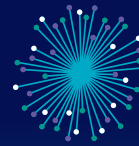




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Centre for
Evidence-based
Veterinary Medicine
at the University of Nottingham

Centre for Evidence-based Veterinary Medicine Review 2010–2020



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Image credits: Dog with toy courtesy of Laura Beesley. Frog and twin rabbits photographs: www.mikebeardphotography.co.uk



Foreword

By Hywel Williams OBE, Centre for Evidence Based Dermatology



When I talk to members of my family or patients and the public about the concept of evidence-based medicine – that is combining the best evidence with the care of individual patients – they look at me as if I am mad. “Aren’t all the things that doctors do based on good evidence?” they ask. Sadly not. Take for example the ritual of freezing warts – a painful ritual that would terrify some children – shown to be no better than salicylic acid bought over the counter. Or antibiotics for infected eczema – they don’t work and possibly contribute to antibiotic resistance. It is these sorts of things that drove me to get involved with evidence-based medicine in my own field of dermatology – and to start up a Centre of Evidence-based Dermatology with some wonderful colleagues in the late 1990s. So far so good.

Then, in around 2006 to 2008, I was invited by the Dean of Medicine at Nottingham University, Sir Peter Rubin, to sit on an advisory group to set up a new School of Veterinary Medicine and Science. To be honest with you, I didn’t know what I was doing there. I don’t think I contributed much at all as it was all about business planning and teaching regulations. But the one suggestion I made was to consider developing a Centre for Evidence-based Veterinary Medicine (CEVM). After all, why should not veterinary practitioners and nurses and animal owners also benefit from the same principles of striving for better evidence and applying it to animal welfare? The new veterinary school opened, and I thought that was the last I would hear about the CEVM idea. But some senior people did listen, and before long it was my pleasure to attend the opening of the CEVM in 2010 and to start fostering two-way collaborations with the then lead, Rachel Dean, and now Marnie Brennan and her team.

And what a success the CEVM has been – still the only one of its kind, and deeply embedded in clinical practice rather than an ivory tower. The CEVM has been incredibly productive over the last 10 years – just look at the timeline on page 18 to see the range and depth of diverse activities in summarising and mapping evidence, generating new evidence and applying that knowledge along with teaching and education. My favourite innovation is the BestBETs for Vets website – what a practical and useful notion.

Since 2010, the CEVM has developed its own character and research space and it is now an international leader in this field. I wish Marnie and her colleagues all the best for the next 10 years and beyond – constantly innovating and producing needed evidence and evidence summaries for animal welfare.

Hywel Williams OBE

Professor of Dermato-Epidemiology and Co-Director of the Centre of Evidence Based Dermatology, Faculty of Medicine and Health Sciences

Welcome

Welcome to the 10 year impact review of the work of the Centre for Evidence-based Veterinary Medicine (CEVM). This report will tell you more about the activities of the CEVM and what we have managed to achieve since starting our journey.

After 10 years, we are still the only research centre worldwide focused on evidence-based veterinary medicine (EBVM) and the application of evidence to practice. We primarily undertake research relevant to the cases and conditions seen in everyday practice. As a result of feedback we've received from the partners we've worked with, I believe we have made a contribution to increasing the quality of decision-making in institutions and practices that have come to rely on the Centre.

Whilst compiling this report I have been reminded about the extensive number of achievements we've attained since 2010 when Rachel Dean and I formed the CEVM. There has been a paradigm shift in the profession over the last 10 years, and we believe the CEVM played an important role, alongside others, in the increasing awareness of the value of using an evidence-based approach and the development of excellent resources to support this. Additionally, we've helped increase appreciation of the need for good quality research.

The key to our success has been a strong team, passionate about evidence-based veterinary medicine and about contributing back to the profession, along with an openness for collaborating with others. It has been inspiring to witness the dedication and enthusiasm of the members of this wider team. Along with external funders and supporters focused on the same key goals as us, we have accomplished great things. I'm really proud of the achievements of our team, and where their dedication has taken them as individuals, and us as a group. The profession needs strong leadership in this area, and through this initiative, we believe we have contributed a much-needed voice for the profession.

I hope you enjoy looking through our report. We have tried to highlight some of the work we believe has made a difference to both veterinary practice and research. This includes highlights of our research outputs (including a selection of our most important papers), our profession-changing work and our knowledge exchange activities. To those of you reading this who have contributed to our success, we thank all of you for giving us your time and assistance. Specifically, our amazing, committed CEVM team who, past and present, deliver high quality research and carry out exceptional knowledge exchange activities, with an important focus on the veterinary professions and animal owners as our key partners. You have been an absolute pleasure and privilege to work alongside – thank you! We also want to thank the practices we've worked with, our professional partners and our funders. A special thanks must go to Novartis (now Elanco) Animal Health and the University of Nottingham for being visionary enough to provide the initial funding to enable the establishment of the Centre. We look forward to continuing to work together with our like-minded partners, colleagues and friends in the future.

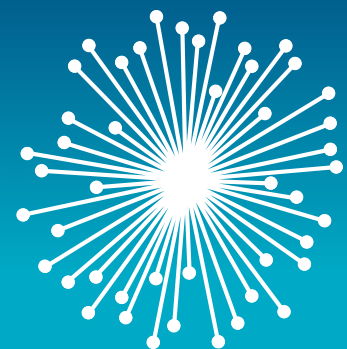
I am very much looking forward to what the future holds for our work, our team and the amazing profession that we are lucky enough to work within.

Dr Marnie Brennan

Director of the Centre for Evidence-based Veterinary Medicine,
School of Veterinary Medicine and Science



Photograph: Jenny Stavisky



Centre for Evidence-based Veterinary Medicine

at the University of Nottingham



Photograph: www.mikebeardphotography.co.uk

Our purpose

The aim of the CEVM is to enhance animal and human health and welfare by furthering the application of the principles of evidence-based veterinary medicine into veterinary practice.

Evidence-based veterinary medicine (EBVM) is the process of considering the scientific evidence, along with clinical expertise and specific owner and patient circumstances to make clinical decisions that are optimal for animal care. Lessons from human evidence-based medicine shows that using this approach can optimise patient care and has been used to prevent serious patient harm. Barriers to using evidence-based medicine have been identified, including long delays between research findings appearing in resources that are commonly used by practitioners (such as textbooks).

Clinical experience is an invaluable resource, but unless tempered by objective frameworks, can be subject to cognitive and recall biases. Therefore, using an EBVM approach is now a fundamental requirement of the Royal College of Veterinary Surgeons (RCVS) Code of Professional Conduct, and appears in the Day One competencies for newly qualified veterinary surgeons both in the UK (RCVS) and Europe (European Association of Establishments for Veterinary Education; EAEVE). There are also potential economic benefits to using evidence-based approaches in a workplace, such as improved efficiency within a practice setting and enhanced job satisfaction which impacts on productivity and client satisfaction. These points emphasize the fundamental importance of evidence-based veterinary medicine to optimal owner and patient care.

“Barriers to using evidence-based medicine have been identified, including long delays between research findings appearing in resources that are commonly used by practitioners (such as textbooks).”

Historically, there have been no large research initiatives focused on evidence-based veterinary medicine, or how to help facilitate the introduction of EBVM approaches into veterinary practice. Additionally, it has only been very recently that there has been formal construction of educational curricula focused on EBVM at either undergraduate or postgraduate levels. For the last 10 years, we at the CEVM have focused on ways to make EBVM accessible and applicable in everyday veterinary practice.

As a group we aim to consolidate and grow the reputation of the CEVM nationally and internationally as providing excellence in clinical research.

Our mission is to work directly with the profession to prioritise and undertake relevant research using appropriate clinical research methodologies. As part of this, we generate accessible evidence-based resources and provide education and training to enhance clinical research and clinical decision-making. The core values of the CEVM are **quality, integrity, collaboration, commitment, independence, and creativity.**

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Photograph: Lisa Gilligan-Lee

The aim of the CEVM is to enhance animal and human health and welfare by furthering the application of the principles of evidence-based veterinary medicine into veterinary practice.

Executive summary

This report highlights the achievements of the Centre for Evidence-based Veterinary Medicine (CEVM) since its inception in 2010. There have been many developments in evidence-based veterinary medicine (EBVM) over the past ten years, yet the CEVM remains the only research centre (worldwide) focused on EBVM and its application into clinical practice.

This report reviews the work of the CEVM in the following sections:

- Our purpose
- Executive summary
- Our activities: three core areas
- Timeline of activities 2010–2020
- Our impact in numbers
- Influencing change in the profession
- Engaging with animal owners and the public
- Our CEVM team
- Resources: Our outputs

Some discussion of the purpose of the CEVM and a timeline of key events serve to provide background information and a chronological perspective of its development so far. A key focus has been and continues to be ‘putting research into practice’, as described in our strapline.

The core work of the CEVM can be categorised into three main areas:

- 1) Evidence synthesis
- 2) Applied clinical research
- 3) Education and knowledge exchange

1. **Major achievements in evidence synthesis** include identifying the optimal places for veterinarians to search for peer-reviewed evidence, developing resources and structured tools for critical appraisal of the evidence, and creation of two secondary evidence-based resources for veterinarians to use in their practise of EBVM. These open-access resources are: “BestBETs for Vets”, a database of structured evidence syntheses that answer specific clinical questions and “VetSRev”, a database of veterinary related systematic reviews.



Photograph: www.mikebeardphotography.co.uk

Photograph: Laura Beesley

2. **There has been exploration of a variety of applied clinical research subject areas**, gathering information from the profession to better inform the needs of those in clinical practice. Examples include identifying common conditions seen, client communication; unowned animals in terms of shelter medicine and how to define these populations, owned animals in terms of canine osteoarthritis, feline chronic kidney disease, preventive medicine practices; farm biosecurity and vaccine use; and collaboratively with others, equine colic.
3. **Education and knowledge exchange has been a significant area of work for the CEVM.** Examples include the development of undergraduate training in EBVM, both locally and internationally; international collaborative development of an online, tutorial-based learning platform for EBVM (<https://learn.rcvsknowledge.org/course/view.php?id=2>); development and continued delivery of a continuing professional development (CPD) course for practising veterinarians and veterinary nurses; incorporation of EBVM into formal postgraduate (PG) studies for veterinarians; provision of easily accessible evidence-synthesis resources for both practitioners and researchers (BestBETs for Vets and VetSRev).

The impact the work of the CEVM can be enumerated by:

- CEVM website visited by people from **178 countries**
- BestBETs for Vets website visitors from **173 countries across 6 continents**
- VetSRev website visitors from **125 countries**
- Published **78** peer-reviewed articles
- Achieved **22** reviews, editorials, and viewpoints
- Published **23** BestBETs for Vets in the Veterinary Record

Another way to measure impact is to consider funding sources. The full report provides a list of funding sources for the CEVM and it clearly illustrates the wide range of EBVM collaborators the Centre works with.

Practice altering work

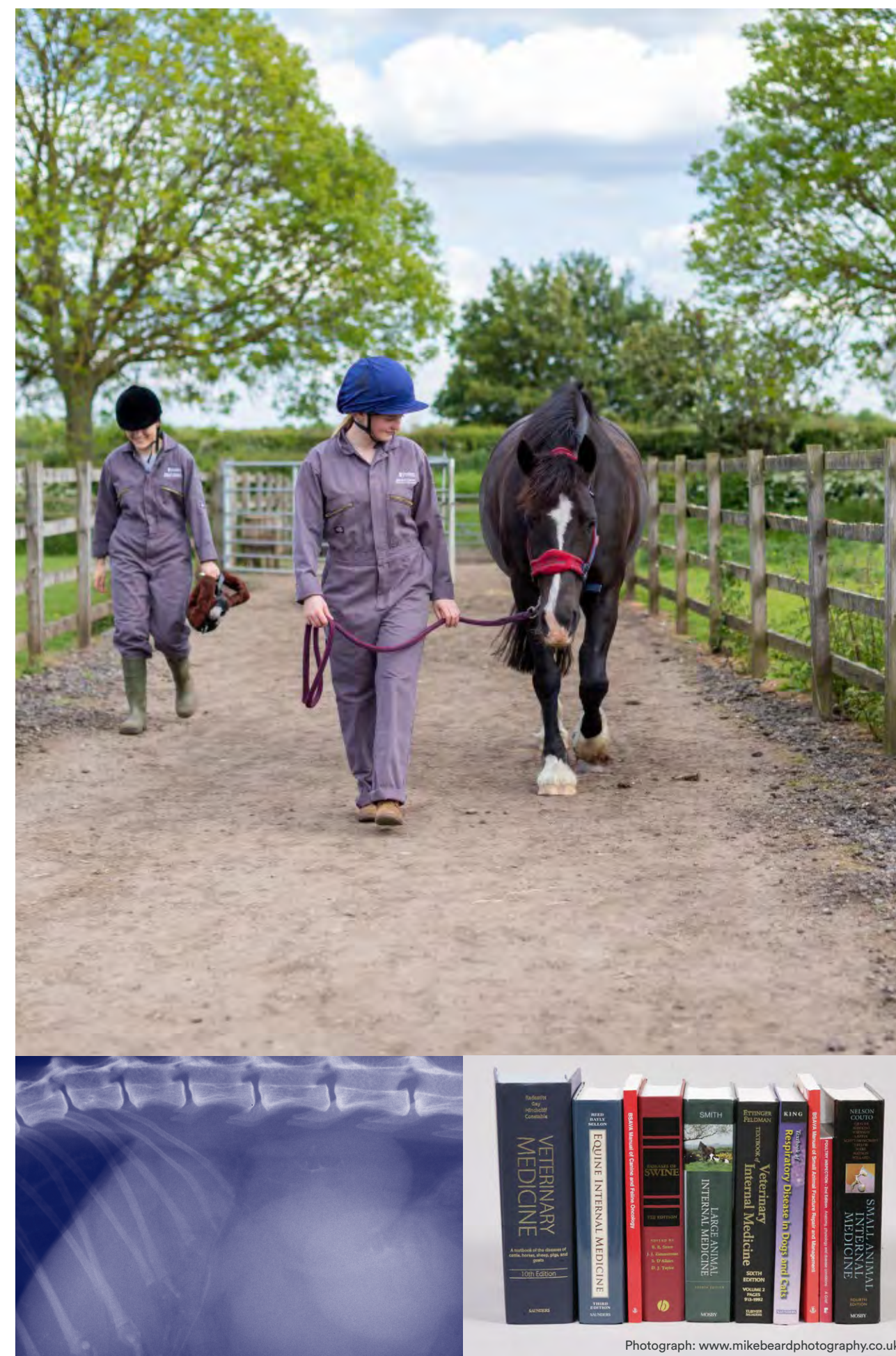
Examples of practice altering work have been highlighted, including **changes to the way donated canine blood was handled resulting in less waste and more lives saved**, the development of evidence-based guidance for small animal preventive medicine consultations and the highly cited critical appraisal tool utilised by both human and veterinary professionals.



The CEVM has actively engaged with many sectors of the veterinary profession to ensure that any research and education initiatives developed are as relevant to the veterinary profession as possible. Stakeholders include: undergraduate and postgraduate students, the clinical community, industry, charities, information specialists and animal owners. The report highlights case studies that illustrate these diverse relationships. There is also a section that showcases the accomplishments of the driving force of the CEVM and the reason for its success – its wonderful team.

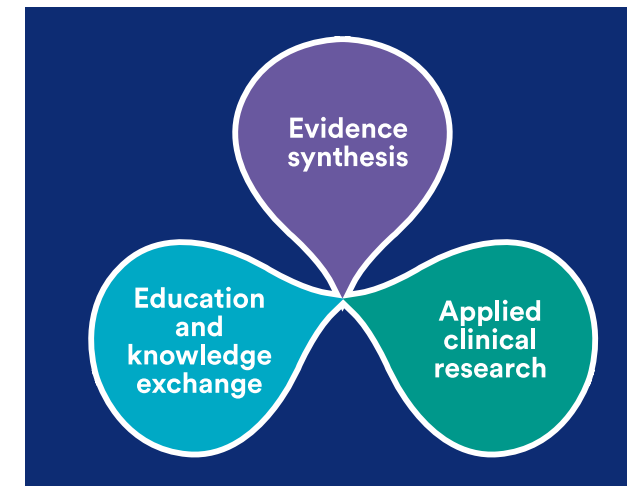
The final section of the report provides details of the publications and resources produced by the CEVM and the awards it has won in the past 10 years. It clearly demonstrates the substantial contributions CEVM has made to many areas, including critical appraisal, evidence synthesis and synthesis methodologies, practice-based research, clinical decision-making, shelter medicine, preventive medicine, stakeholder engagement, quality improvement, and education.

The Centre for Evidence-based Veterinary Medicine has achieved great things during the past 10 years. Current and future work continues to focus on the core themes of assisting with the implementation of evidence into practice and the generation of high quality, novel evidence for clinical decision-making. The next few years are shaping up to be even bigger and better.



Photograph: www.mikebeardphotography.co.uk

Our activities: three core areas



Our activities centre on three main areas:

1 **Evidence synthesis:** Structured reviews of the literature on specific clinical topics and associated tools and resources.

Identification of, and access to the relevant evidence on a particular subject is the first step in practicing in an evidence-based manner. Without access to the primary peer-reviewed literature or secondary evidence-based summaries (evidence syntheses) of the peer-reviewed evidence, it is impossible for individuals to keep abreast of updates or new areas of veterinary medicine. Our work in this area has focused on identifying the optimal places to search for veterinary literature (Grindlay et al. 2012) which previously, was not known.

Additionally, assessing the type of study design used and how well a study has been executed (quality) is an important part of determining whether evidence should be applied to the current patient or circumstances faced by the professional. Using structured critical appraisal tools to help identify how good the 'science' is within the evidence is a standard way of being able to do this. Our work in this area has focused on creating a bespoke critical appraisal tool for cross sectional study designs (AXIS; see page 26) and identifying the common pitfalls that

occur in randomised controlled trials (Wareham et al. 2017; Wareham et al. 2017a – see page 38) as well as how authors should be reporting their science (Grindlay et al. 2014).

We have used the evidence synthesis methodology to answer research questions of interest, from metrics associated with pet populations (Downes et al. 2013), to compliance in small animal practice (Wareham et al. 2018) to the outcomes measured in canine osteoarthritis (Belshaw et al. 2016). Additionally, we have created a number of secondary evidence-based resources that are freely accessible to the veterinary profession which helps individuals to identify whether a systematic review exists on a particular topic (VetSRev database; <https://vetsrev.nottingham.ac.uk/>) and answers specific clinical questions posed by the veterinary community to the CEVM (BestBETs for Vets; <https://www.bestbetsforvets.org/>); further information about these resources can be found in the 'Education and Knowledge Exchange' section on page 16.

2 **Applied clinical research:** Novel research and research methodologies in an applied clinical veterinary environment.

This research area was started with a national and international survey of the veterinary profession. Its purpose was to gain baseline knowledge in relation to common conditions in veterinary practice, attitudes towards EBVM, information sources used for cases and practice-based research, and to gather ideas for research topics of importance (Nielsen et al. 2014; Nielsen et al. 2015; Huntley et al. 2016; Huntley et al. 2017; Huntley et al. 2018). Our understanding of this was expanded when our researchers directly observed 1,720 consultations involving 1,901 patients and recorded every topic discussed (Robinson et al. 2014, a, b, c; Robinson et al. 2015, a; Robinson



et al. 2016). Alternative methods for capturing veterinary consultation data were examined using novel analysis of practice records (Jones-Diette et al. 2016; Jones-Diette et al. 2017; Jones-Diette et al. 2019). A Veterinary Clinical Trials Network has been established as a result of this work (<https://www.nottingham.ac.uk/cevm/practice-based-research/the-veterinary-clinical-trials-network-vctn/the-veterinary-clinical-trials-network-vctn.aspx>). This consultation work was expanded to look at vet-client communication and engaging clients in discussions around what makes a good consultation (McDermott et al. 2015; McDermott et al. 2017; McDermott et al. 2019; Corah et al. 2018; Corah et al. 2019).

Small animal populations involving owned and unowned animals were investigated to understand further the important issues facing these populations (Stavisky et al. 2012; Stavisky et al. 2017b; Kuhl 2017). Shelter medicine has been an important area for the CEVM, with conceptual work carried out looking at defining populations (Gosling et al. 2013) and how these animals are kept (Finka et al. 2014; Hill et al. 2019), which has led to the creation of ISFM guidelines (Sparkes et al. 2013). Important diseases such as FIV, FeLV and pyometra have been investigated (Stavisky et al. 2017; Gibson et al. 2013). This has translated across into education, with the creation of the first UK provision of student led veterinary services for homeless people (ViC; <https://vetsinthecommunity.weebly.com/>). Focusing on the owned population, topic specific projects have been conducted looking at issues considered important by the profession, including canine osteoarthritis (Belshaw et al. 2016, b; Belshaw et al. 2020), feline chronic kidney disease (Doit et al. 2020) and preventive medicine practices (Belshaw et al. 2018, 2018a, 2018b, 2018c, Robinson et al. 2018, 2019). This has resulted in the production of evidence-based guidance on preventive medicine consultations in small animal practice (Belshaw et al. 2019).

We've used research methods that have rarely or never been used in veterinary research before. We wanted to ensure that the people who were going to use or be affected by our research had the opportunity to define what they think is important. We have used consensus

methodologies to collect opinions from diverse groups including veterinary surgeons, clients, industry, policymakers, journal editors and regulatory agencies (Belshaw et al. 2019; Doit et al. 2020), and corpus linguistics methods (Huntley et al. 2018). The value of qualitative research methodologies has been highlighted in much of the work we've carried out looking at people's choices around implementing biosecurity and using vaccines on farms (Richens et al. 2015, 2016; Brennan et al. 2016). In addition to companion and farm animals, we've not forgotten horses, with collaborative work carried out looking at the impact of colic in the equine industry (Bowden et al. 2019, b). The utilisation of quality improvement approaches by veterinary and allied professionals has also been explored (Waine and Brennan 2015; Waine et al. 2018, a, b).

3 Education and knowledge exchange: Educational curriculum development and knowledge exchange initiatives for undergraduate and postgraduate students and veterinary professionals.

From day one we recognised that knowledge exchange would be a key part of the work of the Centre. By embedding EBVM training into the curriculum, we build these skills and abilities into the future of the profession. Our activities have focused on embedding evidence-based veterinary medicine across the undergraduate curriculum at Nottingham, ensuring that graduates are provided with the skills for lifelong learning. We have worked with education colleagues within the UK and internationally to determine what would be required in an undergraduate curriculum focused on EBVM (Dean et al. 2017), and with a team of people, contributed to the first freely accessible resource for postgraduates focused on EBVM (www.ebvmlearning.org/), which has now been updated (<https://learn.rcvsknowledge.org/course/view.php?id=2>).

We have been invited to support other educators and deliver evidence-based curricula at a number of different academic institutions

across the UK. Internationally, we were invited to assist the University of Sydney to shape their curricula to be themed around evidence-based veterinary medicine via a series of training events in 2016. This has resulted in around 20-30% of the yearly undergraduate research projects utilising a critically appraised topic (CAT) structure and has resulted in at least three CATs being published so far, with more planned.

As well as for undergraduate students, we've developed resources for lifelong learning within the profession. We've created a number of how-to guides with a number of co-authors (Dean 2013; Dean 2015). We developed the first taught postgraduate continuing professional development course focused on evidence-based veterinary medicine in 2016 (<https://doi.org/10.1080/17415349.2017.1357885>) which has enabled participants to carry out their own evidence-based research and teaching. This course continues today (<https://www.nottingham.ac.uk/cevm/training-opportunities/training-opportunities.aspx>) and there are future plans to formalise the training as part of structured postgraduate studies.

“We've used research methods that have rarely or never been used in veterinary research before. We wanted to ensure that the people who were going to use or be affected by our research had the opportunity to define what they think is important.”

We strongly believe that accessibility is key to propagating EBVM in the profession. This has led to us creating two popular and well-respected, freely accessible evidence-based resources that the profession can utilise in their clinical decision-making. BestBETs for Vets (www.bestbetsforvets.org) is a database of specific clinical questions posed by the profession that have been answered by our researchers and others from the veterinary community via a structured evidence synthesis format. Some of these BETs are also published in the Veterinary Record (free to access) to further disseminate the findings to the profession. The second database is VetSRev (<https://vetsrev.nottingham.ac.uk/>), a database which provides



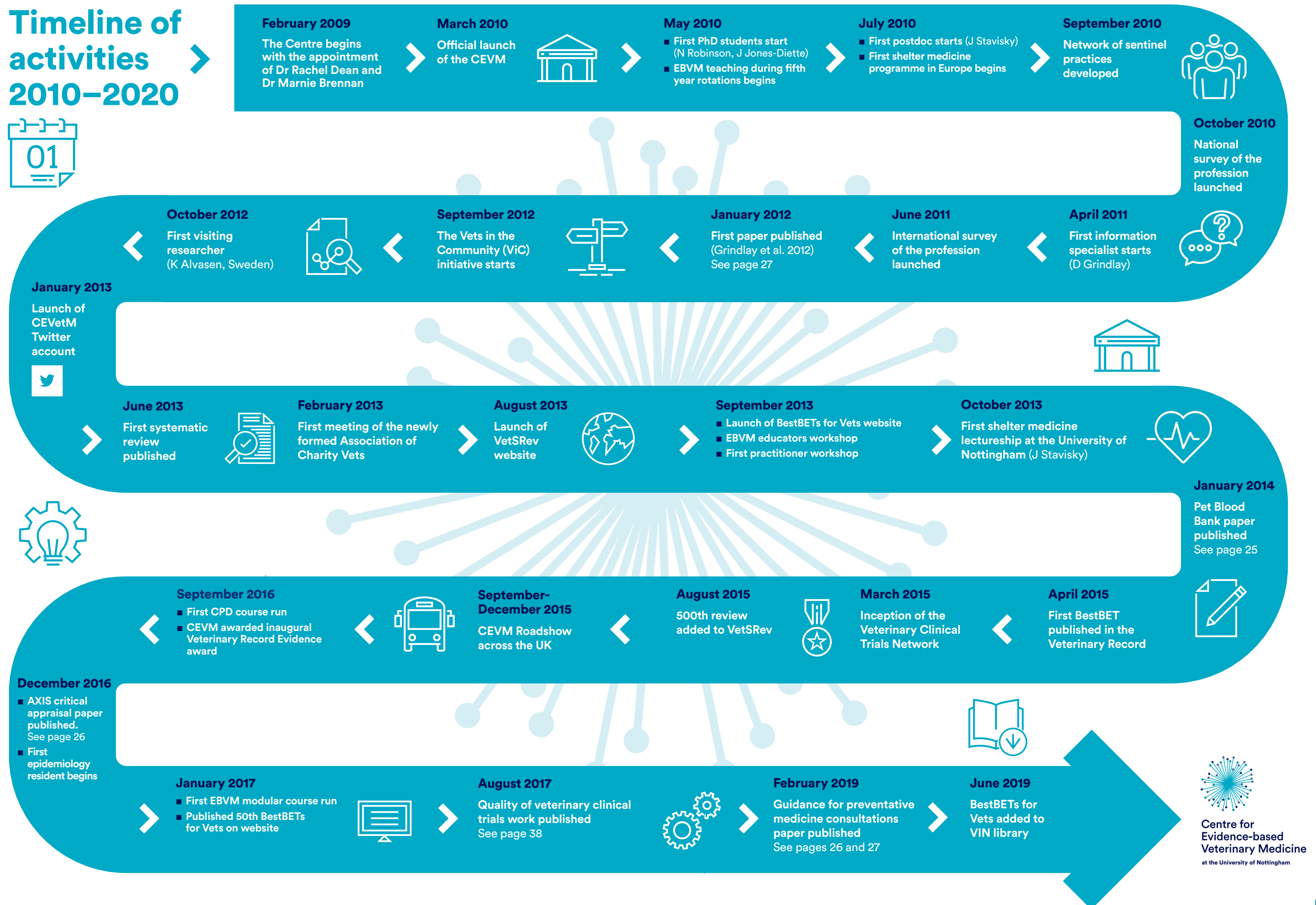
information about all of the systematic reviews (unbiased form of evidence syntheses) of relevance to veterinary medicine. Traditionally these have been difficult to identify via literature searches, so this resource is a much-welcomed addition to the armoury for practitioners and researchers. These databases are updated to ensure they are kept as current as possible.

Other sites such as Facebook (Centre for Evidence-based Veterinary Medicine) and Twitter (@CEVetM) have been used to engage with owners and the veterinary profession on a more day to day basis, and our BestBETs are tagged within a number of other resources (including VetStream, VETbytes and the Veterinary Information Network (VIN)).

We took our message out to the profession with a roadshow around the country in 2015 (<https://www.vettimes.co.uk/news/roadshow-to-bring-evidence-based-medicine-to-veterinary-profession/>), and have highlighted the client viewpoint with a regular column in the Veterinary Record (Belshaw 2017).

See the latter section for further information about engaging with the clinical and animal owning communities.

Timeline of activities 2010–2020



Our impact in numbers

Centre website visited by people from **178** countries

BestBETs for Vets website visitors from **173 countries across 6 continents**

VetSRev website:
Visitors from 125 countries



Taught over **950** veterinary graduates



Top ten web page views by country users

(BestBETs for Vets website 01/10/13 – 17/03/20)

1. UK 36%
2. US 24%
3. Canada 6%
4. Australia 4%
5. Netherlands 4%
6. Ireland 3%
7. France 2%
8. Brazil 1%
9. Germany 1%
10. Russia 1%

Worked with over **300** veterinary clinics across the UK and the US



Our Vets in the Community have overseen more than **2,000** consultations

Providing free veterinary care for some of the most vulnerable members of society while educating veterinary and nursing students in pragmatic, compassionate care

23 BestBETs published in the Veterinary Record



Vets in the Community **Over 800** veterinary student volunteers

as well as student nurses from neighbouring Nottingham Trent University

Generated **78** peer-reviewed publications



Primary funding total **£3,157,323**

Collaborative funding total **£700,522**



Impact – funding successes

Primary funding – total £3,157,323		
Date	Sponsor	Title
2018 – 2019	MSD Animal Health	Disseminating preventive medicine guidelines
2016 – 2019	Boehringer Ingelheim	Harmonising outcome measures in feline chronic kidney disease
2016 – 2018	MSD Animal Health	Optimising the preventative medicine consultation to maximise care – an evidence-based approach
2016 – 2016	Elanco Animal Health	Compliance in small animal practice
2015 – 2018	BBSRC	Integrating research into clinical practice: How to be an evidence-based veterinary professional
2015	Royal Canin	Treatment choices for feline chronic kidney disease
2015	University of Nottingham	Methods and feasibility of randomised controlled trials in veterinary practice
2014 – 2015	MSD Animal Health	What are the health benefits of the preventative healthcare consultation?
2013 – 2019	Dogs Trust	Establishment of shelter medicine programme at Dogs Trust Loughborough (DT)/ Staffing and postgraduate programmes in shelter medicine
2012 – 2016	BBSRC DTP PhD	Decision making in canine osteoarthritis
2010	Petplan Charitable Trust	Establishing BestBETs for Vets
2009	Novartis Animal Health and the University of Nottingham	Establishing a Centre for Evidence-based Veterinary Medicine

Collaborative funding – total £700,522		
Date	Sponsor	Title
2019 – current	Veterinary Defence Society Ltd and University of Nottingham	Developing a 'Just Culture' in the veterinary profession
2018 – current	CVS Group plc and University of Nottingham	Investigating quality improvement methodology in equine clinical practice
2017 – 2019	CIVME	Creating international shelter medicine learning outcomes
2016 – 2019	OnSwitch/University of Nottingham	Defining the 'good' consultation: What is it and how could we measure it?
2015 – 2019	Horse Trust	Optimising equine biosecurity awareness and practices to reduce the welfare impact of infectious diseases
2015	RCVS Knowledge target grant	Development of EBVM online educational tool
2014	University of Nottingham	Big data initiative: Mining the meaning
2013	Novartis Animal Health	Adverse events and NSAIDs: How common are adverse events following NSAID treatment and does the frequency of adverse events vary between different NSAIDs in cats and dogs?
2012	University of Nottingham Cascade fund	Vets in the community: a clinic for the pets of homeless and vulnerably housed people
2012	University of Nottingham	Constraints on the uptake of worming practices by cattle farmers: The motivators and barriers
2012	WM Morrisons Supermarkets Plc	Biosecurity on dairy farms
2011	DairyCo	Infectious disease control in dairy cows: Provision of practical guidance on vaccination and biosecurity using a combined approach
2011	Biosciences Knowledge Transfer Network (KTN) Spark award	Investigation into the inherent variation in factor VIII levels across the canine blood donor population and calculation of the percentage depletion in factor VIII at the time of production of fresh frozen plasma

Impact – engagement with the clinical community

A large amount of training has been delivered by all of the researchers in the CEVM via external conferences and meetings, both nationally and internationally, most of which have been on request by organisers of these events. Therefore, our engagements with the clinical community externally have been extensive, here are a few that are highlights for us:

- We are proud to have worked with individuals in **over 300 veterinary clinics** across the UK and the US as part of our sentinel practice network. These practices have helped us with our research and have shaped future projects.
- We have taught **over 950 veterinary undergraduates** to date about evidence-based veterinary medicine.
- An example of our hands-on approach was the **direct observation of 1,720 consultations involving 1,901 small animals by a single researcher**.
- In one cohort, **98% of students** said that it would be possible to practice evidence-based veterinary medicine after undertaking the teaching at Nottingham.
- We have **trained nearly 150 qualified veterinary professionals** (vets and nurses) via our postgraduate training events.
- We have worked with many other postgraduate students, including **interns, residents, Masters students and PhD students** from Nottingham and other universities.

“Whole heartedly recommend this course for anyone interested in evidence-based vet practice, best CPD I’ve ever done.”
– Veterinary professional

“Relevant to practice. Real world skills to take away.”
– Veterinary professional

“Makes you appreciate the different levels of evidence and how appropriate they are and what to watch out for when you find and read articles.”
– Undergraduate

“Clinically relevant. Lecturer made a potentially dull subject very interesting.”
– Veterinary professional

“Really good insight to EBM and inspired me to think about the decisions I’m going to make in practice”
– Undergraduate

Influencing change in the profession

1. Altering processes for donated blood handling and storage meant less waste and more lives saved

Pet Blood Bank UK (PBB) is a charity that provides a national canine blood bank. It was set up in 2007 after a change in legislation made it possible to collect, process and store canine blood products and has transformed the way we treat veterinary patients.

In 2007, the standard protocol involved processing blood units into red cells and fresh frozen plasma within 6-8 hours.

In January 2011, a change in human blood processing guidelines meant human blood processing was moved to allow a 24 hour room temperature whole blood unit storage pre-processing. If this was also possible in canine blood banking then this would have both a financial and resourcing benefit to Pet Blood Bank.

A collaborative project ensued between the CEVM and Pet Blood Bank to investigate the processing method for canine blood banking by analysing plasma coagulation factors in units of plasma processed this way. Funding for the study was obtained by a joint application to the Healthcare and Bioscience iNet and the East Midlands Development Agency.

The study showed that increasing the time it took to process the blood did not adversely affect its quality, leading to a permanent change in the way blood donations were handled. This meant more donations could be made and far fewer donations were wasted, hence more lives were saved while the working conditions and pressures on the staff at PBB were improved. A peer reviewed paper was collaboratively written and published in the Journal of Veterinary Internal Medicine in 2012.

Walton, JE, Hale, AS, Brooks, MB, Boag, AK, Barnett, W and Dean, RS (2014) Coagulation factor and hemostatic protein content of canine plasma after storage of whole blood at ambient temperature. *Journal of Veterinary Internal Medicine*, 28: doi.org/10.1111/jvim.12277



2. Critical appraisal tool that has been utilised by a number of disciplines for guideline development

Traditionally, randomised controlled trials have been used as the basis for evidence synthesis (for example systematic reviews and meta-analyses) to form guidelines that can be used in clinical practice. Other forms of study design, such as cross sectional studies, have not tended to be utilised for the basis of guideline development because of their observational nature and degree of bias. However, in areas where studies such as randomised controlled trials are scarce, other types of studies should be utilised.

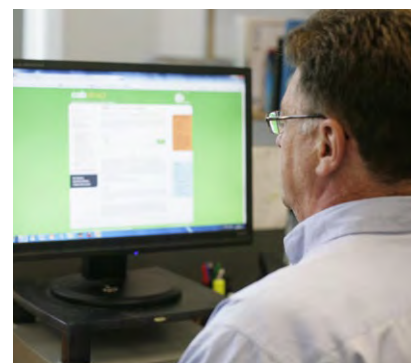
As a result of the evidence synthesis work conducted by the Centre in relation to pet populations (Downes et al. 2013), a gap was identified in relation to the tools that could be used for the assessment of quality and risk of bias in cross sectional studies. A Delphi study was conducted with experienced personnel from the medical, nursing, public health, epidemiology and veterinary sectors to finalise the structure of a critical appraisal tool focused on the assessment of cross sectional studies, the first of its kind to be created.

As a result of this work, a peer reviewed paper was published in the *British Medical Journal* (BMJ) Open in 2016 (Downes et al. 2016) and has been highly cited by a number of authors, primarily from medicine. A number of citations have led to the development of guidelines for clinical decision making and has appeared in a number of policy documents (<https://bmj.altmetric.com/details/14616054/policy-documents>). It has also been cited in the National Institute for Health and Care Excellence (NICE) guideline development manual (<https://www.nice.org.uk/process/pmg20/chapter/appendices>), the TRIP database, a clinical search engine for identifying evidence to support human clinical practice and care (www.tripdatabase.com/) and on the Systematic Review Toolbox website for medics creating reviews and guidelines (www.systematicreviewtools.com).

Downes, MJ, Brennan, ML, Williams, HC and Dean, RS (2016) Development of a critical appraisal tool to assess the quality of cross-sectional studies (AXIS). *BMJ Open*, <http://dx.doi.org/10.1136/bmjopen-2016-011458>

3. Development of guidance for small animal preventative medicine consultations

Preventive medicine consultations make up a large proportion of the consultations that occur in small animal veterinary practice in the UK (Robinson et al. 2014a), and therefore account for a significant proportion of the contact time owners spend with veterinary practice personnel. A large proportion of the research carried out at the Centre has focused on preventive medicine across a number of species, but the most significant work has focused on client-vet interactions in small animal consultations (Robinson et al. 2014, c; Robinson et al. 2015). This work has been



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“The findings from this work have culminated in the provision of novel evidence-based guidance on how to optimise preventive medicine consultations in small animal practice”

cited in reports demonstrating the current state of play in preventive medicine for small animals (Vets4Pets 2015 Annual Vet Report; <https://www.vets4pets.com/siteassets/vet-report/vet-report-2015.pdf>) which was sent to 3.8 million pet owners.

Work has been built on across a number of years to fully understand the ‘preventive medicine consultation journey’ – from when a client makes initial contact with a practice concerning preventive medicine – to once a client has visited the practice (Belshaw et al. 2018, c; Robinson et al. 2019). The findings from this work have culminated in the provision of novel evidence-based guidance on how to optimise preventive medicine consultations in small animal practice (Belshaw et al. 2019). Despite only being published for less than two years, over 3,000 have downloaded the guidance.

Belshaw, Z, Robinson, NJ, Brennan, ML and Dean, RS (2019) Developing practical recommendations for preventative healthcare consultations involving dogs and cats using a Delphi technique. *Veterinary Record*, 184, 348. <https://doi.org/10.1136/vr.104970>

4. Where to find veterinary evidence? Work identifying how to efficiently find veterinary related literature

In order to utilise evidence for clinical decision making, knowing where to look to ensure an efficient and lucrative effort is important. Prior to the creation of the CEVM, knowledge of how to search for veterinary related evidence was primarily held by information specialists. However, proportionally which databases would be most lucrative to utilise was unknown. Thanks to the CEVM, we have clearly identified where the best places to search for veterinary resources are, and how to optimise those searches. Work carried out has identified that for extensive coverage of the veterinary literature, the CAB Abstracts database is the optimal database to utilise, returning 90% of journals containing significant veterinary content. This work is novel and has been of huge benefit to the clinical veterinary profession and for veterinary research. This can be demonstrated by the number of citations achieved. This pioneering work has been cited by individuals within veterinary nursing, disease surveillance, public health, food safety, aquaculture, veterinary physiotherapy, agriculture, exotic animal practice, and even chemical engineering. It has been cited in guidance produced by the European Food Safety Authority (EFSA) relating to literature searching for EFSA risk assessments (<https://efsa.onlinelibrary.wiley.com/doi/pdf/10.2903/sp.efsa.2014.EN-593>).

Grindlay, D.J.C., Brennan, M.L. and Dean, R.S. (2012) Searching the veterinary literature: A comparison of the coverage of veterinary journals by nine bibliographic databases. *Journal of Veterinary Medical Education*, Vol 39 (4), 404-412. <https://doi.org/10.3138/jvme.1111.109R>



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Photograph: www.mikebeardphotography.co.uk

Engaging with animal owners and the public directly

Much of the work carried out by the CEVM has had an element of stakeholder engagement, as owners are a significant part of any clinical decision-making process in relation to the care of animals. The key to bringing about sustained change is to understand issues from a number of perspectives, and work within the confines of these to generate relevant solutions. The information in the accompanying schematic includes some of the work already mentioned, but together, highlights the breadth of the projects carried out involving owners and other stakeholders.

Shelter medicine

- Homelessness accommodation services (L Scanlon)
- Shelter owners/managers (J Stavisky)
- Homeless pet owners (J Stavisky)
- Feral cat rescue workers (L Gosling)

Horses and cattle

- Dairy cattle vaccination (I Richens)
- Biosecurity and preventive medicine (M Brennan)
- Equine emergency conditions (colic) (A Bowden)

Small animals

- Canine osteoarthritis (Z Belshaw)
- Feline chronic kidney disease (H Doit)
- Pedigree dog breeding (C Kuhl)
- Consultations – general (L Corah)
- Consultations – preventative medicine (N Robinson)
- Consultations – communication (M McDermott)

Case study: Vets in the Community (ViC)

Since 2012, ViC has been serving a dual purpose in providing free veterinary care for some of the most vulnerable members of society, and educating veterinary and nursing students in pragmatic, compassionate care.

We work closely with homelessness service providers and initiatives such as Framework and The Big Issue, as well as the police and domestic violence, rape and substance abuse recovery services. We have numerous collaborators and stakeholders, including staff and students at the School of Veterinary Medicine and Science, local veterinary surgeries and businesses.

We have overseen more than 2,000 consultations and enlisted over 800 University of Nottingham veterinary student volunteers, as well as student nurses from neighbouring Nottingham Trent University. We have co-hosted training workshops at the Association of Charity Vets conference. In 2019, we were invited to speak at the British Small Animal Veterinary Association Congress, the largest veterinary conference in Europe. Following this, we created a free webinar for veterinary professionals on treating homeless people's pets, in collaboration with the Royal Veterinary College (RVC) and Streetvet (a veterinary charity providing care to homeless people's pets across the UK, who have credited us with being part of their inspiration).

Photograph: Jenny Stavisky

“On behalf of the women’s aid pet project I would like to say how important your project is. It’s been so good for the women I work with who are vulnerable and often don’t have a fixed address because of the abuse they are experiencing, to use your project to get their animals checked out and treated.”

– From a partner service which helps women fleeing domestic violence

Photograph:
Jenny Stavisky

“The fact that we as students can give back to our community whilst at uni is amazing. I have been able to see just how big a difference it makes to those who cannot afford proper healthcare for their pets. It is clear to see that their human-animal bond is so vital to their day-to-day life and for that I am proud to have been a part of a project that truly supports this important relationship.”

– From a former student



Photograph: Laura Beesley



“I’ve had my dog long before, when I was working and when I did have somewhere [to live]. Doesn’t mean that just because I’ve fallen on hard times I’m going to get rid of my dog. That’d be like chopping my arm off...love you [Vets in the Community] guys, be lost without you.”

– ViC client

Photograph: Emma Drinkall

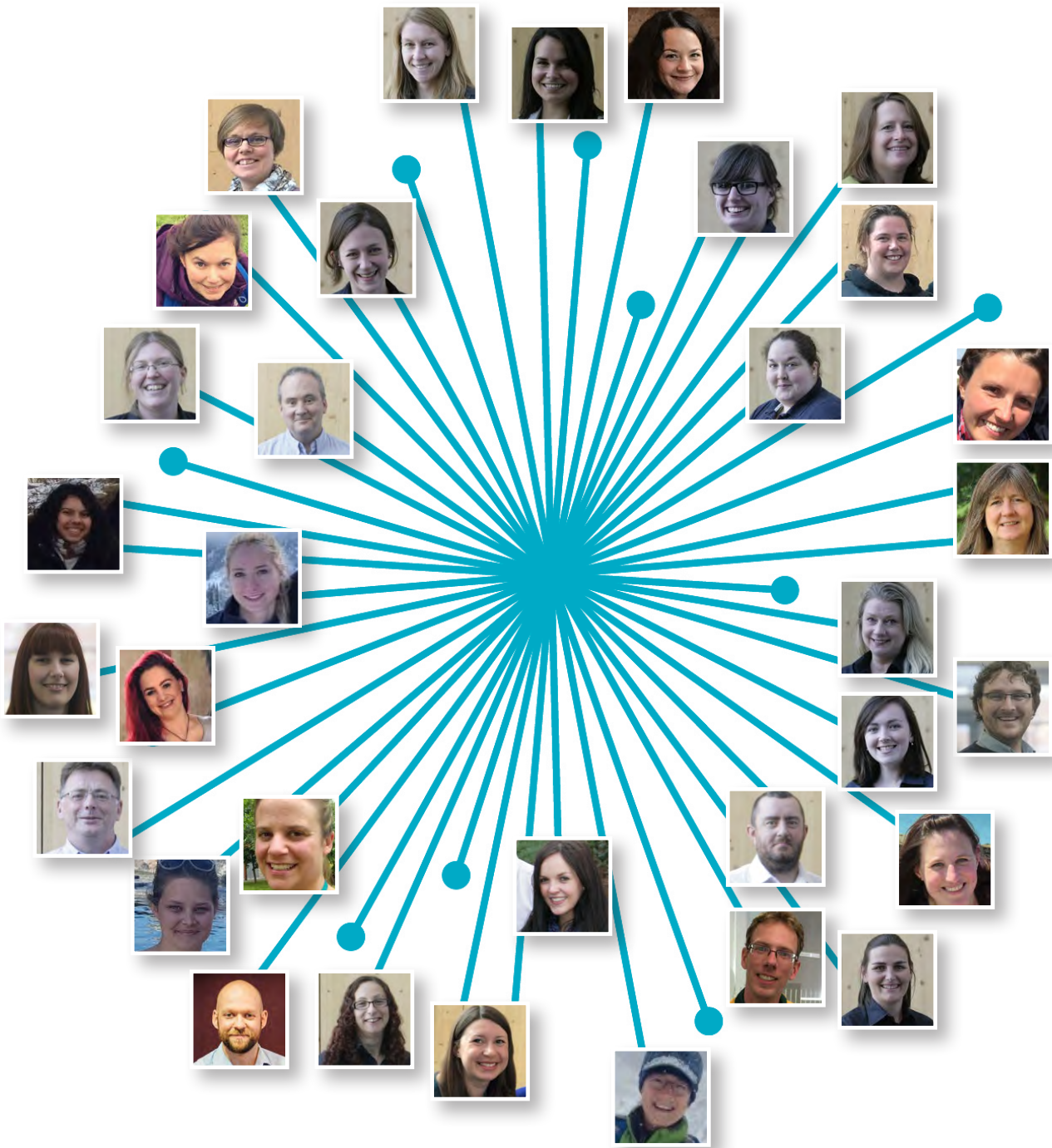


Photograph: Emma Drinkall



Photograph: www.mikebeardphotography.co.uk

Our CEVM team



We have been lucky enough to work with an amazing team over the years who have been committed to producing the best quality research outputs imaginable and ensuring that the results from this work are presented back to the communities who need them.

Professional successes

Where our researchers are now

Leadership and scholarship plays an important role in research success, and in fostering the development of the researchers of the future. A mark of a successful initiative is the growth and progression of its employees and researchers. We have been fortunate to work with, and help develop, a group of highly skilled individuals who are already making an impact in their chosen fields.



Photograph: David Richens



Photograph: Rachel Dean



Photograph: Imogen Richens



A number of our PhD students and postdoctoral researchers have established themselves as academics in their own right, with eight obtaining veterinary lectureship posts or responsibilities after working with us. Three have had their skills and expertise recruited by the medical field for evidence-based research and analysis and one works in animal marketing and communications. Two are now private consultants advising on research methodologies, data analysis and evidence synthesis and one runs a digital marketing and research business. A number are veterinary practitioners. Our former Director Rachel Dean is now Director of Clinical Research and Excellence in Practice for VetPartners Ltd, a corporate practice group in the UK, helping lead their practitioners to use an evidence-based framework in their clinical decision-making.

Case study

Jenny Stavisky



“I joined the CEVM in 2010 as their first postdoctoral researcher and stayed until 2013 when I transferred to a lectureship, also at Nottingham. It was exciting to be part of something new, and it was great to have the freedom to explore my own interests. In that time, we laid the foundations of our innovative shelter medicine teaching and research program and started Vets in the Community. Both of these initiatives continue to go from strength to strength and have inspired and empowered other similar initiatives in the UK and beyond.

What I loved best about being part of the CEVM was the open culture. We all supported each other and learnt together, there was a great atmosphere of openness which I've never experienced elsewhere and is reflected in the diverse areas the CEVM team have gone on to succeed in. Even though over time many of us have moved to different institutions and different countries, we still keep in touch, chat where we can and look for opportunities to collaborate with each other. I think it shows how much having such positive relationships within a team can lead to creativity and success.”

Case study

Natalie Robinson



Photograph:
www.mikebeardphotography.co.uk

“I joined the CEVM in 2010 as one of their first PhD students, and later stayed as a postdoctoral researcher until 2018. It was really exciting to be part of something new and innovative, it's great to see how much the Centre has achieved in the past decade and feel that I was able to contribute to that. At CEVM I was able to work on varied projects which helped me develop my research skills and also figure out where my own interests lay. The projects I worked on covered everything from qualitative interviewing to multi-level modelling, and it was great to work with a collaborative team who were always willing to share their knowledge and skills. There was always a clear focus on who the end-user of our research would be, and how best to share our research with them, so I had lots of opportunity to explore different ways of communicating research. There was also lots of opportunity to get involved in various aspects of undergraduate teaching and research. I really enjoyed the teaching side of my role, giving me experience to go on to teach both on short courses and in further education after leaving the CEVM.

I now work as Clinical Data Manager for VetPartners and feel like my time at the CEVM has given me a wealth of useful experience and knowledge to take back into the veterinary industry and use to drive quality improvement in patient care.”



Awards

H Doit, BSAVA Clinical Abstract Medicine Award for congress presentation entitled 'Core outcomes in feline chronic kidney disease: What should we be measuring?', 2019

A Collinson, Graduate School Travel Prize, 2018

L Corah, Graduate School Travel Prize, 2018

M Brennan, British Cattle Veterinary Association President's award for best congress presentation entitled 'The reluctant hero: The role of the vet in on-farm cattle biosecurity', 2017

J Stavisky: Chris Laurence Vet of the Year, 2017

M Brennan: ISESSAH conference prize for best presentation entitled 'Using psychological models of behaviour change to identify barriers to and motivators for biosecurity', 2017

J Stavisky: Vice-Chancellor's Medal, 2016

R Dean: BSAVA Beattie Travel Scholarship, 2016



CEVM Team: Veterinary Record Veterinary Evidence award (CEVM), 2016

H Doit, Postgraduate student poster award for poster entitled 'What is important in canine osteoarthritis research', 2015

N Robinson, Graduate School Travel Prize, 2012

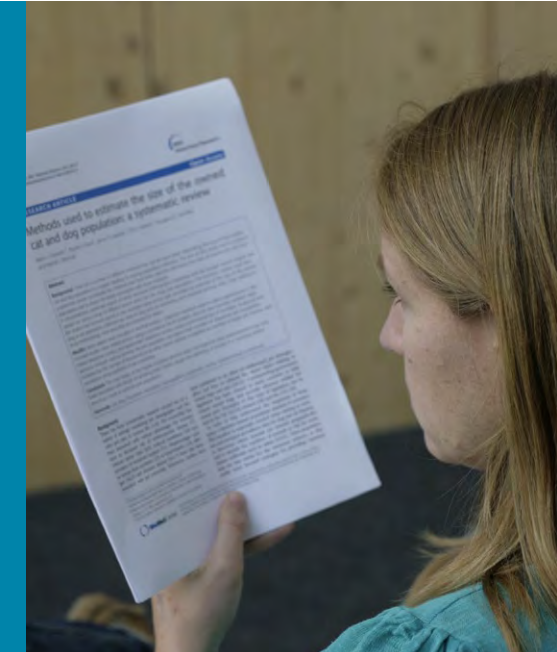
J Jones-Diette: Building Experience and Skills Travel Scholarship (BESTS), 2011



Resources: Our outputs

One of the ways the CEVM have put research into practice is by publishing a rich collection of articles that provide practical information to the profession. We have also employed novel methodologies to be able to answer important questions from veterinary professionals in relation to the practice of evidence-based veterinary medicine.

We have shared a selection of important articles not already mentioned that help to demonstrate the breadth of our activities.



1 Robinson, NJ, Dean, RS, Cobb, M and Brennan, ML (2015) Investigating common clinical presentations in first opinion small animal consultations using direct observation. Veterinary Record, 176:18. <https://doi.org/10.1136/vr.102751>

This seminal work summarised in the UK's leading veterinary journal applied data collection methodologies in a novel way to identify the common presentations in small animal consultations, which had previously not been attempted before. This article provided a benchmark for understanding first opinion small animal veterinary caseloads, the findings of which has implications for veterinary research (prioritisation of important research gaps) and education (enabling curriculums to be focused on common presentations). This was selected for an editorial when published.

Photographs on this page:
www.mikebeardphotography.co.uk

2 Nielsen, TD, Dean, RS, Robinson, NJ, Massey, A and Brennan, ML (2014) Survey of the UK veterinary profession: Common species and conditions nominated by veterinarians in practice. Veterinary Record 174 (13) <https://doi.org/10.1136/vr.101745>

Early work using a survey methodology to engage the veterinary profession in relation to their role in research, and a baseline for identifying topics to prioritise for research for the CEVM. Conditions involving the skin, musculoskeletal and reproductive systems were commonly nominated across species.



3

Jones-Diette, J, Robinson, NJ, Cobb, M, Brennan, ML and Dean, RS (2017) Accuracy of the electronic patient record in a first opinion veterinary practice. *Preventive Veterinary Medicine*, 148: 121-126. <https://doi.org/10.1016/j.prevetmed.2016.11.014>

Innovative research looking at the interactions during small animal consultations. This has focused on the subset of information that appears in the free text within electronic clinical records compared with the information that was discussed during the consultation as an observed information exchange event. This research contributes to understanding the information that may be omitted if practice management software information is used for veterinary research purposes.

4

Stavisky, J, Brennan, ML, Downes, M and Dean, R (2012) Demographics and economic burden of un-owned cats and dogs in the UK: Results of a 2010 census. *BMC Veterinary Research*, 8:163, <https://doi.org/10.1186/1746-6148-8-163>

An important baseline study in shelter medicine determining the extent and features of the dog and cat populations within UK shelters, crucial for identification of stakeholders and the issues faced by them. A large survey connecting with 735 organisations in the UK.

8

Doit, H, Dean, RS, Duz, M and Brennan, ML (2020) Use of quantitative and qualitative methodologies to identify a Core Outcome Set (COS) for feline chronic kidney disease research. van Schaik, G and Brennan, M (eds) *Proceedings of the Society for Veterinary Epidemiology and Preventive Medicine annual meeting held online, March-April 2020*.

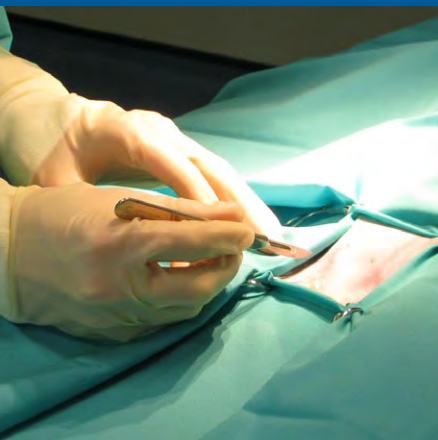
In this study, a novel research methodology was used to determine the most appropriate outcomes to measure in future trials relating to chronic kidney disease, entitled a Core Outcome Set (COS). These important outcomes were identified by a combination of a systematic review of the literature, a Delphi study and a consensus meeting, combining peer-reviewed evidence with opinion to identify the most important outcomes to veterinary professionals, animal owners and other important stakeholders.



5

Belshaw, Z, Dean, R and Asher, L (2020) Slower, shorter, sadder: a qualitative study exploring how dog walks change when the canine participant develops osteoarthritis. *BMC Veterinary Research*, 16:85, <https://doi.org/10.1186/s12917-020-02293-8>.

A powerful article highlighting the value of using a qualitative research approach to identify important but previously unknown impacts of canine osteoarthritis on the activity levels for both dogs and their owners. This key article highlights the strong bond between dogs and their owners and the significant role of dogs in human health and welfare.



6

Wareham, KJ, Hyde, RM, Grindlay, D, Brennan, ML and Dean, RS (2017a) Sample size and number of outcome measures of veterinary randomised controlled trials of pharmaceutical interventions funded by different sources, a cross-sectional study. *BMC Veterinary Research*, 13: 295, <https://doi.org/10.1186/s12917-017-1207-0>

7

Wareham, KJ, Hyde, RM, Grindlay, D, Brennan, ML and Dean, RS (2017) Sponsorship bias and quality of randomised controlled trials in veterinary medicine. *BMC Veterinary Research*, 13: 234, <https://doi.org/10.1186/s12917-017-1146-9>

Randomised controlled trials (RCTs) are an important part of veterinary clinical decision-making in relation to the application of evidence into practice. A large study, published across two papers, was carried out identifying the most common study design limitations in veterinary RCTs and the relationship between these factors and source of research funding. There were many omissions in relation to important study design features, such as failing to report primary outcomes and justification for the sample sizes used. A higher proportion of trials supported by pharmaceutical funding reported positive trial outcomes. This work has highlighted the importance of employing methodological rigour and transparent reporting when conducting veterinary research.



9

Grindlay, DJC, Dean, RS, Christopher, MM and Brennan, ML (2014) A survey of the awareness, knowledge, policies and views of veterinary journal Editors-in-Chief on reporting guidelines for publication of research. *BMC Veterinary Research*, 10:10, <https://doi.org/10.1186/1746-6148-10-10>

Research looking at the use of reporting guidelines, templates for authors to use to ensure they are including the essential study design information when reporting about their research, by veterinary journals. This work highlighted a knowledge gap for veterinary editorial teams and an educational opportunity for this important component of EBVM.



10

Huntley, SJ, Mahlberg, M, Wiegand, V, van Gennip, Y, Yang, H, Dean, RS and Brennan, ML (2018) Analysing the opinions of UK veterinarians on practice-based research using corpus linguistic and mathematical methods. *Preventive Veterinary Medicine*, 150: 60-69, <https://doi.org/10.1016/j.prevetmed.2017.11.020>

Research looking at the veterinarian nominated advantages and disadvantages of practice-based research and what practitioners could do to improve the veterinary knowledge base. Application of novel methodologies not seen before in the peer-reviewed veterinary literature. A good example of interdisciplinary research spanning sectors (veterinary medicine and humanities) including corpus linguistic analyses and topic modelling.



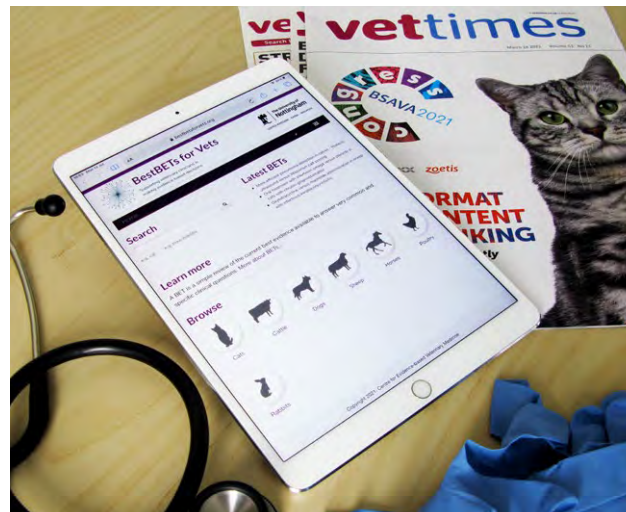
Our web resources

BestBETs for Vets website www.bestbetsforvets.org

Part of the focus for the Centre for Evidence-based Veterinary Medicine has been to carry out structured reviews of the literature, summarising the research evidence to support veterinary clinical decision-making and to identify the important gaps in the research that need to be filled.

We created an open access website to house a specific type of structured review called critically appraised topics (CATs). The website, BestBETs for Vets (www.bestbetsforvets.org), was at the time of launch in 2013 the only veterinary database of its kind globally. These CATs focus on narrow, clinical questions that have been posed to us by veterinary professionals and undergraduate veterinary students. The idea of having these reviews on a website meant free access to veterinary professionals anywhere and permitted a level of interaction with our users, primarily posing questions for us to answer and getting involved in a BestBET.

We have received great feedback on BestBETs to date – other websites have linked to our website to support decision-making (<https://kind.cats.org.uk/>; VIN; VETbytes and VetStream). In an online CPD presentation about BestBETs, 43% of participants had used a BestBET to help inform a clinical decision made about a patient. We've had feedback from individual vets in practice include comments like 'I've just finished reading through the BestBET, I really enjoyed it and will be very useful to our practice'. The Veterinary Record journal publish a selection of our BestBETs on a regular basis which helps to widen the dissemination to clinical staff for use.



VetSRev website <https://vetsrev.nottingham.ac.uk/>

It was realised quite quickly after our literature database work (Grindlay et al. 2012) that it was difficult to easily search for and find all systematic reviews published in veterinary medicine. From feedback from both the veterinary and human medicine fields, it was identified that there was a need for these studies to be easily identified to enhance clinical decision-making. If these publications were in theory the least biased studies available on which to base decisions, they needed to be easily accessed by end-users. We created a novel database of all published systematic reviews meeting our criteria, freely accessible to all, called VetSRev (database of veterinary systematic reviews). Where possible, direct links to the full texts are provided. We regularly add to the database to ensure it is kept up to date.

We have many end-users of this resource, with a number of 'hosts' based in agricultural and veterinary libraries across the globe who are VetSRev hubs for other information dissemination networks. This goes some way to demonstrate the importance of this database.

Full list of peer-reviewed publications and other published outputs

The following list of outputs involve work carried out by the CEVM, and those generated as a result of collaborative working with other individuals and groups. These outputs have been categorised into seven different sections, and within each section appear in reverse date order.

Evidence synthesis and evidence synthesis methodologies:

- Bradford, NG, Huntley, SJ, Grindlay, DJC and Brennan, ML (2019) Is there an evidence base for veterinarians to utilise when treating commonly seen conditions in cattle? *Cattle Practice* 27: 12-25
- Corah, L, Mossop, L, Cobb, K and Dean, R (2018) Measuring the success of specific health problem consultations in cats and dogs: a systematic review. *Veterinary Record* 183: 22, <http://dx.doi.org/10.1136/vr.104759>
- Wareham, KJ, Brennan, ML and Dean, RS (2018) Systematic review of the factors affecting cat and dog owner compliance with pharmaceutical treatment recommendations. *Veterinary Record* 184: 154, <https://doi.org/10.1136/vr.104793>
- White, C and Brennan, ML (2018) An evidence-based rapid review of surgical techniques for correction of prolapsed nictitans glands in dogs. *Veterinary Sciences*, 5: 75, <https://doi.org/10.3390/vetsci5030075>
- Robinson, NJ, Belshaw, Z, Brennan, ML and Dean, RS (2018) Measuring the success of canine and feline preventative healthcare consultations: A systematic review. *Preventive Veterinary Medicine*, 158: 18-24, <https://doi.org/10.1016/j.prevetmed.2018.07.005>
- Falzon, LC, Lechner, I, Chantziaras, I, Collineau, L, Courcoul, A, Filippitzi, ME, Laukkanen-Ninios, R, Peroz, C, Ferreira, JP, Postma, M, Prestmo, PG, Phythian, CJ, Sarno, E, Vanantwerpen, G, Vergne, T, Grindlay, DJC and Brennan, ML (2018) Quantitative outcomes of a One Health approach to study global health challenges. *EcoHealth*, 15: 209-227, <https://doi.org/10.1007/s10393-017-1310-5>
- Wareham, KJ, Hyde, RM, Grindlay, D, Brennan, ML and Dean, RS (2017a) Sample size and number of outcome measures of veterinary randomised controlled trials of pharmaceutical interventions funded by different sources, a cross-sectional study. *BMC Veterinary Research*, 13: 295, <https://doi.org/10.1186/s12917-017-1207-0>
- Wareham, KJ, Hyde, RM, Grindlay, D, Brennan, ML and Dean, RS (2017) Sponsorship bias and quality of randomised controlled trials in veterinary medicine. *BMC Veterinary Research*, 13: 234, <https://doi.org/10.1186/s12917-017-1146-9>
- Strong, VJ, Grindlay, D, Redrobe, S, Cobb, M and White, K (2016) A systematic review of the literature relating to captive great ape morbidity and mortality. *Journal of Zoo and Wildlife Medicine*, 47: 697-710, <https://doi.org/10.1638/2015-0240.1>
- Downes, MJ, Brennan, ML, Williams, HC and Dean, RS (2016) Development of a critical appraisal tool to assess the quality of cross-sectional studies (AXIS). *BMJ Open*, 6:e011458, <http://dx.doi.org/10.1136/bmjopen-2016-011458>

- Belshaw, Z, Asher, L and Dean, RS (2016) Systematic review of outcome measures reported in clinical canine osteoarthritis research. *Veterinary Surgery*, 45: 480-487, <https://doi.org/10.1111/vsu.12479>
- Belshaw, Z, Asher, L, Harvey, ND and Dean, RS (2015) Quality of life assessment in domestic dogs: An evidence-based rapid review. *The Veterinary Journal*, 206: 203-212, <https://doi.org/10.1016/j.tvjl.2015.07.016>
- Grindlay, DJ, Dean, RS, Christopher, MM and Brennan, ML (2014) A survey of the awareness, knowledge, policies and views of veterinary journal Editors-in-Chief on reporting guidelines for publication of research. *BMC Veterinary Research*, 10: 10, <https://doi.org/10.1186/1746-6148-10-10>
- Downes, MJ, Dean, RS, Stavisky, JH, Adams, VJ, Grindlay, DJC and Brennan, ML (2013) Methods used to estimate the size of the owned cat and dog population: a systematic review. *BMC Veterinary Research*, 9: 121, <https://doi.org/10.1186/1746-6148-9-121>
- Grindlay, DJC, Brennan, ML and Dean, RS (2012) Searching the veterinary literature: A comparison of the coverage of veterinary journals by nine bibliographic databases. *Journal of Veterinary Medical Education*, 39: 404-412, <https://doi.org/10.3138/jvme.1111.109R>

Practice-based research:

Veterinary practice

- Corah, L, Lambert, A, Cobb, K, Mossop, L (2019) Appointment scheduling and cost in first opinion small animal practice. *Heliyon*, 5: e02567, <https://doi.org/10.1016/j.heliyon.2019.e02567>
- Jones-Diette, JS, Dean, RS, Cobb, M and Brennan, ML (2019) Validation of text-mining and content analysis techniques using data collected from veterinary practice management software systems in the UK. *Preventive Veterinary Medicine*, 167: 61-67, <https://doi.org/10.1016/j.prevetmed.2019.02.015>
- Jones-Diette, J, Robinson, NJ, Cobb, M, Brennan, ML and Dean, RS (2017) Accuracy of the electronic patient record in a first opinion veterinary practice. *Preventive Veterinary Medicine*, 148: 121-126, <https://doi.org/10.1016/j.prevetmed.2016.11.014>
- Jones-Diette, JS, Brennan, ML, Cobb, M, Doit, H and Dean, RS (2016) A method for extracting electronic patient record data from practice management software systems used in veterinary practice. *BMC Veterinary Research*, 12:239, <https://doi.org/10.1186/s12917-016-0861-y>
- Robinson, NJ, Dean, RS, Cobb, M and Brennan, ML (2016) Factors influencing common diagnoses made during first-opinion small-animal consultations in the United Kingdom. *Preventive Veterinary Medicine*, 131: 87-94, <https://doi.org/10.1016/j.prevetmed.2016.07.014>
- Hunt, JR, Dean, RS, Davis, GN and Murrell, JC (2015) An analysis of the relative frequencies of reported adverse events associated with NSAID administration in dogs and cats in the United Kingdom. *The Veterinary Journal*, 206: 183-190, <https://doi.org/10.1016/j.tvjl.2015.07.025>
- McDermott, M, Tischler, V, Robbe, I and Dean, RS (2015) Veterinarian-client communication skills: Current state, relevance and opportunities for improvement. *Journal of Veterinary Medical Education*, 42: 305-314, <https://doi.org/10.3138/jvme.0115-006R>
- Robinson, NJ, Brennan, ML, Cobb, M and Dean, RS (2015a) Agreement between veterinary patient data collected from different sources. *The Veterinary Journal*, 205: 104-106, <https://doi.org/10.1016/j.tvjl.2015.04.023>
- Robinson, NJ, Dean, RS, Cobb, M and Brennan, ML (2015) Investigating common clinical presentations in first opinion small animal consultations using direct observation. *Veterinary Record*, 176: 463, <https://doi.org/10.1136/vr.102751>

- Walton, JE, Hale, AS, Brooks, MB, Boag, AK, Barnett, W and Dean, R (2014) Coagulation factor and hemostatic protein content of canine plasma after storage of whole blood at ambient temperature. *Journal of Veterinary Internal Medicine*, 28: 571-575, <https://doi.org/10.1111/jvim.12277>
- Robinson, NJ, Brennan, ML, Cobb, M and Dean, RS (2014c) Clinical examination and weighing of patients in small animal consultations. *Veterinary Record*, 176: 387, <http://dx.doi.org/10.1136/vr.102829>
- Robinson, NJ, Dean, RS, Cobb, M and Brennan, ML (2014b) Diagnostic testing in first opinion small animal consultations. *Veterinary Record*, 176: 174, <http://dx.doi.org/10.1136/vr.102786>
- Robinson, NJ, Brennan, ML, Cobb, M and Dean, RS (2014a) Capturing the complexity of first opinion small animal consultations using direct observation. *Veterinary Record*, 176: 48, <https://doi.org/10.1136/vr.102548>
- Robinson, NJ, Dean, RS, Cobb, M and Brennan, ML (2014) Consultation length in first opinion small animal practice. *Veterinary Record*, 175: 486, <http://dx.doi.org/10.1136/vr.102713>

Clinical decision making

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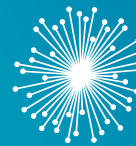
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