

A single survey instrument reliably measures safety culture across 117 US primary and specialty care veterinary clinics

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Objective

To validate an adapted version of the Nottingham Veterinary Safety Culture Survey in US private practice veterinary hospitals, encompassing primary and specialty care settings, and to characterize differences in safety culture perceptions among veterinary care worker populations.

Methods

A prospective cross-sectional safety culture survey was conducted between October 4 and November 24, 2023. Veterinary care workers of 123 VCA hospitals were invited to participate. The survey included 27 adapted statements from the original instrument. Confirmatory and exploratory factor analyses evaluated model performance.

Results

Responses were received from veterinary technicians or assistants (461 of 702 [65.7%]), other support staff (150 of 702 [21.4%]), and veterinarians (91 of 702 [13.0%]). Responses were received from primary care (502 [71.51%]), specialty care (137 [19.52%]), and hybrid hospitals (63 [8.97%]). Results of the confirmatory factor analysis showed adequately performing fit indices. Differences in responses were observed between leadership and nonleadership roles (75.86% of statements). Veterinarian responses differed from both veterinary technician and assistant (33.3%) and support staff (29.6%) roles.

Conclusions

The psychometric properties of the Nottingham Veterinary Safety Culture Survey remain consistent when applied to a US private practice veterinary setting. Additionally, the adapted instrument, consisting of 27 statements, is appropriate for use across primary and specialty care hospital settings.

Clinical Relevance

Safety culture is intrinsically linked to the safety of veterinary care workers and the patients in their care. Using validated survey instruments allows for assessment of safety culture that supports monitoring of potential intervention effectiveness and changes in patient and worker safety or health.

Keywords: safety culture, safety culture survey, patient safety, veterinary patient safety, medical error

Veterinary and human health care organizations are recognized as high-hazard and high-risk industries for health care workers (HCWs)^{1,2} and veterinary care workers (VCWs)^{3,4}; these risks also affect the patients under their respective care.^{5,6} It is vital that HCWs feel valued, supported, and, most importantly, safe in order to deliver a high caliber of care to their patient populations.¹ This underlying concept

is best defined by the culture of safety of the health care organization, which is often evaluated at the individual hospital or departmental unit. Safety culture refers to the knowledge, beliefs, and attitudes that determine commitment, approach, and proficiency of an organization's safety management.^{7,8}

In health care professions, safety culture is built on the notion of supporting safe patient care while also ensuring that HCW safety is secure.⁹ Evidence supports a strong association between perceived safety culture and worker injury. Within poorer safety culture environments, there is an increased risk of injury and illness among workers.^{9,10} Moreover, a poor safety culture has been shown to increase the risk of patient safety events (PSEs) in human health care¹¹;

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conversely, a positive safety culture has been associated with decreases in hospital length of stay and other prognostic indicators of care.^{12,13} This further illustrates the interconnection of risks and hazards underpinned by safety culture among workers and patients alike. These observations are understudied in veterinary medicine,¹⁴ but it can be inferred that similar implications would apply between VCWs and their respective patient populations.

The underlying safety culture of an organization can be readily measured and evaluated through the shared perceptions of the organization's workforce as determined by psychometrically validated instruments.^{7,11} There are over 20 such instruments available in human medicine, with the Safety Attitude Questionnaire and Hospital Survey on Patient Safety Culture being the most common instruments used to measure safety culture in human health care.¹⁵ In contrast, there are only 2 safety culture instruments that have been developed and validated for use in veterinary health care. The Nottingham Veterinary Safety Culture Survey (NVSCS) was developed on the basis of adapted questions from the Safety Attitude Questionnaire and Hospital Survey on Patient Safety Culture and was validated for use within a UK veterinary hospital setting.¹⁶ A psychometrically modified version of the NVSCS was subsequently developed and validated within a single academic teaching hospital in the US.¹⁷ In the US private practice setting, consisting of primary care (PC) and specialty care (SC) hospitals (among other classifications), there isn't a validated safety culture instrument reported for veterinary use.

The purpose of this study was to psychometrically validate an instrument for the assessment of safety culture in private practice veterinary hospitals across multiple care settings, including PC, SC, and practices offering both services (hybrid care [HC]), as well as across a wide geographic range within the US. Additionally, this study aimed to characterize the safety cultures and perceptions among a large pool of veterinary hospitals including analyses of potential differences among care settings, professional roles, and leadership levels. We hypothesized that a single instrument, a US-adapted NVSCS, could measure safety culture across a variety of hospital settings in US private practice clinics. We also hypothesized that the existing psychometric properties of the NVSCS, specifically the safety domain or factor structure, would remain consistent when applied to this US population.

Methods

A cross-sectional survey study using a 1-stage cluster sampling design was conducted within VCA Animal Hospitals, a group of private veterinary practices spanning the continental US, Hawaii, and Alaska. A total of 123 PC, SC, or HC hospitals representing 4,852 VCWs were included in the study by random selection using a random number function. All VCWs of selected hospitals, regardless of role or position, were invited to join the research study. Invites were sent via email to each VCW employer-provided

email address. Each email included an overview of the study purpose and aims as well as a link to the study survey. The survey was hosted via a secure web platform (Forms; Microsoft Corp) and first distributed on October 4, 2023. The survey remained open for responses until November 24, 2023, with additional reminder prompts sent via email on October 25 and November 14, 2023. Participation or completion rates were not determined because view/read rates of the email invites were unknown. All survey questions were elective, allowing for incomplete survey submissions; *not applicable* was also a selectable option for all safety culture statements. Incentives were not offered for survey completion. Survey content was displayed over 5 screens, without adaptive questioning, and questions were not randomized in presentation. Prior to submission of the survey, participants were able to review or edit their responses.

Safety culture instrument

The original NVSCS consists of 29 statements representing 4 domains of safety culture.¹⁶ The instrument was modified to remove 2 questions that were less applicable to the intended study population: "Management regularly discusses the results of clinical audit with the team at this practice," and "Information is sometimes lost at handover between part-time workers at this practice." All other questions were kept with minimal changes made to verbiage, which was adjusted for the application of the instrument to the US veterinary setting based on initial instrument piloting. The resulting safety culture instrument consisted of 27 questions spanning 4 safety domains including the following: (1) Organizational Safety Systems and Behaviors; (2) Staff Perceptions of Management; (3) Risk Perceptions; and (4) Teamwork and Communication (**Supplementary Table S1**). Two additional questions were added to the survey for evaluation in the study. The first question was added from the North Carolina State University Veterinary Safety Culture Survey and had a high loading score on exploratory analysis: "I would feel safe having my own pet treated here."¹⁷ On the basis of Fowler et al,¹⁸ the second question was added to include a statement describing potential hierarchy implications on safety dynamics between veterinarians and other VCWs: "When animal handling is required, 'protecting the veterinarian at all costs' is a common practice or belief at this hospital." All safety culture questions were formatted as 5-point Likert scale statements ranging from 1 = strongly disagree to 5 = strongly agree. Several statements were negatively worded and recoded to reflect the same scoring and scale of the positively worded statements prior to analysis.

Ethical approval and data management

Ethical review exemption status was obtained from an external institutional review board (Solutions IRB) prior to the study's start date. Surveys were conducted anonymously; no information was collected for the purpose of identification of individual VCWs. The collected demographic details included information that could be

used to triangulate the identity of the respondent. However, this could not be done with any degree of accuracy and was not attempted by the investigators. All collected data were treated with anonymity and confidentiality; only a single author (TSM) had access to the raw data responses. All surveys were considered elective; participants could elect to not participate in the study or end their participation at any time. An informational sheet was provided to all participants that identified the investigator and outlined the intent of the research, the nature of the questions, any potential risks, the expected survey length, and data storage considerations.

Collected demographic information included hospital classification (PC, SC, or HC) and geographic location. Participant information included self-identified hospital roles: (1) *veterinary technicians and assistants*, including credentialed veterinary technicians, veterinary technician specialists, and veterinary assistants; (2) *veterinarians*, encompassing interns, residents, veterinarian specialists, and PC, emergency, and practice-limited veterinarians; (3) *support staff*, including client service representatives, kennel attendants, office coordinators, and other supportive roles not identified by the other categories; and (4) *leadership*, a self-identified role that may include supervisors, managers, and directors at the local or regional level. The leadership role was not mutually exclusive to the other VCW role types; therefore, veterinary technicians and assistants, support staff, or veterinarians could also be self-identified as being in a leadership role.

Statistical analysis

All analyses were performed with SAS, version 9.4 (SAS Institute Inc). A confirmatory factor analysis (CFA) of the 27 variables and 4 safety domains from the NVSCS was performed with PROC CALIS in SAS. The CFA was performed to determine whether the 4 safety domain structures (factors) were reproducible with appropriate fit when tested in this study population. To utilize all available information in all observations, the full information maximum likelihood estimation method was used. Cronbach α 's were calculated for each safety dimension. An exploratory factor analysis (EFA) was performed to further examine the interrelationships between all 29 available statements (27 statements from the NVSCS and the 2 additional statements added by the authors). The EFA was used to determine factor structure of the instrument without consideration of the a priori factors (4 safety domains) of the original NVSCS. The EFA was set to a 4-factor solution, and oblique (oblimin) rotation was used. Both CFA and EFA analyses were also stratified by hospital classification as secondary analyses. Specialty care and HC hospitals were grouped together because of similarities in hospital structure and the average statement responses were more statistically similar between these 2 hospital classifications. Maps were created with open-source QGIS, version 3.40 LTR (QGIS).

Model fit is often evaluated by the χ^2 statistic; however, this test becomes overinflated in large sample sizes.¹⁹ Psychometric performance of the model

under the CFA was instead assessed by model fit indices, including comparative fit index (CFI) for absolute fit, root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) for misfit of the model.²⁰ The following fit indices criteria were used to assess the CFA: (1) CFI values between 0.9 and 0.95 were reflective of adequate model fit, with > 0.95 being indicative of exceptional fit, and (2 and 3) RMSEA and SRMR values of < 0.08 were reflective of adequate fit, with < 0.05 being regarded as exceptional fit.^{19,20} Exploratory factor analyses were evaluated on the basis of loading values of individual statements (> 0.5) and by the proportion of variance explained by each identified factor.

A generalized linear mixed model was used to analyze each question response with a multinomial distribution and cumulative logit link as appropriate for ordinal data. The model had fixed effects of hospital leadership, position role type, and hospital class as well as a random intercept of individual hospital location. The Satterthwaite *df* method and residual pseudolikelihood estimation were used in the analysis. Multiple comparisons were performed between role types and between hospital classes. All *P* values from all questions as a single family were adjusted for multiplicity using the false discovery method of Benjamini and Hochberg.²¹ Radar plots were used to visualize the statistically significant (*P* < .05) differences in individual safety culture statement responses among position role types as well as hospital classifications. Radar plots were created with PowerPoint (Microsoft Corp).

Results

A total of 123 hospitals were surveyed; at least 1 response was received from 117 hospital locations (95.1%). Of the 4,852 VCWs surveyed, 70 of the emails were delivery fails. There were 702 individual survey responses received; 25.2% (177) had missing values where at least 1 question was not answered (**Figure 1**). Responses were received from PC (502 [71.51%]), SC (137 [19.52%]), and HC hospitals (63 [8.97%]; **Figure 2**). Veterinary technicians and assistants (461 [65.7%]), support staff (150 [21.4%]), and veterinarians (91 [13.0%]) contributed responses. Two hundred eleven respondents (30.1%) self-identified as being in a leadership role. Leadership roles were reported most commonly among support staff (74 [49.33%]), followed by veterinarians (35 [38.46%]) and, lastly, veterinary technicians and assistants (102 [22.13%]). The median survey response time was 6 minutes and 13 seconds (mean, 13 minutes and 39 seconds; minimum, 23 seconds; maximum, 4 hours, 54 minutes, and 48 seconds).

Responses to 9 of the 27 NVSCS statements (33.3%) statistically differed (*P* < .05) between the veterinary technicians and assistants group and the veterinarians group. Similarly, support staff responses differed from veterinarians on 8 statements (29.6%). In contrast, there was greater alignment between responses from the veterinary technicians and assistants group and the support staff group, with only 2 statements (6.9%) differing (**Figure 3**;

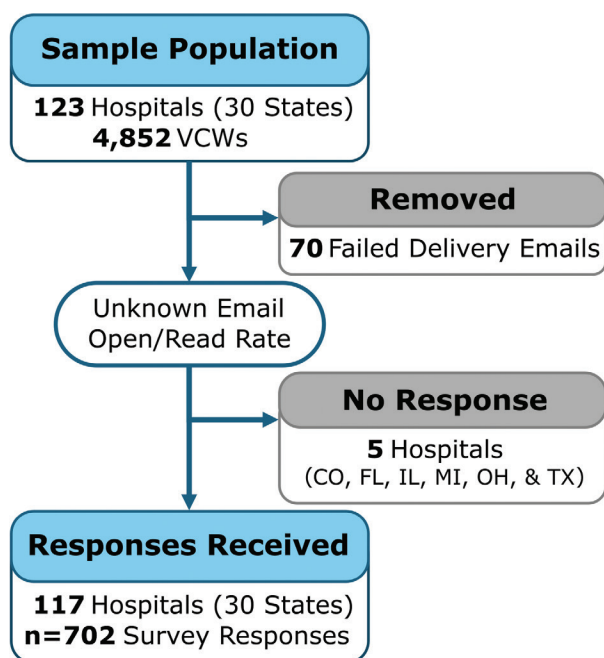


Figure 1—An adapted Nottingham Veterinary Safety Culture Survey instrument was shared with veterinary care workers (VCWs) in small animal hospitals spanning the US between October 4 and November 24, 2023. This flow diagram shows the total population invited to participate and the total received responses (n = 702).

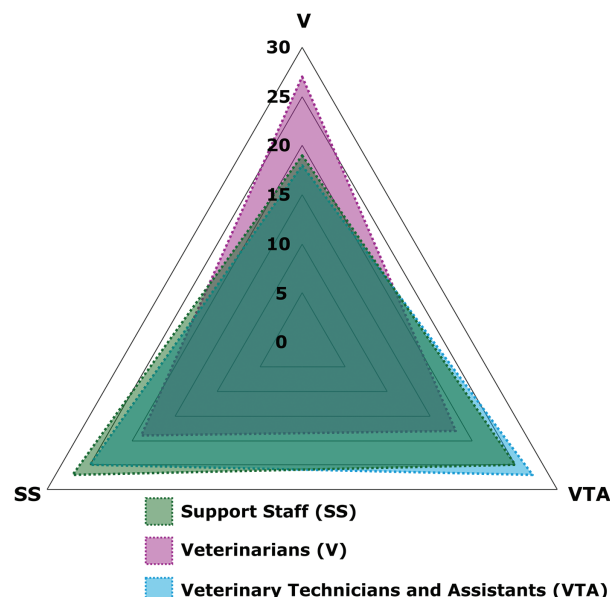


Figure 3—Radar plot of statistically significant ($P < .05$) differences in responses to the 27 statements from an adapted safety culture instrument. Responses were grouped by hospital role types, including veterinarians (V), veterinary technicians and assistants (VTA), and support staff (SS). Each corner of the plot represents the total number of possible survey statements for agreement within each group. Each group is displayed as a colored triangle, with the corners of each respective triangle extending along the inner axis to indicate the number of agreed statements (ie, statements that did not differ statistically [$P > .05$]) and each possible group comparison including itself. Visually, the more the triangles overlap, the greater the agreement between those respective groups to each other and to the opposing group. The study description is in Figure 2.

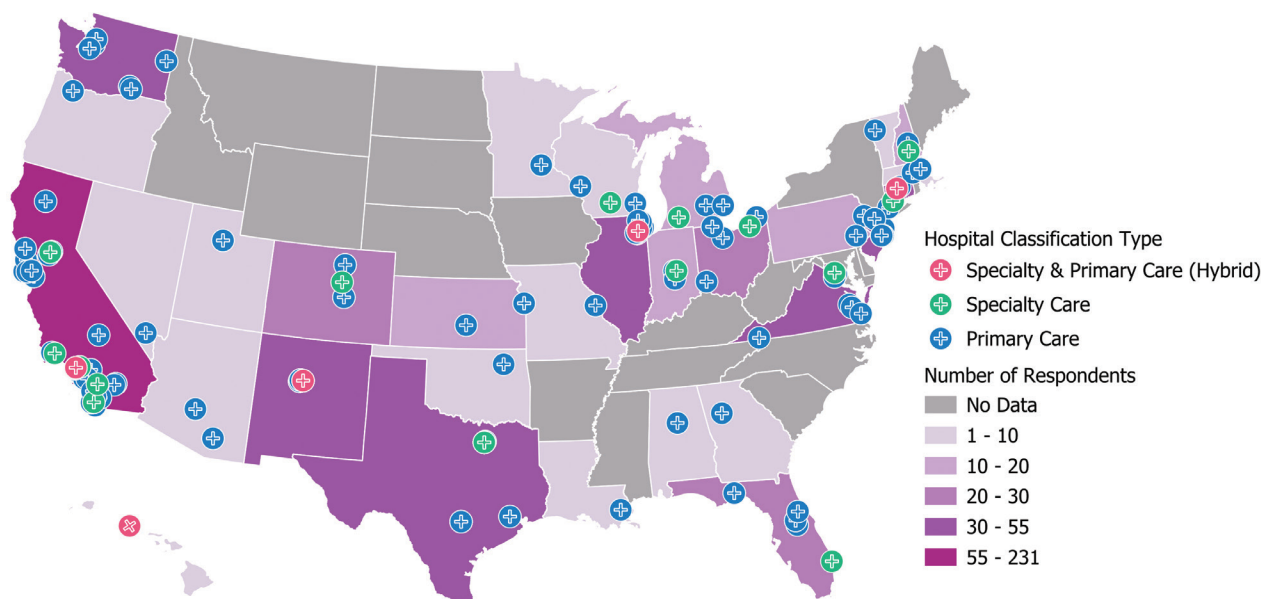


Figure 2—An adapted Nottingham Veterinary Safety Culture Survey instrument was shared with VCWs in small animal hospitals spanning the US between October 4 and November 24, 2023. This geographic map shows the number of safety culture survey respondents by state from 702 total survey respondents. Hospitals are mapped by location and classified as either primary care, specialty care, or primary care/specialty (hybrid) care; all hospitals (n = 117) had at least 1 respondent. States marked as *no data* did not have any hospitals invited to participate in the study.

Supplementary Tables S2 and S3). Response comparisons between leadership and nonleadership roles showed statistical disagreement ($P < .05$) on 22 of 29 statements (75.86%; **Supplementary Table S4**). Responses from PC hospitals statistically differed from responses at both SC (13 statements [48.1%]) and HC (16 statements [59.3%]) hospitals, but responses to all statements were statistically similar ($P > .05$) between SC and HC locations (**Figure 4; Supplementary Tables S5 and S6**).

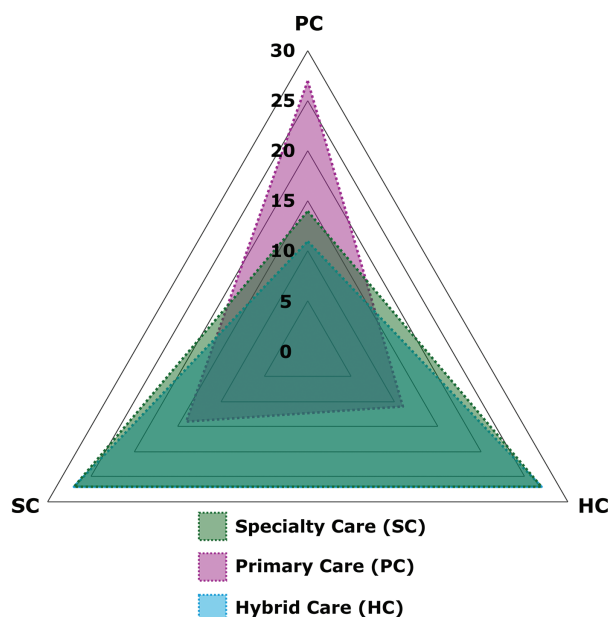


Figure 4—Radar plot of statistically significant ($P < .05$) differences in responses to the 27 safety culture instrument statements described in Figure 1. Responses were grouped by hospital classification, including primary care (PC), specialty care (SC), or primary care/specialty (hybrid) care (HC) settings. The study description is in Figure 2, and interpretation of the plot is described in Figure 3.

The crude CFA including all 702 responses was assessed with the a priori safety domain structures and the 27 statements of the original NVSCS (**Supplementary Table S7**). The χ^2 statistics were 1,607.7725, with adequately performing RMSEA (0.0760) and SRMR (0.0660) fit indices and an inadequate CFI (0.8504). All Cronbach α 's were ≥ 0.58 (**Table 1**).

Table 1—An adapted Nottingham Veterinary Safety Culture Survey instrument was shared with veterinary care workers at US small animal hospitals between October 4 and November 24, 2023.

Factor	No. of statements	Cronbach α
Organizational Safety Systems and Behaviors	7	0.838*
Staff Perceptions of Management	8	0.821*
Risk Perceptions	4	0.582
Teamwork and Communication	8	0.885*

The Cronbach α is shown for each of the 4 Nottingham Veterinary Safety Culture Survey safety dimensions from 702 survey responses within 117 US private practice hospitals. Cronbach α 's are measures of internal consistency within a factor or safety dimension; values > 0.7 are considered an acceptable fit. *Value > 0.7 .

The stratified CFA between PC and SC or HC did not show any meaningful differences in model fit indices, both models had adequate RMSEA and SRMR values of < 0.08 , and there was no improvement in CFI values (0.8312 and 0.8419, respectively). An iterative CFA process was performed with the use of the crude population for instrument refinement. There were 8 statements selected for removal from the instrument based on poor loading values ≤ 0.5 from the crude CFA and consensus among the authors. The second CFA comprised 19 statements and 3 safety domains; the Risk Perceptions domain was removed in the process (**Supplementary Table S8**). The model fit did not improve from this refinement step (CFI = 0.8923, RMSEA = 0.0867, and SRMR = 0.653). At this stage, all statements had an appropriate loading value of ≥ 0.53 and all domains had a Cronbach $\alpha \geq 0.82$; there were no further statements or domains eligible for removal to refine the CFA further (Supplementary Table S8 and **Supplementary Table S9**).

An EFA was performed to determine whether there was an underlying factor structure that differed from the a priori structure of the original NVSCS. The EFA was performed using only responses that were considered complete ($n = 525$) for all 29 statements (including the 2 added statements that were not part of the NVSCS). Only 13 of the 29 statements (44.83%) had a sufficient loading score of > 0.5 on the EFA. One statement reorganized to a different factor structure. "I respect hospital leadership" had a loading value of 0.63 for Factor 1, which included 6 of the 7 statements from the Organizational Safety Systems and Behaviors domain of the NVSCS (**Supplementary Table S10**). The identified factors' explained proportions of variance were 9.48, 6.12, 4.55, and 1.34 for Factors 1, 2, 3, and 4, respectively. The EFA was then stratified on hospital classification comparing PC ($n = 366$) to SC or HC (159) to elucidate whether there were potential differences in factor structuring between the 2 hospital groupings that could be an underlying cause for the lack of model fit in the other analyses (both EFA and CFA alike). The stratified EFA for both PC and SC or HC had 14 statements (28.28%) with loading values > 0.5 . Although there were some variations in which statements loaded appropriately between the stratified EFAs, all statements remained within the a priori safety domains for the NVSCS, except for the previously identified statement from the crude EFA that loaded under Factor 1. Thus, there were not any meaningful changes in domain structure that would support the need for stratification of the instrument for model fit.

Discussion

This study represents the largest safety culture instrument validation study to be conducted within the veterinary profession and the only study to be performed within the US private practice setting. Our findings suggest that the adapted instrument's properties are sufficient for application and use in the US private practice setting. This conclusion is exemplified by the results of the crude CFA, which showed that most fit indices met adequate model performance criteria. While the CFI was indeed below the criteria threshold, this could be considered

acceptable given that fit indices thresholds can be subjective and not always reproducible in varying studies or instruments.¹⁹ This conclusion is supported by the second CFA performed on the refined instrument, which did not produce sufficient improvement in model fit to justify changing the instrument. Thus, we accepted our first hypothesis that the psychometric properties of the NVSCS would remain consistent in this population. Furthermore, the lack of model fit differences found in the stratified CFA by hospital classification indicates that a single instrument is appropriate for measuring safety culture across PC, SC, and HC settings, supporting the acceptance of our second hypothesis.

Similar findings were reported by Love et al¹⁷ in their validation study of the NVSCS in a single academic teaching hospital (North Carolina State University). However, their results showed a much poorer performance of fit indices in the CFA (RMSEA > 0.05, CFI = 0.555), indicating that the psychometric safety domain structures were not reproducible. Additionally, their EFA results showed 25 of the 33 statements (75.8%) having a loading value > 0.5, with 12 statements (36.4%) deviating from the predefined domains of the original NVSCS. We also conducted an EFA to investigate whether similar conclusions could be reached in our study population. Our results did not provide an EFA performance that was strong enough to warrant restructuring of the instrument domains at both the crude and stratified (by hospital classification) levels, nor did it warrant the inclusion of the 2 additional statements explored alongside the NVSCS. One potential reason for the difference in our conclusions is that there are many operational and clinical differences to the structure, staffing, presenting patient population, and function of private practice hospitals compared to a university teaching hospital. These differences are most extreme when comparing against private practice PC hospitals. However, contrasts are less stark when comparing against private practice SC hospitals given that many of these practices are considered teaching hospitals that offer house-officer training programs. These differences in population reinforce the divergence in CFA findings between our study in US private practice hospitals and the findings of Love et al¹⁷ in a US academic teaching hospital. We posit that while the findings of Love et al¹⁷ rejected the domain structure and properties of the NVSCS, our study's results supported the NVSCS's domain structure and properties, likely owing to greater similarities between the hospital settings in our study and that of Oxtoby et al.¹⁶ Although this study was limited to hospitals within the VCA Animal Hospitals network, these practices are added to the network as acquisitions and are not subscribed to formulary-based practices. Therefore, this population of hospitals represents an appropriate approximation for hospital structures existing within the private sector for PC, SC, and HC clinics alike.

The 4 safety domains of the NVSCS capture meaningful components that comprise an organization's safety culture. Safety culture consists of 7 contributing subcultures: (1) strong and committed leadership; (2) a

safe team environment; (3) utilization of evidence-based practices; (4) strong team communication; (5) encouraging learning environment; (6) a just culture for error management; and (7) patient-centered care.^{14,22} These components can be evaluated by the 4 NVSCS safety domains, with overlapping themes presenting in the domain statements and domain function. When evaluating the safety culture of a hospital, it is important to consider whether the overarching culture is considered positive and healthy, but it is also important to evaluate the safety domains and individual statements. This is particularly beneficial when the safety culture is poor because it provides direction for organizational intervention.

The first safety culture domain of the NVSCS is Organizational Safety Systems and Behaviors. The present study's adaptation of the NVSCS removed a single statement from this safety domain. However, the domain continued to have strong CFA performance measures despite this change to the instrument. This safety domain is concerned with the systems that are in place to prevent human error that may cause PSEs. It is also concerned with how the culture of the hospital responds to these errors and PSEs. A healthy or positive safety culture foremost recognizes that human error is inevitable, and thus preventive systems are necessary to minimize the frequency, severity, and impact of medical errors.^{23,24} Furthermore, when these adverse or safety events occur, hospitals should have systems in place to both report and track these incidents. This is largely considered foundational to building a culture that prioritizes safety in both human^{23,25} and veterinary^{26,27} medical fields. While the number of published articles on PSE reporting is small in the veterinary field,^{24,28} it is gaining traction with 2 recent publications^{27,29} on multihospital PSE-reporting systems. Lastly, organizational commitment to safety culture must extend to action. Error discussion among teams is intertwined with a balanced environment that prioritizes honesty and transparency with a sense of security and a value in learning, progression, and development.^{30,31}

The second NVSCS domain, Staff Perceptions of Management, also performed strongly on CFA; no statements were removed in our present adaptation of the instrument. Safety culture is spearheaded by leadership and requires commitment at all levels of the organization, including senior-level personnel as well as formal leadership roles.^{14,32} At its base, patients receive better care when teams are well led and supported.^{33,34} At its apex, leadership is directly responsible for engendering a culture of safety for patients as well as security among team members.^{16,22} In turn, this directly influences the shape and form the organization's culture will take. In our study, we found that leadership perceptions of safety culture were not statistically similar to those of individuals in nonleadership roles on the majority of instrument statements. This disconnect may be expected since leaders are expected to set the tone for promoting a healthy safety culture. However, this could be a cause of culture dysfunction if the disconnect in perceptions is drastic or present in an overall poor safety culture setting. Another component

of leadership's role in safety culture is its impact on psychological safety, which is a subcomponent of safety culture and has a synergistic relationship with patient safety.³⁵ For teams to feel psychologically safe, individuals must feel safe to question leaders or senior members, the culture must support learning, and, foremost, individuals must be able to discuss mistakes without fear of repercussion.^{35,36} Psychologically safe environments can be challenging to achieve in veterinary medicine because of inherent traditional clinical hierarchies.³⁷ Clinical hierarchies promote asymmetry among teams, leading to interprofessional gaps in communication and conflict.^{38,39} Flattening of the clinic hierarchy is key to supporting high-functioning and psychologically safe teams by promoting freedom of communication regardless of perceived seniority or hierarchy position.^{37,40}

The third NVSCS safety domain is Risk Perceptions, and it is the smallest of the 4 safety domains. The original instrument included 5 statements; when adapted to our hospital population, a single statement was removed. This safety domain also had the poorest performance in the factor analysis. This domain is concerned with individual perceptions of workload and fatigue limitations in providing care. It originates from human medicine, where surgeons had unrealistic expectations of their ability to perform medical care unaffected by limiters of fatigue, excess workloads, and stress.^{16,41} For instance, 70% of surgeons in 1 study⁴² stated that fatigue did not affect their performance. One reason this domain may not have performed well is that the veterinary profession and medical working cultures in general have changed over time. There is greater recognition of work-life balance^{43,44} in addition to more constant pressures of chronic understaffing of veterinarians and veterinary technicians.^{45,46} Human medicine commonly recognizes nurse-to-patient ratios as a contributor to PSEs.⁴⁷ This is also starting to be recognized in veterinary medicine, with Hayes et al⁵ showing that patient-to-veterinary technician ratios of < 4:1 in an ICU setting were associated with a reduction in errors. They also affirmed that maintaining patient safety during peak workloads is dependent on increasing staffing numbers accordingly.⁵ However, when this safety domain was dropped from the instrument as part of the iterative CFA, the performance did not significantly improve to justify its removal. Therefore, this domain still provides relevant information contributing to safety culture that warrants its continued inclusion.

The last NVSCS domain is Teamwork and Communication. No changes were made to the statement structure for this domain, and the CFA measures continued to perform appropriately in our results. Teamwork and communication are essential to supporting a positive safety culture and are also paramount to improving patient care and avoiding PSEs.⁴⁸ The function of healthy teamwork and communication is underpinned by the need for psychologically safe environments and interprofessional collaboration and respect. For instance, psychologically safe environments facilitate open communication, allowing

VCWs to raise concerns when errors are identified. Pinho et al²⁶ found that team members were more likely to identify errors as opposed to self-identification, highlighting the importance of teamwork dynamics in preventing PSEs. When teamwork and communication fail or are unsupported by psychological safety, an increase in PSEs has been observed in veterinary settings.^{48,49} A healthy interprofessional collaborative environment is best supported by flattening the clinical hierarchy. In veterinary medicine, veterinarians and veterinary technicians tend to work in professional silos despite the high level of daily collaboration required among these roles, causing a hindrance to the flow of information and a breakdown of communication.³⁷ Moreover, in our study, we found that perceptions of safety culture differed significantly between the veterinarian group and the veterinary technician and assistant and support staff groups (Figure 2; Supplementary Table S2), while there were few differences observed between both nonveterinarian role types. We can also conclude that this difference in perception is not inherently tied to leadership implications. While the veterinarian group had a higher proportion of leadership respondents than the veterinary technician and assistant group, the support staff group had the highest proportion of leadership roles. Therefore, we'd expect to see a greater similarity between the veterinarian and support staff groups if leadership responsibilities influenced differing perceptions between professional roles. This was not supported by our results and instead supports the concept of professional silos and clinical hierarchies being present in this population.

Our findings support the use of the NVSCS instrument in the US private practice setting; however, there is room for improvement of the instrument's fit performance. Future research should focus on shortening the length of the instrument to encourage greater participation by VCWs. The adapted NVSCS presented here consists of 27 statements, which took an average of 13 minutes for respondents to complete. An ideal survey instrument should minimize participants' time commitment,⁵⁰ thereby increasing completion rates among VCWs to better capture safety perceptions within an organization.²⁰ Because our findings support the validation of the existing NVSCS structure, future research using this instrument will promote greater comparability of the safety culture scores between publications. Use of the existing NVSCS structure is preferable over creating an alternate version of the NVSCS that would instead promote splintering of safety culture instruments resulting in a diminished capacity for future comparative effectiveness research in systematic reviews or meta-analyses.

There were several limitations to this research. Survey response rates may have been limited by access constraints. This study provided print flyers with QR codes to mitigate potential digital barriers; however, having the option for print responses could have helped increase response rates. This barrier may have contributed to an overrepresentation of

respondents in leadership roles in the sample population and potentially introduced selection bias in our results. An additional limitation may include differing interpretations of the survey purpose. The fact that many of the statements appear clinical in nature could have reduced nonclinical roles, such as those within the support staff category (including office support or housekeeping roles), from responding to the survey. All roles within a given hospital contribute toward the safety culture of the institution. It may be important to further emphasize this in future distributions of safety culture instruments.

In conclusion, our findings support that the psychometric properties of the NVSCS instrument remain consistent when applied to a US private practice veterinary setting. Additionally, the single adapted NVSCS instrument (27 statements) is appropriate for use across the range of private PC, SC, and HC hospitals within the US.

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Disclosures

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