movement
REFERRALS
INDEPENDENT VETERINARY SPECIALISTS

Where the experience matters

Clinical Research Report 2024

Contents

Introduction to Movement Referrals

Movement Referrals was founded in 2022 and opened its first Specialist Referrals Centre in May 2023. The first centre is located at Preston Brook, Cheshire, a convenient location just off junction 11 of the M56 motorway, making it very accessible from the counties and conurbations of the North of England and North Wales.

In April 2025, Movement Referrals opened its second centre, in Uttoxeter, in the English Midlands region. Like the first, this new centre provides Specialist referral services in canine and feline neurology and orthopaedics in a convenient location just two minutes off the A50 trunk road, making it a convenient and accessible centre for the cities of Birmingham, Stoke-on-Trent, Derby and Nottingham.

The directors of Movement Referrals are all experienced RCVS-registered Specialists with a track record of leadership in their clinical disciplines and a strong sense of what the veterinary sector should deliver and how it should behave. We strongly seek to offer value: value being a combination of quality, service and costs. We are fortunate to have some other great referrals vets in our clinical teams, and we work alongside outstanding veterinary nurses and client care colleagues.

Despite its recent inception, Movement Referrals is determined to make an impact in the veterinary sector, not only through veterinary-led services and expertise, but also through contributions to the clinical research literature, through responsible innovation, and evidence-based veterinary medicine and surgery.

In this, our second clinical research report, we aim to summarise the contributions we have made to clinical research and quality improvement in 2024. We also aim to measure the impact this work has and so you will see various metrics that reflect this.

We are always happy to discuss potential research projects. We have considerable expertise and networks of trusted and valuable contacts, nationally and internationally.

The Directors,
Movement Referrals.

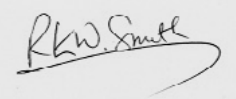
Foreword by Professor Roger Smith MA VetMB PhD DipECVS DEO FRCVS

Professor Roger K.W. Smith
Professor of Equine Orthopaedics
The Royal Veterinary College

It is an honour for me to have been invited to write a Foreword for this year's Movement Referrals Clinical Research Report which documents a substantial body of research from this independent practice.

Vets are naturally inquisitive and we all come across problems or gaps in our knowledge during our daily work. Research provides an opportunity to fill some of these gaps and also gain satisfaction from doing so. I have been fortunate to be able to combine clinical work and research throughout most of the last 35 years at the Royal Veterinary College but I also recognise the value of clinical research within veterinary practices, not only for the intellectual benefits it provides the vets but also because of the wealth of information that resides there. Consequently, I have become passionate about developing new ways of helping support clinical research within veterinary practices, and so, from interactions with Professor John Innes in his previous life as Professor of Small Animal Surgery at Liverpool University, I have had a particular interest in the development of Movement Referrals since its inception in 2022. While much of 'traditional' research takes place understandably within academic institutions, 'big data' for assessing clinical outcomes frequently lies within practices, although it is often difficult to unlock through limitations on time and funding. It is therefore impressive how this independent veterinary practice has embedded a culture of research and development at the heart of its activities and has developed a substantial portfolio of projects which not only contributes to maximising patient care within the practice, but also helps to drive forward clinical practice. The canine cruciate registry is a prime example of how clinically relevant outcome data can be harnessed from veterinary practices. This registry has become the largest database on canine cruciate repair and has collated data from over 500 practices with more than 2000 patients enrolled and is supported by RCVS Knowledge.

Without research there cannot be progress and, while ring-fencing time and, if necessary, sourcing required funding, are difficult, there are opportunities out there to achieve this within practice and I would encourage as many veterinary practitioners as possible to read the full report which shows what can be done within clinical practice and encourage more to get involved in work-place based research and development. Research has many facets to it and can range from more conventional publishable studies to smaller practice-focussed clinical projects which can improve processes and patient care within specific environments, all of which can add value to the practice. This report serves as a great example of what research activities a practice can achieve successfully and I salute the efforts of all the team at Movement Referrals on these achievements and look forward to following development of the practice in the future.



Roger Smith is Professor of Equine Orthopaedics at the Royal Veterinary College (RVC). He holds the Diploma of Equine Orthopaedics from the Royal College of Veterinary Surgeons and is a Royal College of Veterinary Surgeons Specialist in Equine Surgery. He is a Diplomate of the European Colleges of Veterinary Surgeons and Veterinary Sports Medicine and Rehabilitation, and is also a Large Animal Imaging Associate of the European College of Veterinary Diagnostic Imaging. In 2016, he was awarded the Fellowship of the Royal College of Veterinary Surgeons for meritorious contribution to knowledge and was elected to president of the European College of Veterinary Surgeons in July 2017. He was elected President of the British Equine Veterinary Association in September 2023. Roger is also a director of Credivet Ltd., a company that promotes and supportes R&D activities within veterinary businesses.

Our major research themes:

Canine cruciate ligament rupture

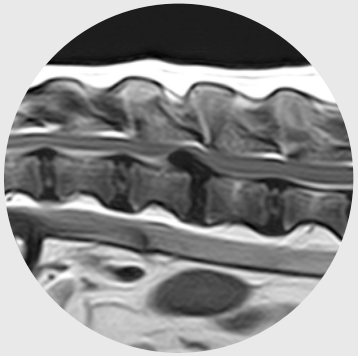
RCVS KNOWLEDGE

CANINE CRUCIATE REGISTRY

Design and validation of novel implants using additive manufacturing technology

- Orthopaedics
- Spinal surgery
- Maxillofacial surgery

Intervertebral disc disease (IVDD)



Clinical outcomes measures

- Validation
- Automation of collection of client-reported outcomes measures

Movement disorders and dyskinesia

Osteoarthritis

- Clinical trials

Our impact and track record

The directors at Movement Referrals all have a track record of peer-reviewed publications and research impact.

Between us we have:

Publications

128

Total

From **1991** to **2025**

Citing Articles

2,725 Analyze

Total

2,653 Analyze

Without self-citations

Times Cited

3,611

Total

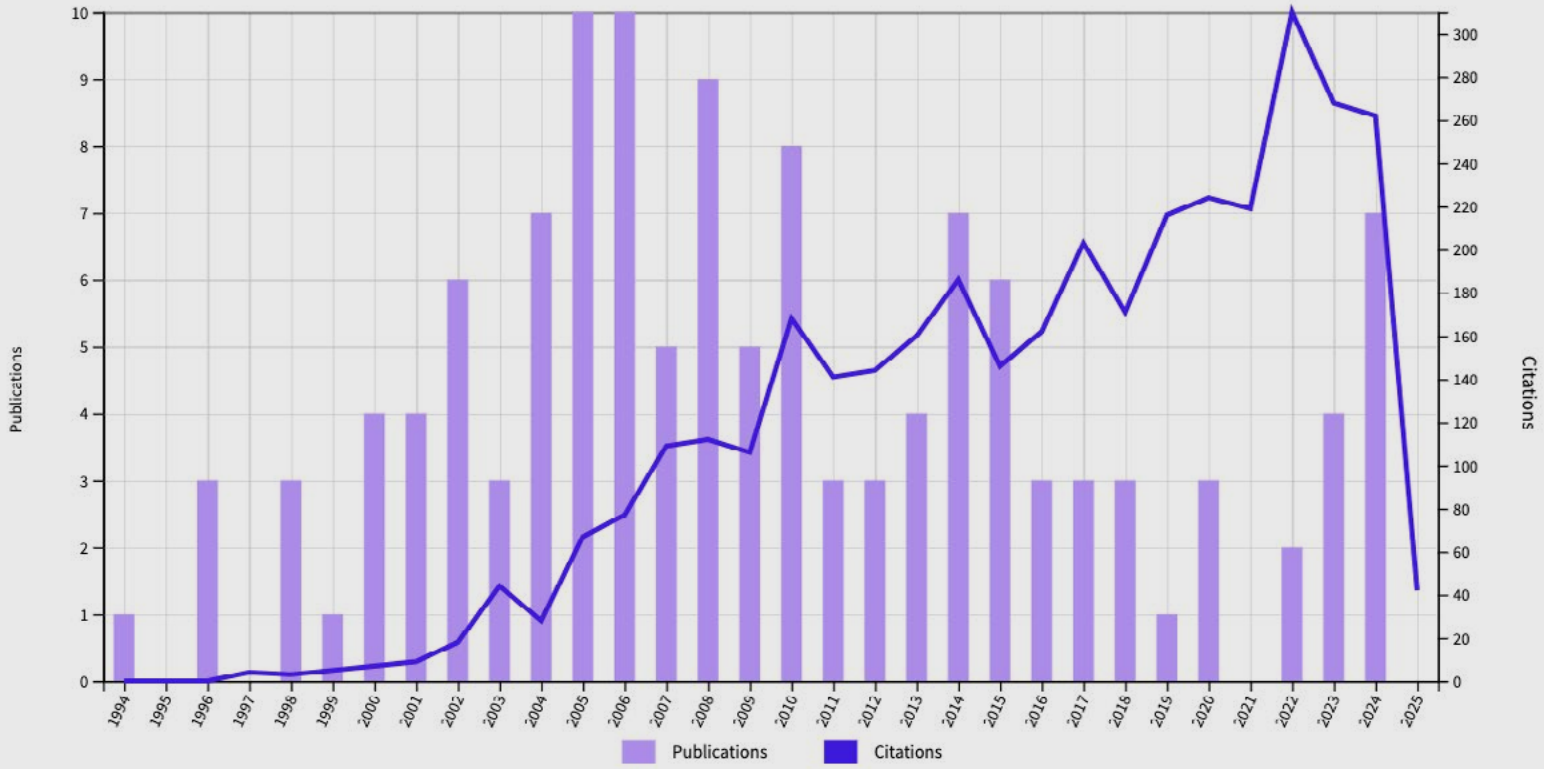
3,428

Without self-citations

28.21

Average per item

Our impact and track record



Graph showing peer-reviewed publications and citations of these papers for all four Movement Referrals Directors

(*Data for 2025 are to end of February 2025 only)

The Directors

Mr Ben Walton

BVSc DSAS(Orth) MRCVS

Major Interests and Expertise

- **Humeral Intracondylar Fissures and Humeral Condylar Fractures in Dogs**
- **Novel orthopaedic implant design and development**
- **Canine Elbow Dysplasia**
- **Patient-specific, 3D-printed surgical guides and implants**
- **Spinal Stabilisation**
- **Gait Analysis**
- **Clinical metrology (measurement) of osteoarthritis**

Career Summary

Ben has over 20 years of experience in small animal orthopaedics and spinal surgery. After eight years in mixed and first-opinion, small animal practice, Ben returned to the University of Liverpool in 2010 in a clinical research post, running a clinical trial comparing treatments for canine osteoarthritis, and researching and refining measurement tools for this condition. He is also Research and Development Director for Fusion Implants, an advanced veterinary devices company based in Liverpool, specialising in additive manufacturing, anatomic implants, and patient-specific surgical guides.

Awards and Achievements

- BSAVA Simon Award (2024) for “Outstanding Contribution to Small Animal Surgery”
- Brian Pound Award for Clinical Excellence, CVS UK LTD, 2018
- RCVS Specialist in Small Animal Surgery (Orthopaedics), 2015
- 15 peer-reviewed papers
- BVOA Co-chair for Education, 2020-2023
- Co-supervisor of four PhDs on novel surgical solutions in veterinary orthopaedics
- Co-developer of eight novel surgical implants

Research Activity in 2024

In 2024, Ben’s main research focus has been on the development and testing of several novel implants for the management of orthopaedic conditions and trauma in dogs and cats.

Jaw Fractures in Cats

Working with a team of small animal surgeons and dentists, and biomedical engineers at Fusion Implants, Ben helped to design the Ramus Anatomical Plate (RAP). This is a 3D-printed, titanium bone plate used to treat complicated fractures of the mandible. Prior to the development of this implant, there was no option for “internal fixation” of these fractures. They would have to be managed by immobilising the mandible for several months, often by bonding the teeth of the upper and lower and jaws. This is a very uncomfortable and prolonged management option for the patient. The RAP allows rigid stabilisation internally, and early return to normal jaw function.

Mr Ben Walton

BVSc DSAS(Orth) MRCVS

In May 2024, McFadzean and others published the results of a clinical case series of the application of this novel plate.

Treatment of Elbow Dysplasia

When dogs get elbow dysplasia, many of them have more damage on the inner (medial) side of the joint than the outer (lateral) side. A similar situation often occurs in people who develop osteoarthritis in their knees. In young human patients, who are not good candidate for knee replacement, an established treatment option is a "load shifting osteotomy": the tibia (the bone beneath the knee) is cut, and re-angled to shift load from the painful medial part of the knee, to the relatively healthy lateral part.

Load-shifting osteotomies for the treatment of elbow dysplasia have been examined and used before, but with unclear clinical benefit and sometimes with significant safety concerns. With the Fusion Implants team and researchers from the University of Liverpool, Ben and colleagues have been testing various osteotomy techniques for off-loading the medial part of the elbow. In 2024, they published the data from their laboratory experiments (Crystal et al, 2024) and are now moving forward with research to allow safe implementation of their design in clinical cases.

Novel Anatomic Plates for Fractures

Ben and the Fusion Implants team have brought several novel fracture implants to the market in recent years. Anatomic bone plates are designed to match bone shape and fracture configuration to facilitate faster, smoother operations, and more predictable clinical outcomes. In 2024, Jones and others reported on clinical outcomes of series of cases using the Lateral Epicondylar Anatomic Plate (LEAP), a bone plate designed to fit the complicated shape of the distal humerus, and used to treat a common form of elbow fractures.

Other bone plates that have been released include the Medial Anatomic Plate (MAP) for elbow fractures, and the Feline Lateral Iliac Plate (FLIP) and the Acetabular (ACE) plate for pelvic fractures.

Tibial Plateau Levelling Osteotomy (TPLO) Plates and Guides for the management of Cranial Cruciate Ligament (CCL) Failure in Dogs

TPLO is a commonly performed and effective treatment for the management of CCL failure. Ben and the Fusion implants team have designed and manufactured a novel range of surgical guides and bone plates for the safe completion of this procedure. CT scans of dogs were used to map the bone topography after completion of the TPLO to inform the guide and plates designs. The plates are 3D-printed from titanium alloy, which has the strength of surgical steel (unlike pure titanium), and might be associated lower risk of infection.

Treatment for Humeral Intracondylar Fissure (HIF)

HIF is a fissure in the lower part of the humerus. In Spaniels and some other breeds, where it mostly develops in adults, it is believed to be a form of stress fracture with characteristics similar to some fracture non-unions. Some young dogs, especially French Bulldogs, develop similar lesions, but the cause might be different, ie a delay in the "ossification" of the bone.

Mr Ben Walton

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In 2020, Ben and others reported on the clinical outcomes of the Humeral Intracondylar Repair System (HIRS). This is a technique, instrumentation and implant that were designed under the supervision of Ben and Prof. John Innes, which applies the principles of non-union management to HIF: namely, debridement of sclerotic bone, stable fixation, compression and bone-grafting. The major complication rate in that study was 6%, which was very favourable compared to other case series. In 2024, Hood and others reported on the long-term (>1 year) complication rates in HIRS cases. No new complications were reported in the long-term and clinical outcomes were good or excellent in the vast majority of cases.

Not all cases, especially the unstable fractures that can occur associated with HIF, are suitable candidates for the use of HIRS. For these cases, Fusion implants have developed several versions of an alternative implant called the Humeral Intracondylar Stabilisation System (HISS), which prioritises implant strength and bone purchase.

Peer-reviewed Publications in 2024

Crystal, ., Brettle A, Maddox TW, Jones D and Walton MB (2024). “Effect of Medial Opening Wedge and External Rotational Humeral Osteotomies on Medial Elbow Compartment Pressure: An Ex Vivo Study.” Veterinary and Comparative Orthopaedics and Traumatology 37(04): 196-205.

Hood RS, Walton MB and Innes JF (2024). “Long term outcomes of the Humeral Intracondylar Repair System for management of canine humeral intracondylar fissures and humeral condylar fractures.” Frontiers in Veterinary Science 10.

Jones RL, Tomlinson AW, Barnes D, Hood RS, McClement JP, Ogden DM, Owen MA, Onyett JR and Walton MB (2024). “Clinical Assessment of a Lateral Epicondylar Anatomical Plate for the Stabilization of Humeral Condylar Fractures in Dogs.” Veterinary and Comparative Orthopaedics and Traumatology 37(05): 243-250.

Journal Letters

Innes JF and Walton MB (2024). “Proximal ulnar osteotomy for the management of humeral intracondylar fissure.” Veterinary Surgery 53(3): 413-414.

Other References

McFadzean A, Freeman A, Sage J, Perry A (2024). Use of a novel three-dimensional anatomical plating system for treatment of caudal mandibular fractures in cats: 13 cases (2019-2023). Journal of Feline Medicine and Surgery 26:1098612X241243134. doi: 10.1177/1098612X241243134

Walton MB, Crystal E, Morrison S, Onyett J, McClement J, Allan R, Straw M, Innes JF (2020). “A humeral intracondylar repair system for the management of humeral intracondylar fissure and humeral condylar fracture.” Journal of Small Animal Practice 61(12):757-765. doi: 10.1111/jsap.13206

Mr Mark Morton

BVSc DSAS(Orth) MRCVS

Major Interests and Expertise

- **Cranial Cruciate Ligament Rupture (treatment and audit of outcomes)**
- **Common Calcaneal Tendon (Achilles Tendon) Injuries**
- **Total Hip Replacement**
- **Quality Improvement (QI) and Clinical Audit**
- **Efficiency**

Career Summary

Mark Morton has 17 years experience in small animal orthopaedic surgery training and working at some of the largest referral clinics in the UK. I have developed a surgical technique for treating Common Calcaneal Tendon Injuries in dogs. This technique is now used world-wide. We and others have adapted these principles, and they are now used to treat other tendon injuries. I am the founder and the clinical lead of the RCVS Knowledge Canine Cruciate Registry (CCR) the first automated registry for veterinary patients.

Awards and Achievements

- Founder and Clinical Lead of RCVS Knowledge Canine Cruciate Registry 2018- current
- BSAVA J.A Wight Memorial Award (2025) for "Outstanding Contribution to Welfare of Companion Animals"
- RCVS Impact Award (2024)
- Quality Improvement Lead, CVS Referrals, 2020-2023
- Brian Pound Award for Clinical Excellence, CVS (UK) Ltd, 2019
- British Veterinary Orthopaedic Association Co-chair for Education, 2020-2023
- Developer of novel surgical techniques for managing ligament and tendon injuries.

Research Activity in 2024

The Canine Cruciate Registry continues to go from strength to strength. We now have over 500 veterinary professionals signed up, over 2000 patients enrolled and over 1700 surgical procedures record. We believe this is now the biggest prospective data set around cruciate surgery in dogs. We published our second annual report and have complete a project looking at the effect of antibiotic use around surgeries on the registry. There has been significant interst in this work and I have presented this to several international groups. We hope to publish this data more widely. We are exploring launching the registry internationally; the potential for this data to improve outcomes for patients across the world is huge. I continue to work with RCVS Knowledge around other initiatives exploring how we might develop similar intiatives for other conditions as Clinical Lead for Registries.

Publications in 2024

National Reports

RCVS Knowledge 'Canine Cruciate Registry' Annual Report (2024).

Mr Mark Lowrie

MA VetMB MVM DipECVN MRCVS

Major Interests and Expertise

- **Movement Disorders**
- **Intervertebral Disc Disease**
- **Feline neurology**
- **Inflammatory central nervous system disease**
- **Epilepsy**
- **Myasthenia gravis**

Career Summary

Mark Lowrie continues to push the boundaries of veterinary neurology, striving to improve treatments for spinal conditions once thought to be untreatable. His dedication to identifying and understanding emerging neurological disorders has been instrumental in advancing both diagnosis and prognosis for affected patients. With over two decades of clinical experience, Mark has played a key role in shaping specialist training programs within leading multi-disciplinary referral centres across the UK. His research into meningoencephalitis has led to treatment approaches that have dramatically improved survival rates, and he remains at the forefront of developing innovative strategies for complex neurological diseases. Beyond clinical practice, Mark contributes as a veterinary consultant to the International Society of Feline Medicine (ISFM) and serves as an assessor for the Kennel Club IVDD scheme in Dachshunds, furthering his commitment to improving neurological health in companion animals.

Awards and Achievements

- Over 80 peer-reviewed papers
- Over 1800 citations, H index: 24, i10-index: 38
- 10 textbook chapters
- Petplan ‘Vet of the Year’, 2022
- CVS Group plc Colleague Awards 2022 Winner for “Outstanding contribution to clinical care improvement”
- Nottingham Vet School Veterinary Student Awards 2018 Winner for “Favourite Associate Staff Member”
- CVS Group plc Colleague Awards 2020 Highly Commended for “Best Clinical/Practice Director”
- Widely read, most downloaded ‘Classic’ Journal of Feline Medicine and Surgery article award in 2015, 2016 and 2021
- Winner of Best Poster Prize at 7th APP Congress, Barcelona, 2009
- Winner of Marbocyl Achievement Award at University of Glasgow, 2008
- Distinction, Level 5 Operations / Departmental Manager, City and Guilds, 2020

Research Activity in 2024

In 2024, we introduced a novel subdural shunt placement technique for treating thoracolumbar arachnoid diverticulae in dogs, offering a promising solution to prevent recurrence. Our results show significantly better long-term outcomes compared to durotomy alone. This technique is now being applied at Movement Referrals with positive patient results.

We also conducted a detailed study on myoclonus in Cavalier King Charles Spaniels, a progressive condition causing involuntary movements. Our findings highlight the importance of early diagnosis and treatment, as levetiracetam can create a freedom

Mr Mark Lowrie

MA VetMB MVM DipECVN MRCVS

from the myoclonic seizures, eliminating postictal signs and improving the dog's overall demeanour and quality of life.

In collaboration with geneticists, we discovered a mutation in RNF170 linked to neuroaxonal dystrophy in Miniature American Shepherds. This genetic finding mirrors spastic paraplegia-85 in humans and opens avenues for potential therapeutic research for both species.

Lastly, our research into thoracolumbar hydrated nucleus pulposus extrusion (HNPE) revealed key differences from intervertebral disc extrusion. HNPE primarily affects older, non-chondrodystrophic dogs and is often triggered by exercise-related trauma, highlighting the need for accurate diagnosis and tailored management strategies.

Publications in 2024

Peer-reviewed research outputs

Cook SR, Schwarz C, Guevar J, Assenmacher CA, Sheehy M, Fanzone N, Church ME, Murgiano L, Casal ML, Jagannathan V, Gutierrez-Quintana R, Lowrie M, Steffen F, Leeb T, Ekenstedt KJ (2024). "Canine RNF170 Single Base Deletion in a Naturally Occurring Model for Human Neuroaxonal Dystrophy." Movement Disorders 39(11):2049-2057. doi: 10.1002/mds.29977.

Alcoverro E, Schofield I, Spinillo S, Tauro A, Ruggeri M, Lowrie M, Gomes SA (2024). "Thoracolumbar hydrated nucleus pulposus extrusion and intervertebral disc extrusion in dogs: Comparison of clinical presentation and magnetic resonance imaging findings." The Veterinary Journal 306:106178. doi: 10.1016/j.tvjl.2024.106178.

Reviews

Mandigers PJJ, Santifort KM, Lowrie M, Garosi L (2024). "Canine paroxysmal dyskinesia—a review." Frontiers in Veterinary Science 11:1441332. doi: 10.3389/fvets.2024.1441332.

Professor John Innes

BVSc PhD CertVR DSAS(orth) FRCVS

Major Interests and Expertise

- **Clinical outcomes measures**
- **Osteoarthritis**
- **Total hip replacement**
- **Arthroscopy**
- **Humeral intracondylar fissure (HIF)**
- **Extracellular matrix biology**

Career Summary

John Innes has over 30 years experience in small animal orthopaedics and spinal surgery. He has a PhD in canine osteoarthritis from University of Bristol and he was Professor of Small Animal Surgery at University of Liverpool (2001-2013) and Visiting Professor at University of Sydney in 2010. During his 22-year period in academia, he led clinical and laboratory research in to clinical outcomes measures, gait analysis, and extracellular matrix biology.

Awards and Achievements

- Over 100 peer-reviewed papers
- 15 textbook chapters
- BSAVA Blaine Award (2023) for 'Outstanding contribution to Veterinary Science'
- Chair, RCVS Fellowship Board (2019-2022)
- Fellowship of Royal College of Veterinary Surgeons for 'meritorious contributions to knowledge' (2016)
- President, European Society for Veterinary Orthopaedics (2014-2016)
- BSAVA Simon Award (2005) for 'Outstanding contribution to Small Animal Surgery'
- British Veterinary Orthopaedics Association 'Leslie Vaughan' Prize (1997)
- H index: 31

Research Activity in 2024

'One cannot improve what one does not measure'. Measuring clinical outcomes is a prerequisite to quality improvement, and also important to identify problems and set expectations.

Client-reported outcomes measures (CROMs) are increasingly important in veterinary medicine and surgery but such measures need to be carefully developed and validated. John Innes was one of the earliest proponents of CROMs and developed the 'Liverpool Osteoarthritis in Dogs' (LOAD) tool for outcomes assessment in canine musculoskeletal disorders. LOAD has been through validation processes and these have been previously published; LOAD is now recommended by the World Small Animal Veterinary Association for the assessment of chronic musculoskeletal pain in dogs (Monteiro, Lascelles et al. 2022).

In 2024, we used LOAD in a clinical study with our long-term collaborator, Professor Duncan Lascelles and his research group at North Carolina State University. The study investigated the response to treatment with grapiprant as part of a standard multimodal regimen in young dogs with appendicular joint osteoarthritis associated pain. Included dogs were 9 months-4 years of age; ≥3.6 kg body weight; had ≥1 appendicular joint with radiographic OA and obvious joint pain; had a Liverpool Osteoarthritis in Dogs (LOAD) score of ≥5. The non-steroidal anti-inflammatory piprant (grapiprant)

Professor John Innes

BVSc PhD CertVR DSAS(orth) FRCVS

was given at the recommended dose daily, omega-3 fatty acid supplementation was initiated at 100 mg/kg and then increased to 200 mg/kg daily, and leash exercise was gradually increased to a target of 60 min daily. Client-reported outcome measures (CROMs) and force plate gait analysis were collected at baseline and monthly for 4 months. The index limb was defined as the most severely affected limb at baseline.

Forty-eight dogs were enrolled (mean ± SD age of 30.7 ± 10.7 months). Hips, elbows, and stifles were commonly affected. Medication and supplement compliance was excellent (≥95% of target administered), and treatments were well-tolerated. CROMs showed significant improvement over time and at each time point. Overall, peak vertical force (PVF) increased significantly (<0.001), and vertical impulse increased numerically. Increase in PVF from baseline was significant at all time points except 4-months.

This study demonstrated a clinically meaningful benefit of a multimodal treatment regimen over a 4-month period for young dogs (<4 years old) with OA-pain. Future work should determine if early, effective treatment is of long-term benefit.

Publications in 2024

Peer-reviewed research outputs

1. Hood RS, Walton MB, Innes JF (2024) “Long term outcomes of the Humeral Intracondylar Repair System for management of canine humeral intracondylar fissures and humeral condylar fractures”. Frontiers in Veterinary Science 10.
2. Enomoto M, Hash J, Cole T, Porcel, Sanchez MD, Thomson A, Perry E, Aker S, Nakanishi-Hester A, Haupt E, Opperman L, Roe S, Thompson NA, Innes JF, Lascelles BDX (2024) “Response to treatment with grapiprant as part of a standard multimodal regimen in young dogs with appendicular joint osteoarthritis associated pain”. Front. Vet. Sci. 11:1461628 doi: 10.3389/fvets.2024.1461628
3. Enomoto M, de Castro N, Hash A, Thomson J, Nakanishi-Hester A, Perry E, Aker S,. Haupt E, Opperman L, Roe S, Cole T, Thompson NA, Innes JF, and Lascelles BDX (2024). “Prevalence of radiographic appendicular osteoarthritis and associated clinical signs in young dogs.” Scientific Reports 14(1).

Journal letters

1. Innes, JF and MB Walton (2024). “Proximal ulnar osteotomy for the management of humeral intracondylar fissure.” Veterinary Surgery 53(3): 413-414.
2. Innes JF (2024) “Proper use of client-reported outcome measures” Veterinary Record 194 (3), 0042-4900; https://doi.org/10.1002/vetr.3928

References

Monteiro, BP, BDX Lascelles, J Murrell, S Robertson, PVM Steagall and B Wright (2022). “2022 WSAVA guidelines for the recognition, assessment and treatment of pain.” Journal of Small Animal Practice

Dr Dafni Sivolapenko

BVM&S PGDip(VCP)

DVetMed DipECVN MRCVS

Major Interests and Expertise

- **Feline neurology**
- **Degenerative diseases and cognitive dysfunction**
- **Cerebellar and thalamic diseases**
- **Neurosurgery**

Education and clinical training Career summary

In addition to her neurology specialist training, Dafni has completed a certificate in feline behaviour and a professional doctorate in veterinary medicine. She is an active member of the European College of Veterinary Neurology (ECVN) as part of the credentials committee, evaluating neurology residents that are completing their training. She is also an honorary member of the ISFM Academy of Feline Practitioners. She has written and edited several chapters of the online resource “VINcyclopedia”.

Awards and Achievements

- EBVS European specialist and RCVS-recognised specialist in veterinary neurology
- Professional doctorate in veterinary medicine (2024) with the University of Edinburgh

Research Activity in 2024

Dafni’s doctoral thesis was studying the cisterna magna in dogs using magnetic resonance imaging. She is currently working on several reviews and case reports as first author, in both canine and feline neurology.

Dr Guillaume Albertini

DVM DipECVN MRCVS

Major Interests and Expertise

- **Intervertebral disc disease management and intervertebral disc fenestration**
- **Brachycephalic breeds spinal diseases**
- **Spinal fractures and vertebral stabilisation**
- **Epilepsy and epileptic seizure management**
- **Inflammatory diseases of the central nervous system**

Career summary

Guillaume Albertini started his journey in veterinary Neurology in 2018 at a French referral hospital. He moved to the United Kingdom in 2019 where he worked in several multidisciplinary hospitals. During these years, Guillaume finalised his preparation for the Neurology specialisation and took part in numerous peer-reviewed publications. Guillaume was involved in the teaching of interns and other residents; leading and organising teaching rounds. Guillaume achieved his Neurology and Neurosurgery Specialisation (DECVN) in 2025.

Awards and Achievements

RCVS and EBVS® recognised specialist in Neurology and Neurosurgery

Research Activity in 2024

"Frenchies leave pawprints in our hearts" (unknown).

French bulldogs are becoming increasingly popular in the UK. Despite their popularity, the general population is relatively unaware of their risk of intervertebral disc disease (IVDD). Though reported in the veterinary literature, there was little information on the characterisation of intervertebral disc extrusion (IVDE) in the French Bulldog breed. After collecting data on French bulldog IVDE throughout the residency years, we obtained further characterisation on the IVDE in French Bulldog and published our results in a peer-reviewed journal. These data now allow to provide owners and their pets the best care possible for this challenging condition and provide answers regarding recovery expectations.

Publications in 2024

Research posters

1. Peverelli S, Albertini GM, Foreman M (2024) "Combined malonic and methylmalonic aciduria in a Pomeranian dog" Proceedings of the 36th Symposium ESVN-ECVN 12th-14th September 2024 in Journal of Veterinary Internal Medicine https://doi.org/10.1111/jvim.17225

2. Pereira T, Albertini GM, Ives EJ, Gonçalves R, Posporis C, De Fritas JM, Lopes BA (2024) "Spinal arachnoid diverticulum presumed secondary to thoracolumbar decompressive surgery for intervertebral disc extrusion in two dogs" Proceedings of the 36th Symposium ESVN-ECVN 12th-14th September 2024 in Journal of Veterinary Internal Medicine https://doi.org/10.1111/jvim.17225

Manuscripts

1. Vargas G, Albertini GM (2024) "How to resolve an aberrant microchip implantation" Vet Times, 25 June 2024

Other research activities

1. Reviewer for peer-reviewed journals in Veterinary Neurology:
a. Vet Record Case Reports
b. Frontiers in Veterinary Science

In depth: client-reported outcomes measures

John F. Innes
BVSc, PhD, DSAS(orth), FRCVS

(this article was originally published in Today's Veterinary Practice March/April 2023 issue)

Dogs and cats commonly suffer from chronic or recurrent conditions and these can be very challenging to manage beyond a response mode approach when a condition worsens. As a profession, we owe it to our clients to try to improve our management of chronic health conditions, but one cannot improve what one does not measure. Measuring outcomes for chronic disorders can be challenging but the science of doing this is improving and technology is helping provide solutions.

As veterinary scientists, our instinct for measuring disease is to turn to objective measures, such as blood biomarkers. However, not all problems have an obvious objective measure. For example, how does one measure pruritus or epilepsy? In addition, a blood biomarker is usually just a surrogate outcome and what really matters in most scenarios is the health-related quality of life of the animal. In my own specialty of orthopedics, for many years the gold standard outcomes measure for lameness was the force platform. This is a machine which sensitively measures ground reaction forces.[1] The objectivity of the force platform is very appealing but the machines are costly, acquiring data is time-consuming, and in the face of multifocal musculoskeletal disease, there are issues with data interpretation. Furthermore, the commonly used force platform measures are somewhat unidimensional and do not capture the full impact of lameness, or joint pain, on a dog; effects of joint pain may also include inactivity stiffness, different types of pain, loss of economy of motion, and more.[2] So, in the last two decades, client-reported outcomes measures (CROMs) have emerged in orthopedics and other disciplines. CROMs have also been termed " clinical metrology instruments" and "owner-reported outcomes measures."[3]

The Evolution of CROMs

In human medicine, there is now a strong focus on patient-centered healthcare and seeking the patient's opinion on their functional status, health-related quality of life, symptom and symptom burden, personal experience of care, and health-related behaviors such as anxiety and depression. Patient-reported outcomes (PROs) are measured using tools called patient-reported outcomes measures (PROMs).[4] These tools are often patient-completed questionnaires. PROMs can be either general in nature or disease-specific. Broad PROMs, such as EuroQol EQ-5D (https://euroqol.org/), examine aspects that fit a variety of different conditions and allow comparison across these various medical conditions to assist in the evaluation and the implementation of new methods of providing care. In contrast, disease-specific PROMs are designed to identify specific symptoms and their impact on the function of those specific conditions. The author's view of the current situation is that disease-specific PROMs have greater face validity and credibility than generic PROMs.[4]

PROMs were initially developed for use in pharmacological and health service research. In 1975, the medical profession in Sweden established the nationwide use of PROMs for healthcare quality registers. By 2000, PROMs were introduced into some parts of the U.S. with the aim of extending PROMs as a reimbursement mechanism for accountability within care organizations. This increasing usage of PROMs has culminated in regulatory bodies adopting their use in clinical trials. For instance, the U.S. Food and Drug Administration has released guidelines that mandate the use of PROMs to support labelling claims.[5]

In veterinary medicine, given that the patient cannot communicate, we must rely on the pet owner as a proxy. There are data to support the validity of this approach in pediatrics and where human patients cannot communicate for themselves (e.g. neurodisability).[6] The earlier client-reported outcomes began to appear in the veterinary literature in the late 1990s and early part of this century.[7,8] Since then, a number of CROMs have been validated across a range of conditions such as chronic pain, pruritus, epilepsy, osteoarthritis, and dental disease (Table 1).[3,9-15]

In depth: client-reported outcomes measures

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Components of CROMs

There are five main components for good quality CROMs: item generation and subsequent selection, validity, reliability, responsiveness, and interpretability.

Item generation

Items can be generated from pre-existing CROMs, from client focus groups or surveys, and from clinicians. The language in a CROM should be clear and not technical. Once the pool of items has been created, statistical techniques can be used in order to select the most relevant items. The number of items can be reduced using principal components analysis without loss of descriptive value.[10,31]

Validity

Validation of a CROM is a continuous process and involves demonstrating three categories of validity: face, construct, and criterion. Face, or content validity assesses whether the instrument addresses the relevant and important aspects of the condition. This is typically done through assessment by expert panel. Construct validity assesses whether the candidate CROM accurately assess what it purports to measure. This is typically assessed by comparison to other measures of disease such as other validated CROMs or other accepted disease measures; factor analysis can also contribute to construct validity. Criterion validity measures the correlation with an accepted 'gold standard' measure. This is often used when an existing measure is potentially to be replaced by, for example, a more time-efficient or more cost-effective measure.

Table 1: Examples of validated client-reported outcomes measures (CROMs) in veterinary medicine

Specialty	Client-Reported Outcomes Measure	Species	Main and Allied Indications	Citations
Cardiology	Functional Evaluation of Cardiac Health (FETCH)	Dog	Cardiac disease	14, 16, 17
Dentistry	Dental Homecare Dental Health	Dog Dog	Periodontal disease Periodontal disease	15 15
Dermatology	Pruritus Severity Score	Dog	Pruritus	12, 13, 18, 19
Internal medicine	Diabetes Quality of Life (DIAQoL-pet) Diabetes Quality of Life (DIAQoL-pet) Cushing's Quality of Life (CushQoL-pet)	Dog Cat Dog	Diabetes mellitus Diabetes mellitus Cushing's disease	20 21 22
Neurology	Epilepsy Quality of Life (EpiQoL)	Dog	Epilepsy	10
Oncology	Canine Symptom Assessment Score	Dog	Solid tumors	23
Orthopedics	Canine Brief Pain Inventory (CBPI) Liverpool Osteoarthritis in Dogs (LOAD) Canine Orthopedic Index (COI) Feline Musculoskeletal Pain Index	Dog Dog Dog Cat	Osteoarthritis and lameness Osteoarthritis and lameness Osteoarthritis and lameness Osteoarthritis and lameness	3,24-27 3,28-32 3,33-35 11,36-38

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Reliability

The reliability of the candidate CROM is typically assessed by calculating internal consistency (e.g. by Cronbach's alpha), which essentially assesses how the items correlate with each other. Another important assessment of reliability is a test-retest scenario. In this exercise, clients are asked to assess their animal, which should be clinically stable, at baseline, and again at a minimum interval of 14 days. The intraclass correlation coefficient is then typically used as an estimate of the agreement between the two assessments.
CROMs should also be assessed in territories and cultures that are different to those of the original validation. Technically, translation of the CROM in to a new language requires revalidation.[32,39]

Interpretability

To aid using CROM in clinical practice, veterinarians should be able to translate the CROM score to clinical meaning by knowing the minimal clinically-important difference change (MCID). The MCID is defined as "the smallest difference in score in the domain of interest which clients perceive as beneficial".[40] There are various methods that can be used to estimate MCID and these are divided in to anchor-based methods, which rely on client responses to an anchor question, and distribution-based methods which rely on statistical methods using clinical datasets of CROM responses. MCIDs for many veterinary CROMs have not yet been estimated, but data are emerging for some.[28]

Clinical use of CROMs

Given that there are several CROMs that have been developed for common, chronic conditions, it seems that one of the greatest hurdles to uptake of these tools into everyday veterinary practice is time. That is understandable to some extent but it may also be that systems are also at fault. A traditional model of veterinary practice is that clients book an appointment when a condition worsens, are seen by a veterinarian in a compressed timeframe, and leave *(Figure 1)*. This places the burden wholly on the veterinarian and, for chronic conditions, may leave clients feeling unsupported in between visits. Alternative workflows *(Figure 1)* allow for CROM completion in the clinic waiting room, or with a veterinary technician or veterinary nurse prior to, or after, seeing the veterinarian. In this way, the CROM can save the veterinarian time rather than be an extra burden. In addition, the involvement of, and appropriate delegation to, professional colleagues such as nurses or veterinary technicians frees up time for the veterinarian and adds to the job satisfaction of veterinarian-led team colleagues.

Other potential barriers to the collection of CROMs data are the manual steps required to acquire the data. In a chronic disease scenario, the logical thing to do is to automate data collection as much as possible. This can now be achieved using information technology solutions. For example, once an animal is diagnosed with a particular condition that will require long-term monitoring and management, they can be scheduled to receive automated surveys via email or text message at user-defined intervals *(Figures 1 and 2)*. Alternatively, an appointment can be tagged for a particular body system problem (e.g. pruritus, lameness) and the client can automatically receive an appropriate survey by email or text message prior to attending the clinic. With this latter workflow, data are available to clinical colleagues prior to seeing the patient. If the client fails to complete the survey, a popup survey can easily be completed on a device using a QR code link.

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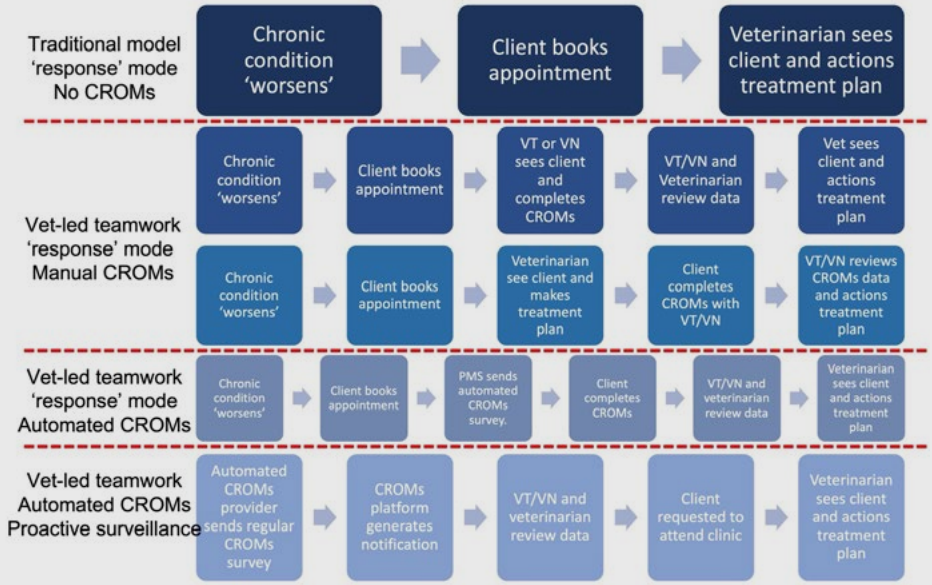

Figure 1:
Examples of workflows in veterinary practice with particular relevance to chronic conditions. CROMs can be incorporated in to workflows in varying ways. Automated collection of CROMs data provides opportunities for time efficiency and automated collation of data.

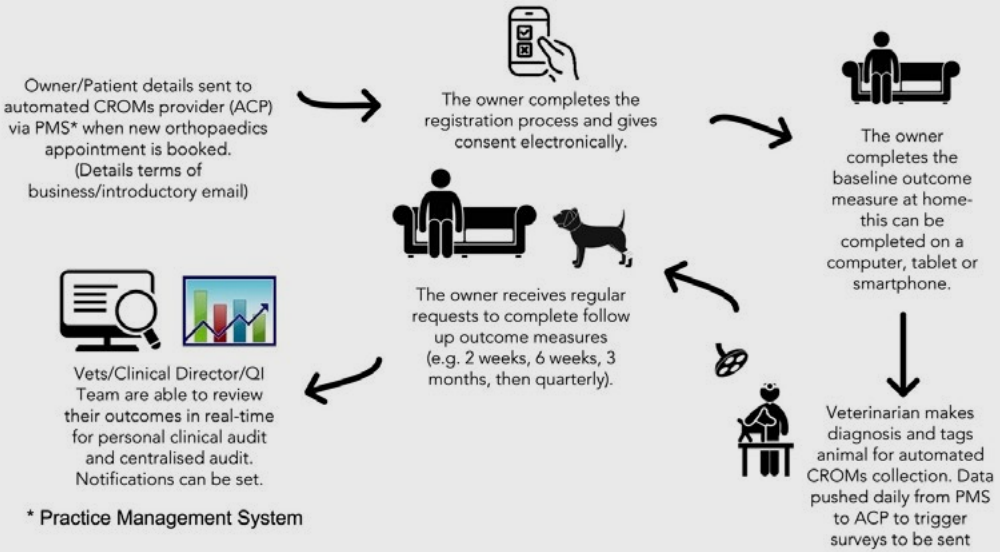

Figure 2:
Workflow for automated collection of CROMs data. A suitable tag to an appointment in the practice management system can initiate the process. Data are automatically assembled into a dashboard.

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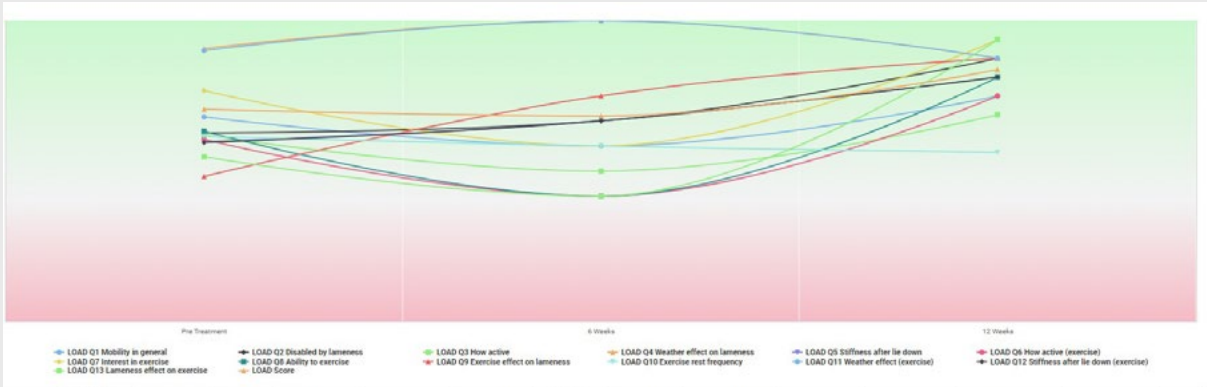
Automation of CROMs collection has the additional advantage that data can be collated on to a dashboard and sliced and diced in many ways. This tool means that clinicians and clinic managers can see data at the level of individual patient, veterinarian, clinic, or organization level *(Figure 2)*. Such data can be very useful for clinical audit and quality improvement processes *(Figure 3)*. Data can also be exported for full statistical analysis if one is compiling a clinical research manuscript or report.



	LOAD Q1 Mobility in general	LOAD Q2 Disabled by lameness	LOAD Q3 How active	LOAD Q4 Weather effect on lameness	LOAD Q5 Stiffness after lie down	LOAD Q6 How active (exercise)	LOAD Q7 Interest in exercise	LOAD Q8 Ability to exercise	LOAD Q9 Exercise effect on lameness	LOAD Q10 Exercise rest frequency	LOAD Q11 Weather effect (exercise)	LOAD Q12 Stiffness after lie down (exercise)	LOAD Q13 Lameness effect on exercise	LOAD Score
Pre Treatment	1.28 (100)	1.49 (100)	1.52 (100)	0.37 (97)	1.61 (100)	1.58 (100)	0.93 (100)	1.47 (100)	2.07 (100)	1.54 (100)	0.40 (98)	1.62 (100)	1.81 (100)	17.67 (100)
6 Weeks	1.67 (3)	1.33 (3)	2.00 (3)	0.00 (3)	1.33 (3)	2.33 (3)	1.67 (3)	2.33 (3)	1.00 (3)	1.67 (3)	0.00 (3)	1.33 (3)	2.33 (3)	19.00 (3)
12 Weeks	1.00 (4)	0.50 (4)	1.25 (4)	0.50 (4)	0.75 (4)	1.00 (4)	0.25 (4)	0.75 (4)	0.50 (4)	1.75 (4)	0.50 (4)	0.75 (4)	0.25 (4)	9.75 (4)

Figure 3:
Screenshot from an automated CROMs collection dashboard for the 'Liverpool Osteoarthritis in Dogs' (LOAD) CROM.

Summary

The last 20 years or so have seen the publication of a number of validated CROMs for use in veterinary medicine. Uptake in everyday practice has been slow, perhaps due to an adherence to traditional models of ways of working and the pressure of time on veterinarians. However, taking time to introduce different ways of working may bring long term benefits. The integration of CROMs in to workflows using technological solutions is likely to accelerate the use of CROMs. The author would suggest that the everyday use of CROMs would bring benefits to animals with chronic health conditions and improve the impact that our professions can have on animal welfare.

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Dr Brian Beale

Brian Beale is a equity shareholder and non-executive director of Movement Referrals. He attended the University of Florida College of Veterinary Medicine and also completed a 3 year residency in small animal surgery and joined the faculty there as an assistant professor from 1990–1992. Brian became board-certified by the American College of Veterinary Surgeons in 1991 and joined Gulf Coast Veterinary Specialists in 1992.

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