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ORIGINAL RESEARCH

Reporting outcome measures in veterinary physiotherapy with particular reference to the treatment of canine and equine joint cases in the UK

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Abstract

Background: Outcome measures are extensively used within human physiotherapy, but a widely accepted issue in veterinary physiotherapy is that outcome measures lack sufficient evaluation and standardisation in terms of how they are implemented. This cross-sectional study aimed to provide clarity on (1) the current selection of outcome measures in canine and equine physiotherapy and (2) investigate external influences on outcome measure selection, including comparative literature availability, professional memberships and background.

Methods: A structured scoping literature review consolidated current understanding and limitations. This informed a survey of qualified veterinary physiotherapists (n = 40). The statistical analysis comprised descriptive statistics.

Results: Key observations included (1) a lack of difference in outcome measure application between veterinary physiotherapists with and without a human physiotherapy background, (2) enhanced outcome measure utilisation by registry body members and (3) an overall skew towards subjective, rather than objective, outcome measure use.

Limitations: The study was limited by the absence of a defined veterinary physiotherapist population and subsequent convenience sample size.

Conclusion: The apparent skew towards subjective outcome measures highlights objective outcome measure underutilisation and the need for a more extensive evidence base. In conclusion, there is a need to develop comprehensive professional development resources promoting the use of repeatable outcome measures such as goniometers and the Liverpool osteoarthritis scoring.

KEYWORDS
canine, equine, goniometry, kinematic analysis, LOAD score, outcome measures, pain score, veterinary physiotherapy, video tracking

INTRODUCTION

Veterinary physiotherapists provide postoperative care, rehabilitation, sports maintenance and support for their patients with age-related conditions. It follows, therefore, that when used in collaboration with complementary veterinary treatment, the quality of patient care is maximised.[1,2] While human physiotherapists can act both as a first point of contact and for referral treatment options,[3] in the UK, the 2015 Veterinary Surgery Exemptions Order[4] and the current RCVS definition of 'under care' means that full responsibility rests with the attending veterinarian, including the approval of an individual to carry out an act of physiotherapy on an animal.[1]

Human physiotherapy has an excellent reputation for its competent and qualified practitioners, in part for their use of evidence-based practice to

maintain high standards across the profession.[3] Failure to uphold professional standards may result in removal from the Health and Care Professions Council register, meaning that they could no longer practice under the protected title of 'physiotherapist'.

The Register of Animal Musculoskeletal Practitioners (RAMP) and the Animal Health Professions Register (AHPR) are two examples of voluntary registry bodies for animal musculoskeletal professionals; continual membership of these bodies requires practitioners to maintain high professional standards of conduct and practice. However, at the time of writing, there are no legally mandated regulatory bodies (registry bodies or professional interest groups) for veterinary physiotherapists in the UK. Registry bodies govern and regulate their members and, in specific cases, the entire profession, such as with the RCVS for qualified veterinary surgeons. Comparatively, professional interest groups act as forums for support, courses, continued professional development (CPD) events, seminars and training, while requiring their members to pay a membership fee and adhere to a professional code of conduct and ethics. Examples include the Association of Chartered Physiotherapists in Animal Therapy (ACPAT), the Institute of Registered Veterinary & Animal Physiotherapists (IRVAP) and the National Association of Veterinary Physiotherapists (NAVP).

In contrast to other areas of the veterinary sector, where outcomes such as healing and infection are binary in assessment, patient outcomes in veterinary physiotherapy are typically non-binary. They are instead monitored using reliable judgement indicators described as outcome measures. The use of outcome measures is required as part of the professional standards for both the RAMP and AHPR, promoting evidence-based practice, professional accountability and quality assurance; however, individual outcome measures are not specified. Consequently, the selection of outcome measures depends on the strength of the evidence base supporting their use, practitioner familiarity and ease of application.

For the purposes of this study, the term 'outcome measures' refers to subjective and objective tools, tests or scales that have been shown to repeatedly measure a particular attribute of interest, and these attributes, in turn, are expected to be influenced by outcome. The attributes investigated, which included pain, range of motion, muscle mass, function and dynamic function, have been measured via methodologies that vary in terms of subjectivity and objectivity. Within this study, the term 'subjective' is used to refer to a test or measurement that can be influenced by inter- or intraclinician application or interpretation. With the variation between individuals, breeds and species, a truly perfect objective measurement, standardised in both application and interpretation, is challenging. Instead, the 'objective' outcome measures referred to in this study will reduce inter- and intraclinician variability by ensuring that a specific outcome measure is applied and interpreted in the same way, for example, the Liverpool Osteoarthritis in Dogs (LOAD) score.

TABLE 1 The finalised search function that was input into the database search engines

Final search function
(Dog.mp. OR dogs.mp. OR canine.mp. OR canines.mp. OR canis.mp. OR exp dogs/OR Horse.mp. OR Horses.mp. OR Equine.mp. OR Equines.mp. OR Equus.mp. OR exp horses/)
AND
(Postoperative therapy.mp. OR post-operative therapy.mp. OR postoperative therapies.mp. OR post-operative therapies.mp. OR post-operative rehabilitation.mp. OR postoperative rehabilitation.mp. OR physical therapy.mp. OR physical therapies.mp. OR physical therapy modality.mp. OR physical therapy modalities.mp. OR exp physical therapy modalities/OR physiotherapy.mp. OR physiotherapies.mp. OR physiotherapist.mp. OR physiotherapists)

In contrast to human physiotherapy, there has been little research in this area. Indeed, a recently published survey[5] of equine veterinary physiotherapists revealed that six of 71 respondents did not use outcome measures at all since they believed there were no validated measures available. A comparative study of canine physiotherapists was not found during the literature search.

This cross-sectional study aimed to provide clarity on (1) the current selection of outcome measures in canine and equine physiotherapy and (2) investigate external influences on outcome measure selection, including comparative literature availability, professional membership and background.

METHODS

Published research on outcome measures used in veterinary physiotherapy was identified by searching CAB Abstracts, PubMed and Web of Science in September 2021. The search took place using species parameters and rehabilitative terms linked with the Boolean operators AND and OR and the qualifying search factors for subject headings (exp/) and keywords (.mp.) (Table 1).

Output from the scoping review included the identification of multiple outcome measures. These were subsequently discussed with a consultant group of veterinary physiotherapists (University of Nottingham), and a list of specific outcome measures was produced (Table 2) for the purpose of this study. This list was included in an online survey of qualified veterinary physiotherapists created using the Joint Information Systems Committee system (Supporting Information 1). Questions regarding the respondent's background were added to allow for inter- and intraclinician comparisons, including previous relevant human healthcare qualifications, registry body membership and their patients' species. Likert-scale questions were included to rate participants' frequency of use of the listed outcome measures for treatment of joint cases (Table 2). Participants were then asked to separately rate how effective each outcome measure was when applied to both acute and degenerative joint cases.

TABLE 2 List of outcome measures included in the study with contextual definitions

Outcome measure	Definition
How well is the animal?	Subjective clinical judgement of the current health status of the animal and involves no other specific tests.
How well does the animal move?	Subjective clinical judgement of the animal's movement capabilities and involves no other specific tests.
Hands-on assessment	Subjective clinical judgement and subsequent recording of the status of the animal based on a physical assessment.
Owner-reported capability	The owner stating whether their animal can do a specific function, for example, animal can jump on the sofa.
Owner-reported interpretation	The owner's subjective judgement as to how well their animal can do a specific function, for example, animal can jump on the sofa easier than before.
Standardised pain score	Subjective clinical judgement of the current pain status of the animal compared with standardised descriptive pain levels.
LOAD score	Subjective clinical judgement of the current osteoarthritis status of the animal against the standardised LOAD score levels.
Muscle mass measurement/atrophy measurement	Measuring muscle mass change after increased or decreased muscle use to indirectly monitor the effect of the veterinary physiotherapist's treatment, for example, tape measure.
Video tracking + gait analysis (camera)	Videoing the animal's movement across the treatment and visually comparing gait changes.
Video tracking + gait analysis (kinematic monitoring)	Videoing the animal's movement across the treatment using contrast markers and visually comparing gait changes.
Video tracking, digital mapping + gait analysis (camera)	Videoing the animal's movement across the treatment, using computer software to map the gait, and then visually comparing gait changes.
Video tracking, digital mapping + gait analysis (kinematic monitoring)	Videoing the animal's movement across the treatment using contrast markers, having advanced computer software digitally map the movement and comparing gait changes though computer and visual analysis.
Goniometer	The use of a goniometer device to measure changes in the range of motion angles of the joints undergoing treatment.
Weight-bearing measurements on pressure mat	The veterinary physiotherapist using a weight distribution mat to monitor any changes in how the animal weight bears through its limbs.

Abbreviation: LOAD, Liverpool Osteoarthritis in Dogs.

Since the size of the population that identifies themselves as veterinary physiotherapists is undefined, a convenience sample approach was adopted to capture as broad and relevant a population as possible. The survey was distributed via alumni pools, via social media groups and through several registry and professional bodies: RAMP, AHPR, ACPAT, IRVAP and NAVP. The dataset produced from the fully completed responses enabled comparison between the literary evidence base and the prevalence and perceived quality of outcome measures in veterinary physiotherapy practice using descriptive statistics. The study was carried out in accordance with the STROBE checklist for cross-sectional studies.[6]

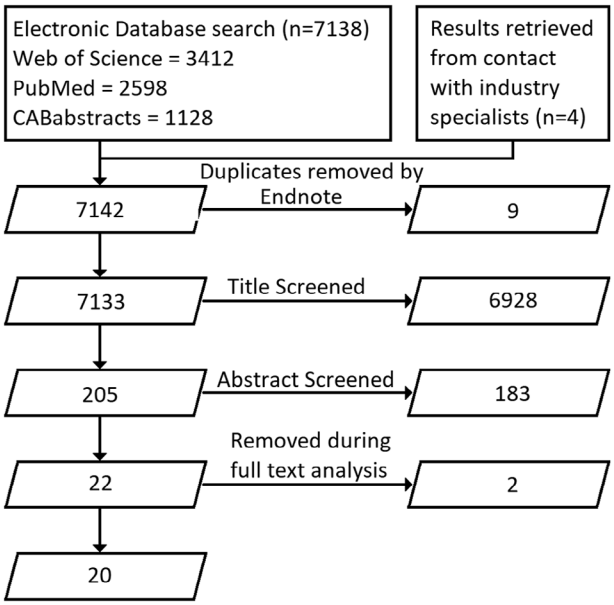

FIGURE 1 Flow chart showing the systematic selection of papers for literature review analysis

RESULTS

The results from the database search and an additional two papers and two published books (McGowan and Stubbs,[7] Lindley and Watson[2]) suggested by the consultant group of veterinary physiotherapists (University of Nottingham School of Veterinary Medicine and Science) were narrowed from 7142 (Figure 1), through the application of predetermined inclusion and exclusion criteria, to a final list of 20 papers (Table 3). Of these papers, only four compared specific outcome measures in terms of reliability and none compared application to both canine and equine physiotherapy treatment.

The demographic breakdown of the respondents is outlined in Table 4. Notably, the largest proportion of the respondents were canine practitioners (n = 19), and there was a relatively even split across memberships of registry bodies and professional interest groups. Of current or previously held additional qualifications, human physiotherapy was the most abundant (n = 11).

The 40 survey respondents were subdivided into 'solely canine' (n = 19), 'solely equine' (n = 11) and 'mixed' (n = 10), and descriptive statistics were used to compare the populations. The prevalence and perceived effectiveness of outcome measures in canine and equine practice are summarised in Tables 5 and 6, respectively. Overall, there was a

TABLE 3 List of all 20 papers included in the literature review

Paper	Author	Year
Rehabilitation of the canine forelimb	Brown et al.[24]	2021
Development of an ethogram for a pain scoring system in ridden horses and its application to determine the presence of musculoskeletal pain	Dyson et al.[17]	2018
Non-surgical management of hip dysplasia	Farrell et al.[12]	2008
Goniometric assessment in French bulldogs	Formenton et al.[26]	2019
An equine pain face	Gleerup et al.[18]	2015
Physiotherapy assessment for the equine athlete	Goff et al.[3]	2016
Psychometric testing of the Helsinki chronic pain index by completion of a questionnaire in Finnish by owners of dogs with chronic signs of pain caused by osteoarthritis	Hielm-Björkman et al.[20]	2009
Reliability of goniometry in Labrador Retrievers	Jaegger et al.[27]	2002
Use of standardised outcome measures in physical therapist practice: perceptions and applications	Jette et al.[30]	2009
Kinematic analysis of the hind limb during swimming and walking in healthy dogs and dogs with surgically corrected cranial cruciate ligament rupture	Marsolais et al.[25]	2003
Evidence for canine rehabilitation and physical therapy	Millis et al.[19]	2015
Abdominal myofascial pain syndrome must be considered in the differential diagnosis of chronic pelvic pain	Montenegro et al.[31]	2009
Fundamental principles of rehabilitation and musculoskeletal tissue healing	Shaw et al.[21]	2020
Objective measurement in equine physiotherapy (special issue: equine practice)	Tabor et al.[5]	2020
The use of outcome measures in equine rehabilitation	Tabor et al.[5]	2018
Generation of domains for the equine musculoskeletal rehabilitation outcome score: development by expert consensus	Tabor et al.[16]	2020
Routine equine physiotherapy	Tabor[23]	2020
Physiotherapy optimising result	Tanner et al.[10]	2018
Evaluation of construct and criterion validity for the 'Liverpool Osteoarthritis in Dogs' clinical metrology instrument and comparison to two other instruments	Walton et al.[14]	2013
Biomechanics of rehabilitation (rehabilitation and physical therapy)	Weigel et al.[28]	2005

TABLE 4 Summary of the key survey results

Demographic breakdown	Number of respondents		
Dataset of survey respondents	($n = 40$)		
Species practitioner breakdown	Solely canine ($n = 19$)	Solely equine ($n = 11$)	Mixed ($n = 10$)
UK Registry body members (AHPR, RAMP)	Canine members ($n = 16$) Equine members ($n = 11$)	Canine non-members ($n = 10$) Equine non-members ($n = 9$)	
Additional/previous human qualification	Human physiotherapist ($n = 11$) (canine $n = 6$, equine $n = 6$)	None/other ($n = 29$) (canine $n = 23$, equine $n = 13$)	

Demographic comparison	Comparison summary
Professional registrative bodies (RAMP/AHPR) members versus non-members	Membership associated with a slight increase in use of outcome measures. Differences appear more evident in canine rather than equine subsections. Biggest differences were an increase in use of videoing gait analysis by members (84% vs. 40% frequent use or higher) and a decrease in use of standardised pain scoring by members (31% vs. 40%)
Background training: human physiotherapist versus other	Although analyses revealed no differences between the two demographics, a key limitation was the species sub-section sample size (canine, $n = 6/29$; equine, $n = 6/19$)

Abbreviations: AHPR, Animal Health Professions Register; RAMP, Register of Animal Musculoskeletal Practitioners.

generally higher frequency of use for the more subjective outcome measures across both species but no obvious difference in perceived effectiveness between the outcome measures that were more or less objective.

DISCUSSION

The data presented in this report illustrate that the choice of which outcome measures to use in the assessment of physiotherapy outcomes in canine and

TABLE 5 Prevalence of outcome measures and their perceived effectiveness in canine acute and degenerate joint conditions

	Prevalence		Perceived effectiveness							
			Acute				Degenerative			
Canine outcome measures ($n = 29$)	**Minimal or no use**	**Frequent or constant use**	**Should not be used**	**Should only be used in combination**	**Usable individually, best in combination**	**Excellent individually and in combination**	**Should not be used**	**Should only be used in combination**	**Usable individually, best in combination**	**Excellent individually and in combination**
How well is the animal	10% (3)	90% (26)	0% (0)	38% (11)	41% (12)	21% (6)	3% (1)	48% (14)	31% (9)	17% (5)
How well does the animal move	7% (2)	93% (27)	3% (1)	21% (6)	41% (12)	34% (10)	0% (0)	41% (12)	31% (9)	28% (8)
Hands-on assessment	3% (1)	97% (28)	3% (1)	17% (5)	31% (9)	48% (14)	0% (0)	28% (8)	24% (7)	48% (14)
Owner-reported capability	3% (1)	97% (28)	0% (0)	66% (19)	21% (6)	14% (4)	0% (0)	52% (15)	38% (11)	10% (3)
Owner-reported interpretation	7% (2)	93% (27)	0% (0)	62% (18)	24% (7)	14% (4)	0% (0)	55% (16)	34% (10)	10% (3)
Standardised pain score[a]	66% (19)	34% (10)	0% (0)	45% (13)	41% (12)	14% (4)	7% (2)	45% (13)	38% (11)	10% (3)
LOAD score[a]	66% (19)	34% (10)	0% (0)	59% (17)	31% (9)	10% (3)	3% (1)	48% (14)	31% (9)	17% (5)
Muscle mass measurement[a]	45% (13)	55% (16)	3% (1)	55% (16)	38% (11)	3% (1)	0% (0)	45% (13)	45% (13)	10% (3)
Video tracking and gait analysis—kinetic monitoring and analysis equipment	93% (26)	7% (2)	0% (0)	28% (8)	45% (13)	28% (8)	3% (1)	28% (8)	48% (14)	21% (6)
Video tracking and gait analysis—phone/camera	31% (9)	69% (20)	0% (0)	34% (10)	48% (14)	17% (5)	0% (0)	41% (12)	34% (10)	24% (7)
Video tracking with digital mapping and gait analysis—kinetic monitoring and analysis equipment[a]	97% (28)	3% (1)	3% (1)	28% (8)	48% (14)	21% (6)	3% (1)	31% (9)	45% (13)	21% (6)
Video tracking with digital mapping and gait analysis—video recording and computer analysis apps[a]	93% (27)	7% (2)	3% (1)	31% (9)	48% (14)	17% (5)	3% (1)	28% (8)	48% (14)	21% (6)
Goniometer[a]	59% (17)	41% (12)	7% (2)	55% (16)	31% (9)	7% (2)	0% (0)	55% (16)	38% (11)	7% (2)
Weight-bearing measurements on pressure mat[a]	83% (24)	17% (5)	7% (2)	38% (11)	41% (12)	14% (4)	3% (1)	38% (11)	38% (11)	21% (6)

Note: The percentages shown are purely mathematical, calculated from the data and are not statistically significant or representative. This table contains combined data from the 'solely canine' practitioners and canine-specific data from the 'mixed' practitioners.

[a]More objective outcome measures.

TABLE 6 Prevalence of outcome measures and their perceived effectiveness in equine acute and degenerate joint conditions

	Prevalence		Perceived effectiveness							
			Acute				Degenerative			
Equine outcome measures ($n = 21$)	**Minimal or no use**	**Frequent or constant use**	**Should not be used**	**Should only be used in combination**	**Usable individually, best in combination**	**Excellent individually and in combination**	**Should not be used**	**Should only be used in combination**	**Usable individually, best in combination**	**Excellent individually and in combination**
How well is the animal	0% (0)	100% (21)	0% (0)	57% (12)	19% (4)	24% (5)	0% (0)	52% (11)	24% (5)	24% (5)
How well does the animal move	0% (0)	100% (21)	0% (0)	38% (8)	29% (6)	33% (7)	0% (0)	43% (9)	24% (5)	33% (7)
Hands-on assessment	0% (0)	100% (21)	0% (0)	29% (6)	38% (8)	33% (7)	0% (0)	33% (7)	33% (7)	33% (7)
Owner-reported capability	0% (0)	100% (21)	0% (0)	62% (13)	24% (5)	14% (3)	0% (0)	57% (12)	29% (6)	14% (3)
Owner-reported interpretation	0% (0)	100% (21)	0% (0)	62% (13)	24% (5)	14% (3)	0% (0)	62% (13)	24% (5)	14% (3)
Standardised pain score[a]	57% (12)	43% (9)	0% (0)	76% (16)	19% (4)	5% (1)	0% (0)	76% (16)	19% (4)	5% (1)
Muscle mass measurement[a]	71% (15)	29% (6)	0% (0)	76% (16)	19% (4)	5% (1)	0% (0)	67% (14)	29% (6)	5% (1)
Video tracking and gait analysis—kinetic monitoring and analysis equipment	90% (0) (19)	10% (0) (2)	0% (0)	57% (12)	24% (5)	19% (4)	5% (1)	52% (11)	24% (5)	19% (4)
Video tracking and gait analysis—phone/camera	48% (10)	52% (11)	0% (0)	62% (13)	24% (5)	14% (3)	5% (1)	52% (11)	24% (5)	19% (4)
Video tracking with digital mapping and gait analysis—kinetic monitoring and analysis equipment[a]	90% (0) (19)	10% (0) (2)	0% (0)	57% (12)	24% (5)	19% (4)	5% (1)	52% (11)	24% (5)	19% (4)
Video tracking with digital mapping and gait analysis—video recording and computer analysis apps[a]	86% (18)	14% (3)	0% (0)	57% (12)	24% (5)	19% (4)	5% (1)	52% (11)	24% (5)	19% (4)
Goniometer[a]	86% (18)	14% (3)	0% (0)	67% (14)	29% (6)	5% (1)	5% (1)	62% (13)	29% (6)	5% (1)
Weight-bearing measurements on pressure mat[a]	95% (1) (20)	5% (1)	0% (0)	67% (14)	24% (5)	10% (0) (2)	5% (1)	57% (12)	29% (6)	10% (0) (2)

Note: The percentages shown are purely mathematical, calculated from the data and are not statistically significant or representative. This table contains combined data from the 'solely equine' practitioners and equine-specific data from the 'mixed' practitioners.

[a]More objective outcome measures.

equine patients relies on a limited evidence base. A scoping review yielded only 20 papers, and of these, only four papers discussed the reliability of and made comparisons between two or more specific outcome measures, while none covered both canine and equine outcome measures. The majority of these studies focused on the perceived benefits of a single outcome measure, whereas a smaller number extended this to the perceived benefits of three to five outcome measures. Despite this, a survey across 40 veterinary physiotherapists confirmed that 14 outcome measures (Table 2), selected from the literature and by consultation with the University of Nottingham veterinary physiotherapy teaching team, are extensively used in the assessment of canine and equine cases. To our knowledge, this is the first study to report the usage of 14 outcome measures within and between two species. The usage of these was broadly similar across the two species, with outcome measure usage skewed towards subjective measurements. The data presented illustrate that the two outcome measures with the highest perceived effectiveness across both species were 'How well does the animal move' and 'Hands-on assessment', both of which have potential for significant intra- and interclinician variability. We therefore conclude that there is a need for the establishment of a more robust evidence base and CPD guidance to enable the objective selection of individual and combined outcome measures within the veterinary physiotherapy profession.

In the current study, we demonstrated an enhanced utilisation of outcome measures by members of a registration body but a lack of difference in the application of outcome measures from veterinary physiotherapists with and without human physiotherapy training. In contrast, Tabor and Williams[5] reported enhanced outcome measure usage by veterinary physiotherapists with a history of performing human physiotherapy. This discrepancy may be influenced by the lower number of respondents in the current study (40 vs. 71)[5] and the time period in which the study was carried out. Specifically, Tabor and Williams' study[5] was undertaken 3 years prior to the present study, suggesting variation due to the advancement of the profession.

In contrast to veterinary physiotherapists, human physiotherapists place a large emphasis on patient-reported functional self-assessments and questionnaires, which have been shown to be both repeatable and reliable.[8] One of the biggest challenges across animal healthcare is the non-verbal capability of patients,[9] leading to patient monitoring through repeated clinical assessments and owner-reported outcome measures, which are also referred to in the literature as client-reported outcome measures.

To overcome the lack of self-reporting, veterinary physiotherapists rely heavily on owners as a vital part of the rehabilitation process.[10] Owner-reported outcome measures rely on the owner's ability to provide a reliable assessment of objective animal capability, and therefore quality of life, outside of treatment consults.[11] The problem with this, however, is that the owner's interpretations of chronic or mild acute clinical signs are often inaccurate, especially when compared to clinically trained individuals.[12] It is therefore not surprising that the vast majority of survey respondents indicated that although owner-reported outcome measures are frequently applied, they should only be used alongside other measures implemented by the practitioner.

Awareness of owner-reported outcome measures in the profession is evidenced by Cook,[13] who advocated active client participation in treatment, citing improved compliance and satisfaction through giving owners an outcome measure scorecard. The scorecard included subjective interpretation and objective functional assessment, enabling clients to record their own findings outside of sessions. Since the current survey results highlight the value of owner-reported outcome measures, it follows that combining at-home objective assessments with contextualised subjective interpretation within a scorecard would help provide essential information at the start of the physiotherapy consultation. This approach also optimises the limited hands-on time clinicians have and allows for the inclusion of more evidence-based objective measures within the session. A specific example of an owner-reported outcome measure is the LOAD questionnaire. The LOAD questionnaire was designed to score osteoarthritis progression repeatedly and as objectively as possible. Walton et al.[14] evaluated 222 dogs with osteoarthritis and concluded that LOAD scoring is a reliable and recommended outcome measure. Despite this, the survey data evaluated in this report showed that this outcome measure currently has a very low usage among the veterinary physiotherapists surveyed. This raises the possibility of incorporating LOAD scoring into a pre-appointment digital questionnaire, thus providing immediate and valuable low-cost progression data. For this to work effectively, owner compliance would rely on good communication with the physiotherapist.

Of note, the launch of the RCVS Knowledge: Canine Cruciate Registry[15] has provided veterinary physiotherapists with an opportunity to utilise this outcome measure with relative ease. The owners automatically send postoperative outcome measure forms at set intervals, which include the LOAD questionnaire and the canine orthopaedic index. While initially intended to be an outcome measure to monitor long-term surgical results by veterinary surgeons, it also has massive potential to be exploited by veterinary physiotherapists involved in postoperative care. The referring veterinary surgeon would need to be signed up to the scheme and log the case. Upon handover of the case, the veterinary physiotherapist would simply need to request that the referring veterinary surgeon nominate them as a delegate to view the data.[15]

The outcome measures, 'How well is the animal?', 'How well does the animal move?' and 'Hands-on assessment', are intrinsic parts of a veterinary physiotherapist's clinical exam to assess joint movement dysfunctions[3] and were all highly used by the survey

respondents. Fundamentally, these criteria are based on previous experience of manipulating joints and surrounding soft tissue along with familiarity with and interpretation of lameness scales, and as such, have the potential for inter- and intraclinician variation in application and interpretation. Continuity of care with the same practitioner for follow-up reassessments of a patient eliminates the risk of interclinician variability. Full reference to accurate patient records and consistent methodology would reduce intraclinician variability, facilitating more reliable assessment of therapy-linked developments.

Relevant to the effective utilisation of outcome measures is a reliable assessment of pain. Although pain recognition is crucial in ensuring welfare and identifying quality of life, it can be subjective and open to bias and misinterpretation.[10,16] Dyson and Pollard[17] aimed to produce an ethogram for equine pain and behaviour assessment using lame and sound control horses to identify pain markers. Since the study shows a standardised, evidence-based list of behaviours, indicating their significance allows for a reliable and repeatable assessment of equine pain by the same practitioner.[17] Multiples of the behaviours identified were also found via a different methodology by Gleerup et al.,[18] indicating the accuracy and validity of assessing equine pain via this method.

Millis and Ciuperca[19] and Hielm-Björkman et al.[20] have reported that the Helsinki chronic pain index is a reliable assessment tool for chronic pain in canine osteoarthritis cases, while the former also mentions acute scales, such as the Glasgow composite measure pain scale and the University of Melbourne pain scale. Despite the availability of a range of acute and chronic pain indexes, survey data presented in this study showed mixed usage in canine and equine cases, with increased usage by multi-species practitioners. This suggests that the veterinary physiotherapy profession lacks a widespread standardised approach to assessing pain in joint cases. Since this may reflect the time constraints of a consultation, this once again raises the possibility of a pre-session owner-reported survey incorporating pain scoring.

Animals alter their postures and gait to minimise pain by reducing the use of painful joints. Muscle atrophy can be caused by periods of reduced usage or immobilisation, including post-surgery, which reduces measurable muscle mass.[19,21] Regaining muscle mass and strength is a rehabilitation target that can be achieved through establishing baseline and progression measurements. Hyytiäinen et al.[11] reported that the evaluation of muscle mass atrophy is highly sensitive, particularly in long-term degenerative cases. Given these visible indices, outcome measures around these characteristics are widely used by physiotherapists. In the current study, although respondents agreed with the effectiveness of such outcome measures, they had surprisingly low usage. Based on interviews with veterinary physiotherapists, muscle mass is most often quickly and crudely evaluated via roughly judging symmetry by eye or measuring with hands. Accurate, objective measurement techniques, such as quantitative CT and MRI, are not practical in most cases due to high costs and the requirement for sedation.[19] Lower cost alternatives, such as a Gulick girthometer[22] or a tape measure,[19] could be used in an objective, effective manner as long as specific variables are controlled, such as consistent tension and animal positioning. Utilising specific bony landmarks ensures that the same area is used for repeatable valid comparisons[3,19] but should account for variables such as hair/fur and subcutaneous fat, exercise-induced muscle fluctuations and animal temperament.

Gait analysis by eye is a quick and inexpensive outcome measure but with low reliability due to subjective inter- and intraclinician variability.[23] The human eye is very good at identifying patterns from innately variable repetitive events. Rewatching a recorded motion maximises pattern recognition of subtle gait changes, therefore reducing variability between practitioners.[3,19] Recording the motion has the added benefit of allowing the clinician to review the gait without the need to repeatedly move a painful animal. The clinician can watch specific limbs and joints at various speeds, allowing subtle changes to be picked up and compared with previous recordings for long-term cases and demonstrate this to clients. The more expensive and time-consuming equipment, including kinematic gait analysis, can objectively categorise joint motion through contrast markers, enabling a digital replication of the target.[24,25] The costs also come with potential inaccuracy from human placement of contrast markers and a requirement for a dedicated space in the facility. In the present study, of the four gait analysis outcome measures surveyed, the basic phone/camera video recording had the highest usage. For a valid comparison, video gait recordings should maintain consistency in location, distance from the device, contrast marker placement and animal speed. Controlling speed can be difficult as body size, pain and lameness intrinsically change the speed of movement. This can be overcome by altering playback speed during analysis.

Goniometry is a low-cost, extremely efficient, reliable, objective and user-friendly outcome measure to assess changes in the range of motion over time[26] to a degree of high statistical accuracy[27] and has high inter- and intra-assessor repeatability[5] through reducing the errors associated with human recall and judgement. In the current study, goniometers had a much higher usage by sole species practitioners, particularly solely canine clinicians, and a far lower usage by mixed respondents.

Pressure plate analysis quantifies weight-bearing forces while a limb is in contact with the ground during motion and at rest. This can be achieved through high-cost, high-detailed pressure walkway analysis equipment,[28] force plates or even four sets of bathroom scales.[19,21] Weight-bearing measurements using a pressure mat had the lowest usage of any outcome measure surveyed and yet were perceived to be

potentially very useful when used with other outcome measures.

Current guidance for course accreditation by the RAMP and AHPR mentions the use of outcome measures but does not specify the type or comment on subjective or objective outcome measures, potentially causing significant variations in interpretation and implementation between teaching institutions. Both background demographics surveyed had far higher usage of more subjective outcome measures than objective outcome measures. A potential explanation is that the sector is still developing, and this is reflected by the limited evidence base for specific outcome measures demonstrated in the current study. As part of many veterinary physiotherapy courses, students are advised to shadow qualified veterinary physiotherapists, and their subsequent exposure to outcome measures therefore depends on this experience and what is taught in the curriculum. Consequently, exposure through education is a means by which outcome measure usage can be consolidated.

Upon graduation from an accredited course, registration with the RAMP or AHPR is not automatic or required, unlike the RCVS for veterinary surgeons. With membership of a registry body being voluntary, membership requirements, including the CPD and quality standard that refer to outcome measures, are therefore also voluntary. With the absence of a defined veterinary physiotherapist population, the study used a convenience sample, which may have introduced limited elements of bias. However, the multifaceted distribution methods of the survey ensured the broadest coverage of veterinary physiotherapist professionals providing the dataset. The data presented in this report show a slight increase in the use of outcome measures by members of regulatory bodies, including improved use of video recording and LOAD scoring as outcome measures; however, many comparisons with non-members showed few differences. Despite the mandatory requirement for outcome measure usage for members of both RAMP and AHPR, the similarity in outcome measure preferences among the member and non-member populations underscores the need for CPD courses and educators to provide guidance on the selection and implementation of more objective outcome measures.

The inability to detect significant incremental changes over a period of time is referred to as 'sustained change blindness'.[8] In context, small changes between sessions may be attributed to normal fluctuations or go unnoticed. Trend identification facilitates earlier interventions to redirect or improve therapies, thus shortening treatment times with enormous benefits to patient welfare and performance. Within veterinary physiotherapy, this could be achieved through the use of a baseline outcome measure with regular repeats, such as a goniometer, or shown in context to the original baseline, such as a video with gait analysis. While not a requirement in veterinary physiotherapy, within human physiotherapy, insurance companies require audits to provide evidence of outcome measures used for each private insurance claim. Supporting Information 2 shows an example of such a form required by Bupa to ensure professional accountability and quality assurance.[29] Logically, as the veterinary physiotherapy profession continues to advance, insurance companies may also mandate this to accept animal claims. We therefore recommend the implementation of outcome measures with accurate record keeping before insurance companies likely mandate audit inclusion.

The data presented in this study demonstrate that, among the veterinary physiotherapists surveyed, outcome measures are underutilised. The study further suggests the need to introduce guidance for when and how to implement objective outcome measures through standardisation processes in order to reduce subjectivity and its inherent inter- and intra-veterinary physiotherapist variability. Specifically, these data stress the need for maintaining clinician consistency in re-assessing animals and the introduction of video recording for dynamic assessments and retrospective analysis.

Our findings also suggest that outcome measure use could be more effective through improved owner pre-evaluation, via a scorecard system or through utilisation of a pre-existing system such as the RCVS Knowledge: Canine Cruciate Registry. From an educational perspective, a set of comprehensive CPD resources could be introduced, specifically around the incorporation of objective outcome measures into clinical practice, and a review of the training course curricula performed to increased emphasis on outcome measure teaching.

In conclusion, consistent use of outcome measures is important to record case progression, which allows the veterinary physiotherapist to produce an adaptable tailored course for the animal. The literature suggests that sustained use of outcome measures can positively impact owner compliance, expectation and satisfaction, which can result in a higher standard of care for the patient. Many objective outcome measures have a lower perceived effectiveness and usage than their evidence base would suggest. While it appears that outcome measures are used extensively by the veterinary physiotherapists surveyed, there is a lack of consistency in their use.

AUTHOR CONTRIBUTIONS

William Brookes, Richard Payne and Richard Lea contributed to the study design and questionnaire development. The scoping review and analysis were carried out by William Brookes. William Brookes, Richard Payne and Richard Lea drafted the initial manuscript. William Brookes, Richard Payne and Richard Lea contributed to and approved the final paper.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest that could be perceived as prejudicing the impartiality of the research reported.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

This study was approved by the University of Nottingham Committee for Animal Research and Ethics (Reference number: 3401 210707).

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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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