Characteristics associated with negative attitudes toward mental illness among US veterinarians

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OBJECTIVE
To explore associations between demographic, occupational, and mental health characteristics and negative attitudes toward mental illness among veterinarians.

DESIGN
Cross-sectional survey.

SAMPLE
9,522 veterinarians employed in the United States.

PROCEDURES
Data from a previously conducted voluntary, anonymous, web-based survey were used. Negative attitude was defined as slight or strong disagreement with 2 statements: "Treatment can help people with mental illness lead normal lives" (treatment effectiveness) and "People are generally caring and sympathetic to people with mental illness" (social support). Multivariable logistic regression was used to identify variables associated with negative attitudes.

RESULTS
Of the 9,522 respondents, 6,585 (69.2%) were female, 4,523 (47.5%) were 40 to 59 years old, 291 (3.1%) had a negative attitude toward treatment effectiveness, and 4,504 (47.3%) had a negative attitude toward social support. After adjusting for other variables, negative attitude toward treatment effectiveness was significantly more likely in males, those with 10 to 19 (vs 1 to 9) years of practice experience, solo practitioners, those in government (vs "other") practice, those with evidence of serious psychological distress, and those reporting suicidal ideation after veterinary school and significantly less likely in those receiving mental health treatment. A negative attitude toward social support was significantly less likely in males and significantly more likely in 40 to 59 (vs 20 to 39) year olds, childless respondents, solo practitioners, those without membership in a veterinary association, those with evidence of serious psychological distress, those reporting depression during or after veterinary school, and those reporting suicidal ideation after veterinary school.

CONCLUSIONS AND CLINICAL RELEVANCE
Characteristics such as age, sex, practice setting, and mental illness history might be useful to consider when targeting interventions to support and educate veterinarians about mental illness. (*J Am Vet Med Assoc* 2019;254:979–985)

Reports[1-4] published from 1980 to 1995 indicate that veterinarians from the United States and California have a higher risk of suicide than the general population. A survey conducted in 2014[5,6] showed that US veterinarians had a higher prevalence of serious psychological distress, depression, and suicidal ideation than the general US population. Of 394 Minnesota veterinarians surveyed in 2012, approximately 10% reported physician-diagnosed depression, compared with 5.9% in the general population of that state.[7] In a 2008 survey[8] of 701 veterinarians in Alabama, 66% reported a problem with clinical depression. Studies[9-13] in Australia, Belgium, Denmark, Finland, France, Germany, New Zealand, Norway, and the United Kingdom have also revealed higher rates of suicide and mental illness among veterinarians than in the general population.

Despite the availability of multiple evidence-based pharmacological and psychosocial interventions for mental illness, not everyone with a mental illness seeks or receives care.[14] Some persons might not seek care and others might seek but not receive care for various reasons (eg, lack of health insurance). Among veterinarians surveyed in Alabama, 32% of those with clinical depression reported that they did not receive treatment, although the underlying reasons for not receiving care remain unclear.[8] According to Andersen's Behavioral Model of Health Services Use, health beliefs, including attitudes, perceptions, values, and knowledge related to health and health services, are important determinants of help-seeking behavior.[15,16] A systematic review[17] of 56 studies, which included data from 27,572 participants, showed that mental health–related stigma had a negative effect on seeking mental health care. A meta-analysis[18] of 45 studies of people living with mental illness showed that internalized stigma resulting from personal experiences, perceptions, or anticipation of

negative social reactions to their mental illness was associated with poorer adherence to treatment.

Data regarding veterinarians' attitudes toward mental illness are limited. A previous study[6] showed that veterinarians employed in the United States were less likely to have positive attitudes toward mental illness than the general population.[19] Specifically, 89.4% of veterinarian respondents somewhat or strongly agreed that treatment helps persons with mental illness lead normal lives (vs 93.0% of US adults), and 31.8% of veterinarian respondents somewhat or strongly agreed that people are caring toward persons with mental illness (vs 60.2% of US adults). The purpose of the study reported here was to analyze previously described survey data[6] to explore demographic, occupational, and mental health characteristics associated with negative attitudes toward mental illness among US veterinarians.

Materials and Methods

Study population

Data from a cross-sectional survey[6] of veterinarians employed in the United States that was conducted from July 1 to October 20, 2014, were analyzed for the study reported here. In brief, 12,707 respondents completed a voluntary, anonymous, web-based questionnaire[a] that was made available through the Veterinary Information Network, an online community for veterinarians; a Veterinary Information Network News article describing the survey; and a *JAVMA* News article describing the survey, or through email messages sent by veterinary medical associations, departments of agriculture or livestock, or health departments to veterinarians in 49 states (Maine did not participate) and Puerto Rico. The email messages were sent at the beginning of the survey recruitment period, and monthly reminder emails were sent over the remaining 3 months. The protocol for that previous study was approved by the Auburn University Institutional Review Board. The present study included data from 9,522 eligible respondents after excluding 216 who were never employed as veterinarians, 653 with a non-US occupational location, 889 with an unknown occupational location, 695 who were not employed as a veterinarian, and 732 with incomplete responses to questions about attitudes toward mental illness.[6]

Measurement of negative attitudes toward mental illness

Attitudes toward mental illness were assessed by use of 2 statements: "Treatment can help people with mental illness lead normal lives" (referred to as treatment effectiveness) and "People are generally caring and sympathetic to people with mental illness" (referred to as social support). Respondents indicated whether they strongly agreed, somewhat agreed, were unsure or undecided, somewhat disagreed, or strongly disagreed with each statement. Respondents were defined as having a negative attitude if they indicated somewhat or strong disagreement with a statement. Both statements were previously validated and used in general population surveys.[19–21] Only respondents who provided answers for both statements were included in the study reported here.

Measurement of demographic, occupational, and mental health characteristics

Available demographic data from the previous survey included sex, age, marital status, and number of children. Available occupational data included years of veterinary practice experience, primary veterinary practice type, primary role in veterinary practice, membership in a veterinary medical association, and whether the respondent was working with other veterinarians. Respondents to the previous survey also reported whether they had "a significant problem with clinical depression" (referred to as depression), "seriously considered suicide" (referred to as suicidal ideation), or "attempted suicide" (referred to as suicide attempt) for 2 separate periods: during veterinary school and after graduating from veterinary school. Respondents were also asked to indicate whether they were taking medicine or receiving treatment for any mental health condition or emotional problem at the time of the survey (referred to as "mental health treatment") and to complete the Kessler psychological distress scale (K6), a screening tool for serious mental illness.[22] Using the K6 scale, respondents indicated how frequently they had 6 feelings or experiences during the past 30 days; respondents were classified as having evidence of serious psychological distress if the total score was ≥ 13 of a maximum possible score of 24.[22]

Statistical analysis

All variables included in the analysis were categorical. Because the proportion of missing responses was generally < 0.5%, observations with missing values were excluded.

We calculated the frequency distribution for all variables and compared characteristics of respondents with and without each of the 2 negative attitudes by use of the χ^2 test or 2-sided Fisher exact test when an expected cell frequency was low (< 5). Characteristics associated with each of the negative attitudes were explored by use of logistic regression models. Initially, each characteristic was evaluated as an independent variable in a univariable model. Because we had no a priori hypotheses about which independent variables had greater importance than others, we built 2 separate multivariable models, one for each of the negative attitudes. All independent variables were entered into each model simultaneously and retained. The Wald test was used to evaluate the overall association between each independent variable with > 2 levels (eg, practice type) and each of the negative attitudes. Values of $P < 0.05$ were considered significant for all statistical tests. All statistical analyses were conducted with commercially available statistical software.[b]

Table 1—Demographic, occupational, and mental health characteristics of veterinarians employed in the United States classified by their responses to 2 statements to assess their attitude toward mental illness.

	Treatment can help people with mental illness lead normal lives			People are generally caring and sympathetic to persons with mental illness		
Characteristic	**Strongly or somewhat agree or undecided (n = 9,231)**	**Strongly or somewhat disagree (n = 291)**	***P* value***	**Strongly or somewhat agree or undecided (n = 5,018)**	**Strongly or somewhat disagree (n = 4,504)**	***P* value***
Demographic						
Sex			< 0.001			< 0.001
Male	2,815 (30.5)	119 (40.9)		1,819 (36.3)	1,115 (24.8)	
Female	6,413 (69.5)	172 (59.1)		3,198 (63.7)	3,387 (75.2)	
Age (y)			0.10			< 0.001
20–39	3,545 (38.4)	94 (32.3)		1,867 (37.2)	1,772 (39.4)	
40–59	4,369 (47.3)	154 (52.9)		2,296 (45.8)	2,227 (49.5)	
≥ 60	1,316 (14.3)	43 (14.8)		855 (17.0)	504 (11.2)	
Married			0.07			< 0.001
No	2,230 (24.2)	84 (28.9)		1,120 (22.3)	1,194 (26.5)	
Yes	6,998 (75.8)	207 (71.1)		3,896 (77.7)	3,309 (73.5)	
Children			0.44			< 0.001
No	3,943 (42.8)	117 (40.5)		1,956 (39.0)	2,104 (46.8)	
Yes	5,277 (57.2)	172 (59.5)		3,057 (61.0)	2,392 (53.2)	
Occupational						
Practice experience (y)			0.01			< 0.001
1–9	3,158 (34.2)	76 (26.1)		1,641 (32.7)	1,593 (35.4)	
10–19	2,283 (24.7)	93 (32.0)		1,142 (22.8)	1,234 (27.4)	
20–29	1,996 (21.6)	67 (23.0)		1,106 (22.1)	957 (21.3)	
≥ 30	1,788 (19.4)	55 (18.9)		1,126 (22.5)	717 (15.9)	
Practice type			0.38			< 0.001
Small animal	6,342 (68.8)	190 (65.5)		3,334 (66.5)	3,198 (71.1)	
Large animal	202 (2.2)	6 (2.1)		131 (2.6)	77 (1.7)	
Equine	272 (3.0)	12 (4.1)		171 (3.4)	113 (2.5)	
Mixed animal	999 (10.8)	37 (12.8)		618 (12.3)	418 (9.3)	
Academia	423 (4.6)	15 (5.2)		221 (4.4)	217 (4.8)	
Government	166 (1.8)	9 (3.1)		92 (1.8)	83 (1.9)	
Other†	815 (8.8)	21 (7.2)		444 (8.9)	392 (8.7)	
Role in practice			0.09			< 0.001
Owner	3,471 (37.7)	126 (43.3)		2,020 (40.3)	1,577 (35.1)	
Associate	4,128 (44.8)	110 (37.8)		2,138 (42.7)	2,100 (46.7)	
Relief	419 (4.6)	17 (5.8)		2,11 (4.2)	225 (5.0)	
Other or do not work in a veterinary practice	1,193 (13.0)	38 (13.1)		640 (12.8)	591 (13.2)	
Solo practitioner			< 0.001			0.08
Yes	1,648 (17.9)	79 (27.2)		877 (17.6)	850 (19.0)	
No	7,538 (82.1)	211 (72.8)		4,114 (82.4)	3,635 (81.1)	
Member of a veterinary association			0.07			< 0.001
No	323 (3.5)	16 (5.5)		146 (2.9)	193 (4.3)	
Yes	8,905 (96.5)	275 (94.5)		4,871 (97.1)	4,309 (95.7)	
Mental health						
Current						
Serious psychological distress			< 0.001			< 0.001
Yes	859 (9.3)	64 (22.0)		310 (6.2)	613 (13.6)	
No	8,372 (90.7)	227 (78.0)		4,708 (93.8)	3,891 (86.4)	
Mental health treatment			0.19			< 0.001
Yes	1,978 (21.4)	53 (18.2)		909 (18.1)	1,122 (24.9)	
No	7,249 (78.6)	238 (81.8)		4,107 (81.9)	3,380 (75.1)	
During veterinary school						
Depression			< 0.01			< 0.001
Yes	1,574 (17.1)	70 (24.1)		662 (13.2)	982 (21.8)	
No	7,653 (82.9)	221 (75.9)		4,354 (86.8)	3,520 (78.2)	
Suicidal ideation			< 0.001			< 0.001
Yes	535 (5.8)	31 (10.7)		207 (4.1)	359 (8.0)	
No	8,694 (94.2)	260 (89.3)		4,810 (95.9)	4,144 (92.0)	
Suicide attempt			0.68			< 0.001
Yes	52 (0.6)	2 (0.7)		14 (0.3)	40 (0.9)	
No	9,179 (99.4)	289 (99.3)		5,004 (99.7)	4,464 (99.1)	
After veterinary school						
Depression			< 0.001			< 0.001
Yes	3,205 (34.7)	132 (45.5)		1,437 (28.7)	1,900 (42.2)	
No	6,020 (65.3)	158 (54.5)		3,577 (71.3)	2,601 (57.8)	
Suicidal ideation			< 0.001			< 0.001
Yes	1,683 (18.3)	102 (35.1)		647 (12.9)	1,138 (25.3)	
No	7,541 (81.8)	189 (64.9)		4,367 (87.1)	3,363 (74.7)	
Suicide attempt			0.01			< 0.001
Yes	124 (1.3)	10 (3.4)		41 (0.8)	93 (2.1)	
No	9,104 (98.7)	281 (96.6)		4,976 (99.2)	4,409 (97.9)	

Data represent number (%) of respondents. The total number of observations (and, hence, the denominators for column percentage calculations) varies for some characteristics because of unknown or missing responses.

*Based on χ^2 test or 2-sided Fisher exact test (when an expected cell frequency was < 5). †Options represented by ≤ 1% of respondents (ie, shelter practice, zoo, exotics, laboratory animal, scientific research, and regulatory).

Data were obtained from a previously reported cross-sectional survey.[6] Values of $P < 0.05$ were considered significant.

Table 2—Results of multivariable logistic regression to explore associations between demographic, occupational, and mental health characteristics and negative attitudes toward treatment effectiveness and social support for the veterinarians described in Table 1.

Characteristic	Strongly or somewhat disagree that treatment can help people with mental illness lead normal lives	Strongly or somewhat disagree that people are generally caring and sympathetic to persons with mental illness
Demographic		
Sex		
Male	1.79 (1.36–2.36)*	0.72 (0.65–0.80)*
Female	Referent	Referent
Age (y)		
≥ 60	1.14 (0.61–2.13)	0.98 (0.79–1.23)
40–59	1.10 (0.74–1.65)	1.18 (1.02–1.37)*
20–39	Referent	Referent
Married		
No	1.29 (0.96–1.73)	0.99 (0.89–1.10)
Yes	Referent	Referent
Children		
No	0.96 (0.71–1.28)	1.12 (1.02–1.24)*
Yes	Referent	Referent
Occupational		
Practice experience (y)		
≥ 30	0.98 (0.52–1.80)	0.85 (0.68–1.06)
20–29	1.17 (0.69–1.97)	0.88 (0.74–1.06)
10–19	1.55 (1.03–2.36)*	1.06 (0.91–1.22)
1–9	Referent	Referent
Practice type		
Small animal	1.25 (0.73–2.16)	1.12 (0.94–1.33)
Large animal	1.06 (0.40–2.83)	0.89 (0.64–1.24)
Equine	1.55 (0.70–3.42)	0.80 (0.59–1.08)
Mixed animal	1.50 (0.79–2.82)	0.93 (0.75–1.16)
Academia	1.77 (0.87–3.60)	1.23 (0.97–1.58)
Government	2.73 (1.17–6.38)*	1.25 (0.88–1.77)
Other†	Referent	Referent
Role in veterinary practice		
Owner	1.15 (0.6–2.03)	0.93 (0.77–1.13)
Associate	1.20 (0.70–2.04)	0.99 (0.83–1.19)
Relief	1.56 (0.77–3.15)	1.04 (0.80–1.34)
Other or do not work in a veterinary practice	Referent	Referent
Solo practitioner		
Yes	1.60 (1.17–2.19)*	1.23 (1.09–1.39)*
No	Referent	Referent
Member of a veterinary association		
No	1.43 (0.84–2.43)	1.29 (1.02–1.61)*
Yes	Referent	Referent
Mental health		
Current		
Serious psychological distress		
Yes	2.11 (1.51–2.93)*	1.55 (1.32–1.81)*
No	Referent	Referent
Mental health treatment		
Yes	0.52 (0.37–0.73)*	0.97 (0.86–1.09)
No	Referent	Referent
During veterinary school		
Depression		
Yes	1.40 (0.98–2.02)	1.22 (1.07–1.40)*
No	Referent	Referent
Suicidal ideation		
Yes	1.15 (0.71–1.86)	1.02 (0.82–1.26)
No	Referent	Referent
Suicide attempt		
Yes	0.62 (0.14–2.72)	1.49 (0.78–2.86)
No	Referent	Referent
After veterinary school		
Depression		
Yes	1.12 (0.81–1.54)	1.21 (1.08–1.35)*
No	Referent	Referent
Suicidal ideation		
Yes	1.83 (1.33–2.53)*	1.66 (1.46–1.89)*
No	Referent	Referent
Suicide attempt		
Yes	1.50 (0.74–3.02)	1.26 (0.85–1.87)
No	Referent	Referent

Data represent OR (95% confidence interval).

*Odds differ significantly ($P < 0.05$) from that of the referent group.

The multivariable models included all variables simultaneously. Because of missing values, a total of 9,407 observations were included in these models.

See Table 1 for remainder of key.

Results

Descriptive analyses

Of the 9,522 respondents, 6,585 (69.2%) were female, 4,523 (47.5%) were 40 to 59 years old, 291 (3.1%) had a negative attitude toward treatment effectiveness, and 4,504 (47.3%) had a negative attitude toward social support **(Table 1)**.

Univariable analyses

Characteristics associated with a negative attitude toward treatment effectiveness—Veterinarians with a negative attitude toward treatment effectiveness were more likely than those without a negative attitude to be male (40.9% vs 30.5%), have 10 to 19 years of veterinary practice experience (32.0% vs 24.7%), be a solo practitioner (27.2% vs 17.9%), and have evidence of serious psychological distress (22.0% vs 9.3%; Table 1). They were also more likely to have had depression or suicidal ideation during and after graduating from veterinary school. Veterinarians with a negative attitude toward treatment effectiveness were slightly less likely than those without a negative attitude to report receiving mental health treatment (18.2% vs 21.4%).

Characteristics associated with a negative attitude toward social support—Veterinarians with a negative attitude toward social support were more likely than those without a negative attitude to be female (75.2% vs 63.7%), unmarried (26.5% vs 22.3%), childless (46.8% vs 39.0%), in a primarily small animal practice (71.1% vs 66.5%), and to not be a member of a veterinary association (4.3% vs 2.9%; Table 1). They were also more likely to have evidence of serious psychological distress or to report receiving mental health treatment. Veterinarians with a negative attitude toward social support were also more likely than those without a negative attitude to report depression, suicidal ideation, or suicide attempt during and after graduating from veterinary school.

Multivariable logistic regression

Because the results of the univariable logistic regression models were mostly in agreement with the univariable analyses, only the results of the multivariable logistic regression models are presented here.

Characteristics associated with a negative attitude toward treatment effectiveness—The odds of having a negative attitude toward treatment effectiveness were significantly higher for males versus females (OR = 1.79), solo versus nonsolo practitioners (OR = 1.60), those with versus without evidence of serious psychological distress (OR = 2.11), and those reporting versus reporting no suicidal ideation after graduating from veterinary school (OR = 1.83; **Table 2**). The odds of having negative attitude toward treatment effectiveness were significantly lower among those reporting receiving mental health treatment versus those who did not (OR = 0.52). In addition, respondents with a negative attitude toward treatment effectiveness were significantly more likely to be primarily in government (vs "other" [included shelter, zoo, exotics, laboratory animal, scientific research, and regulatory]) practice (OR = 2.73) and to have 10 to 19 (vs 1 to 9) years of veterinary practice experience (OR = 1.55). Results of the Wald test indicated that years of practice experience was a significant (P = 0.046) overall predictor of having a negative attitude toward treatment effectiveness.

Characteristics associated with a negative attitude toward social support—The odds of having of a negative attitude toward social support were significantly lower for males versus females (OR = 0.72; Table 2). Respondents with a negative attitude toward social support were significantly more likely to be 40 to 59 (vs 20 to 39) years old (OR = 1.18), childless (OR = 1.12), solo practitioners (OR = 1.23), not belong to a veterinary association (OR = 1.29), have evidence of serious psychological distress (OR = 1.55), have had depression during or after graduating from veterinary school (OR = 1.22 and OR = 1.21, respectively), and report suicidal ideation after graduating from veterinary school (OR = 1.66). Results of the Wald test indicated that age was a significant (P = 0.01) overall predictor of having a negative attitude toward social support.

Discussion

The cross-sectional study reported here showed that a higher proportion of veterinarians reported a negative attitude toward social support (47.3%) than toward treatment effectiveness (3.1%) for mental illness. Males were more likely to have a negative attitude toward treatment effectiveness, whereas females were more likely to have a negative attitude toward social support. Veterinarians who were solo practitioners, had evidence of serious psychological distress, or reported depression during veterinary school or depression or suicidal ideation after graduating from veterinary school were all more likely to have negative attitudes toward social support and treatment effectiveness for mental illness than their respective comparison groups.

Findings described in the present report were consistent with those from a study[19] of 243,062 US adults from 35 states who participated in the Behavioral Risk Factor Surveillance System during 2007 and 2009. In that study, women (41.7%) were more likely than men (32.2%) to slightly or strongly disagree with the statement "People are generally caring and sympathetic to people with mental illness," whereas men (6.3%) were more likely than women (4.2%) to slightly or strongly disagree with the statement "Treatment can help people with mental illness lead normal lives." The Behavioral Risk Factor Surveillance System study also showed that adults with evidence of serious psychological distress were more likely to slightly or strongly disagree with these statements than those with no evidence of such distress. Our findings regarding attitudes toward mental illness were consistent with those of a meta-analysis[18] in which a diagnosis of mental illness and severe mental illness symptoms at baseline were shown to be associated with increased levels of internalized stigma at follow-up.[18] Taken together, the findings of the present study were not only consistent with those from a more general population but also provided insight into how characteristics specific to veterinarians, such as prac-

tice setting, professional association membership, and mental illness history during and after graduating from veterinary school, may influence attitudes toward mental illness among members of this profession.

Extrapolating from findings for the general population,[19] there are various potential explanations for how negative attitudes toward mental illness may develop among veterinarians. For instance, veterinarians who have a negative experience with an employee assistance or workplace counseling program, which are increasingly available to the veterinary workforce, may develop a negative attitude toward the effectiveness of treatment for mental illness. Veterinarians in an unsupportive work environment may develop the belief that social support is lacking for persons with mental illness and may be more likely to choose solo practice or avoid membership in professional associations as a result. Negative attitudes toward mental illness could also develop during veterinary school (eg, because of negative personal experiences or lack of support services), and these attitudes may also be influenced by any mental health problems that the student may be experiencing. Additional studies are needed to explore these possibilities.

Our findings have implications for public health. We found that negative attitudes toward mental illness were common in the veterinary profession, which is similar to what has been reported in other occupational groups.[23] In the present study, males were more likely than females to have a negative attitude toward the effectiveness of treatment for mental illness. This finding may have important implications in light of the demographic shift in the veterinary profession, with more female practitioners entering the workforce and a disproportionate number of male practitioners filling senior leadership positions.[24] It is possible that a veterinary leadership that is overrepresented by males with a largely negative attitude toward the effectiveness of treatment for mental illness might be reluctant to support access to mental health services.

The strengths of the study reported here included the availability of data from a large sample of veterinarians employed in the United States that allowed the examination of multiple demographic, occupational, and mental health characteristics in conjunction with a validated measure of attitudes toward mental illness. There were several limitations that may have impacted the findings. The cross-sectional design did not permit examination of the temporal relationship between the independent variables and the outcomes of interest. The convenience sample that was used might hinder generalizability of these findings to other veterinarians. It was not possible to calculate a response rate, and nonresponse bias may have occurred if respondents differed in meaningful ways from nonrespondents. The fit of our regression models may have been less than optimal because we did not use a process for variable selection. However, we felt that the simultaneous inclusion of all variables in the models was appropriate given the exploratory nature of this study. Lastly, self-reported data that were not objectively assessed could be subject to recall or respondent bias. For instance, reports of depression or suicidal ideation by respondents were not verified by a mental health professional, which could potentially result in under- or overestimation of these findings.

The findings of the present study indicated that negative attitudes toward mental illness among surveyed US veterinarians were associated with characteristics such as sex, veterinary practice setting, and mental illness history. Identification of potentially at-risk populations of veterinarians, through use of self-reported data or administrative records, might be helpful when targeting interventions to support and educate veterinarians about mental illness. Bartram et al[25] proposed various individual- and organization-level interventions to promote mental health, improve access to support services, and improve working conditions to help alleviate psychological distress among veterinary surgeons in the United Kingdom. Interventions such as these could potentially benefit veterinarians by helping them to develop more positive attitudes toward mental illness, increasing their willingness to seek care, and reducing their risk of suicide. Workplace interventions targeting mental illness, such as antistigma workshops and mental health first aid training, have been shown to be effective in modifying knowledge, attitudes, and behavior toward coworkers and others with mental illness.[23] Further research is needed to investigate the effectiveness of similar interventions among veterinarians.

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Footnotes

a. The questionnaire is available from the author on request.
b. SAS, version 9.3, SAS Institute Inc, Cary, NC.

References

1. Blair A, Hayes HM. Cancer and other causes of death among United States veterinarians, 1966–1977. *Int J Cancer* 1980; 25:181–185.
2. Blair A, Hayes HM. Mortality patterns among US veterinarians, 1947–1977: an expanded study. *Int J Epidemiol* 1982;11:391–397.
3. Lange WR, Frankenfield DL, Carico J, et al. Deaths among members of the Public Health Service Commissioned Corps, 1965–89. *Public Health Rep* 1992;107:160–166.
4. Miller JM, Beaumont JJ. Suicide, cancer, and other causes of death among California veterinarians, 1960–1992. *Am J Ind Med* 1995;27:37–49.
5. Nett RJ, Witte TK, Holzbauer SM, et al. Notes from the field: prevalence of risk factors for suicide among veterinarians—United States, 2014. *MMWR Morb Mortal Wkly Rep* 2015;64:131–132.
6. Nett RJ, Witte TK, Holzbauer SM, et al. Risk factors for suicide, attitudes toward mental illness, and practice-related stressors among US veterinarians. *J Am Vet Med Assoc* 2015;247:945–955.
7. Fowler HN, Holzbauer SM, Smith KE, et al. Survey of occu-

pational hazards in Minnesota veterinary practices in 2012. *J Am Vet Med Assoc* 2016;248:207–218.
8. Skipper GE, Williams JB. Failure to acknowledge high suicide risk among veterinarians. *J Vet Med Educ* 2012;39:79–82.
9. Bartram DJ, Baldwin DS. Veterinary surgeons and suicide: a structured review of possible influences on increased risk. *Vet Rec* 2010;166:388–397.
10. Platt B, Hawton K, Simkin S, et al. Systematic review of the prevalence of suicide in veterinary surgeons. *Occup Med (Lond)* 2010;60:436–446.
11. Platt B, Hawton K, Simkin S, et al. Suicidal behaviour and psychosocial problems in veterinary surgeons: a systematic review. *Soc Psychiatry Psychiatr Epidemiol* 2012;47:223–240.
12. Hatch PH, Winefield HR, Christie BA, et al. Workplace stress, mental health, and burnout of veterinarians in Australia. *Aust Vet J* 2011;89:460–468.
13. Shirangi A, Fritschi L, Holman CD, et al. Mental health in female veterinarians: effects of working hours and having children. *Aust Vet J* 2013;91:123–130.
14. Kohn R, Saxena S, Levav I, et al. The treatment gap in mental health care. *Bull World Health Organ* 2004;82:858–866.
15. Andersen RM. National health surveys and the behavioral model of health services use. *Med Care* 2008;46:647–653.
16. Babitsch B, Gohl D, von Lengerke T. Re-revisiting Andersen's Behavioral Model of Health Services Use: a systematic review of studies from 1998–2011. *Psychosoc Med* 2012;9:Doc11.
17. Clement S, Schauman O, Graham T, et al. What is the impact of mental health–related stigma on help-seeking? A systematic review of quantitative and qualitative studies. *Psychol Med* 2015;45:11–27.
18. Livingston JD, Boyd JE. Correlates and consequences of internalized stigma for people living with mental illness: a systematic review and meta-analysis. *Soc Sci Med* 2010;71:2150–2161.
19. Kobau R, Zack MM. Attitudes toward mental illness in adults by mental illness–related factors and chronic disease status: 2007 and 2009 Behavioral Risk Factor Surveillance System. *Am J Public Health* 2013;103:2078–2089.
20. Kobau R, Diiorio C, Chapman D, et al. Attitudes about mental illness and its treatment: validation of a generic scale for public health surveillance of mental illness associated stigma. *Community Ment Health J* 2010;46:164–176.
21. CDC. Attitudes toward mental illness—35 states, DC, and Puerto Rico, 2007. *MMWR Morb Mortal Wkly Rep* 2010;59:619–625.
22. Kessler RC, Barker PR, Colpe LJ, et al. Screening for serious mental illness in the general population. *Arch Gen Psychiatry* 2003;60:184–189.
23. Hanisch SE, Twomey CD, Szeto AC, et al. The effectiveness of interventions targeting the stigma of mental illness at the workplace: a systematic review. *BMC Psychiatry* 2016;16:1.
24. AVMA. *Veterinary Workforce Study (2013): modeling capacity utilization.* Schaumburg, Ill: AVMA, 2013.
25. Bartram DJ, Sinclair JM, Baldwin DS. Interventions with potential to improve the mental health and wellbeing of UK veterinary surgeons. *Vet Rec* 2010;166:518–523.

From this month's *AJVR*

Variability among strain variables derived from two-dimensional speckle tracking echocardiography in dogs by use of various software

Giorgia Santarelli et al

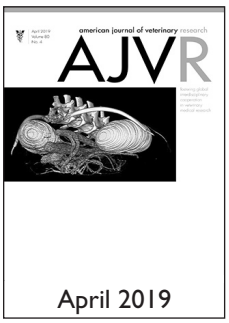
OBJECTIVE
To determine variability of global longitudinal strain (GLS) and strain rate (SR) measurements in dogs with and without cardiac disease derived from 2-D speckle tracking echocardiography (STE) by use of various software.

ANIMALS
2 cohorts comprising 44 dogs (23 cardiovascularly healthy and 21 with cardiac disease) and 40 dogs (18 cardiovascularly healthy and 22 with cardiac disease).

PROCEDURES
Transthoracic echocardiographic images in each cohort were analyzed with vendor-independent software and vendor-specific 2-D STE software for each of 2 vendors. Values for GLS and SR obtained from the same left parasternal apical views with various software were compared. Intraobserver and interobserver variability was determined, and agreement among results for the various software was assessed.

RESULTS
Strain analysis was not feasible with vendor-independent software for 20% of images obtained with the ultrasonography system of vendor 1. Intraobserver and interobserver coefficient of variation was < 10% for GLS values, whereas SR measurements had higher variance. There was a significant difference in GLS and SR obtained for each cohort with different software. Evaluation of Bland-Altman plots revealed wide limits of agreement, with variance for GLS of up to 6.3 units in a single dog.

CONCLUSIONS AND CLINICAL RELEVANCE
Results of longitudinal strain analysis were not uniform among software, and GLS was the most reproducible measurement. Significant variability in results among software warrants caution when referring to reference ranges or comparing serial measurements in the same patient because changes of < 6.5% in GLS might be within measurement error for different postprocessing software. (*Am J Vet Res* 2019;80:347–357)



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