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Development, validation, and cut-off points for a questionnaire to measure sources of stress in veterinary medicine (SOS-VetMed)

A. Osca^{1*}, L. Millán¹, L. Vela¹ and J. Barrado¹

Abstract

Background Occupational stress is a serious problem in veterinary medicine; however, validated instruments to measure this problem are lacking. The aim of the current study was to address this literature gap by designing and validating a questionnaire and establishing the cut-off points for identifying veterinarians with high and low levels of stress.

Methods The study involved two sub-studies with two Spanish samples. The first study ($N=30$ veterinarians; 66.7% women; 63.33% from small animal clinics) investigated the factors related to the work environment that caused the most stress; the results were analyzed using thematic content analysis. The second study ($N=1082$; 70.8% women; 71.4% from small animal clinics) involved designing and validating a questionnaire to measure sources of stress in veterinary medicine, as well as establishing the cut-off points for interpreting the results using receiver operating characteristics (ROC) curve analysis.

Results The first study showed the main sources of stress and allowed items to be defined for the questionnaire. The second study validated the Sources of Stress in Veterinarian Medicine (SOS-VetMed) questionnaire and confirmed five sources of stress with adequate reliability and validity indices: "work overload," "work-family conflict," "emotional burden of work," "organizational factors," and "emergency problems." Exploratory and confirmatory factor analyses verified a structure of five factors (Cronbach's alpha values ranging between 0.92 and 0.69). The five subscales of the SOS-VetMed questionnaire were positively correlated with two indicators of distress: "psychological complaints" and "psychosomatic complaints." The cut-off points indicated that 45.83% and 19.95% of the veterinarians surveyed had high and low levels of stress, respectively.

Conclusions The results confirmed that the SOS-VetMed questionnaire could be used to determine the stress levels of veterinarians and to design intervention programs to improve their workplace health.

Keywords Veterinary medicine, Source of stress, Questionnaire, Psychometric properties, Cut-off point

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Background

Most studies on workplace stress in veterinary medicine focus more on describing its consequences on health and less on its causes. Some of these studies have focused on the symptoms of psychological distress in these professionals, including burnout, anxiety, and depression [1, 2], compassion fatigue [3], or post-traumatic stress [3, 4]. Other studies have focused on physical symptoms (including pain and psychosomatic disorders) [5] and suicidal tendencies [6]. In describing this symptomatology, reference is made to three sources of stress: stress specific to the profession, stress associated with interactions with animals, and stress associated with interactions with individuals responsible for the animals, but progress has not been made in the assessment of these sources of stress [7].

Several systematic reviews [8–10] confirm the absence of evaluation instruments and terminological confusion. Scotney et al. [8] concluded by alluding that the disparity in terminologies used renders the determination of differences between workplace stress and its consequences. Stetina and Krouzecky [9] subsequently identified three categories of stressors: biological, psychological, and social. However, some of the items included in these categories are stress precursors but not stressors in the strict sense, for example, sex and age are biological stressors, and rumination and alcohol abuse are psychological stressors. The last systematic review [10], distinguished between stress as a source and strain as an outcome. Although it does not refer to this distinction, it confirms that more studies exist on the consequences of stress rather than on its causes.

Studies analyzing the sources of workplace stress in veterinary medicine can be described in terms of their qualitative [11–13] or quantitative [1, 2, 14–19] nature; however, they only offer classifications or taxonomies of stressors ordered according to their importance. First, qualitative studies using interviews were conducted to identify and describe the main sources of stress. For example, O'Connor [11] describes five stressors: “poor work–life balance,” “interaction with animal owners,” “specific aspects of euthanasia,” “dealing with poor animal welfare,” and “staff management responsibilities.” To date, qualitative studies are still being conducted to delve into specific stressors such as violent reactions from clients [12] and bullying and cyberbullying [13].

Gardner [14] was one of the first authors to use a quantitative methodology to assess the sources of stress in this profession. In a study involving 927 Australian veterinarians, she identified of the seven most important blocks of stressors: working hours, client expectations, unexpected outcomes, the need to update, personal relationships, economic issues, and personal expectations. Subsequently, the Merck Animal Health Veterinary Wellbeing

Survey [1] questioned 3,540 veterinarians regarding the importance of 11 issues; the topics most frequently considered critically important were “high levels of student debt,” “stress levels of veterinarians,” and “suicide rate among veterinarians.” Connolly et al. [15] also developed a taxonomy of occupational factors that impact the mental health of Australian veterinarians. This contained nine general stressors with the most common being “negative working conditions,” “challenging relationships with clients,” and “adverse events and patient outcomes.” Vande Griek et al. [2] subsequently identified a taxonomy of 15 major categories of stressors and 40 subcategories of more specific stressors ($N=1422$ United States veterinarians). The most common stressor categories included “financial insecurity,” “client issues,” “coworker or interpersonal issues,” and “work–life balance,” although the most common subcategories were “clients unwilling to pay,” “low income,” “cost of maintaining practice,” and “government or state board policies.”

Other quantitative studies assessed the stress levels of veterinarians using questionnaires designed for other healthcare professionals, usually nursing or emergency medicine [16]. These studies focused on work overload [17], lack of control [18] or emotional stress [19].

As discussed, these studies differed and included a wide variety of stressors. The findings of most confirmed issues such as difficulties with clients, overwork, work–family conflict, economic problems, and euthanasia, but only two employed questionnaires with psychometric guarantees for identifying general sources of stress in this profession. The first questionnaire is the Veterinary Job Demands and Resources Questionnaire (Vet-DRQ) [20], developed in the Netherlands. The authors combined qualitative and quantitative methodologies. They began with three group interviews involving 13 recently graduated veterinarians in different fields. The gathered information was used to design a questionnaire comprising 32 questions covering seven sources of stress, although they were not specific to veterinary medicine: “task ambiguity,” “work overload,” “physical demands,” “job insecurity,” “working conditions,” “work–self conflict,” and “role conflicts.” The questionnaire was tested, using a sample of 727 recently graduated veterinarians, and the subscales were assessed using exploratory factor analysis. Andela [21] in France also combined qualitative and quantitative methodologies to design the Veterinarians Stressors Inventory. First, she interviewed 25 professionals and developed a 39-question questionnaire that she tested on a sample of 490 veterinarians. Through factor analyses, she categorized eight valid and reliable sources of stress: “negative work–home interactions,” “issues with coworkers,” “workload,” “responsibilities,” “financial issues,” “emotional demands,” “issues with clients,” and “feelings of being in danger.”

Finally, two questionnaires were used to assess stress caused by the relationship with animal owners, which is one of the most common sources of stress. These were the Burden Transfer Inventory [22] and the Positive and Negative Experiences Scale [23].

However, none of the proposed questionnaires offer information on the cut-off points that allow identifying stress levels. Cut-off points are essential to make reliable diagnoses and formulate appropriate recommendations.

Considering this background, the objective of this study was to develop and validate the Sources of Stress in Veterinary Medicine (SOS-VetMed) questionnaire with regard to circumstances faced by veterinary professionals in Spain, and to establish the cut-off scores for identifying professionals who have high levels of stress and may have more health issues. This study focused on (1) analyzing the internal consistency and reliability of the SOS-VetMed; (2) examining its factor solution through confirmatory factor analysis; and (3) exploring cut-off scores or thresholds for identifying high levels of stress using receiver operating characteristics (ROC) curve analysis.

Methods

Two studies were conducted. In the first one, 30 veterinarians from different sectors were asked to describe the situations that caused the most stress in their daily work. Their answers were analyzed by using thematic content analysis. This procedure allowed the investigation of problems as they were experienced by the affected individuals. Based on the information from the first study, the second study involved designing a questionnaire and testing its psychometric characteristics by using a final sample of 1082 veterinarians. Finally, cut-off points for identifying veterinarians with stress were determined. This study was approved by the Ethics Committee of the National University of Distance Education (Madrid, Spain; reference no.: 26-SISH-PSI-2023). Written informed consent was obtained from all survey participants.

Qualitative study

Convenience sampling was used for the qualitative study. Volunteers were recruited through a private social media group with a membership of more than 1,500 veterinarians. The interviews were conducted by a practicing veterinarian with a degree in psychology. This procedure allowed the interviewees to be candid and provide adequate information. Thirty veterinarians were interviewed about different aspects of their profession. One question was asked in this study: "What do you find most stressful in your daily work?" and the objective was to identify categories of the sources of stress. Thematic saturation (i.e. the point during the analysis of the interviews at which no new themes emerge) was reached after the first

15 interviews were coded and the analysis of the transcripts generated no additional themes [11]. Therefore, the sample was expanded to include another 15 younger professionals from different sectors. Eleven (36.6%) interviews were conducted face-to-face, and the rest were conducted via videoconference. The audio and video recordings were subsequently transcribed and anonymized. Thematic content analysis involves familiarization with the responses, coding of initial categories, reviewing categories and refining and naming final categories. Two meetings were held to reach a consensus on all categories and their meaning. In the first meeting, the coding and data analysis process was discussed, checking the responses to ensure they accurately reflected the transcripts' contents. This stage identified 35 main sources of stress in 4 categories and 9 subcategories. This stage ensured the categories were informative and concise and had names that clearly defined their meaning. In the second meeting: (1) the 35 stressors were classified into the corresponding categories; (2) the number of stressors in each category was counted; (3) the percentages of the total number of stressors (35 stressors) identified in the thirty interviews were calculated; and finally, (4) it was checked whether the categories were more prevalent depending on the work of the veterinarians (with small or large animals, on hospitals or farms, etc.).

Quantitative study

Based on the responses collected in the qualitative part of the study, an online questionnaire was developed. It remained active for completion from October 2023 to December 2023. The questionnaire was advertised through the researchers' social network, specifically in a private Facebook group of veterinarians named "Ser Veterinario", which has over 1,500 active members. This group is frequently used to consult on doubts, complicated cases, and to share about emotionally difficult situations.

Results

Qualitative study

Sample characteristics

The final sample consisted of 30 veterinarians who worked in the north of Spain (Castile and Leon, Asturias, Galicia, and Catalonia). More than 60% of the participants were women (66.7%) and the rest were men (33.3%). The average age (standard deviation [SD]) was 42.37 (8.65) years, and the average (SD) length of service as a working professional was 16.80 (7.24) years. 50% of the sample were self-employed. The veterinarians were working in small animal clinics (63.33%), in hospitals (20%) and livestock farms (16.66%).

Findings

The following categories of statements related to the sources of stress were obtained, and they were ordered, based on the number of times they were reported in interviews (Table 1). The first category of statements was related to “stress caused by problems with animal owners”. These statements were recorded in 17 (48.57%) of 35 sources of stress. This statement was made by 10 self-employed veterinarians and seven regularly employed veterinarians. This statement is the most frequent among all veterinarians, regardless of whether they work with small or large animals.

This category grouped problems with animal owners because they have to manage their own emotional reactions when delivering bad news (e.g., “Owners are very upset because they consider their animals members of their families”) or they do not understand the diagnoses or follow the recommendations. A veterinarian working on a livestock farm explained: “The most stressful thing, an argument with a farmer who did not agree with what I was telling him ... These are people who have been working all their lives and do not deal well with changes ... My job is to convince them with good words that they are doing it wrong, so that they will do it right.” The other statements in this category were related to stress due to the lack of recognition for the work they do and allusions to not being considered on the same level as human doctors (e.g., “They don’t realize that we are the doctors for their animals”).

The second category included statements related to work overload. These statements were made by self-employed veterinarians (4 individuals) and regularly

employed veterinarians (5 individuals), with allusions to fatigue caused by “excessive working hours” or “excessive bureaucratic burden.” These statements were made on nine (25.71%) occasions. For veterinarians working on livestock farms or in the countryside, the burden is increased by the time spent on “commuting.” Emergencies and on-call duty also represent an overload to the point that some veterinarians indicated having stopped performing such jobs. One veterinarian spoke of the uncertainty and fear this cause: “We no longer do emergencies, but I used to warn all my friends in case I didn’t come back from duty.”

The third category included responses related to “problems with the organization and working conditions.” These problems included conflicts between colleagues or between bosses and employees, lack of coordination, inadequate distribution of tasks and responsibilities, and low salaries. This was observed in five (14.28%) responses from veterinarians working as employees.

The fourth category comprised statements related to ethical dilemmas. These statements were made by four (11.43%) respondents: three veterinarians were regularly employed, and one veterinarian was self-employed. These dilemmas arise primarily because of economic reasons and to avoid confrontations with animal owners who are used to many medical services being free of charge. The interviewees recognized the pressure they receive to reduce treatments and make them more economical (e.g., one veterinarian explained: “To have the feeling that you could have done more, that the animal could have been saved. I’ve had several of those cases. That creates stress for me because you could do more, and it’s not done for money”).

Table 1 Categories, sub-categories, and percentages

Category 1: Stressors related to problems with animal owners (48.57% respondents):

Sub-categories:

Excessive emotional reactions

Do not follow the recommendations

Lack of recognition

Category 2: Sources of stress related to work overload (25.71% respondents):

Sub-categories:

Excessive working hours

Emergencies

Category 3: Source of stress related to “problems with the organization and working conditions” (14.28% respondents)

Sub-categories:

Social conflicts

Low salaries

Category 4: Sources of stress related to ethical dilemmas (11.42% respondents):

Sub-categories:

Economic reasons

Avoid confrontations with animal owners

Quantitative study

Sample characteristics

The questionnaire was answered by 1215 veterinarians involved in small animal care (71.4%), large animals (13.9%), intensive production (3.7%), animal health (1.8%), agriculture (1.7%), research (1%), sales (1.1%), administration (2.1%), and other jobs (3.2%). There were fewer professionals in non-healthcare than in other sectors, and they were excluded from the study. Thus, the final sample comprised 1082 veterinarians dedicated to small animal medicine (80.22%), large animal medicine (15.62%), and intensive production (4.16%). Women accounted for 70.8% of the respondents and the rest were men. The average age was 41.60 (SD=10.33) years, and the average length of service in the profession was 16.67 (SD=9.97) years. In all, 39.7% had a bachelor’s degree, and the rest had a doctorate, master’s, or postgraduate degree. With regard to their employment status, 52.9% were contracted workers. Only 30.2% stated that they worked 40 h per week; 26% stated that they worked

Table 2 Subscales and items of the *SOS-VetMed* questionnaire and descriptive data (means and standard deviations)

Subscales and items	X	SD
Workload	3.95	0.72
1. Workload	4.04	0.93
2. Working long hours	3.90	1.03
3. Performing tasks that require more time than expected	3.78	1.00
4. Bureaucratic administrative tasks, which are also increased by new laws and regulations	4.11	1.04
Work–family conflict	3.91	0.96
5. Difficulties in reconciling work and family life	4.06	1.03
6. Work keeps me away from my family activities	4.10	1.02
7. The time I devote to my work prevents me from participating in family responsibilities	3.74	1.16
8. After work I am too stressed out to participate in family activities	3.77	1.17
9. Having trouble reconciling family and work	3.88	1.15
Emotional burden of work	3.62	0.79
10. Communicating bad news to clients about their pets	3.58	0.99
11. Demands from difficult clients	4.25	0.88
12. Arguments with customers over financial issues	3.90	1.09
13. The emotional overload of work due to the bond with animals	3.80	1.08
14. The feeling of being in danger due to dealing with difficult customers	3.14	1.29
15. Cruelty to animals	3.64	1.23
16. Believing that much more can be done for the animal, but nothing else being done due to economic issues	3.87	1.08
17. Clients come with a diagnosis that has already been arrived at and only want one to confirm it	3.26	1.29
18. Clients do not accept the death of their pets	3.42	1.19
19. Clients' emotional attachment to their pets	3.52	1.14
20. Performing euthanasia	3.29	1.21
Organizational factors	3.31	0.90
21. Lack of social recognition	3.93	1.17
22. Having no one to turn to for help and advice	3.25	1.25
23. Problems with colleagues	3.11	1.29
24. Problems with responsible bosses	2.86	1.50
25. Difficulties in professional development	3.44	1.17
Emergency problems	3.05	1.05
26. On-call duty	3.27	1.57
27. Always being reachable	3.73	1.46
28. Having no one to turn to for help and advice in emergencies	3.00	1.37
29. The feeling of being in danger during on-call time	2.49	1.42
30. The feeling of being in danger from handling and caring for animals	2.75	1.17

N=1082 veterinarians; Response: 1 = "It never affects me" – 5 = "It always affects me"

between 41 h and 50 h per week, and 15.9% stated that they worked for more than 50 h per week.

Findings

Table 2 shows the 30 items to evaluate the sources of stress for veterinarians. No veterinarian considered work–family conflict as their main source of stress in the first study, but it appeared throughout the interviews because it is related to work overload. Previous research on work stress in veterinarians has also included work–family conflict [2, 14, 21], considering that for women is an important source of stress [24].

Construct and criterion validity and reliability

First, we performed an exploratory factor analysis (EFA, principal components analysis with direct varimax rotation) for the 30 items of the questionnaire. The EFA suggested the presence of five factors (eigenvalues > 1 and scree plot) that could explain 58.76% of the variance. Subsequently, we performed two confirmatory factor analyses to confirm this structure: (i) a five-correlated-factor model (M1) and (ii) a hierarchical five-factor model with a general factor (second-order factor) (M2). The five-correlated-factor model showed a better model fit than the hierarchical model: $\chi^2=3364.61$; $\chi^2/\text{degrees of freedom}=8.52$; root mean square error of approximation=0.073; and comparative fit index=0.89 [24]. Furthermore, the reliabilities of all factors were adequate, with Cronbach's alpha (α) values ranging between 0.92 for work–family conflict and 0.69 for emergency problems (Table 3). With regard to the descriptive results, all mean scores of the subscales were above the central point of the response scale and ordered from the highest to the lowest, as follows: work overload ($\bar{x} = 3.95$; $SD=0.72$), work–family conflict ($\bar{x} = 3.91$; $SD=0.73$), emotional burden of work ($\bar{x} = 3.62$; $SD=0.79$), organizational factors ($\bar{x} = 3.31$; $SD=0.90$), and emergency problems ($\bar{x} = 3.05$; $SD=1.05$).

The criterion validity of the questionnaire was tested by calculating the Pearson correlations between the five sources of stress and two indicators of distress from the Burnout Assessment Tool [25]: "psychological complaints" (five items; item example "I feel tense and stressed"; $\alpha=0.83$) and "psychosomatic complaints" (five items; item example "I suffer from palpitations or chest pain"; $\alpha=0.78$) (Table 3). This questionnaire was administered alongside the *SOS-VetMed*. The Spanish version offered by its authors was used (https://burnoutassessmenttool.be/wp-content/uploads/2020/08/BAT_Spanish-short.pdf). The correlations were highly significant for all cases, although the highest correlations were for the "emotional burden of work" (correlation was 0.49 for psychological distress and 0.42 for physical distress) and "work–family conflict" (correlation of 0.45

Table 3 Means, standard deviations, correlations and reliabilities

	\bar{X}	DT	1	2	3	4	5	6	7
1. Emotional burden	3.62	0.79	0.89						
2. W/F Conflict	3.91	0.96	0.45**	0.92					
3. Emergency problems	3.05	1.05	0.51**	0.50**	0.80				
4. Organizational factors	3.31	0.90	0.54**	0.50**	0.56**	0.74			
5. Workload	3.95	0.72	0.42**	0.57**	0.40**	0.38**	0.69		
6. Psychological complains	3.27	0.98	0.49**	0.45**	0.39**	0.43**	0.40**	0.83	
7. Psychosomatic complains	2.68	0.91	0.42**	0.36**	0.36**	0.35**	0.33**	0.70**	0.78

Response: 1 = "It never affects me", 5 = "It always affects me"

ρ ** The correlation is significant at 0.01 (bilateral)

Cronbach's alpha in the diagonal

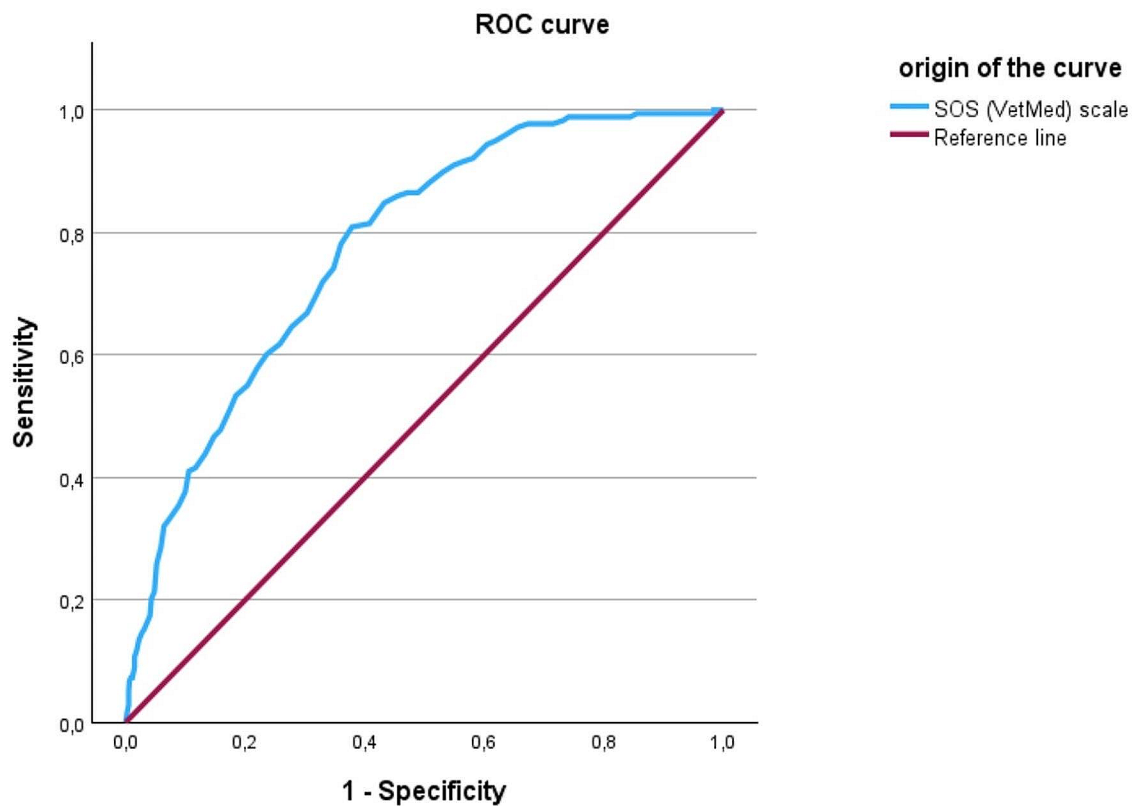


Fig. 1 ROC curve for the higher threshold

for psychological distress and 0.36 for physical distress). The source of stress that showed weaker correlations, although also highly significant, was "emergency problems" (correlation of 0.39 for psychological distress and 0.36 for physical distress).

Cut-off points

The cut-off points were calculated for the 30 items of the SOS-VetMed questionnaire to differentiate veterinarians who have high levels of stress (i.e., above the high threshold) from those who do not (i.e., below the low threshold). Based on a previous report [26], two gold standards related to stress were used: "psychological complaints"

scores and "psychosomatic complaints" scores [25]. For both cases, the maximum threshold corresponds to the 75th percentile and the minimum threshold corresponds to the 25th percentile. The SPSS 29 software allows calculation of the 25th and 75th percentiles of the gold standards: (1) 25th percentile: 2.60 for "psychological complaints" and 2.00 for "psychosomatic complaints", and (2) 75th percentile: 4.00 for "psychological complaints" and 3.40 for "psychosomatic complaints". SPSS29 software, in the classification option, also allows for the calculation of ROC curves and the areas under the curve (AUC) (Figs. 1 and 2). An ROC curve is constructed by plotting sensitivity (proportion of true positives/all cases)

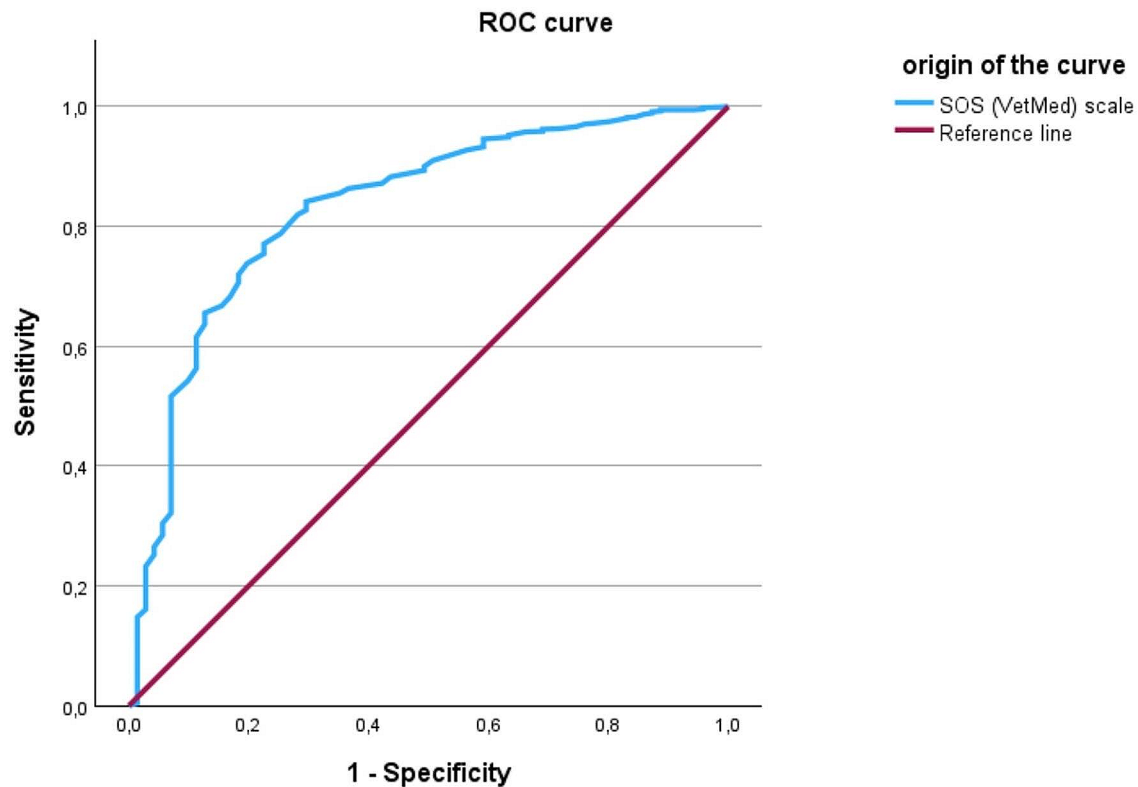


Fig. 2 ROC curve for the lower threshold

Table 4 SOS-VetMed higher threshold cut-off score

SOS VetMed	Sensitivity	1 - Specificity	Youden Index
3.55	0.865	0.472	0.393
3.58	0.860	0.455	0.405
3.62	0.848	0.432	0.416
3.65	0.815	0.408	0.407
3.68	0.809	0.378	0.431
3.72	0.781	0.360	0.421
3.75	0.742	0.348	0.394
3.78	0.719	0.329	0.390
3.82	0.697	0.318	0.378
3.85	0.669	0.303	0.365

Table 5 SOS-VetMed lower threshold cut-off score

SOS VetMed	Sensitivity	1 - Specificity	Youden Index
2.85	0.883	0.437	0.446
2.88	0.872	0.423	0.449
2.92	0.863	0.366	0.497
2.95	0.855	0.352	0.503
2.98	0.841	0.296	0.546
3.02	0.836	0.296	0.540
3.05	0.827	0.296	0.531
3.08	0.820	0.282	0.538
3.12	0.804	0.268	0.537
3.15	0.788	0.254	0.535

against 1 – specificity (proportion of false positives/all controls), for each possible cut-off score. By convention, sensitivity is plotted along the Y axis, whereas 1 – specificity is plotted along the X axis. The ROC curve provides a graphical representation of the proportion of veterinarians with stress correctly identified against the proportion incorrectly identified. The AUC for the high threshold cut-off was 0.776 and for the low threshold cut-off was 0.831. In Table 4 the value 0.776 falls between 0.780 and 0.882 (95% CI=0.741–0.810; $p < 0.000$). Similarly, the value 0.831 falls between 0.780 and 0.882 (95% CI=0.780–0.882; $p < 0.000$) (Table 5). An AUC value close to 1 indicates high precision [27], demonstrating that both thresholds were effective. The Youden index, defined as the maximum sum of sensitivity and specificity minus one [28], is another measure of diagnostic accuracy. Its values range from –1.0 to 1.0, with higher values indicating a test cut-off with greater discriminative ability. The results show that the two Youden indexes also offer the highest values.

As shown in Tables 4 and 5, the optimal cut-off points were 3.68 for the upper threshold and 2.98 for the lower threshold. Therefore, veterinarians with scores ≤ 2.98 on the SOS-VetMed questionnaire were considered not stressed, while veterinarians with scores ≥ 3.68 were considered highly stressed. Based on these results, the

percentage of veterinarians with high, low, and intermediate stress scores were 45.83%, 19.95%, and 34.20% respectively.

Discussion

As we have observed, research on workplace stress in veterinary medicine has focused more on its health consequences rather than on its causes. Descriptive studies and taxonomies for the different sources of stress among veterinarians exist, but questionnaires that provide sufficient information on the psychometric characteristics of questionnaires are few. Therefore, the objective of this study was to develop and validate the SOS-VetMed questionnaire and establish cut-off points for identifying veterinarians who have high levels of stress and may have more health issues. None of the existing studies have provided cut-off points, but these are essential for accurate diagnoses and the design of effective and efficient prevention programs.

Two sub-studies were conducted. In the first, which was qualitative, a sizeable group of professionals were asked about the main sources of stress in their daily work. Using the information obtained from the qualitative study, an online questionnaire was then developed and applied in a quantitative study that allowed the corroboration of the main sources of stress among Spanish veterinarians. The analyses allowed us to assert that the SOS-MedVet questionnaire assesses different sources of stress with psychometric guarantees, and the determination of the cut-off points allowed us to identify veterinarians who have high stress levels and an increased risk of health issues. In line with the results of research in this area [5, 6, 8–10], a high proportion of the participants showed high levels of workplace stress.

This study also had other strengths, involving sample quality related to the number and diverse characteristics of the participating veterinarians. Although we did not analyze a representative sample of the Spanish population, the size of our two samples, as well as the diversity and professional experience of the veterinarians included, validate our results.

Thirty interviews were conducted, and more than 1000 veterinarians in small and large animal care were surveyed. They had numerous years of professional experience, which is not common in research. This factor allowed us to gather valuable information.

For the qualitative and quantitative studies, relationships with the respondents responsible for the animals and work overload were the main sources of stress for veterinarians who participated in this research.

The qualitative study showed that “problems with animal owners” were the main sources of stress, which is consistent with reports of reviews on the subject [22]. In the quantitative study, questions on this source of stress

were grouped with questions referring to negative emotions produced by these relationships (because of cruelty to animals, ethical aspects, etc.), and a subscale called “emotional burden of work” was created.

In the quantitative study, the main source of stress was “work overload,” confirming one of the main issues in the profession, which is also reflected in the reviews on the subject [10]. For both studies, the discrepancy in the order of importance of these two sources of stress may be explained by the differences in assessment. The interviews asked about the most stressful situations, whereas the questionnaire used the Likert scale.

Work–family conflict was considered the next most important source of stress. This finding was consistent with the reports of several studies and can be explained by long working hours and the high proportion of women [29, 30]. Stress due to “organizational factors” and “emergency problems” had lower scores that were above the midpoint of the scale. Organizational factors [1] have also been identified in other studies and include problems between colleagues, problems between employees and employers, or difficulties in career advancement.

The source of stress with the lowest score was “emergency problems.” However, this finding may be attributed to the large proportion of veterinarians with considerable seniority and who performed the fewest shifts, as several interviewees acknowledged. Nevertheless, it is a source of stress to be considered, as observed in other studies [31].

The correlations between the sources of stress and health were highly significant for psychological and psychosomatic complaints [9, 22] and the strongest correlations were for stress due to the “emotional burden of work” and “work–family conflict.”

In addition to the aforementioned contributions, one of the main contributions of this study is that it has provided cut-off points for the developed questionnaire. These data confirmed that nearly 50% of the sample analyzed were at risk because they showed high stress levels (45.83%). This finding has been reported in other reviews on the subject [8, 10], albeit it is empirically confirmed. Only approximately 20% of participants had low levels of stress; the remaining participants had intermediate levels.

As with any research, this study has some limitations that should be addressed in the future. First, the sample was collected in Spain, and therefore it would be useful to use information from other countries to improve generalizability. Second, determining whether the different stressors could be grouped into clusters that may be dangerous to health would be useful [32]. Some clusters may have deleterious effects such as working as a freelancer in a bad working environment and spending many hours in the emergency room. In addition, future studies should

include sociodemographic data because differences may exist, depending, for instance, on sex or age. Other variables that may modulate the correlations between sources of stress and health issues, such as coping strategies [33] or family or work support [33, 34], should also be included in future studies. Other sociodemographic variables should also be considered, as recent research has emphasized the influence of psychological characteristics among veterinary medicine students, suggesting that these factors play a crucial role in their overall well-being [35]. Finally, longitudinal studies should be considered to more accurately explain the correlations found in this study and to investigate whether reverse correlations exist (i.e., whether veterinarians with more health issues also perceive their work as more stressful) [36].

Despite these limitations, we believe that this article is valuable from theoretical and applied perspectives. It allowed us to theoretically describe and classify the main sources of stress with regard to circumstances faced by veterinary professionals in Spain and to develop and validate a questionnaire, the SOS-MedVet questionnaire, with psychometric guarantees. As we have observed, many studies refer to stress in the profession, but very few offer questionnaires [20, 21] and we have not found any study that provided cut-off points. The cut-off points allowed clinicians to know what the obtained scores indicated. From an applied perspective, the value of this study is that it permitted a diagnosis of the sources of stress that cause the most health issues and/or design intervention programs. For example, if two of the most significant sources of stress were “emotional burden” and “work overload,” specific activities could be organized in an attempt to reduce them. Training programs aimed at improving communication with animal owners and helping them manage their emotions and the problems that may arise in their relationship can be implemented [12]. Employers should create safe environments where employees feel comfortable to seek help and foster healthy work cultures [1]. To reduce the perception of work overload, veterinarians can also be trained in organizational skills and task design because an adequate and balanced distribution of tasks [37] can reduce physical fatigue and emotional exhaustion. In addition, these types of interventions would indirectly contribute to decreasing other stressors that we also found to cause many issues such as difficulty in balancing work and family demands, and conflicts with colleagues. Finally, by knowing the cut-off points of this questionnaire, veterinarians who require individual psychological care by specialists may be diagnosed.

Conclusions

This study provided a validated tool to assess stress in veterinary professionals. By identifying specific stressors and quantifying stress levels, the SOS-VetMed questionnaire allows for targeted interventions to promote veterinarian well-being and improve workplace health. Furthermore, given the growing awareness of mental health issues in the veterinary profession, this study offered valuable information for practitioners, researchers, and policymakers alike. The findings enhance the understanding of the challenges faced by veterinarians and pave the way for evidence-based interventions to mitigate stress and promote health.

Abbreviations

AUC	Area under the curve
ROC	Receiver operating characteristic
SD	Standard deviation

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Author contributions

AO was involved in the study design, data analysis, creation of data collection tools, data analysis, interpretation of results, writing and editing the manuscript. LM was involved in the study design, data analysis, creation of data collection tools, data analysis (qualitative study) and interpretation of results. LV was involved in data analysis (qualitative study). JB was involved in the data analysis (quantitative study), interpretation of results and writing the manuscript.

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Data availability

The dataset used and/or analyzed for the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the National University of Distance Education (Madrid, Spain; reference no.: 26-SISH-PSI-2023). All the methods included in this study are in accordance with the declaration of Helsinki. Written informed consent was obtained from all survey participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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