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Perception of challenges in management of neurological cases in the emergency room

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Abstract

Objective: To investigate emergency clinicians' comfort level in assessing neurological emergencies and to identify opportunities to foster enhanced training of clinical neurology in the emergency room.

Design: Internet-based survey.

Setting: University teaching hospitals and private referral centers.

Subjects: One hundred and ninety-two emergency and critical care specialists and resident trainees (ECC) and 104 neurology specialists and resident trainees (NEUR) in clinical practice.

Interventions: An internet-based survey was distributed via veterinary professional organizations' listserves and message boards and responses were collected between March and April 2020. ECC completed a survey evaluating stress levels associated with neurological emergencies, confidence with neurological examinations, and neuroanatomical localization. NEUR completed a similar survey to report their perception of their ECC colleagues' confidence in the assessment of neurological cases. Chi-square and Mann–Whitney *U*-tests were used to compare categorical responses and confidence scores between groups. $P < 0.002$ was considered significant.

Measurements and Main Results: Fifty-two percent of ECC found neurological emergencies slightly challenging, whereas 85% of NEUR found them moderately to extremely challenging for ECC ($P < 0.0001$). ECC's median self-reported confidence score in performing a neurologic examination on a scale of 0–100 was 75 (interquartile range [IQR], 27), while NEUR reported a median ECC confidence of 44 (IQR, 25; $P < 0.0001$). Median self-reported ECC confidence in localizing intracranial, spinal, and neuromuscular disease was 67 (IQR, 40), 88 (IQR, 21), and 60 (IQR, 37), respectively, which was significantly higher than median NEUR-reported ECC confidence of

Abbreviations: CI, confidence interval; ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; ER, emergency room; FET, Fisher's exact test; IQR, interquartile range; MCMC, Markov chain Monte Carlo; NEUR, board-certified and residency-trained neurology specialists and resident trainees; t-test$_{boot}$, bootstrapped t-test.

35 (IQR, 38), 51 (IQR, 31), and 18 (IQR, 20), respectively (all $P < 0.0001$). Following case transfer, 34% of ECC received NEUR feedback in >75% of cases.

Conclusions: Noticeable discrepancies between ECC and NEUR perceptions of ECC clinical confidence were seen, while no firm evidence of neurophobia could be inferred. Improvements in interdepartmental communication and teaching of clinical neurology may be warranted.

KEYWORDS
comfort level, emergency and critical care medicine, neurophobia, residency training

1 | INTRODUCTION

The discomfort experienced by many physicians and medical students when dealing with neurological cases has been recognized and described as early as 1959.[1] Later, the term "neurophobia" was coined to describe the fear of neural sciences and clinical neurology that arises due to the students' inability to apply their knowledge of basic sciences to clinical situations.[1] Since then, many other publications have reported similar perceptions.[2–6] Medical students, senior house officers, and general practitioners have ranked neurology as far more difficult than other disciplines and felt least confident in handling neurological cases and least knowledgeable in this specialty.[2] The reasons for this phenomenon are believed to be multifactorial, including limited exposure to neurological cases, the complexity of the neurosciences, and poor teaching of the subject.[4] Since the nature of the specialty and its underlying complexity cannot be changed, efforts are best directed at optimizing teaching.

Although this phenomenon has not yet been reported among veterinary students or in clinical veterinary practice, parallels between veterinary and human medicine likely exist. Recently, a group of veterinary neurologists reported the development of neurology curriculum learning objectives for undergraduate veterinary students to address and hopefully reduce the risk of veterinary neurophobia.[7] The emergency room (ER) is where dogs and cats with urgent or emergent neurological disorders present first, often in need of immediate intervention or stabilization. This need for quick decision-making, the fact that specialty neurology consultations are not available to every emergency practice, and a potential lack of experience with neurological cases all have the potential to predispose veterinary emergency and critical care clinicians to neurophobia.

The primary objective of this study was to investigate the confidence of residency-trained emergency and critical care clinicians in assessing neurological emergencies and to evaluate the existence of neurophobia within the specialty. We sought to identify individual components of the neurological examination and neuroanatomical localizations that are perceived as especially difficult and where training opportunities in clinical neurology might be improved.

2 | MATERIALS AND METHODS

2.1 | Questionnaires

Two separate questionnaires were constructed to collect data for this study (Supporting Information). The first one was developed with the primary intent of investigating the confidence level of board-certified and residency-trained emergency and critical care specialists and resident trainees (ECC) in assessing neurological emergencies. The second was adapted from the first questionnaire to investigate how board-certified and residency-trained neurology specialists and resident trainees (NEUR) perceive the confidence of ECC when assessing neurological emergencies, in an attempt to establish a frame of reference from experts in the field of neurology. Both questionnaires consisted of 30 questions that included single-answer, multiple-choice, slider scales, and categorical and numerical ranking questions.[8,9] Five multiple-choice questions included an "other" option allowing a free-text response, and 1 question investigating the most challenging neurological emergency for ECC exclusively collected free text answers. The initial 12 questions surveyed population characteristics and conditions at the current workplace (workflow, departmental organization, case load), years of practical experience, postgraduate specialty training circumstances, and opportunities for ECC to consult or share case responsibility with NEUR. The second part of the questionnaire contained 18 questions that covered ECC stress levels and confidence with individual aspects of the neurological examination and in recognizing specific neuroanatomical localizations. Participants were able to navigate back and forth and change their answers as they went through the questionnaire. Based on a prerelease trial run, the expected time necessary to complete the questionnaire was approximately 10 minutes. Questionnaires were designed through the collaboration of ECC (F.M., S.H.) and NEUR (J.G.) and the instruments were evaluated by the authors (S.H., J.G., V.M.) for construct, content, and face validity. Participation in the survey was on a voluntary basis, and no incentives were provided.

2.2 | Data collection

A commercial, internet-based platform[a] was used to develop and distribute the questionnaire and to anonymously collect participant responses. The platform only allowed participation in the survey once. The internal ethics review board of the Vetsuisse Faculty at the University of Bern waived the need for ethical approval for the survey procedure. To increase external validity and reach a broad representation of ECC and NEUR, 2 different communication channels were used. A short description of the intent and nature of the survey was provided in an introductory text along with the link to participate in the online survey. Members of the American and European Colleges of Veterinary Emergency and Critical Care were invited to participate in the survey by email to the organization listserv reaching 725 members on March 31, 2020. An email reminder was sent on April 13, 2020. The project information and survey link were distributed to veterinary neurologists through a large popular online veterinary subscription forum, the Veterinary Information Network (VIN)[b] neurology listserv on March 10, 2020. A total of 808 members were reached through this channel and included diplomates of the European College of Veterinary Neurology and the American College of Veterinary Internal Medicine (Neurology), neurology residents and interns, as well as other clinicians with an interest in neurology (only accepted by invitation by the moderator). Both surveys were closed on April 24, 2020.

2.3 | Inclusion and exclusion criteria

Survey responses were included for analysis if they stemmed from diplomates of the American or European Colleges of Veterinary Emergency and Critical Care, American College of Veterinary Internal Medicine (Neurology), or European College of Veterinary Neurology, from residency trained veterinarians, or residents currently enrolled in training programs of the aforementioned colleges. Responses were excluded from analysis if only demographical data were provided or if more than 4 questions were left unanswered. Veterinarians not currently practicing were excluded, as were any respondents who were not residency trained and not currently undergoing residency training in emergency and critical care or neurology, such as interns, general practitioners, diplomates of other specialties, or doctoral students.

2.4 | Statistical analyses

Survey responses from the collector homepage were downloaded into a commercial computer program spreadsheet,[c] reviewed, and edited to exclude responses that met the exclusion criteria. Data were subsequently imported into a commercially available statistical program for analyses.[d] For categorical data, percentages of group total and 95% confidence intervals (CIs) were calculated, and results are presented as percentage (95% CI) unless stated otherwise. Categorical population characteristics and response frequencies of binary answers were compared between ECC and NEUR using Fisher's exact test (FET). If sufficient responses per answer choice were available, the response frequencies of multiple answers between the 2 groups were compared using Chi-square tests. Normality testing on continuous data from slider scales was performed using the Shapiro–Wilk test and by examining normal plots. Nonnormally distributed data or data that were normally distributed in 1 but not the other respondent group were compared between groups using Mann–Whitney *U*-test. Post hoc Bonferroni correction was used to control for multiple testing with *P*-values of <0.002 considered statistically significant.[10,11] The robustness of the estimations was subsequently verified using either FET with *P*-values simulated using Markov chain Monte Carlo (MCMC) simulation (FET_{MCMC}) or a bootstrapped *t*-test ($t\text{-test}_{boot}$) where applicable,[e] following the approach of Mayer & Rathmann.[12] Both simulations are using 10,000 samples each and *P*-values of <0.05 are considered statistically significant. MCMC and bootstrapping are data-driven resampling simulation methods used to make robust statistical inferences, for instance with increased statistical power under nonnormality.[13–15]

3 | RESULTS

A total of 247 and 127 veterinarians completed the ECC and NEUR survey, respectively. A total of 192 ECC and 104 NEUR were included in the final analyses after exclusion criteria were employed (Figure 1). The survey response rate was 34.1% for ECC and 15.7% for NEUR. No datasets were normally distributed in both respondent groups.

3.1 | Demographics and work environment

An overview of population and clinical environment characteristics of the respondents can be found in Table 1. Table 2 summarizes the average weekly number of cases of their respective specialty seen by ECC and NEUR. The average number of weekly neurological cases seen by NEUR was significantly lower than the average number of weekly emergency cases seen by ECC (FET $P < 0.0001$; FET_{MCMC} $P < 0.001$). The average number of weekly neurological emergencies directly seen by NEUR was significantly lower than the weekly average of neurological emergencies seen by ECC (FET $P = 0.0006$; FET_{MCMC} $P = 0.001$), as shown in Table 3.

Seventy-three percent (95% CI: 67%–79%) of ECC worked at an institution with a board-certified NEUR on staff and 67% (95% CI: 58%–76%) of NEUR workplaces employed a board-certified ECC (FET $P = 0.2835$). Thereof, 1% (95% CI: 0%–4%) of ECC only had NEUR and 1% (95% CI: 0%–5%) of NEUR only had ECC on staff irregularly. The responsibility for initial treatment and further workup of neurological emergencies was handled significantly differently between ECC's and NEUR's institutions (Chi-square $P < 0.0001$; FET_{MCMC} $P < 0.001$) and detailed distribution of case responsibilities for neurological emergencies for both groups can be found in Table 4. ECC reported to have an NEUR diplomate in house 24/7 in 3% (95% CI: 1%–7%), to be able to call in an NEUR diplomate if needed at 45% (95% CI: 38%–52%), or consult with them over the phone after regular business hours at 15% (95% CI: 11%–21%) of institutions. NEUR was not available out

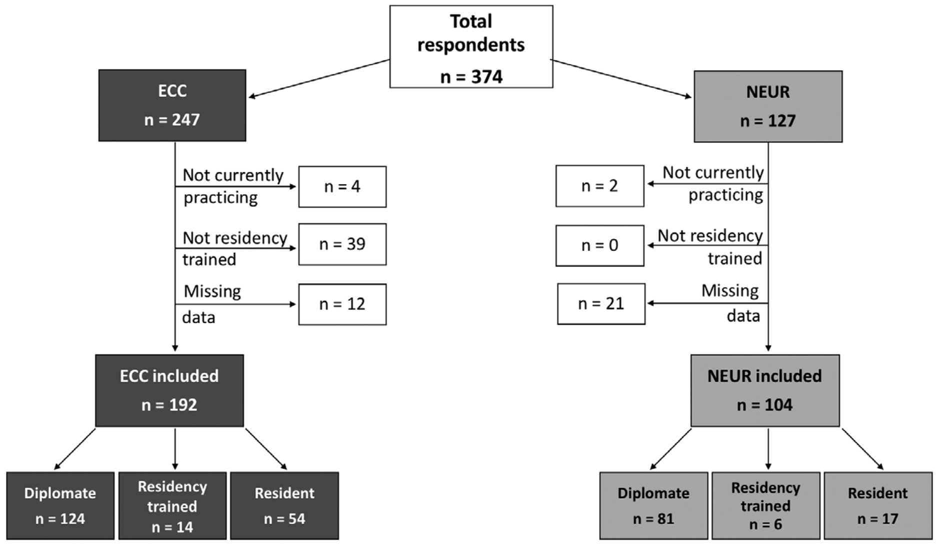

FIGURE 1 Flow diagram of survey responses and overview of respondents included in the final analysis. ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; NEUR, board-certified and residency-trained neurology specialists and resident trainees

TABLE 1 Population and clinical environment characteristics by groups of respondents

Variable	ECC	NEUR	*P*-value
Respondents per group	192	104	
Years of practicing	5–10 years	11–15 years	**0.022**
Years since residency	<5 years	5–10 years	**0.005**
Working environment	Referral hospital/24-hour clinic	Referral hospital/24-hour clinic	0.231
Residency training environment	Academic institution/University hospital	Academic institution/ University hospital	**0.003**
Weekly average number of consultations in own specialty	>100	21–50	<**0.001**
Weekly average number of neurological emergencies	>20	6–10	**0.001**

Note: *P*-values were MCMC simulated; data are expressed as the group mode. Statistically significant values are printed in bold.
Abbreviations: ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; NEUR, board-certified and residency-trained neurology specialists and resident trainees.

TABLE 2 Average weekly number of cases in the respective specialty (ie, emergency cases seen by ECC and neurological cases seen by NEUR) seen by groups of respondents

Weekly number of cases	ECC	NEUR
<5	0 (0–2)	1 (0–5)
6–20	4 (2–8)	41 (32–51)
21–50	11 (8–17)	51 (41–60)
51–100	24 (18–30)	6 (3–12)
>100	60 (53–67)	s1 (0–5)

Note: Data are expressed as the percentage of group total (95% confidence interval).
Abbreviations: ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; NEUR, board-certified and residency-trained neurology specialists and resident trainees.

TABLE 3 Average number of weekly neurological emergencies seen by groups of respondents

Weekly number of neurological emergencies	ECC	NEUR
<2	4 (2–7)	3 (1–8)
3–5	14 (9–19)	14 (9–22)
6–10	24 (18–30)	45 (36–55)
11–20	26 (20–33)	24 (17–33)
>20	33 (27–40)	13 (8–21)

Note: Data are expressed as the percentage of group total (95% confidence interval).
Abbreviations: ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; NEUR, board-certified and residency-trained neurology specialists and resident trainees.

TABLE 4 Allocation of responsibility for the workup of neurological emergencies by groups of respondents

	ECC	NEUR
Respondents per group	*n* = 177	*n* = 102
Intern/resident with direct supervision of an ECC diplomate	40 (33–47)	23 (16–32)
ECC diplomate	6 (3–10)	5 (2–11)
ECC resident without direct supervision	4 (2–8)	1 (0–5)
Intern/resident with direct supervision of an NEUR diplomate	4 (2–8)	13 (8–21)
NEUR diplomate	1 (0–4)	15 (9–23)
NEUR resident	1 (0–4)	9 (5–16)
Intern without direct supervision	2 (0–5)	6 (3–12)
Other	42 (35–50)	29 (21–39)

Note: Data are expressed as the percentage of group total (95% confidence interval).
Abbreviations: ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; NEUR, board-certified and residency-trained neurology specialists and resident trainees.

of hours in 27% (95% CI: 21%–34%) of ECC's institutions. Ten percent (95% CI: 6%–15%) of ECC had an irregular neurology backup or access to a neurology department in another institution. NEUR self-reported to be in house 24/7 in 6% (95% CI: 3%–12%), to be available to return to the hospital for in person consultations in 75% (95% CI: 66%–82%), or perform telephone consultations with ECC in 18% (95% CI: 12%–27%) after regular business hours. NEUR was not available out of hours in 0% (95% CI: 0%–4%). In 1% (95% CI: 0%–5%) of cases, another form of on-call services was provided, mostly by NEUR residents. Access to an NEUR diplomate, either in house, on call, or available for phone consultations, was significantly lower for ECC (Chi-square $P < 0.0001$; FET_{MCMC} $P < 0.001$).

3.2 | Collaboration

Thirty-six percent (95% CI: 30%–43%) of ECC and 54% (95% CI: 44%–63%) of NEUR reported to have regular joint case rounds or discussion session (FET $P = 0.0046$; t-$test_{boot}$, 10,000 samples; 27% of ECC vs. 39% of NEUR; $P = 0.025$). If shared rounds took place, ECC reported them to take place daily in 56% (95% CI: 44%–67%), weekly in 11% (95% CI: 6%–21%), monthly in 4% (95% CI: 1%–12%), and less than once a month in 29% (95% CI: 19%–40%). NEUR reportedly held shared rounds with ECC daily in 57% (95% CI: 44%–69%), weekly in 13% (95% CI: 6%–24%), monthly in 4% (95% CI: 0%–12%), and less than once a month in 27% (95% CI: 17%–40%).

Twenty-eight percent (95% CI: 22%–35%) of ECC reported they get input from NEUR before transferring a case to their service in less than 25% of all neurological cases. Fourteen percent (95% CI: 10%–20%) got input before transferring 26%–50% of the time, 24% (95% CI: 18%–31%) 51%–75% of the time, and 34% (95% CI: 27%–41%) 76%–100% of the time. In contrast to reported practice, 50% (95% CI: 43%–57%) of ECC reported they would like to have NEUR input before transferring a case in 76%–100% of the cases. Twenty-nine percent (95% CI: 23%–36%) would appreciate NEUR consulting in 51%–75% of the neurological emergency cases, 14% (95% CI: 10%–20%) in 26%–50% of the cases, and only 6% (95% CI: 4%–11%) think that a neurological consult is needed for less than 25% of patients.

NEUR's reported consultation rates were similar to those reported by ECC in that 19% (95% CI: 13%–28%) of NEUR consult on less than 25% of cases prior to transfer, 23% (95% CI: 16%–32%) consult on 26%–50% of cases, 27% (95% CI: 19%–36%) on 51%–75% of cases, and 31% (95% CI: 23%–40%) on 76%–100% of cases, which was not statistically significantly different (Chi-square $P = 0.1177$; FET_{MCMC} $P = 0.122$). NEUR perceived the benefit of pretransfer neurological consultations to be significantly lower than ECC (Chi-square $P = 0.006$; FET_{MCMC} $P = 0.007$). Two percent (95% CI: 0%–7%) reported that it would be helpful in less than 25% of cases, 28% (95% CI: 20%–37%) in 26%–50% of cases, 34% (95% CI: 25%–43%) in 51%–75%, and 37% (95% CI: 28%–46%) in 76%–100% of cases.

Following case assessment, 21% (95% CI: 16%–27%) of ECC got feedback from NEUR in less than 25%, 13% (95% CI: 9%–19%) in 26%–50%, 27% (95% CI: 21%–34%) in 51%–75%, and 39% (95% CI: 32%–46%) in 76%–100% of the neurological emergencies. This was in accordance with NEUR-reported feedback rates of 18% (95% CI: 12%–27%) on less than 25% of the cases after transfer, 16% (95% CI: 10%–25%) in 26%–50% of the cases, 31% (95% CI: 23%–40%) in 51%–75%, and 35% (95% CI: 26%–44%) in 76%–100% of the cases (Chi-square $P = 0.7362$; FET_{MCMC} $P = 0.742$).

3.3 | Perception of assessment of emergent neurological cases

3.3.1 | Estimation of preparedness for and stress levels associated with neurological emergencies

When asked how well their ECC residency prepared them for the assessment of neurological emergencies, 3% (95% CI: 1%–6%) of ECC responded that they were not at all satisfied, 8% (95% CI: 5%–12%) stated that they were slightly satisfied, 30% (95% CI: 24%–36%) were moderately satisfied, 42% (95% CI: 35%–49%) quite satisfied, and 18% (95% CI: 13%–24%) completely satisfied. No NEUR (95% CI: 0%–4%) assessed ECC to be not at all prepared for the treatment of neurological emergencies. Nine percent (95% CI: 5%–16%) thought ECC were slightly prepared, 51% (95% CI: 41%–60%) moderately prepared, 34% (95% CI: 26%–44%) quite prepared, and 6% (95% CI: 3%–12%) estimated their colleagues to be completely prepared.

Most ECC (52% [95% CI: 45%–59%]) found neurological emergencies to be slightly challenging, 31% (95% CI: 25%–38%) found them to be moderately challenging, and 14% (95% CI: 9%–19%) not at all challenging. No ECC (95% CI: 0%–2%) rated neurological emergencies to be extremely challenging and merely 4% (95% CI: 2%–7%) found them quite challenging. In contrast, most NEUR felt that neurological

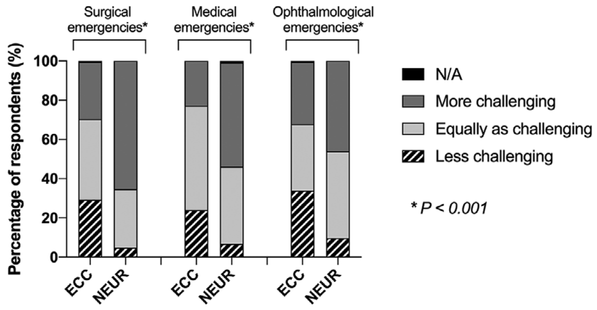

FIGURE 2 Perceived level of challenge neurological emergencies pose to ECC as self-reported by ECC and assessed by NEUR compared to surgical, medical, and ophthalmological emergencies. Data are expressed as percentage of respondents per group. Fisher's exact test with MCMC simulated *P*-values, 10,000 replications. ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; N/A, not available; NEUR, board-certified and residency-trained neurology specialists and resident trainees

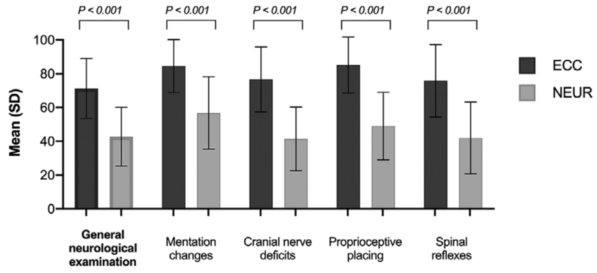

FIGURE 3 Mean reported confidence (scale: 0–100) with which ECC conduct a neurologic examination overall and its separate components. ECC self-reported confidence was compared with ECC confidence assessed by NEUR. Data are expressed as mean ECC confidence reported per group and error bars indicate the standard deviation. Group differences estimated by bootstrapped *t*-test, 10,000 samples each. ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; NEUR, board-certified and residency-trained neurology specialists and resident trainees; SD, standard deviation

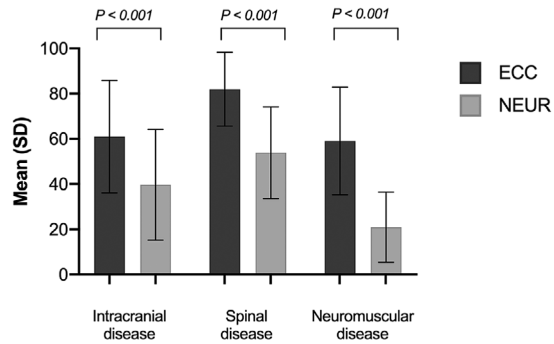

FIGURE 4 Mean reported confidence (scale: 0–100) with which ECC achieve a neuroanatomical localization in a patient that is not neurologically normal. ECC self-reported confidence was compared with ECC confidence assessed by NEUR. Data are expressed as mean ECC confidence reported per group and error bars indicate the standard deviation. Group differences estimated by bootstrapped *t*-test, 10,000 samples each. ECC, board-certified and residency-trained emergency and critical care specialists and resident trainees; NEUR, board-certified and residency-trained neurology specialists and resident trainees; SD, standard deviation

emergencies were moderately (56% [95% CI: 46%–65%]) or quite challenging (26% [95% CI: 18%–35%]) for ECC. Only 1% (95% CI: 0%–5%) and 14% (95% CI: 9%–22%) thought that they were not at all and slightly challenging, respectively, and 3% (95% CI: 1%–8%) thought they were extremely challenging for ECC.

When asked to name the neurological emergencies they struggle most with in an open question format, ECC most commonly mentioned seizure disorders ($n = 38$), encephalitis/meningitis ($n = 18$), and inflammatory diseases of the central nervous system ($n = 12$), as well as multifocal disease ($n = 13$), head trauma ($n = 12$), neuroanatomical localization in general ($n = 12$), intracranial issues ($n = 11$), and spinal trauma/fractures ($n = 10$). Correspondingly, NEUR listed conditions ECC clinicians struggle most with as seizure disorders ($n = 37$), intracranial issues ($n = 19$), head trauma ($n = 15$), neuromuscular disease ($n = 13$), and spinal trauma/fractures ($n = 9$).

Respondents were further asked to assess the level of difficulty of neurological emergencies for ECC compared to surgical, medical, and ophthalmological emergencies and results are shown in Figure 2.

3.3.2 | Estimation of confidence in neurological examination and deriving a neuroanatomical localization

To evaluate their confidence in performing specific aspects of the neurological examination and arriving at a neuroanatomical localization, ECC respondents were asked to self-assess, and NEUR were asked to estimate the confidence levels of their ECC colleagues using a sliding scale ranging from 0 to 100. Reported ratings were all nonnormally distributed in the ECC group. In the NEUR group, all but perceived ECC confidence in assessing spinal nerves, localizing intracranial disease, and neuromuscular disease was normally distributed.

Mean confidence with which ECC conducts a neurologic examination overall and its separate components are shown in Figure 3. In the performance of all aspects of the neurological examination, ECC rated their own confidence significantly higher than NEUR-rated ECC confidence (Mann–Whitney *U*-test $P < 0.0001$; $t\text{-test}_{boot}$ $P < 0.001$). Similarly, the self-reported confidence of ECC in recognizing different neuroanatomical localizations was significantly higher than the NEUR-rated ECC confidence (Mann–Whitney *U*-test $P < 0.0001$; $t\text{-test}_{boot}$ $P < 0.001$) as shown in Figure 4.

When asked how often their diagnosis matched that of NEUR, ECC reported agreement in diagnoses in <20% of cases in 1% (95% CI: 0%–4%), in 21%–40% of cases in 2% (95% CI: 0%–5%), 41%–60% of cases in 13% (95% CI: 9%–19%), 61%–80% of cases in 44% (95% CI: 37%–51%), and 81%–100% of cases in 40% (95% CI: 33%–47%) of respondents. This was significantly higher than the answers provided by NEUR, estimating that ECC diagnoses matched NEUR diagnoses in <20% of cases in 3% (95% CI: 1%–8%), 21%–40% of cases in 17% (95% CI: 11%–26%), 41%–60% of cases in 39% (95% CI: 31%–49%), 61%–80% of cases in 38% (95% CI: 29%–47%), and 81%–100% of cases in 3% (95% CI: 1%–8%) (Chi-square $P < 0.0001$; $t\text{-test}_{boot}$ $P < 0.001$).

4 | DISCUSSION

This study identified that the self-reported confidence in assessing neurological emergencies by ECC differed from NEUR-perceived confidence of ECC in assessing neurological cases. The majority of NEUR perceived ECC preparedness to receive and assess neurological emergencies to be moderately to quite satisfactory, whereas the majority of ECC reported it to be quite to completely satisfactory. About half of ECC felt that neurological emergencies were only slightly challenging, whereas a large majority of NEUR felt they represented a moderate to quite challenging situation for ECC. Despite the high confidence in assessing neurological emergencies, the majority of ECC expressed that NEUR input prior to case transfer in a majority of neurological emergencies would be beneficial.

In order to put these results in perspective, the possibility of "self-other bias," a well-known reason in social sciences for one's self-evaluation to be more favorable than one's evaluations of others, must be considered.[16] Research shows that metacognitive skills (the ability to know how well one is performing, when one is likely to be accurate in judgement, and when one is likely to be in error) and the better-than-average effect[17,18] (a self-enhancement bias, where people tend to exaggerate self-perceptions of their own characteristics toward the perceived ideal) can represent social–perceptual biases.[19,20] The combination of these biases present a possible reason for the discrepancies in perception between ECC and NEUR. The same effects are believed to affect the differences in perception of the complexity of different types of emergencies (surgical, medical, ophthalmological) and the confidence in performing individual aspects of the neurological examination and arriving at a neuroanatomical localization. The assessment of how challenging emergencies of different specialties are is likely further influenced by respondents' exposure to other specialties and comfort level. The self–other bias may have affected both groups surveyed, with NEUR perceiving a specialty they have mastered as being more difficult to others, and ECC's self-evaluations potentially skewing more favorably as well. Furthermore, these perceptions could evolve over the span of careers, furthering the perceived divide. The inclusion of neurology residents at various stages of their training in this survey likely led to a more inhomogeneous NEUR group and could have broadened the expected responses.

In addition to the "self-other bias," a selection bias regarding the responding ECC's level of interest in neurology is likely to have influenced the responses of this survey. ECC with a special interest in neurology might be more likely to respond to the survey and rate their confidence level higher than ECC with a lower interest and comfort level in neurology. While there is also the possibility that ECC with a greater fear of neurology and higher motivation to propagate improvements in teaching of clinical neurology in the ER were more likely to take the survey, this seems less likely given the overall confidence levels reported by ECC. Demographics and work environments differed between the respondent groups in our study. Various workplace environments will influence how out-of-hour neurology support and own skill levels in assessing neurological emergencies when support is not available are perceived, especially since ECC and NEUR survey respondents do not all work at the same institutions. Lastly, by the nature of their respective specialties, it is possible that the expectations against which the 2 groups assess ECC's confidence in neurological case assessment differ markedly, with ECC focusing on deriving sufficient information to allow patient stabilization and NEUR aiming for definitive diagnosis and treatment.

In addition to demographic and social factors discussed above, the choice to only include residency trained individuals or those undergoing residency training at the time of survey conduction in our study could have further influenced the survey results. These inclusion criteria were set to gather preliminary information on how well ECC feel prepared to assess neurological emergencies by their emergency and critical care programs, but it might have selected for individuals with above average postgraduate neurology training and case exposure and could at least partially account for high confidence in assessing neurological emergencies found in the surveyed ECC group.

Considering these various influences on the survey responses, and the lack of standardized, validated metrics to more objectively measure neurophobia in veterinary medicine, no definitive conclusion can be made regarding the existence of neurophobia amongst ECC.

Of the individual aspects of the neurological examination, ECC were most confident in neuroanatomical localization of spinal disorders and felt less confident localizing intracranial and neuromuscular disorders. Reasons for this are likely multifactorial and include the frequency of presentation, the phenomenology, and ECC training in neurology. Patients with spinal cord disorders are common in the ER, especially those with acute severe thoracolumbar spinal cord injuries that account for 1%–2% of cases in general practice[21,22] and 4% of ER cases in North America.[23,24] This high volume of cases allows for frequent exposure and may favor teaching and learning through repetition.[25] Although animals with spinal cord disease can have various degrees of severity, they have limited ways of presenting. In combination with the high prevalence of spinal cord disease, this leads to an intuitive appreciation of clinical phenomena and disease probability, a form of pattern recognition involving System 1 thought processes in learning and clinical practice, avoiding the effortful mental activity of referencing previously learned theory.[26–29] The programming of pattern recognition starts when one is a student during clinical exposure, evolves, and is refined throughout internship and residency training. In brief, common exposure makes for better preparedness. On the other end of the spectrum, neuromuscular disorders have a lower prevalence in clinical neurology, and present as emergencies less frequently,[23,30–31] and thereby likely do not provide ECC adequate opportunities for clinical learning and teaching of these entities in the ER. Recommendations for learning the patterns of neuromuscular diseases could include digital education through educational case videos.[f] The high prevalence of seizures in the referral population of dogs and cats, the multitude of etiologies, the high interindividual variance in clinical presentations, the complexity in treatment and variable response to therapeutic strategies, as well as the high percentage of refractory epilepsy in dogs likely contribute to seizures being reported as a very challenging neurological emergency to be faced with.[32–36] Further research into the challenges presented by the management of intracranial disorders is warranted; however, the severity of the initial clinical presentation and the poor outcome of these patients are likely to blame for the insecurity they engender.[37,38] Although no less urgent, a paraplegic patient without nociception appears less critical and less anxiogenic to evaluate and treat.

By studying the collaboration between the 2 specialties, it was identified that joint ECC–NEUR rounds occurred for 36% (ECC) to 54% (NEUR) of the participants. However, these rounds occurred less than once a month for more than 1 in 4 participants. Input from a neurologist was received and given for less than half of the neurological patients coming through the ER before transfer, whereas it was desired by ECC and believed to be needed by NEUR in a majority of cases. Feedback following case assessment was received and given in two thirds of the participants for over half of the cases. These findings suggest that there is room for improvement from (1) neurologists in terms of providing input on cases prior to transfer, as both groups perceived it is beneficial; (2) both groups on performing joint ECC–NEUR rounds more frequently; and (3) neurologists on providing feedback to ECC after case transfer and workup have taken place. We wish to underline that we did not investigate further how this feedback was perceived by ECC. Feedback is indeed not uniform in use or in concept. How, when, and by whom feedback is being delivered matters and this has the propensity to influence its effects, beneficial or not, toward learning.[39,40]

This study has several limitations. First, as with any questionnaire-based research there is a degree of subjectivity inherent to the design and interpretation of survey questions. Additionally, apart from the previously outlined possible psychological biases and potential bias in survey respondents based on their interest in neurology, the internet-based nature of the survey may have affected the number and quality of responses. Internet-based surveys have lower response rates when compared to postal surveys but are nevertheless efficient, cost-effective, and may lead to a more complete response of the questionnaire than postal surveys.[41–43]

The NEUR survey was intended to put ECC survey responses into perspective, considering there is no gold standard to compare ECC's confidence or even competence in neurological case assessment with. This is especially important to note in light of our finding that NEUR appear to primarily receive significantly fewer numbers of neurological emergencies than ECC. The NEUR survey responses presented herein can therefore not be seen as the undisputed evaluation of ECC competency in managing neurological emergencies. Depending on the institutional organization, however, NEUR is likely to consult on a relevant number of neurological emergencies seen by ECC. Considering the lack of a gold standard to assess ECC confidence in managing neurological emergencies, this shared exposure to cases and NEUR's expertise in neurological examinations justified the use of an NEUR survey to establish a frame of reference for ECC survey responses.

Lastly, this survey was conducted during a very unique and challenging time with the COVID-19 pandemic affecting most of the world. A survey initiated in March and April of 2020 showed that by then 60% of responding emergency veterinary hospitals had made changes in operating hours and approximately 75% had reduced staff.[44] The majority of veterinary hospitals furthermore reported an increase in caseload as well as demand for emergency- and specialty-level care in companion animals and that burnout among staff was considered high.[45] With this in mind, it is possible that the timing of our survey impacted the responses. While ECC caseload was higher than usual, increasing financial constraints and reduced staffing during the pandemic might have led to less advanced diagnostics being performed.[46] However, since for most institutions, implementation of changes related to COVID-19 only begun in March 2020, the overall impact of COVID-19 on the current study is thought to be small.

In conclusion, this study did not definitively demonstrate the existence of neurophobia among ECC, despite NEUR's perception that ECC might not be as confident as they claimed. Biases inherent to surveys and the self-reporting methodology used might be responsible for this discrepancy. By the nature of their specialty, ECC should not, however, be expected to have the same level of knowledge and expertise as a clinical neurologist. This study identified that improvements are needed in the provision of input through case consultation prior to case transfer, but also in the frequency at which feedback is provided following case workup. Finally, clinical and theoretical rounds involving both specialties should be performed on a more frequent basis. Considering the perceived absence of neurophobia in ECC, and with the recommendations on clinical input, rounds, and feedback, there is no reason to believe that the ER could not foster a great learning and teaching ground for clinical neurology.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ENDNOTES

[a] SurveyMonkey, www.surveymonkey.com.
[b] VIN, Veterinary Information Network, Davis, CA.
[c] Microsoft Office Excel 2019, Microsoft, Redmond, WA.
[d] Prism 9.0, GraphPad Software, La Jolla, CA.
[e] R and RStudio Version 3.6.1, Boston, MA; www.rstudio.com
[f] http://www.neurovideos.vet.cornell.edu.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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