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Survey of animal shelter managers regarding shelter veterinary medical services

B.E. Laderman-Jones [a,*], K.F. Hurley [b], P.H. Kass [c]

[a] Placer Society for the Prevention of Cruelty to Animals, Roseville, CA 95678, USA
[b] Koret Shelter Medicine Program, Center for Companion Animal Health, UC Davis School of Veterinary Medicine, University of California, Davis, 1 Garrod Drive, CA 95616, USA
[c] Department of Population Health and Reproduction, UC Davis School of Veterinary Medicine, University of California, Davis, 1089 Veterinary Medicine Drive, CA 95616, USA

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ABSTRACT

Veterinary services are increasingly used in animal shelters, and shelter medicine is an emerging veterinary specialty. However, little is known about working relationships between animal shelters and veterinarians. The aims of this survey were to characterize working relationships that shelter personnel have and want with veterinarians, identify opinions that shelter managers have regarding the veterinarians they work with, and determine areas for relationship growth between veterinarians and shelter managers. An electronic survey was distributed to 1373 managers of North American animal shelters; 536 (39.0%) responded.

Almost all shelters had some veterinary relationship, and most had regular relationships with veterinarians. The proportion of shelters that used local clinics (73.9%) was significantly higher than the proportion that retained on-site paid veterinarians (48.5%). The proportion of respondents who did not have but wanted a paid on-site veterinarian (42%) was significantly higher than the proportion of respondents who did not use local clinics but wanted to (7.9%). These data suggest shelter managers valued veterinary relationships, and wished to expand on-site veterinary services. Almost all shelters in this study provided some veterinary care, and all respondents identified at least one common infectious disease, which, for most, had a substantial negative impact on shelter successes. Respondents indicated that the most important roles and greatest expertise of veterinarians were related to surgery, diagnosis and treatment of individual animals. Education of both veterinarians and shelter managers may help ensure that shelters benefit from the full range of services veterinarians can provide, including expertise in disease prevention and animal behavior.

Introduction

In recent years, society's expectations for care of animals in shelters have increased (Miller and Hurley, 2009), requiring shelters to use veterinarians to a greater extent than ever before (Burns, 2006).[1] For example, surveys of Ohio animal care agencies found that the proportion of agencies that had associations with veterinarians doubled between 1996 and 2006 (Lord et al., 1998, 2006). Concurrently, veterinarians have become more involved in animal shelters (Yoffe-Sharp and Olson, 1996; Foley, 2003; Lofflin, 2007; Ellis, 2008). The Association of Shelter Veterinarians (ASV) was formed in 2001, and in 2014, the American Board of Veterinary Specialties and American Veterinary Medical Association recognized shelter medicine practice as a veterinary specialty under the American Board of Veterinary Practitioners.[2] Educational opportunities in shelter medicine have increased for veterinary students (Monti, 2000; Foley, 2003; Snowden et al., 2008), as well as veterinary interns and residents, and shelter medicine tracks have become more widely available at veterinary conferences. Additionally, textbooks have been published on shelter medicine (Miller and Zawistowski, 2013), infectious disease management in shelters (Miller and Hurley, 2009), and related fields such as veterinary forensics (Sinclair et al., 2006; Cooper and Cooper, 2007; Munro and Munro, 2008; Merck, 2012).

In many ways, national humane organizations have welcomed veterinarians into their realm. In 1998, the American Humane

* Corresponding author. Tel.: +1 530 9025874.
E-mail address: barbj@pspca.org (B.E. Laderman-Jones).

[1] See: Avanzino, R., 2007. What is shelter medicine, and what is the role of a veterinarian in a shelter? www.maddiesfund.org/About_Us/Maddies_Editorials/What_is_the_Role_of_a_Veterinarian_in_Animal_Shelters.html (accessed 10 February 2016).

[2] See: Association of Shelter Veterinarians Board Specialty. www.sheltervet.org/board-specialty (accessed 10 February 2016).

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Association, in collaboration with a team of 12 veterinarians, published a book on recognizing and reporting animal abuse (Olson, 1998). *Animal Sheltering Magazine*, published by the Humane Society of the United States (HSUS), has regularly included articles on shelter medicine since 2004. Several humane organizations, such as the American Society for the Prevention of Cruelty to Animals (ASPCA), are registered providers of continuing veterinary education. In 2010, the ASV published Guidelines for Standards of Care in Animal Shelters,[3] which included a forward signed by the National Federation of Humane Societies, the Society of Animal Welfare Administrators (SAWA), the National Animal Control Association (NACA), the ASPCA, and the HSUS.

While a partnership is undoubtedly developing between the veterinary profession and the animal sheltering community, the relationship has sometimes been strained[1] (Miller, 2007; Scarlett, 2008; Miller and Hurley, 2009). According to Foley (2003), '*many (shelters) have some level of dissatisfaction with their veterinarian*', and the expected roles and benefits of veterinarians to shelters may be unclear. It has been suggested that '*shelters often can't afford a veterinarian*' (Burns, 2006), and that veterinarians may feel pressured to donate or discount services to avoid being viewed as selfish (Goldberg, 1990; Robinson, 1990).[4] The benefits of increasing veterinary involvement in shelters have been debated (Levy, 2004; Mangiamele, 2004), and may have variable impact on costs, disease rates and other important outcomes. For example, a study of animal care agencies in Ohio showed no significant association between use of veterinary services and euthanasia rate (Lord et al., 2006). Nevertheless, surveys in that state consistently identified veterinary services as one of the five most pressing needs of animal care agencies (Lord et al., 1998, 2006). The veterinary profession may also benefit from increased attention to shelter practice.

The purposes of this study were to characterize the working relationships that animal shelter personnel have and want with veterinarians, to identify the opinions of shelter managers regarding the veterinarians with whom they work, and to determine areas for growth in relationships between veterinarians and shelter managers.

Materials and methods

A list of 3353 US animal shelters was obtained from the HSUS (A. Rowan, personal communication; Rowan, 2006). This was produced by aggregating lists from three national humane organizations (HSUS, ASPCA and American Humane Association), then further expanding the list by directly asking each listed organization to identify additional sheltering organizations in their own or nearby metropolitan areas, cities, or counties. Only shelters with valid email addresses were included in the sampling frame. An additional 147 email addresses were obtained by electronically distributing requests for shelter managers to participate in the survey to members of SAWA, NACA, and ASV. The final list was sorted alphabetically by organization name in order to identify and eliminate duplicates. The total sample size was 1373.

An email invitation containing a link to a survey was sent to each address using an online survey application.[5] To maintain as much anonymity as possible, email addresses were not stored with survey responses, and respondents were not asked to provide any identifying information about themselves or their shelters. The survey was given exempt approval status by the Institutional Review Board at the University of California, Davis.

The survey was developed with guidance from shelter veterinarians, survey-research experts, epidemiologists, and statisticians. It consisted of 42 questions related to shelter and respondent demographics, existing and desired veterinary relationships, preventive or screening procedures performed, identification and impact of infectious diseases, perceived importance of veterinary tasks, perceived knowledge level of respondents and veterinarians, and satisfaction with veterinary services. To assess the importance of veterinary tasks, respondents were presented with a list of 15 tasks and asked to indicate the five most and five least important for veterinarians working with their shelters to perform. Two primary strategies were used to develop the task list. First, tasks that were most often listed in posted shelter veterinary job descriptions on the ASV website and elsewhere were identified and included. Second, experts in shelter medicine were consulted and the job task analysis contained in the Petition for a Recognized Veterinary Specialty in Shelter Medicine Practice[6] was referred to in order to identify additional activities that were considered important potential contributions of shelter veterinarians. An importance score for each task was calculated by subtracting the number of respondents who chose the task among the five least important from the number who selected the task among the five most important. To assess perceived knowledge levels, respondents were asked to rate their own levels of knowledge and those of the veterinarians who worked with their shelters in the subject areas of shelter operations, cleaning and disinfection products and protocols, vaccination products and protocols, population management (e.g. quarantine, isolation, segregation, adoptability, euthanasia decisions), diagnosis of common shelter infectious diseases (e.g. upper respiratory infections, canine parvovirus and canine distemper infections, feline panleukopenia, dermatophytosis), treatment of common shelter infectious diseases listed above, diagnosis and treatment of other medical problems, and behavior of shelter animals (including stress reduction, behavioral assessment, and behavioral and environmental enrichment). Rating choices were 'not at all knowledgeable,' 'slightly knowledgeable,' 'knowledgeable,' 'very knowledgeable,' and 'not applicable.' The last choice was provided for respondents who did not work with and therefore could not rate the knowledge level of veterinarians, but was also an available choice for respondents' ratings of themselves.

Twenty-three shelter managers with whom the first author (BEL) was acquainted pilot-tested the survey, and revisions were made based on feedback from this group. Survey invitations were sent to 1373 managers of animal shelters. To encourage participation, the invitation stated that respondents would be entered in a prize drawing. Additional invitations were sent five times at approximately 10-day intervals to those who had not responded. Only respondents who identified themselves as the 'director' or 'manager' of an eligible animal shelter were included. Eligible shelters were those operated by a government department and/or a tax-exempt nonprofit organization that had a central facility for housing dogs and/or cats and operated an adoption program.

Statistical methods

Categorical data were summarized using counts and percentages. Respondents were grouped into four regions (Northeast, Southeast, Midwest and West) as previously described by Blagburn et al. (1996). In data analysis, a 'regular relationship' with a veterinarian was defined as one or more of the following: veterinarian as director, veterinarian on board of directors, paid on-site veterinarian, regular use of local veterinary clinics, and regular visiting volunteer veterinarian. Chi-square tests of homogeneity were used to evaluate the distribution of categorical response variables between groups. Proportions of respondents indicating different veterinary relationships were compared using Fisher's exact tests. Differences in the distribution of ordinal variables between shelters with and without certain veterinary relationships were evaluated using Kruskal–Wallis tests. Comparisons of ordinal ratings of respondents' own knowledge levels and their appraisals of the knowledge levels of veterinarians in different subject areas were made using Wilcoxon signed-rank tests for paired data. The Wilcoxon rank-sum test was used to compare ordinal ratings of knowledge levels by shelter managers who were veterinarians with ordinal ratings of knowledge levels by shelter managers who were not veterinarians. P values <0.05 were considered statistically significant.

Results

Five hundred thirty-six responses were received from managers of shelters that met all eligibility criteria (39.0% response rate.) All managers completed the entire survey except for 43 respondents who left the last four questions unanswered. Responses from these questions were not included in data analysis, so incomplete responses were included with complete responses in all analyses. The response rate for shelters in the West (145 responses of 313 invitations, 46.3%) was significantly higher ($P = 0.012$) than response rates for shelters in the Northeast (101/282, 35.8%), Southeast

[3] See: Newbury, S., Blinn, M.K., Bushby, P.A., Cox, C.B., Dinnage, J.D., Griffin, B., Hurley, K.F., Isaza, N., Jones, W., Miller, L., et al. Guidelines for Standards of Care in Animal Shelters. Association of Shelter Veterinarians. http://www.sheltervet.org/assets/docs/shelter-standards-oct2011-wforward.pdf (accessed 10 February 2016).

[4] See: Kirkwood, S., 1999. A prescription for better veterinary relations. http://www.hsi.org/assets/pdfs/eng_prescrip_vet_relations.pdf (accessed 10 February 2016).

[5] See: www.surveymonkey.com (accessed 10 February 2016).

[6] See: Petition to the American Board of Veterinary Specialties for Provisional Recognition of a Recognized Veterinary Specialty in Shelter Medicine Practice under the American Board of Veterinary Practitioners. http://www.sheltervet.org/assets/docs/SMP-Petition.pdf (accessed 10 February 2016).

Table 1
Characteristics of 536 North American animal shelters whose managers responded to a survey on shelter veterinary medical services.

Variable	*n*	%
Overall responses	536/1373	39.0
Respondent characteristics		
Paid employee	460	85.8
Non-veterinarian	524	97.8
Region		
Northeast[a]	101	18.8
Southeast[b]	170	31.7
Midwest[c]	120	22.4
West[d]	145	27.1
Agency type		
Public	146	27.2
Private	232	43.3
Private with public contract	158	29.5
Intake policy[e]		
Open	304	56.7
Limited	215	40.1
Other[f]	17	3.2
Community type served[g]		
Urban	240	44.8
Suburban	300	56.0
Rural	364	67.9
Shelter capacity[h]		
Small (<100 animals)	188	35.1
Medium (100–299 animals)	261	48.7
Large (300–499 animals)	62	11.6
Very large (>499 animals)	25	4.7
Annual intake of dogs and cats		
<561 animals	123	22.9
561–1699 animals	123	22.9
1700–4754 animals	124	23.1
>4754 animals	123	22.9
Not specified	43	8
Annual operating expenditures		
Low (<$500,000)	284	53.0
Moderate ($500,000–$1,499,999)	160	29.9
High ($1,500,000 or greater)	92	17.2

[a] Northeast region includes CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, PEI, RI, VT.
[b] Southeast region includes AL, AR, FL, GA, KY, LA, MS, NC, OK, PR, TN, SC, TX, VA, WV.
[c] Midwest region includes IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI.
[d] West region includes AB, AK, AZ, CA, CO, ID, HI, MT, NM, NV, OR, UT, WA, WY.
[e] Specific definitions for the terms 'open intake' and 'limited intake' were not provided to respondents.
[f] This response choice was provided as an alternative to 'open' or 'limited' but was not defined for survey respondents.
[g] The sum of responses is greater than 536 because respondents could select more than one community type served.
[h] Defined for survey respondents as the total number of dogs and cats that can be housed at any one time.

(170/479, 35.5%), and Midwest (120/299, 40.1%). Data regarding characteristics of respondents and the shelters they represented are shown in Table 1. Additional data regarding combined and average annual intake for shelters in each region are shown in Appendix: Supplementary Table S1.

Almost all respondents (534/536; 99.6%) reported having some relationship with veterinarians, and 438/536 (81.7%) respondents reported regular relationships. The percentage of respondents who reported each type of veterinary relationship is shown in Table 2. The sum of these percentages is greater than 100%, as many respondents reported multiple relationships. Local clinics were used, either on an ad-hoc or regular basis, by 396 shelters (73.9%), while on-site paid veterinary services, either full- or part-time, were retained by 260 shelters (48.5%). The proportion of all shelters that used local clinics was significantly higher than the proportion that had paid on-site veterinarians ($P < 0.001$). In addition, the proportion of public shelters that used local clinics was significantly higher than the proportion that had paid on-site veterinarians (44.9% vs. 11.9%; $P < 0.002$), the proportion of private shelters that used local clinics was significantly higher than the proportion that had paid on-site veterinarians (37.2% vs. 3.6%; $P < 0.001$), and the proportion of private shelters with public contracts that used local clinics was significantly higher than the proportion that had paid on-site veterinarians (47.4% vs. 9.5%; $P < 0.001$). There was no significant difference in the likelihood of retaining on-site paid veterinary services or using local clinics based on shelter type. As shelter capacity decreased from very large, to large, to medium, to small, the proportion of shelters using on-site paid veterinary services decreased significantly from 92% to 82.3%, 51.7%, and 27.1%, respectively ($P < 0.001$). Similarly, as annual operating expenditures decreased from high to moderate to low, the proportion of shelters using paid on-site veterinarians decreased significantly from 93.5% to 61.3% and 26.8%, respectively ($P < 0.001$). Just over a third (197/536, 36.8%) of respondents reported that volunteer veterinarians provided on-site care and/or served as board members for their shelters, but only 10 shelters (1.9%) relied solely on volunteer veterinarians. Private shelters were significantly more likely than other shelter types to use the services of volunteer veterinarians ($P < 0.001$).

All respondents indicated a desire to have a relationship with a veterinarian. Most (473/536; 88.2%) indicated that they wanted to expand their veterinary relationships. The number and percent of respondents who indicated each desired relationship (of those who did not already have such relationships) are shown in Table 3. Of 276 respondents who did not already have a paid on-site veterinarian, 42% indicated that they wanted one. This percentage is significantly higher ($P < 0.001$) than the 7.9% of 140 respondents who did not already use local veterinarians but indicated a desire to do so. The percentage of respondents who did not already have a paid on-site veterinarian but wanted one was also significantly higher than the percentage of respondents who did not already use local veterinarians but indicated a desire to do so when comparisons were restricted to respondents representing public shelters (44.9% vs. 11.9%; $P < 0.001$), private shelters (37.2% vs. 3.6%; $P < 0.001$), and private shelters with public contracts (47.4% vs. 9.5%; $P < 0.001$).

Nearly all respondents (530/536; 98.9%) indicated that at least some preventive or screening procedures and/or treatments were provided for most or all animals handled by their shelters. The percentage of respondents who reported that each procedure was performed at their shelters is shown in Table 4. Respondents representing shelters with paid on-site veterinarians were significantly more likely to report physical exams performed by veterinarians ($P = 0.002$), physical exams performed by non-veterinarians ($P = 0.038$), vaccination ($P = 0.036$), treatment of internal parasites ($P = 0.004$), testing for feline leukemia and/or feline immunodeficiency virus ($P = 0.009$), testing for dermatophytosis ($P = 0.045$), microchip implantation ($P < 0.001$), and spay and neuter surgery ($P < 0.001$). Provision of some veterinary care (e.g. physical exam by a veterinarian, vaccination, diagnostic testing [for fecal parasites, feline leukemia virus, feline immunodeficiency virus, heartworm and/or dermatophytosis], and/or spay or neuter surgery) was reported by 97.8% of respondents.

Every respondent reported at least one common infectious disease (upper respiratory tract infections, canine parvovirus infections, canine distemper infections, feline panleukopenia, and/or dermatophytosis) in their shelter populations. Almost 77% of respondents agreed that common shelter infectious diseases had a substantial negative impact on their shelters' successes, and 86.4% indicated that these diseases negatively impacted their financial outcomes. Additional data regarding identification and treatment of various health problems in shelters and the extent to which shelter-acquired infectious diseases in shelter animals impaired shelters' success in various areas are shown in Appendix: Supplementary Tables S2 and S3.

The perceived relative importance of 15 tasks for veterinarians working with shelters is shown in Table 5. The most important

Table 2
Number and percent[a] of managers of North American animal shelters who reported various types of veterinary relationships.

	Public shelters[b]		Private shelters[b]		Private shelters with public contracts[b]		All shelters[b]	
	n	%	*n*	%	*n*	%	*n*	%
Director is veterinarian[c]	4	2.7	3	1.3	4	2.5	11	2.1
Veterinarian on board of directors[c]	9	6.2	56	24.1	59	37.3	124	23.1
Full-time veterinarian (employee or independent contractor)[c]	31	21.2	50	21.6	34	21.5	115	21.5
Part-time veterinarian (employee or independent contractor)[c]	57	39.0	80	34.5	60	38.0	197	36.8
Paid on-site veterinarian (full- or part-time, employee or independent contractor)[c]	77	52.7[d]	103	44.4[e]	80	50.6[f]	260	48.5[g]
Regular use of local veterinary clinics[c,h]	32	21.9	98	42.2	40	25.3	170	31.7
Ad hoc use of local veterinary clinics[i]	83	56.8	96	41.4	82	51.9	261	48.7
Use of local veterinary clinics (regular or ad hoc)[h,i]	104	71.2[d]	176	75.9[e]	116	73.4[f]	396	73.9[g]
Regular visiting volunteer veterinarian[c,h]	7	4.8	18	7.8	19	12.0	44	8.2
Ad hoc visiting volunteer veterinarian[i]	15	10.3	30	12.9	21	13.3	66	12.3
Visiting volunteer veterinarian (regular or ad hoc)[h,i]	21	14.4	46	19.8	38	24.1	105	19.6

[a] The sum of these percentages is greater than 100%, as many respondents reported multiple relationships.
[b] Of 536 shelters represented by respondents, 146 were public, 232 were private, and 158 were private with public contracts.
[c] In data analysis, this relationship was included in the definition of a 'regular veterinary relationship'.
[d] The proportion of public shelters that used local clinics is significantly higher than the proportion that had paid on-site veterinarians ($P < 0.002$).
[e] The proportion of private shelters that used local clinics is significantly higher than the proportion that had paid on-site veterinarians ($P < 0.001$).
[f] The proportion of private shelters with public contracts that used local clinics is significantly higher than the proportion that had paid on-site veterinarians ($P < 0.001$).
[g] The proportion of all shelters that used local clinics is significantly higher than the proportion that had paid on-site veterinarians ($P < 0.001$).
[h] A specific definition of the term 'regular' was not provided to survey respondents.
[i] A specific definition of the term 'ad hoc' was not provided to survey respondents.

tasks were surgical sterilization, diagnosis and treatment of shelter animals, and providing authorization for purchase and administration of drugs. The task given lowest priority was providing expertise on animal behavior. The distributions of respondents' perceived knowledge ratings of themselves and the veterinarians they work with are shown in Figs. 1,2. Responses from 12 shelter managers who were also veterinarians and responses that included a choice of 'not applicable' were excluded from these figures. Respondents rated themselves as significantly more knowledgeable than veterinarians about shelter operations ($P < 0.001$), cleaning and disinfection ($P < 0.001$), population management ($P < 0.001$) and shelter animal behavior ($P < 0.001$). Respondents rated veterinarians as significantly more knowledgeable than themselves about vaccination and diagnosis and treatment ($P < 0.001$). There were no significant differences between respondents who were also veterinarians and respondents who were not veterinarians in their knowledge ratings of the veterinarians they worked with. Shelter managers who were also veterinarians rated themselves significantly more knowledgeable in diagnosis and treatment of medical problems other than common shelter infectious diseases than did shelter managers who were not veterinarians ($P < 0.003$). Managers who were veterinarians rated themselves as significantly less knowledgeable regarding behavior of shelter animals than did non-veterinarian managers ($P < 0.05$). There were no significant differences in self-knowledge ratings between veterinarian and non-veterinarian respondents in the subject areas of shelter operations, cleaning and disinfection, population management, vaccination, and diagnosis and treatment of common shelter infectious diseases. Additional data regarding respondents' rankings of the importance of various characteristics of

Table 3
Number and percent of managers of North American animal shelters who reported wanting but not having various veterinary relationships.

	Public shelters[a]		Private shelters[a]		Private shelters with public contracts[a]		All shelters[a]	
	n	%	*n*	%	*n*	%	*n*	%
Veterinarian as director	0/142[b]	0.0	2/229	0.9	2/154	1.3	4/525	0.8
Veterinarian on board of directors	1/137	0.7	31/176	17.6	19/99	19.2	51/412	12.4
Full-time veterinarian (employee or independent contractor)	31/115	27.0	34/182	18.7	34/124	27.4	99/421	23.5
Part-time veterinarian (employee or independent contractor)	25/89	28.1	41/152	27.0	31/98	31.6	97/339	28.6
Paid on-site veterinarian (full- or part-time, employee or independent contractor)	31/69	44.9[c]	48/129	37.2[d]	37/78	47.4[e]	116/276	42.0[f]
Regular use of local veterinary clinics[g]	13/114	11.4	8/134	6.0	3/118	2.5	24/366	6.6
Ad hoc use of local veterinary clinics[h]	6/63	9.5	6/136	4.4	3/76	3.9	15/275	5.5
Use of local veterinary clinics (regular or ad hoc)[g,h]	5/42	11.9[c]	2/56	3.6[d]	4/42	9.5[e]	11/140	7.9[f]
Regular visiting volunteer veterinarian[g]	30/139	21.6	69/214	32.2	54/139	38.8	153/492	31.1
Ad hoc visiting volunteer veterinarian[h]	27/131	20.6	45/202	22.3	24/137	17.5	96/470	20.4
Visiting volunteer veterinarian (regular or ad hoc)[g,h]	25/125	20.0	38/186	20.4	14/120	11.7	77/431	17.9

[a] Of 536 shelters represented by respondents, 146 were public, 232 were private, and 158 were private with public contracts.
[b] The denominators shown are the number of respondents representing each shelter type who reported not having each relationship.
[c] The percentage of respondents representing public shelters that did not already have a paid on-site veterinarian but wanted one is significantly higher ($P < 0.001$) than the percentage that did not already use local veterinary clinics but indicated a desire to do so.
[d] The percentage of respondents representing private shelters that did not already have a paid on-site veterinarian but wanted one is significantly higher ($P < 0.001$) than the percentage that did not already use local veterinary clinics but indicated a desire to do so.
[e] The percentage of respondents representing private shelters with public contracts that did not already have a paid on-site veterinarian but wanted one is significantly higher ($P < 0.001$) than the percentage that did not already use local veterinary clinics but indicated a desire to do so.
[f] The percentage of all respondents that did not already have a paid on-site veterinarian but wanted one is significantly higher ($P < 0.001$) than the percentage that did not already use local veterinary clinics but indicated a desire to do so.
[g] A specific definition of the term 'regular' was not provided to survey respondents.
[h] A specific definition of the term 'ad hoc' was not provided to survey respondents.

Table 4
Number and percent of 536 managers of North American animal shelters who reported that various screening procedures and/or preventive treatments were routinely provided for most or all animals handled at their shelters.

	Shelters that had a paid on-site veterinarian[a]		Shelters that did not have a paid on-site veterinarian[a]		All shelters[a]	
	n	%	*n*	%	*n*	%
Physical exam by veterinarian	130	50[b]	102	37.0[b]	232	43.3
Physical exam by non-veterinarian	204	78.5[c]	195	70.7[c]	399	74.4
Vaccination	253	97.3[d]	258	93.5[d]	511	95.3
Fecal exams	129	49.6	123	44.6	252	47
Treatment of internal parasites[e]	239	91.9[f]	231	83.7[f]	470	87.7
Treatment of external parasites[g]	225	86.5	230	83.3	455	84.9
Testing for canine heartworm	144	55.4	145	52.5	289	53.9
Testing for feline leukemia and/or feline immunodeficiency virus	193	74.2[h]	176	63.8[h]	369	68.8
Testing for dermatophytosis[i]	72	27.7[j]	56	20.3[j]	128	23.9
Microchip implantation	194	74.6[k]	137	49.6[k]	331	61.8
Spay and neuter surgery	239	91.9[l]	202	73.2[l]	441	82.3

[a] Of 536 total shelters represented by respondents, 260 had a paid on-site veterinarian and 276 did not have a paid-on-site veterinarian.
[b] Shelters that had a paid on-site veterinarian were significantly more likely to perform physical exams by a veterinarian than shelters that did not have a paid on-site veterinarian ($P = 0.002$).
[c] Shelters that had a paid on-site veterinarian were significantly more likely to perform physical exams by non-veterinarian than shelters that did not have a paid on-site veterinarian ($P = 0.038$).
[d] Shelters that had a paid on-site veterinarian were significantly more likely to perform vaccination than shelters that did not have a paid on-site veterinarian ($P = 0.036$).
[e] For example deworming and/or heartworm preventive.
[f] Shelters that had a paid on-site veterinarian were significantly more likely to treat internal parasites than shelters that did not have a paid on-site veterinarian ($P = 0.004$).
[g] For example, fleas, ticks, ear mites.
[h] Shelters that had a paid on-site veterinarian were significantly more likely to perform testing for feline leukemia and/or feline immunodeficiency virus than shelters that did not have a paid on-site veterinarian ($P = 0.009$).
[i] Specific methods for dermatophytosis testing were not defined for survey respondents.
[j] Shelters that had a paid on-site veterinarian were significantly more likely to perform dermatophytosis testing than shelters that did not have a paid on-site veterinarian ($P = 0.045$).
[k] Shelters that had a paid on-site veterinarian were significantly more likely to perform microchip implantation than shelters that did not have a paid on-site veterinarian ($P < 0.001$).
[l] Shelters that had a paid on-site veterinarian were significantly more likely to perform spay and neuter surgeries than shelters that did not have a paid on-site veterinarian ($P < 0.001$).

veterinarians working with shelters are shown in Appendix: Supplementary Table S4.

Almost all (97%) respondents agreed that veterinary services were absolutely necessary to their shelters, and only 11.8% of 524 non-veterinarian respondents reported usually asking a veterinarian for help only as a last resort. The majority of shelter managers were satisfied or extremely satisfied with the veterinary services received ($n = 241/536$, 45%; $n = 152/536$, 28.4%, respectively).

Discussion

Results of this survey indicated good working relationships between shelters and veterinarians, widespread provision of veterinary services in shelters, and a reliance of shelter personnel on veterinarians. All respondents reported that they desired a relationship with a veterinarian, nearly all indicated that they have a relationship with a veterinarian, and most had a regular

Table 5
Number and percent of 536 North American shelter managers who ranked various veterinary tasks among the five most important or the five least important tasks for a veterinarian working with their shelters to perform.

	Respondents who ranked among five most important tasks *n* (%)	Respondents who ranked among five least important tasks *n* (%)	Importance score[a]
Spay and neuter shelter animals	498 (92.9)	15 (2.8)	483
Diagnose and/or treat animals that become acutely sick or injured during their shelter stays	389 (72.6)	20 (3.7)	369
Diagnose and/or treat animals that are injured or sick upon arrival at the shelter	365 (68.1)	23 (4.3)	342
Provide authorization for the shelter to buy and administer medications, vaccines, or drugs	257 (47.9)	101 18.8	156
Provide guidance on the management of common infectious diseases[b]	213 (39.7)	63 (11.8)	150
Perform surgical procedures other than sterilization	216 (40.3)	94 17.5	122
Establish preventive population health protocols[c]	165 (30.8)	97 18.1	68
Examine animals before adoption and provide medical background information to adopters	137 (25.6)	169 (31.5)	–32
Spay and neuter animals belonging to the public	149 (27.8)	194 (36.2)	–45
Serve as an expert witness in cases of animal abuse and/or neglect	98 (18.3)	262 (48.9)	–164
Participate in euthanasia decisions	55 (10.3)	267 (49.8)	–212
Provide longer term medical care for shelter animals with chronic diseases[c]	46 (8.6)	276 (51.5)	–230
Provide follow-up veterinary care for adopted animals	49 (9.1)	290 (54.1)	–241
Provide other veterinary care to animals belonging to the public	31 (5.8)	400 (74.6)	–369
Provide expertise on animal behavior	11 (2.1)	409 (76.3)	–398

[a] The importance score for each task was calculated by subtracting the number of managers who ranked the task among the five least important from the number of respondents who ranked it among the five most important.
[b] For example, upper respiratory infections, canine parvovirus and canine distemper infections, feline panleukopenia, dermatophytosis.
[c] For example, vaccination, disinfection, disease recognition and testing, quarantine, isolation.

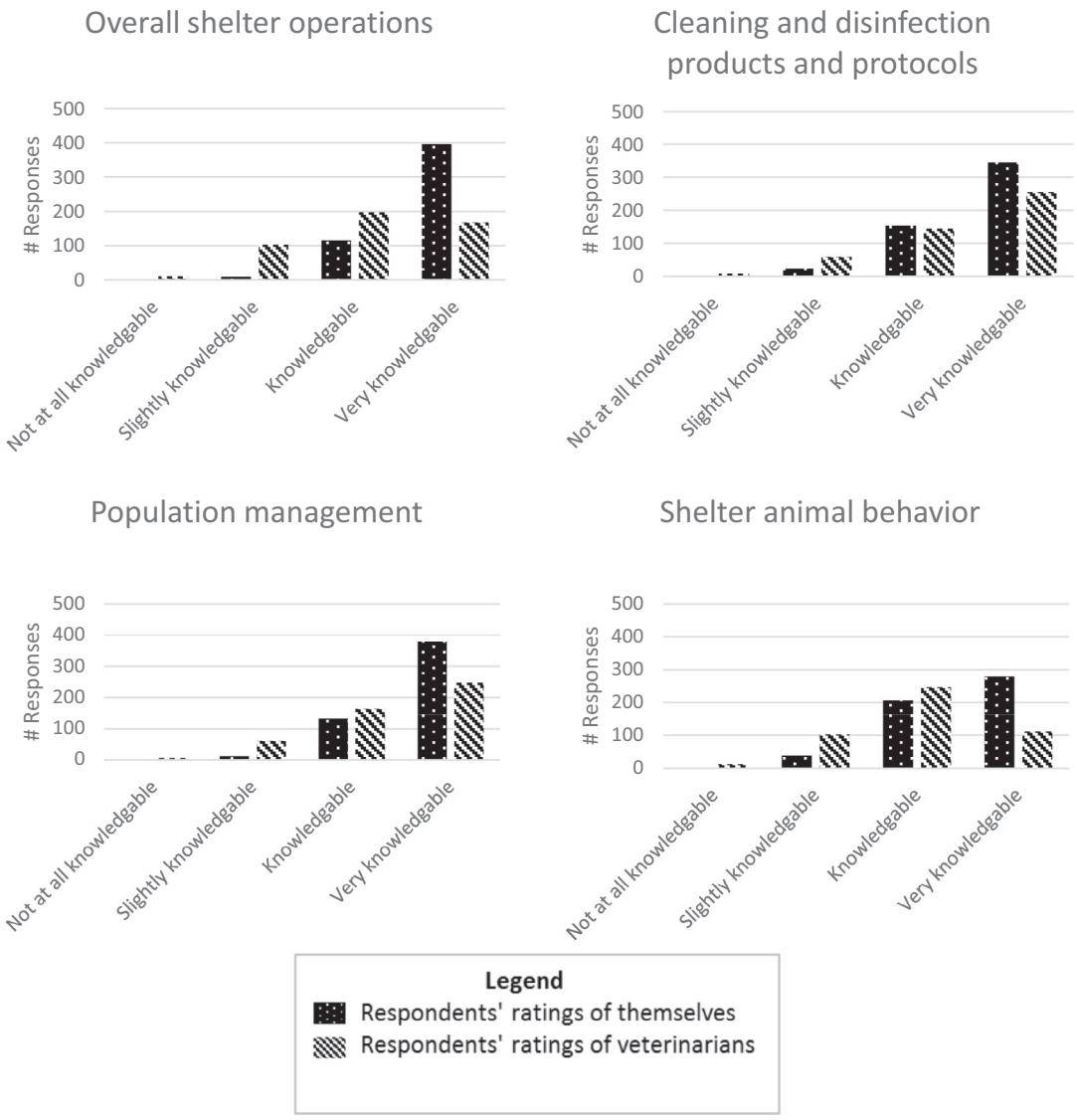

Fig. 1. Perceived knowledge ratings by managers of 524 North American animal shelters of themselves and veterinarians with whom respondents worked in the subject areas of shelter operations, cleaning and disinfection products and protocols, population management, and shelter animal behavior. Shelter managers rated themselves as significantly more knowledgeable than veterinarians in all of these areas ($P < 0.001$ for all comparisons.) Responses from 12 shelter managers who were also veterinarians were excluded from the analysis and this figure.

veterinary relationship. Nearly half of shelters in this study paid on-site veterinarians, while very few relied solely on volunteer veterinarians. Veterinarians were also generous with their time, with over a third of shelters receiving volunteer veterinary services. Almost all shelters in this study provided veterinary services to the animals in their care. Other shelter surveys (Steneroden et al., 2011a; Spindel et al., 2013) had similar findings, with 249/258 (96.5%) shelters having a regular relationship with a veterinarian, 14/32 (44%) shelters with a veterinarian on staff, and 199/203 (98%) shelters performing veterinary procedures such as vaccination. In the present study, nearly all respondents agreed that veterinary services were absolutely necessary to their organizations, very few reported usually asking a veterinarian for help only as a last resort, and satisfaction levels with veterinarians were generally high.

In addition to using and valuing veterinary services, desire to expand on-site shelter veterinary services was commonly reported by survey respondents. In this group of shelter managers, there was less interest in expanding veterinary services through local clinics. Given that shelters with lower annual expenditures and lower capacities were less likely to have on-site veterinarians, this may have been due to budgetary constraints or simply insufficient workload to warrant a regular on-site veterinary presence. This could also have been a result of a relatively long history of shelters using local services on an ad-hoc basis; most of those who desired to do so may have already formed such relationships.

Shelter managers who responded to this survey tended to view the roles of veterinarians in shelters somewhat narrowly, with most prioritizing surgical and medical care to individual pets over prevention of disease and injury. Providing authorization for purchase and administration of drugs was also ranked as important, likely reflecting the importance of access to controlled substances in shelters. Developing preventive protocols, advising on infectious disease management, serving as witnesses in animal cruelty cases, participation in euthanasia decisions and providing behavioral expertise were given relatively lower priority by most respondents. Other surveys have similarly documented a relatively limited role for vet-

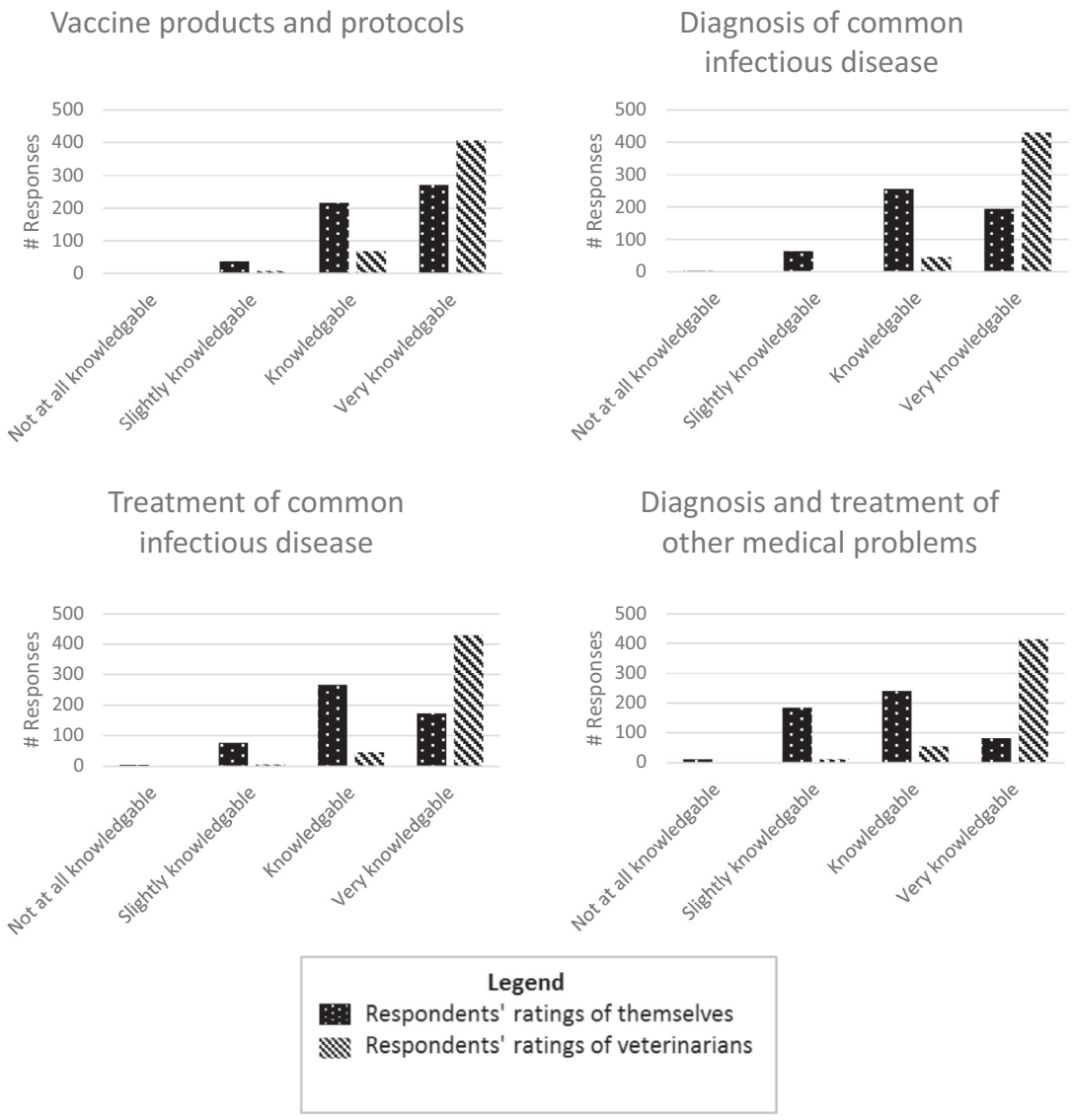

Fig. 2. Perceived knowledge ratings by managers of 524 North American animal shelters of themselves and veterinarians with whom respondents worked in the subject areas of vaccination products and protocols, diagnosis of common infectious diseases, treatment of common infectious diseases, and diagnosis and treatment of other medical problems. Shelter managers rated veterinarians as significantly more knowledgeable than themselves in each of these subject areas ($P < 0.001$ for all comparisons.) Responses from 12 shelter managers who were also veterinarians were excluded from the analysis and this figure.

erinarians in preventive practices and protocol development in shelters. Spindel et al. (2013) found that veterinarians were primarily responsible for establishment and evaluation of protocols for disease management in only 148/252 (59%) shelters, and Steneroden et al. (2011b) reported that a veterinarian was responsible for infection control in only 5/78 (6%) shelters, with shelter directors serving in that role most of the time. In contrast, preventive practices have been described in veterinary texts as the foundation of a successful population health plan[3] (Radostits, 2001). The shelter medicine practice specialty advocates[5] a broad-based and prevention-focused approach, including physical and behavioral health of shelter animals; environmental health of shelter facilities; public health; identification of animal cruelty, abuse and neglect; and animal shelter management.

The expectations of shelter managers in this study seemed particularly divergent from those of the expanding veterinary field of shelter medicine regarding the role of veterinarians in providing animal behavior expertise. The petition for a specialty in Shelter Medicine Practice[5] lists 'optimization of shelter animal behavioral health' as one of the major duties of shelter veterinarians. Previous studies have demonstrated links between physical and behavioral health in dogs and cats (McCobb et al., 2005; Tanaka et al., 2012), and have suggested that an emphasis on behavioral health can help prevent animals from entering shelters (Patronek et al., 1996a, 1996b), reduce stress and disease in shelter animals (Gourkow, 2001; Coppola et al., 2006; Gourkow et al., 2014), and facilitate adoptions (Gourkow, 2001). However, in this study, among the 15 tasks listed in the survey, shelter managers perceived the provision of expertise on animal behavior as the least important task for veterinarians.

The relatively narrow role expected of veterinarians may have reflected shelter managers' beliefs that veterinarians lack knowledge outside the traditional realm of individual animal medical care. Veterinarians were perceived as significantly more knowledgeable than shelter managers regarding diagnosis and treatment of medical problems and vaccination, but significantly less

knowledgeable regarding cleaning and disinfection, population management, and shelter operations. In addition to ranking the provision of expertise in animal behavior as the least important task for veterinarians, more respondents rated veterinarians as 'not at all knowledgeable' regarding animal behavior than in any other subject area. If veterinarians are to successfully expand their roles in shelters, it may be necessary to address real or perceived gaps in their knowledge of animal behavior, preventive practices and shelter management concerns.

To our knowledge, this survey is the most comprehensive evaluation of veterinary services in animal shelters across North America to date. Other studies (Lord et al., 1998, 2006; Steneroden et al., 2011b; Spindel et al., 2013) have evaluated the prevalence and nature of veterinary relationships and the practice of certain veterinary procedures in shelters, but did not collect information about desired veterinary relationships, perceived importance of specific veterinary tasks, or opinions of and attitudes about veterinarians working with shelters. In addition, three of these studies (Lord et al., 1998, 2006; Steneroden et al., 2011b) were geographically limited. Shelters included in the current study represented all but one U.S. state and all regions of North America, served urban, suburban and rural communities, had a range of sizes and budgets, and had a mix of open and limited intake policies. The response rate was highest in the West, perhaps due to greater recognition of University of California, Davis School of Veterinary Medicine in this region, but other regions were comparably represented. However, respondents of this survey may not have accurately represented 'average' shelter managers, since the survey was administered via email and some contact information was obtained through professional organizations. This may have resulted in a bias toward respondents from more sophisticated shelters that were more likely to use regular paid veterinary services. Shelter managers who responded to the survey may also have been those who had particularly strong opinions about the veterinary services their shelters were receiving at the time they were invited to participate. The survey was lengthy, which may have contributed to the relatively low response rate, and also resulted in more data being collected than could be presented in a single journal article. Information regarding non-respondents was not collected, so it was not possible to characterize non-respondents except by geographical location. Finally, online survey responses were not verified in person or by any other means. The accuracy of survey responses could have been influenced by various factors, including respondent education level, extent of respondent involvement in veterinary care of shelter animals, and organizational record keeping.

Conclusions

This study characterized the existing and desired veterinary relationships for a large sample of North American animal shelters. Veterinary relationships were reported by nearly all shelter managers who responded to the survey. Respondents were generally satisfied with veterinarians and interested in expanding on-site veterinary services. Shelter managers had a relatively narrow view of the potential roles and expertise of veterinarians in shelters, particularly regarding shelter animal behavior. This information will be beneficial to veterinarians who are interested or involved in working with animal shelters, and may help shelter managers to better use and understand the services of veterinarians. These findings may also be useful to veterinary educators and shelter management groups who aim to enhance their working relationships. Additional research is needed to evaluate the potential benefits of expanding the roles of veterinarians in animal shelters to include greater involvement in areas such as preventive programs and behavioral care.

Conflict of interest statement

None of the authors of this paper has a financial or personal relationship with other people or organizations that could inappropriately influence or bias the content of this paper.

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Appendix: Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.tvjl.2016.02.007.

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