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Article

Agreement of pain assessment using the Short Form of the canine Glasgow Composite Measure Pain Scale between veterinary students, veterinary nurses, veterinary surgeons, and ECVAA-diplomates

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Simple summary: Pain scoring in dogs can be challenging, particularly in a busy clinical setting and when staff with diverse training and veterinary students are involved. Consequently, concerns about dogs not receiving adequate level of analgesia have been raised before. This study was performed to investigate if veterinary students, veterinary nurses, veterinary surgeons with no specific training in anaesthesia, and diplomates in veterinary anaesthesia and analgesia perform pain scoring using the Short Form of the canine Glasgow Composite Measure Pain Scale (CMPS-SF) in a similar manner. The results obtained indicated good to excellent pain assessment agreement between groups. Nevertheless, the overall agreement amongst all assessors was poor and the intragroup agreement was poor to moderate, suggesting significant individual differences when pain-scoring dogs. Veterinary students tend to pain score higher than more experienced assessors.

Abstract: Several pain-scoring systems have been validated to measure pain in dogs. However, pain may not be adequately assessed since these tools are associated with high-level inter-observer variation. The aim of this study is to evaluate the agreement of pain assessment using the CMPS-SF between veterinary students, veterinary nurses, veterinary surgeons and ECVAA-diplomates. Forty-five client-owned dogs presented to a teaching hospital were enrolled in this prospective observational study. All dogs were pain-scored in vivo, while a video of the assessment was recorded and subsequently evaluated by twenty assessors, five per group. Mean scores between groups were compared and agreement within groups and agreement of average scores between groups were assessed by calculating the intraclass correlation coefficient (ICC). The intervention point at which dogs were deemed to require additional analgesia was also evaluated. Overall agreement of pain assessment was poor (ICC=0.494). Nurses had the best interobserver agreement (ICC=0.656), followed by ECVAA-diplomates (ICC=0.540), veterinary surgeons (ICC=0.478) and veterinary students (ICC=0.432). The best inter-group agreement was between veterinary surgeons and nurses (ICC=0.951) and ECVAA-diplomates and nurses (ICC=0.951). Students were more likely to determine that additional analgesia was required compared to other groups. Pain assessment is key for animal welfare and training in this area should be reinforced to improve consistency.

Keywords: dogs; CMPS-SF; agreement; pain

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1. Introduction

The Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" (Jarrel, 1979; Raja 2020). Animals cannot communicate pain verbally, but this does not exclude that an individual can experience pain and requires analgesia (Jarrel, 1979). The assessment of pain in veterinary patients remains a challenge because of the complexity of this phenomenon (Lascelles, 2014).

Recognition and assessment of pain is an integral part of veterinary clinical practice. This is more present now due to public awareness of pain control in animals and humans. The prompt recognition and treatment of acute pain can influence many physiological factors: acute neurohumoral changes, production of inflammatory cytokines, reduction of systemic stress, improving haemodynamic stability, prevention of postoperative complications and prevention of chronic pain states. Pain assessment during emergency triage should also be a priority (Rousseau-Blass., et al 2020).

Pain in veterinary patients has been measured using behavioral observations quantified with simple tools such as the simple descriptive scale (SDS), numerical rating scale (NRS) and the visual analogue scale (VAS) (Holton et al., 1998b). However, pain may not be adequately captured by the unidimensional nature of these tools, which often are associated with high-level inter-observer variation (Holton et al., 1998a, 1998b). Different evaluation criteria for acute pain using multidimensional scales have also been described in dogs and cats (Hernandez-Avalos, 2019). Several factors, including anxiety, which may be increased in patients post-operatively, can alter the observer's perception of the degree of pain an animal is experiencing; conversely, pain may increase anxiety in patients (Ellwood and Murison, 2022). Discrimination between altered behavior due to the hospital environment and pain may be difficult, particularly with these unidimensional scales.

The Glasgow composite measure pain scale (CMPS) is a multi-item behavioural pain assessment tool, developed using a psychometric approach, to measure acute pain in dogs (Holton et al., 2012; Morton, 2005; Reid et al., 2007). The short form of this scale (CMPS-SF) (Figure 1) was developed for routine clinical use and involves the completion and scoring of six descriptive categories with associated descriptors (vocalisation, attention to wound, mobility, response to touch, demeanour, and posture/activity) and assignment of a final score out of 24 if the patient is ambulatory, or out of 20 if the patient is non-ambulatory. The CMPS-SF has been validated to measure acute pain in dogs with a defined intervention level for provision of rescue analgesia (Reid et al., 2007).

There is evidence in veterinary research of the need for training in pain assessment (Murinson et al., 2011; Yanni et al., 2009). Research by Barletta et al. (2016) found that veterinary students early in their training tend to assign higher pain scores to dogs than experienced veterinary anaesthetists. Another study investigating inter-observer variability of pain assessment performed by diplomates from the American College of Veterinary Anaesthesia and Analgesia (ACVAA) showed no notable differences in pain scores amongst different evaluators (Hofmeister et al., 2018).

Veterinary surgeons (VS), registered veterinary nurses (RVN), and fifth-year veterinary students (VU) are directly involved in the pain scoring of dogs at the author's institution. Although VU always act under direct supervision of qualified VS and/or RVN, the assessment of pain in veterinary patients remains complex and concerns were raised by the attending surgeons over patients receiving insufficient analgesic treatment, particularly when this treatment was administered based on pain scores assigned by VU.

The aim of this study was to evaluate whether VU, RVN, VS (without specific training in pain scoring) and diplomates from the European College of Veterinary Anaesthesia and

Analgesia (ECVAA Dip) perform pain assessment using CMPS-SF in a similar manner. We hypothesized that there is agreement between VU, RVN, VS and ECVAA Dip performing pain scores in dogs. This study also investigated the intervention point at which dogs were deemed to require additional analgesia based on pain scores assigned by different accessors.

SHORT FORM OF THE GLASGOW COMPOSITE PAIN SCALE

Dog's name ______________________________

Hospital Number __________ **Date / / Time**

Surgery Yes/No (delete as appropriate)

Procedure or Condition____

____

In the sections below please circle the appropriate score in each list and sum these to give the total score.

A. Look at dog in Kennel

Is the dog?

(i)

Quiet	0
Crying or whimpering	1
Groaning	2
Screaming	3

(ii)

Ignoring any wound or painful area	0
Looking at wound or painful area	1
Licking wound or painful area	2
Rubbing wound or painful area	3
Chewing wound or painful area	4

In the case of spinal, pelvic or multiple limb fractures, or where assistance is required to aid locomotion do not carry out section **B** and proceed to **C**
Please tick if this is the case ☐ then proceed to C.

B. Put lead on dog and lead out of the kennel.

When the dog rises/walks is it?

(iii)

Normal	0
Lame	1
Slow or reluctant	2
Stiff	3
It refuses to move	4

C. If it has a wound or painful area including abdomen, apply gentle pressure 2 inches round the site.

Does it?

(iv)

Do nothing	0
Look round	1
Flinch	2
Growl or guard area	3
Snap	4
Cry	5

D. Overall

Is the dog?

(v)

Happy and content or happy and bouncy	0
Quiet	1
Indifferent or non-responsive to surroundings	2
Nervous or anxious or fearful	3
Depressed or non-responsive to stimulation	4

Is the dog?

(vi)

Comfortable	0
Unsettled	1
Restless	2
Hunched or tense	3
Rigid	4

Total Score (i+ii+iii+iv+v+vi) = ______

Fig **1**. Short form (CMPS-SF) of the Glasgow Composite Measure Pain Scale by Reid *at al* (2007).

2. Materials and Methods

Study design

This prospective observational study was approved by the University Research Ethics Committee (VREC 1163) of the University of Liverpool. Client written consent was obtained prior to enrolment for all cases. All dogs included in the study were able to ambulate and were deemed to have amenable behaviour. Dogs with unsuitable behaviour and/or conditions impeding the ability to walk were excluded from this study. Behavioral assessment prior to pain scoring was performed by the evaluator (M-M,M; see below); this was based on a brief evaluation of the dog's sociability (assessing how the dog coped during human interaction) and confidence during an unfamiliar procedure such as pain assessment, particularly in the concurrent presence of potential pain. If the dog showed signs of aggression such biting attempts, growling or snapping at the air, or was deemed to be too fearful to allow full pain scoring was not selected for further evaluation.

Assuming a moderate intra-class correlation coefficient (ICC) of 0.7 or more, our sample size calculation indicated that to assess the agreement between pain scores performed by 20 observers (in four groups of five observers), 45 dogs were required to estimate such ICC with a precision of 10%, 95% confidence interval and 80% power. Therefore, based on this power calculation, a total of 45 client-owned dogs were recruited for this study. Case recruitment took place between February and June 2022.

Video recordings were made of each dog undergoing pain assessment using the CMPS-SF. Pain scoring was performed by a single ECVAA resident (MMM; evaluator) in dogs following a variety of surgical and non-surgical interventions. All dogs were assessed by the evaluator and video-recorded in the same room under the same circumstances (i.e., hospital wards or intensive care unit) to simulate real-life pain scoring. Filming was performed using a mobile phone device (iPhone X-Apple, UK 2018) for approximately 60 seconds. For dogs that were anaesthetised prior to assessment, pain scoring was only performed when the patient was awake, alert, responsive and ambulatory. During the 60-second assessment, the first 10 seconds were dedicated to recording the dog in the kennel, maintaining no interaction with the evaluator. After that, the evaluator interacted verbally with the dog for 10 seconds, using positive reinforcement. The dog's name was not used during recording to maintain patient confidentiality. Following the evaluator's introduction to the dog, the kennel door was opened to allow the patient outside, using a lead or harness. Pain scoring was performed using the CMPS-SF; all dogs were walked a few steps and gentle palpation and pressure around the area of interest was performed to assess for signs of discomfort. Analgesic drugs were not withheld for the purpose of this study and were administered based on the Small Animal Teaching Hospital (SATH) standard of care. Methadone 0.2 mg kg-1 intravenously (IV) (Methadyne 10mg/ml -1; Jurox Pty Limited, Australia) was provided if pain score was ≥6/24. This study followed the recommended analgesic intervention threshold proposed by the authors of the CMPS-SF scale (Reid et al., 2007).

To recruit assessors, email invitations containing study information and a consent form were distributed to all VU, RVN, VS, and ECVAA Dip at the SATH between August and September 2022. Participation was voluntary and their participation and results had no impact on the VU's final grades. Five external ECVAA Dip were also invited to participate in this research study; participation of external specialists was required to achieve an adequate number of participants.

When the assessor consent form was signed and returned to the main investigator, another email was sent to each participant (five per group), with a participant number and spreadsheet. All participants were added to a private Microsoft Teams™ channel, which was linked to the previously recorded videos and a demonstration containing detailed explanations on pain assessment using CMPS-SF. Each video was assigned a code name, and the order of the videos was randomised prior to distribution so that each person within a group viewed the videos in a different order. None of the chosen participants were primarily involved in the care of the dogs enrolled in this study.

Statistical analysis

Statistical analyses were performed using SPSS statistical software (IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY). Normality of data was assessed by graphical analysis and with the Shapiro–Wilk test. The mean scores for each animal between groups were compared using Related–Samples Friedman's Two-Way Analysis of Variance, followed by the Dunn post-hoc test with Bonferroni correction for multiple comparisons. Agreement of all individual scores within groups and agreement of mean scores for each animal between groups were assessed by calculating intraclass correlation coefficient (ICC) with 95% confidence intervals (CI), using a two-way random-effect model (with raters and participants considered random) for absolute agreement. ICC values were evaluated as described by Koo and Li (2016).

For the evaluation of the intervention point, which we defined as the point at which an animal is deemed to require additional analgesia based on pain scoring (≥6/24), the binary agreement within groups and between groups was assessed **The scores for all the participants were converted into binary categories, scores of 6 or greater (out of 24) were recorded as 'Yes', the dog required an intervention (i.e., additional analgesia); scores of 5 or lower (out of 24) were recorded as 'No', the dog did not require additional analgesia. The binary categories assigned (Yes/No) were based on whether analgesic intervention was required (Reid et al., 2007).** The binary agreement within groups was assessed with Fleiss' Kappa and binary agreement of the modal response between groups was assessed with Cohen's Kappa and evaluated as described by Landis and Koch (1977). $P<0.05$ was considered significant for all analyses.

3. Results

Animals

A total of 45 dogs were recruited for the study, including 23 females and 22 males. Median age was 75 months (3-195 months), and median bodyweight was 21.1kg (4-43.8kg). Different breeds were included in the study, being crossbreed dogs the most common (n=18), followed by French bulldogs (n=4), Border collies (n=4), Labrador retrievers (n=3), Border terrier (n=2), Staffordshire bull terrier (n=2), Schnauzer (n=2), American bulldog (n=1), Beagle (n=1), German shepherd (n=1), Cavalier King Charles Spaniel (n=1), Pug (n=1), Poodle (n=1), Lurcher (n=1), Italian Greyhound (n=1), West highland white terrier (n=1) and Golden retriever (n=1).

Prior to pain scoring, dogs had undergone different surgical procedures or had underlying medical conditions that were expected to be painful. Surgical procedures included: tibial plateau levelling osteotomy (TPLO) (n=23); humeral condylar fracture repair (n=4); total hip replacement (THR) (n=3); tibial fracture repair (n=3); tibial tuberosity transfer (TTT) (n=1); partial tarsal arthrodesis explant (TTT) (n=1); ovariohysterectomy (OHT) (n=1); mammary mastectomy (n=1) and mast cell tumour scar excision (n=1). Non–surgical cases included: spinal myelopathy (n= 5); polyarthritis (n=1) and pancreatitis (n=1).

Participants (assessors)

A total of 20 participants were recruited and subsequently divided into four groups according to their role: VU, RVN, VS, ECVAA Dip. The assessor group included 14 females and 6 males. Age range (in years) varied amongst the different groups; VU (22–25), RVN (25–40), VS (25–40) and ECVAA Dip (30–40).

Group comparison

Overall agreement of pain assessment (across all assessors) was poor (ICC=0.494, 95% CI 0.390-0.616) and VU mean scores were significantly different from VS ($p<0.001$), RVN ($p<0.001$) and ECVAA Dip ($p=0.048$) (Figure 2 and Table 1). Intra-group agreement was poor to moderate (Koo & Li, 2016). RVN had the best intra-group agreement (ICC=0.656, 95% CI 0.537-0.767), followed by ECVAA Dip (ICC=0.540, 95% CI 0.407-0.675), VS (ICC=0.478, 95% CI 0.339-0.675) and VU (ICC=0.432, 95% CI 0.296-0.582).

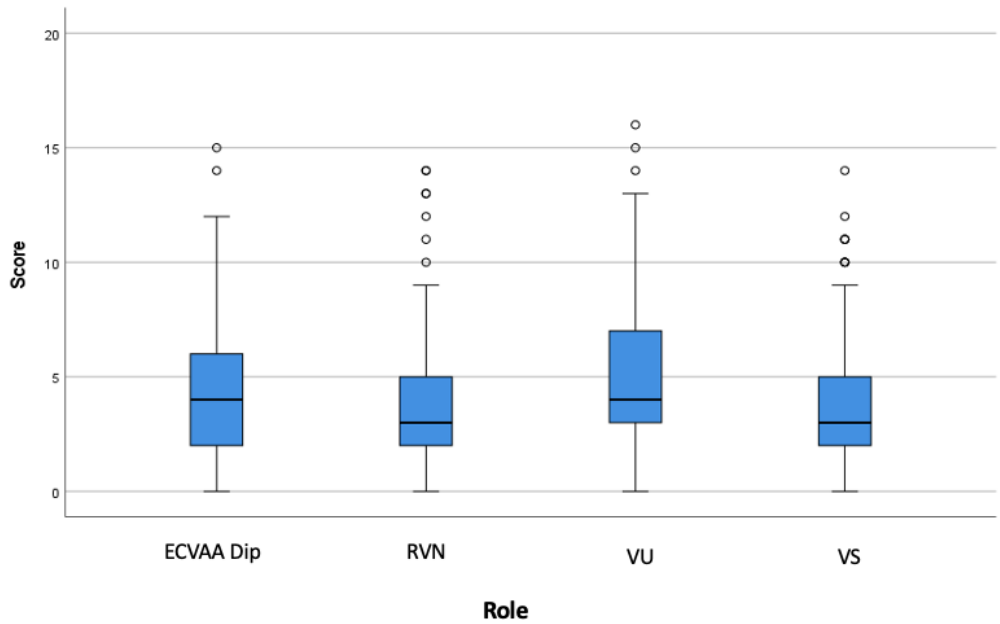

Fig 2. Box and whisker plot summarising all pain scores for each of the groups: ECVAA diplomates (ECVAA Dip.), registered veterinary nurses (RVN), fifth year-veterinary students (VU) and veterinary surgeons (VS). Boxes represent the interquartile range from the 25th and 75th percentile. The horizontal bar in each box represents the median value for all scores. The whiskers indicate the range of data values unless outliers are present, in which case the whisker extend to a maximum of 1.5 the interquartile range. Such outlying data points are represented by dots.

Table 1. Summary of the mean pain scores given by each group for the 45 dogs evaluated by four groups of observers. P-values are from the Related–Samples Friedman's Two-Way Analysis of Variance, followed by the Dunn post-hoc test with Bonferroni correction for multiple comparisons.

Group	**Median of mean scores**	**Interquartile range (IQR)**	**P value (ref. Veterinary Students)**
Fifth-year veterinary students	4.6	3.2-6.4	
Registered veterinary nurses	3.4	2.5-4.7	p<0.001
Veterinary surgeons	3.6	2.4-4.5	p<0.001
ECVAA diplomates	3.6	2.7-5.7	p=0.048

VU mean scores were significantly higher than the other groups (Table 1) and their agreement with the other groups was the poorest (Table 2). The highest inter-group agreement was between VS and RVN (ICC=0.951 95% CI 0.910-0.973) and ECVAA Dip and RVN (ICC=0.951, 95% CI 0.901-0.975) (Table 2); showing a good to excellent agreement between these groups.

Table 2. Inter-group agreement of pain scores.

Group	**ICC**	**95% CI**
VU vs RVN	0.824	0.427-0.927
VU vs VS	0.819	0.417-0.924
VU vs ECVAA Dip	0.840	0.653-0.920
RVNs vs VS	0.951	0.910-0.973
RVNs vs ECVAA Dip	0.951	0.901-0.975
VS vs ECVAA Dip	0.928	0.864-0.961

VU fifth-year veterinary students, RVN registered veterinary nurses, VS veterinary surgeons, ECVAA Dip. ECVAA diplomates, ICC intraclass correlation coefficient. 95% CI 95% confidence intervals.

The overall agreement for analgesic intervention (all assessors) was fair (ICC=0.350, 95% CI 0.327-0.374). The agreement followed the same trend as before; RVN had the best intra-group agreement (moderate agreement, κ=0.470, 95% CI 0.361-0.572), followed by ECVAA Dip (fair agreement, κ=0.385, 95% CI 0.288-0.473), VS (fair agreement, κ=0.321 95% CI 0.218-0.430) and VU (fair agreement, κ=0.297 95% CI 0.204-0.382). Between groups, VU and ECVAA Dip, and VU and RVN had substantial agreement with κ values at 0.695 and 0.663, respectively. The following groups showed moderate agreement: VU and VS (κ=0.604), RVN and ECVAA Dip (κ=0.549), and VU and ECVAA Dip (κ=0.483). VU and RVN had only fair agreement (κ=0.353). Table 3 illustrates the different analgesic intervention points amongst the different groups of assessors. When looking at the modal answer for each of the groups, all the groups agreed that analgesia was necessary for five of the 45 dogs, and not needed for 26 of the dogs. Looking at the individual responses, there was only one dog where every single participant agreed that the animal needed analgesia and only three dogs where every participant agreed that analgesia was not required.VU were more likely to determine that additional analgesia was required compared to other groups.

TABLE 3. Agreement between groups regarding whether further analgesic intervention required. The modal response for each group is presented as:

+ (Yes) Provide analgesia (Pain score ≥ 6/24).

- (No) No need for additional analgesia (Pain score ≤ 5/24).

	MODAL ANSWER			
ROLE	**VU**	**RVN**	**VS**	**ECVAA Dip**
DOG 1	+	-	-	-
DOG 2	+	+	+	+
DOG 3	+	+	+	+
DOG 4	+	-	-	-
DOG 5	+	-	-	-
DOG 6	-	-	-	-
DOG 7	-	-	-	-

DOG 8	-	-	-	-
DOG 9	-	-	-	-
DOG 10	-	-	-	-
DOG 11	-	-	-	-
DOG 12	-	-	-	-
DOG 13	-	-	-	-
DOG 14	+	-	-	-
DOG 15	+	-	-	-
DOG 16	+	-	+	+
DOG 17	-	+	-	+
DOG 18	-	-	-	-
DOG 19	+	-	-	-
DOG 20	+	-	+	+
DOG 21	-	-	-	-
DOG 22	-	-	-	-
DOG 23	-	-	-	-
DOG 24	-	-	-	-
DOG 25	+	-	-	-
DOG 26	+	+	+	+
DOG 27	+	+	+	+
DOG 28	+	+	+	+

DOG 29	-	-	-	-
DOG 30	-	-	-	-
DOG 31	-	-	-	-
DOG 32	-	-	-	-
DOG 33	-	-	-	-
DOG 34	-	-	-	+
DOG 35	-	-	-	-
DOG 36	-	-	-	-
DOG 37	-	-	-	-
DOG 38	+	-	+	+
DOG 39	-	-	-	-
DOG 40	-	-	-	-
DOG 41	-	-	-	-
DOG 42	-	-	-	-
DOG 43	-	-	-	-
DOG 44	-	-	-	+
DOG 45	-	-	-	-
ANALGESIC INTERVENTION REQUIRED (Y)	15	6	8	13

VU fifth-year veterinary students, RVN registered veterinary nurses, VS veterinary surgeons, ECVAA Dip. ECVAA diplomates, ICC intraclass correlation coefficient.

4. Discussion

To the authors' knowledge, this is the first study looking at the agreement between veterinary professionals with different roles and levels of expertise when pain-scoring dogs in a hospital setting. Our study shows good to excellent inter-group agreement of pain assessment using CMPS-SF, meaning that pain score results are comparable across the four groups that we evaluated (ECVAA diplomates, registered veterinary nurses, fifth year-veterinary students and veterinary surgeon)**.** Nevertheless, the overall agreement across assessors appears to be poorer and intra-group agreement is poor to moderate, indicating that individuals within the same group often provide disparate scores. This corroborates the idea that pain assessment in veterinary patients remains a challenge, particularly because of the complexity of this subjective phenomenon. Additionally, the observer's perception of the degree of pain an animal is experiencing is affected by several factors, including behavioural states such as anxiety (Ellwood and Murison, 2022). Pain sensitivity and perception of pain may also differ based on other factors, such as dog breed, for example (Caddiell, et al., 2023), being hunting and working dogs those that thend to have a higher pain sensitivty treshhold. Therefore, even when using validated pain scales, factors which may interfere with their use should be considered.

Veterinary training in the field of pain assessment should be further expanded to ensure adequate pain scoring and provision of analgesia in small animals. Veterinary educational institutions should promote training to ensure that veterinary graduates are familiar with pain scores and feel comfortable performing pain assessment in veterinary species. Although small animal veterinary surgeons appear to demonstrate awareness to pain in their patients and employ various methods for pain assessment, a limited use of validated tools is identified by some authors (Menendez et al., 2023) and likely attributed to challenges such as a lack of established routine, time constraints, insufficient staff, and particularly, a knowledge gap among veterinary staff who do not employ pain assessment scales routinely. This suggests a window of opportunity for the implementation of training programs in small animal pain assessment.

Based on our results, overall agreement of pain assessment amongst participants appears to be suboptimal, resulting in wide discrepancies within the same group of assessors. Because of this, the authors suggest that trainees are encouraged to pain score patients in small groups (2-3 people), to optimise comparison and ensure more consistent results among different assessors. Comparison is a powerful learning process that has been leveraged to improve training in a variety of domains (Rittle-Johnson et al., 2011). Group pain assessment could potentially improve both inter-group and intra-group agreement. Besides, another area of improvement suggested by the authors is the development of pain scales specific for the condition being assessed (e.g., ocular pain, visceral pain, orthopaedic pain). Condition-specific pain scales are established in human pain assessment (Caudle et al., 2007; Trinic et al., 2017; Aydin et al., 2019; Caraceni et al 2019).

Regarding the evaluation of agreement over provision of additional analgesia based on pain scores, our data showed a moderate to fair agreement on requirement for additional analgesia within the different groups, and good to moderate agreement between groups. It seems that the agreement across assessors improves when pain scores are determined to be either high (additional analgesia required) or low (no additional analgesia required). This suggest that regardless of the discrepancies in pain score results across the different assessors, participants seem to agree on the need for additional analgesia. Therefore, pain score agreement appears to be more consistent in dogs with either high or low pain scores, in which the need (pain score ≥ 6/24), or no need (pain score ≤ 5/24) for additional analgesia is less questionable.

Our results reveal that VU tend to score pain higher compared with more experienced assessors and, therefore, students are more proactive when it comes to consider additional analgesia (intervention point) based on pain scores. This same observation has been made before by Barletta and Colleagues (2016). Other studies have shown that veterinary surgeons with less experience also tend to assing higher pain scores to dogs that are given lower scores by more experienced colleagues (Kongara, et al.,2016). Although the exact reason for this tendency is unclear, it could be that newer generations of veterinary surgoens are more aware of pain and its assessment in practice. Consequently, dogs are unlikely to receive insufficient analgesia when rescue analgesia is delivered based on pain scores proposed by VU. Nonetheless, it is important to note that overestimation of pain (suspected amongst those less experienced assessors, including VU) could possibly result in over prescription of analgesic drugs, which is not without side effects, particularly when using drugs such as opioids. A retrospective study comparing two analgesic strategies in dogs after TPLO (Bini et al., 2018) found that dogs receiving methadone every four hours regardless of pain score did not necessarily have a better outcome than those that received analgesia depending on pain score. In fact, dogs receiving opioid analgesia irrespective of pain score were more likely to vomit and vocalise, with a reduction in food intake whilst hospitalized. This emphasises the importance of patients undergoing adequate pain assessment and receiving opioid analgesia only when necessary.

There are several limitations to our study. The first limitation is that pain was evaluated by assessors through pre-recorded videos rather than in a real-life setting. Video-recordings have been used in research for the assessment of quality of recovery from anaesthesia and postoperative pain (Hofmeister et al., 2018), and good agreement video *versus* real-life is described (Catanzaro et al., 2016). Some pain assessors raised concerns related to the inability to differentiate background noise and other sounds such as ‘whining’, that could represent pain and anxiety. Pre-recorded pain assessment videos also precluded direct interaction between the assessors and patient, as is the case in a real-life scenario. Therefore, the authors acknowledge that videos should be used with caution and that pain assessment based on pre-recorded videos may differ from pain assessment in a real-life scenario. Our best effort was put in to recreating a realistic clinical setting. In fact, dogs are usually pain scored in kennels with background noise from other dogs and veterinary staff. Ultimately, video-recorded pain assessment was deemed to be the only feasible (and ethical) method to evaluate the same dog 20 times for the purposes of this study.

Overall participation (assessor recruitment) was optional, being staff members interested in anaesthesia the first ones replying to our study participation invitation email. This could have created an artificial selection bias in which students with greater interest in pain score were more likely to participate, altering our study results (Doodnaught and Colleagues, 2017). Furthermore, our assessor group had a female bias (14 females *versus* 6 males), which although it could have also influenced pain assessment, it reflects the reality of our institution and the profession in which pain assessment is more likely to be carried out by female assessors. Research by Catanzaro and Colleagues (2016) showed that female participants are generally more empathetic and likely to pain score higher than males, especially when assessors experience chronic pain conditions.

5. Conclusions

Our study shows good to excellent inter-group agreement of pain assessment using CMPS-SF. Nevertheless, the overall agreement across different pain assessors appears to be suboptimal, resulting in poor to moderate intra-group agreement. Our data also shows that veterinary students tend to pain score higher and have poorer inter-individual agreement compared to more experienced assessors.

Our findings support the idea that the assessment of pain in veterinary patients remains a challenge, particularly because of the complexity of this subjective phenomenon. Pain assessment is key to ensure animal welfare and training in this area should be reinforced to improve consistency. CMPS-SF is a validated tool but further refinement for specific clinical scenarios may be needed to also improve consistency.

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