the method) was calculated as the number of +/+ dogs divided by the sum of +/+ and +/− dogs. A specificity value (i.e., ratio of true negatives discovered by the method) was calculated as the number of −/− dogs divided by the sum of −/− and −/+ dogs. However, it has to be borne in mind that the aforementioned values were not real sensitivity and specificity values because the classification in real positives and real negatives in the sample was not based on an objective external criterion, but on the subjective opinion of the interviewed staff member. Cohen's k was calculated to assess all correspondences among different observers and methods.

To compare data gathered by using either continuous behavioral rules or instantaneous scan rules, a Spearman rank correlation was calculated between the percentage of time spent in the behavior (for the continuous rule) and the percentage of scans the animal was recorded performing the behavior (for the instantaneous rule). Fifty-two minutes of videos were scored twice by the same observer at a distance of 2 weeks, and intraobserver reliability was calculated as the percentage of scans in agreement as divided for the total number of scans.

Results

Phase A

Proxy interview

Staff reported a 57.94% prevalence of behavioral problems, with significant differences among shelters (Chi-square = 14.80, df = 2, $P < 0.001$; Table 4). The most often reported main problem was "fear-related" issues without explicit aggression (Table 4). The reported prevalence of stereotypies was 1.88%. In only 1 case, the stereotypy was reported to have started during the stay at the shelter (i.e., 1 year after arrival). Overall, only 4.44% of the behavioral problems were reported to have started during the stay at the shelter (Table 4). Intraobserver and interobserver reliability for the proxy interview had Cohen's k = 1 and k = 0.63, respectively (Table 5).

Behavioral test and observations

Only 5 of 17 dogs completed the test. For 8 dogs (7 were reported to have a fear-related issue and 1 to have shown overt aggression), the test was discontinued because they were too afraid, for 4 (3 were reported to have shown overt aggression and 1 to have a fear-related issue) because they showed aggression toward the tester. Of the 5 dogs that completed the test, 1 showed stereotypic behavior during the test (confirming proxy), but was otherwise sociable, 1 was confirmed as having fear-related issues, 1, defined as shy, was scored as sociable, 1, reported to be without issues, was restless, and 1, reported not to have behavior problems, was shy when approached in the pen, but otherwise sociable for the rest of the test.

The results of the behavioral observations are shown in Table 6. Intraobserver concordance was 97% (i.e., 97% of the scans were in agreement). Fifteen dogs, reported by staff as not having a stereotypy, were seen performing stereotypies during the observations and 7 of these "nonreported" dogs showed this kind of behavior for more than 10% of the observation time. Concordance with proxy interview for the presence/absence of problem

Table 5
Agreement between observers/veterinarian and proxy interview and among observers/veterinarian

Comparison	(+/+)	(−/−)	(+/−)	(−/+)	Cohen's K	Sensitivity	Specificity
Proxy versus observer 1	89	80	83	29	0.23	0.52	0.73
Proxy versus observer 2	89	79	94	30	0.19	0.49	0.72
Proxy versus observer 3	118	75	80	42	0.22	0.60	0.64
Proxy versus observer 4	86	66	57	28	0.29	0.60	0.70
Proxy versus veterinarian	106	91	74	32	0.31	0.59	0.74
Observer 1 versus observer 2	58	78	36	33	0.32	n. c.	n. c.
Observer 1 versus observer 3	79	80	25	43	0.40	n. c.	n. c.
Observer 1 versus observer 4	57	61	28	26	0.37	n. c.	n. c.
Observer 1 versus veterinary behaviorist	59	60	29	30	0.34	n. c.	n. c.
Observer 2 versus observer 3	69	78	19	39	0.44	n. c.	n. c.
Observer 2 versus observer 4	52	75	24	29	0.40	n. c.	n. c.
Observer 2 versus veterinary behaviorist	55	67	25	40	0.31	n. c.	n. c.
Observer 3 versus observer 4	87	84	21	20	0.61	n. c.	n. c.
Observer 3 versus veterinarian	86	79	19	15	0.66	n. c.	n. c.
Observer 4 versus veterinarian	54	65	34	19	0.39	n. c.	n. c.
Intra-proxy	68	32	0	0	1	1	1
Inter-proxy	69	16	2	11	0.63	0.97	0.59

(+/+) Dogs reported as having a behavioral problem by both people, (−/−) dogs reported as having no behavioral problem by both people, (+/−) dogs reported to have a behavioral problem by the first person and none by the second, (−/+) dogs reported to have no behavioral problem by the first person and to have one by the second. n. c. stands for "not calculated." Please note that in the case of intra-proxy reliability, the comparisons are made between different interviews to the same person.

Table 4
Problem behavior as reported by staff

Shelter	Problem	No problem	Reported as starting during stay	Reported as solved during stay	Prevalence %	Number of main "aggression"	Number of main "fear"	Number of main "other"
Shelter 1	52	45	1	12	53.61	16	28	8
Shelter 2	84	31	2	0	73.04	38	43	3
Shelter 3	112	104	7 (+1*)	2	51.85	27	71	14
Total	248	180	11	14	57.94	85†	138	25

* One dog was reported to have altered the type of problem she presented (from "very fearful" upon arrival, to "hyper-agitated" 2 months later).
† 51 aggressive only to people, 17 only to dogs, and 17 to both.

Table 6
Comparison between staff classification and behavioral observation results

Name	Problem (proxy)	Stereotypies		Aggression		Fear behaviors	
		Duration %	Scan %	Duration %	Scan %	Duration %	Scan %
Garibaldi	Fear	0.0	0.0	0.0	0.00	0.2	0.0
Tonino	Aggr. fear	1.8	3.3	3.2	0.56	0.0	0.0
Martino	Aggr. fear	10.4	16.7	4.6	9.44	0.0	0.0
Jambo	Stereot.	13.9	16.7	0.0	0.00	0.3	0.6
Dog	Fear	47.3	25.6	0.0	0.00	0.0	0.0
Nausica	Stereot.	61.1	35.0	0.0	0.00	0.0	0.0
Fara	None	0.0	0.6	0.0	0.00	7.1	0.0
Lucrezia	Fear	0.0	0.0	0.0	0.00	0.3	0.0
Matisse	Fear	3.2	6.7	0.1	0.00	0.0	0.0
Pitù	Aggr. fear	27.8	1.1	0.1	0.00	0.1	0.0
Eddy	Fear	1.6	6.1	4.1	2.78	0.0	0.0
Silvestro	Fear	4.5	4.4	0.0	0.00	2.8	0.6
Dodo	Fear	25.3	23.3	0.0	0.0	1.0	1.1
Fiume	Fear	0.0	0.0	0.0	0.0	1.2	0.6
Billy	None	10.7	8.9	0.1	0.0	0.0	0.0
Trixy	None	22.7	21.7	15.7	1.7	0.0	0.0
Pippa	None	4.4	3.3	0.0	0.0	0.0	0.0
Notte	Other	0.2	1.7	1.1	0.6	0.0	0.0
Oscar	Aggr	6.8	10.6	0.5	0.0	0.0	0.0
Steve	None	0.0	0.0	0.0	0.0	2.3	0.0
Foxy	Fear	2.3	8.9	1.0	1.1	4.9	0.6
Griffo	Fear	25.8	26.1	0.1	1.1	0.5	1.1
Luce	Fear	4.0	7.2	0.0	0.0	2.8	2.8

behavior was k = 0 for continuous, and k = 0.10 for scan sampling.

The percentage of time spent performing the behavior (as recorded by continuous behavioral rule) and the percentage of scans the animal was recorded performing the behavior (as recorded by instantaneous scan rule) showed a fair correlation for stereotypies ($r_s = 0.84$, $P < 0.001$) and aggression ($r_s = 0.89$, $P < 0.001$), but a lower correlation for fear behaviors ($r_s = 0.66$, $P < 0.001$).

Phase B

The prevalence of problem behavior according to nonexpert observers varied between 41% and 51%. Overall concordance was rather low (Table 5).

Phase C

The prevalence of dogs showing behavior suggestive of behavioral problems as recorded by VB inspection was 46%. The VB categorization coincided with that of the staff member with a sensitivity = 0.59, a specificity = 0.74, and a k = 0.31 (Table 5). During inspection, the VB identified 3 additional dogs as displaying stereotypies that were reported by the staff as not having a behavioral problem (Table 7). The VB failed to identify 1 of the 2 dogs which the staff had reported as stereotyping, which was included in the behavioral observations, although he was stereotyping for more than 10% of his time during observations.

The behavioral consultations took approximately 50 minutes each (30 minutes approx. history taking with the volunteer and 20 minutes of interaction with the dog inside the pen) and confirmed that the 8 dogs had behavioral problems.

Discussion

This pilot study investigated some methods (i.e., proxy interview and inspection of the pens from outside; performed by either a veterinary student or a VB and, on a subsample, behavioral observation, test and clinical consultation) to assess the prevalence of behavioral problems in shelter dogs, with the aim of evaluating their suitability to be included in a routine official shelter quality/standard assessment.

Table 7
Comparison of what was reported by the staff member and what was reported by the veterinary behaviorist (VB) and the nonexpert observers regarding dogs showing stereotypies

Shelter	Name	Staff interview	VB	Observers Y/N
1	Alì	Yes—repeatedly biting the mesh wire	Not seen	0/2*
1	Baro	Yes—acral lick	Not seen	0/3*
2	Lupo	Yes—spinning	Yes	0/4
2	Jambo	Yes—pacing	No	1/3
2	Malcolm	Yes—pacing	No	0/4
2	Scirocco	Yes—pacing	No	0/4
2	Fragola	Yes—pacing	No	0/4
2	Omar	No	Yes	0/4
3	Tobia	Yes—stereotypic barking	No	0/4
3	Neri	No	Yes	0/4
3	Carol	No	Yes	0/4

* Some of the observers did not see the dog.

The prevalence of behavioral problems found in the present pilot study was 58% for the staff, 46% for the VB, and 45% on average among nonexpert observers. However, the results of the video-recorded behavioral observations performed on a small subsample of dogs suggest that some problems, such as stereotypies, are likely to be severely underestimated and therefore are best assessed by video-recorded behavioral observations. The link between stereotypies and welfare is complex; therefore, the presence of a stereotypy cannot be equated with decreased welfare in all cases (Mason and Latham, 2004). For example, as most stereotypies in the present study were reported as being present from the first day of entry to the shelter, it would be important to assess whether they were already present before arriving at the shelter, as stereotypies can become independent from their causation with time (Mason and Latham, 2004).

Because of the scarcity of studies on the behavioral problems in shelter dogs while in the shelter, comparison of the data of the present study with literature is difficult. Stephen and Ledger (2005) found that 63% of the dogs displayed at least one of the studied poor welfare indicators in the first 2 weeks of their stay in a shelter, but the behaviors targeted in their study overlapped only partially to those targeted by the present pilot study. Barnard et al. (2016) reported a less than 1% prevalence of abnormal behaviors recorded by observers in shelters. This finding disagrees with the results of the present study. Part of the difference could be due to the fact that Barnard et al. (2016) were looking for "abnormal behavior," whereas in the present study, we reported all instances of behavior reported as "problematic" by the staff. The prevalence of stereotypies, which could be considered abnormal behavior, found in the present study (1.88%) is similar to Barnard et al., (2016) data. Orihel and Fraser (2008) found that 16 of the 60 dogs (26.67%) that took part in the study's initial screening showed moderate-to-severe dog-to-dog aggression, which is more than 3 times the value reported by staff members in the present study. Marder et al. (2013) found 20 of 97 (21%) dogs to be aggressive around food items during a routine test upon admittance at a shelter. Bollen and Horowitz (2008) found that 39% of the dogs taking an aggression test in the first days after admission at a shelter failed it. Also this value is higher than that reported by staff members in the present study (i.e., 18.93%). In Italy, many shelters do not have a standardized testing protocol for dogs entering them. Where testing is carried out, dogs found to be "aggressive" are unlikely to be euthanized, even if dogs found to be dangerous are exempt from the no-kill policy enforced by Italian law.

If behavioral problem prevalence is to be included as a relevant indicator in official protocols assessing shelter quality/standard, its evaluation method has to be examined in terms of feasibility, reliability, and validity. Although further research is needed to draw clear conclusions, the results of the present pilot study highlight some major difficulties in objectively assessing behavioral problem prevalence in shelters.

Methods that were feasible in terms of time and resources had some serious validity issues. Inspection of the dogs from outside of the pens by a qualified assessor showed low overall reliability. Sensitivity was even lower than specificity; it was easier for the observer to underestimate possible behavioral problems than to attribute a behavioral problem to a dog that had none. Concordance among different observers (i.e., interobserver reliability) was also low. Even when the observer was a certified veterinary behaviorist, sensitivity and overall concordance did not increase significantly, although the VB was able to identify problems in dogs that were reported not to have behavioral problems by the staff. The low sensitivity is not surprising as the dogs might have a problem that occurred only in situations that were different from those of the inspection. The amount of time spent observing each dog during inspections was limited, because of feasibility constraints, as it is likely to be in a large-scale official shelter assessment protocol. The proxy interview showed excellent intrarespondent repeatability and was feasible in terms of time and resource, but interrespondent reliability was not so good. Staff members may vary in both experience and education and proxy interviews rely entirely on the staff answers. In addition, the staff member may experience conflict as the shelter may be penalized for poor performance, and individual members may have loyalty to individual dogs irrespective of behavior. In addition, staff are likely to underestimate behaviors that appear to be performed mostly in the absence of people, such as stereotypies.

The other methods also appear to have serious limitations, mainly regarding their feasibility. For example, behavioral counseling for each dog by VB has good validity (although it relies partially on history taking), but its feasibility is almost null, when more than a few dogs are to be evaluated. In our pilot study, each consultation took almost an hour (only slightly less than what was reported by Mège et al, 2006, p. 36), so it would be extremely expensive in terms of time and resources to provide it. Performing behavioral tests is less time consuming but still requires a considerable amount of time (Taylor and Mills, 2006; Table 1). However, as the predictive value of testing has been queried (e.g., Christensen et al., 2007; Marder et al., 2013; Patronek and Bradley, 2016), it is reasonable to be cautious as to whether test results are representative of actual problem behavior. Problems such as stereotypies are unlikely to be detected by the usual behavioral battery tests used in shelters (e.g., Valsecchi et al., 2011; Vanderborg et al., 1991), unless the dog performs the behavior when someone is approaching his/her pen. Video-recorded behavioral observations were able to detect behavioral problems, which are more likely to happen when people are not near the dogs, but they are very time consuming (Table 1). Moreover, even when continuous behavior sampling was used, some dogs, which were reported by staff to have fear-related problems, were not recorded showing fear-related behavior. This is not surprising, as the dogs might be afraid of stimuli, which were not present in their pens during the observations, but still limits the usefulness of behavioral observation if not in combination with other methods.

As far as the results of this pilot study are concerned, caution is needed when planning to include the assessment of the prevalence of behavioral problems in any protocol assessing shelter quality/standard because none of the approaches included in the present study was found to be suitable to fulfill both validity and feasibility requirements. Further studies on the topic are needed before a protocol on how to assess behavioral problems in shelters for official evaluation might be formulated.

Conclusions

Although the prevalence of behavioral problems reported by shelter staff members was already rather high (58% approximately), the results of the present pilot study suggest that some problems, such as stereotypies, could be largely underestimated, probably because most of them are more likely to happen when there are no people around. Concordance between what was reported by the shelter staff members and what was recorded by observers inspecting the pens was not high, with ability to identify dogs reported to have a behavioral problem being lower than ability to identify dogs without a behavioral problem. The results of this pilot study suggest that further studies are needed to find a feasible and reliable method to assess the prevalence of behavioral problems in shelter dogs if this variable is to be included in an official shelter quality/standard assessment protocol.

Acknowledgments

The authors wish to thank Piera Piantoni and Angela Newman, for answering the interviews, the Dondi family for granting access to 2 of the shelters, Elizabeth Walsh for language revision, the blind observers, all the shelters' staff, and the dogs. Study funded by Dor/ex60% MIUR. Piera, you will always be missed.

Ethical considerations

Ethical approval is not needed in Italy for this kind of study.

Conflict of interest

There is no conflict of interest.

Authorship

The idea for the paper was conceived by Simona Normando; the experiments were designed by Simona Normando, with the help of Elena Bellaio and Gianna di Raimondo; the experiments were performed by Gianna di Raimondo, Elena Bellaio, and Simona Normando; the data were analyzed by Gianna di Raimondo and Simona Normando; the paper was written by Simona Normando, with the help of Elena Bellaio and Gianna di Raimondo.

References

Aloff, B., 2005. Canine Body Language – a Photographic Guide. Dogwise Publishing, Wenatehee, USA.

Barnard, S., Pedernera, C., Candeloro, L., Ferri, N., Velarde, A., Dalla Villa, P., 2016. Development of a new welfare assessment protocol for practical application in long-term dog shelters. Vet. Rec. 178, 18.

Bollen, K.S., Horowitz, J., 2008. Behavioral evaluation and demographic information in the assessment of aggressiveness in shelter dogs. Appl. Anim. Behav. Sci. 112, 120–135.

Clark, C.C.A., Gruffydd-Jones, T., Murray, J.K., 2012. Number of cats and dogs in UK welfare organisations. Vet. Rec. 170, 493.

Christensen, E., Scarlett, J., Campagna, M., Houpt, K.A., 2007. Aggressive behavior in adopted dogs that passed a temperament test. Appl. Anim. Behav. Sci. 106 (1-3), 85–95.

Diesel, G., Pfeiffer, D.U., Brodbelt, D., 2008. Factors affecting the success of rehoming dogs in the UK during 2005. Prev. Vet. Med. 84, 228–241.

Diesel, G., Brodbelt, D., Pfeiffer, D.U., 2010. Characteristics of relinquished dogs and their owners at 14 rehoming centers in the United Kingdom. J. Appl. Anim. Welf. Sci. 13, 15–30.

De Massis, F., Arena, L., Berteselli, G.V., Ferri, N., Lombardo, F., Messori, S., Dalla Villa, P., 2014. SHELTER QUALITY. Welfare Assessment Protocol for Shelter Dogs. 2nd version. Teramo, © Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "G. Caporale"(first version authors: S. Barnard, C. Pedernera, A. Velarde,

P. Dalla Villa), ISBN 9788890869167. Retrieved at: http://www.carodog.eu/wp-content/uploads/2014/02/Shelter-Quality-Protocol-2014.pdf. Accessed October 20, 2017.

Devoto, G., Oli, G.C., 1995. Dizionario Della Lingua Italiana [Italian Dictionary]. Le Monnier, Firenze, Italy.

Elliott, R., Toribio, J.A., Wigney, D., 2010. The Greyhound Adoption Program (GAP) in Australia and New Zealand: A survey of owners' experiences with their greyhounds one month after adoption. Appl. Anim. Behav. Sci. 124, 121–135.

Kiddie, J.L., Collins, L.M., 2014. Development and validation of a quality of life assessment tool for use in kennelled dogs (*Canis familiaris*). Appl. Anim. Behav. Sci. 158, 57–68.

Marder, A.R., Shabelansky, A., Patronek, G.J., Dowling-Guyer, S., D'Arpino, S.S., 2013. Food-related aggression in shelter dogs: A comparison of behavior identified by a behavior evaluation in the shelter and owner reports after adoption. Appl. Anim. Behav. Sci. 148, 150–156.

Martin, P., Bateson, P., 1986. Measuring Behaviour: An Introductory Guide. Cambridge University Press, Cambridge, UK.

Mason, G.J., Latham, N., 2004. Can't stop, won't stop: is stereotypy a reliable animal welfare indicator? Anim. Welfare 13, S57–S69.

McDonnell, S., 2003. A Practical Field Guide to Horse Behavior—the Equid Ethogram. The Blood Horse Inc., Hong Kong.

Mège, C., Beaumont-Graff, É., Béata, C., Diaz, C., Habran, T., Marlois, N., Muller, G., 2006. Patologia Comportamentale nel Cane [Pathologie comportementale du chien]. Masson s.p.a., Milano, Italy.

Newbury, S., Blinn, M.K., Bushby, P.A., Barker Cox, C., Dinnage, J.D., Griffin, B., Hurley, K.F., Isaza, N., Jones, W., Miller, L., O'Quin, J., Patronek, G.J., Smith-Blackmore, M., Spindel, M., 2010. Guidelines for standards of care in animal shelters. www.sheltervet.org: the Association of Shelter Veterinarians. Retrieved at: https://www.sheltervet.org/assets/docs/shelter-standards-oct2011-wforward.pdf. Accessed October 4, 2018.

Normando, S., Stefanini, C., Meers, L., Adamelli, S., Coultis, D., Bono, G., 2006. Some factors influencing adoption of sheltered dogs. Anthrozoös 19 (3), 211–224.

Orihel, J.S., Fraser, D., 2008. A note on the effectiveness of behavioural rehabilitation for reducing inter-dog aggression in shelter dogs. Appl. Anim. Behav. Sci. 112, 400–405.

Patronek, G.J., Bradley, J., 2016. No better than flipping a coin: Reconsidering canine behavior evaluations in animal shelters. J. Vet. Behav.: Clin. Appl. Res. 15, 66–77.

Patronek, G.J., Glickman, L.T., Beck, A.M., McCabe, G.P., Ecker, C., 1996. Risk factors for relinquishment of dogs to an animal shelter. J. Am. Vet. Med. Assoc. 209, 572–581.

Protopopova, A., Gunter, L.M., 2017. Adoption and relinquishment interventions at the animal shelter: a review. Anim. Welfare 26, 35–48.

Stephen, J.M., Ledger, R.A., 2005. An audit of behavioural indicators of poor welfare in kennelled dogs in the United Kingdom. J. Appl. Anim. Welf. Sci. 8 (2), 79–95.

Taylor, K.D., Mills, D.S., 2006. The development and assessment of temperament tests for adult companion dogs. J. Vet. Behav.: Clin. Appl. Res. 1, 94–108.

Valsecchi, P., Barnard, S., Stefanini, C., Normando, S., 2011. Temperament test for rehomed dogs validated through direct behavioral observation in shelter and home environment. J. Vet. Behav.: Clin. Appl. Res. 6, 161–177.

Vanderborg, J., Netto, W.J., Planta, D.J.U., 1991. Behavioral-testing of dogs in animal shelters to predict problem behavior. Appl. Anim. Behav. Sci. 32 (2-3), 237–251.

Wells, D.L., Hepper, P.G., 2000. Prevalence of behaviour problems reported by owners of dogs purchased from an animal rescue shelter. Appl. Anim. Behav. Sci. 69 (1), 55–65.