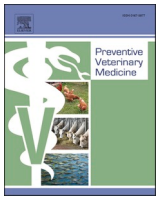
Preventive Veterinary Medicine 216 (2023) 105928

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed



The use of theories, models, and frameworks to inform the uptake of evidence-based practices in veterinary medicine - a scoping review

Rosemary A. Reyneke [a,1], Imogen F. Richens [a,2], Heather Buchanan [b,3], E. Bethan Davies [b,4], Caitlin Sorrell [b,5], Alison Ashmore [c,6], Marnie L. Brennan [a,*,7]

[a] Centre for Evidence-based Veterinary Medicine, The University of Nottingham, United Kingdom
[b] School of Medicine, The University of Nottingham, United Kingdom
[c] University of Nottingham Libraries, The University of Nottingham, United Kingdom

ARTICLE INFO

Keywords:
Implementation
Framework
Model
Theory
Evidence-based veterinary medicine
Scoping review

ABSTRACT

Evidence-based practices (EBPs) provide strategies to improve the health, welfare and productivity of animal species. However, ensuring implementation and uptake into routine practice of these EBPs is often challenging. In human health research, one approach used to improve uptake of EBPs is the use of theories, models and/or frameworks (TMFs), however the extent of the use of this approach in veterinary medicine is unknown. The aim of this scoping review was to identify existing veterinary uses of TMFs to inform the uptake of EBPs, and to understand the focus of these applications. Searches were conducted in CAB Abstracts, MEDLINE, Embase and Scopus, alongside grey literature, and ProQuest Dissertations & Theses. The search strategy consisted of a list of known existing TMFs that have been used to improve uptake of EBPs in human health, alongside more generic terminology for implementation and terminology relevant to veterinary medicine. Peer reviewed journal articles and grey literature detailing the use of a TMF to inform uptake of EBP(s) in a veterinary context were included. The search identified 68 studies that met the eligibility criteria. Included studies represented a diverse spread of countries, areas of veterinary concern and EBP. A range of 28 different TMFs were used, although the Theory of Planned Behaviour (TPB) predominated, featuring in 46% of included studies (n = 31). The majority of studies (n = 65, 96%) utilised a TMF with the aim to understand and/or explain what influences implementation outcomes. Only 8 studies (12%) reported the use of a TMF alongside/in conjunction with the actual implementation of an intervention. It is clear there has been some use to date of TMFs to inform uptake of EBPs in veterinary medicine, however it has been sporadic. There has been a heavy reliance on usage of the TPB and other similar classic theories. This has typically been to inform the understanding of factors, such as barriers and facilitators, that may influence the outcome of an implementation effort without then applying this knowledge to the actual implementation of an intervention. Furthermore, there has been a lack of acknowledgement of wider contextual factors and consideration of sustainability of interventions. There is clear potential to increase and expand the usage of TMFs to improve uptake of EBPs in veterinary medicine, including utilising a wider range of TMFs and developing interdisciplinary collaborations with human implementation experts.

* Corresponding author.
E-mail address: marnie.brennan@nottingham.ac.uk (M.L. Brennan).
[1] ORCID iD: 0000–0001-6386–6272
[2] ORCID iD: 0000–0002-8714–7827
[3] ORCID iD: 0000–0002-0714–5830
[4] ORCID iD: 0000–0003-3134–0879
[5] ORCID iD: 0000–0003-4693–723X
[6] ORCID iD: 0000–0001-6162–2776
[7] ORCID iD: 0000–0002-4893–6583

https://doi.org/10.1016/j.prevetmed.2023.105928
Received 9 September 2022; Received in revised form 19 March 2023; Accepted 1 May 2023
Available online 5 May 2023

1. Introduction

1.1. Rationale

In veterinary medicine, it has long been recognised that there is a research-to-practice 'gap', with many examples of circumstances where there is failure to implement proven evidence-based practices (EBPs) (Garforth et al., 2004; Wolf et al., 2015; Hamilton, 2018). This 'gap' is not solely confined to veterinary medicine, a similar challenge is recognised in human healthcare. It takes on average 17 years for EBPs to be incorporated into routine practice in human healthcare, and even then only about half of EBPs ever make it into general clinical usage (Balas and Boren, 2000). Recognition of this issue led to the emergence of the field of implementation science. Implementation science can be defined as "the scientific study of methods to promote the systematic uptake of research findings and other EBPs into routine practice, and, hence, to improve the quality and effectiveness of health services" (Eccles and Mittman, 2006). It draws on many areas such as social psychology and health behaviour change (Presseau et al., 2021). The backbone of implementation science is the use of formal constructs (theories, models and/or frameworks), or TMFs, to guide, explain and/or evaluate the process of implementation (Nilsen, 2015). These TMFs can be divided into five categories based on three overarching aims of their use (Fig. 1) (Nilsen, 2015):

- Describing and/or guiding the process of translating research into practice
  - o **Process models** seek to detail specific stages in the process of moving research into practice, including the implementation and use of research (Nilsen, 2015). For example, a process model may be used to aid designing an initiative to improve passive transfer in calves on dairy farms, and then to specify the steps involved in implementing this initiative.
- Understanding and/or explaining what influences implementation outcomes.
  - o For example, to understand factors influencing dog owner's intentions to vaccinate against rabies (Beyene et al., 2018) or farmers' intentions to implement measures for control of foot and mouth disease (Jemberu et al., 2015).
  - o TMFs used with this aim can be further divided into three categories:
    - ▪ **Determinant frameworks** - frameworks that specify factors that act as barriers and enablers to influence implementation outcomes.
    - ▪ **Classic theories** - theories developed by fields such as psychology and sociology, that seek to understand and/or explain aspects of implementation.
    - ▪ **Implementation theories –** theories developed by implementation researchers to understand and/or explain aspects of implementation (Nilsen, 2015).
- Evaluating implementation
  - o **Evaluation frameworks** act by specifying aspects of implementation that can be evaluated to determine the success of implementation (Nilsen, 2015). As an example, following implementation of an initiative to improve rates of vaccination against enzootic abortion on sheep farms in a community, an evaluation framework could be used to guide measurement of success of the initiative through specifying to examine the number of farms vaccinating, the number of abortions recorded, whether the initiative has led to vaccination being maintained year after year etc.

Many EBP interventions rely on the behaviour change of individuals such as animal owners, farmers and clinicians, therefore unassisted translation into practice is unlikely (Rogers et al., 2014). A recent veterinary review (Biesheuvel et al., 2021) noted that there has been increasing interest over the last decade in understanding the complexities of implementing behaviour change interventions that improve uptake of EBPs. However, this review also concluded that work to date has often failed to consider contextual environments and tended to lack the use of theoretical frameworks and/or empirically validated constructs (Biesheuvel et al., 2021). The use of appropriate TMFs to improve uptake of EBPs has proven a highly valuable approach in fields such as human healthcare and education (Kirk et al., 2015; Moullin et al., 2019). Thus, it is logical to propose that the implementation science approach could be of considerable value to veterinary medicine, therefore improving the health, welfare and productivity of our domestic animal species.

It is unclear to what extent TMFs have been used to inform uptake of EBPs in veterinary medicine. The aim of our research was to identify existing veterinary uses of TMFs to inform uptake of EBPs, and to understand the focus of this usage including species, area of veterinary concern and EBP. We sought to establish the breadth of evidence already

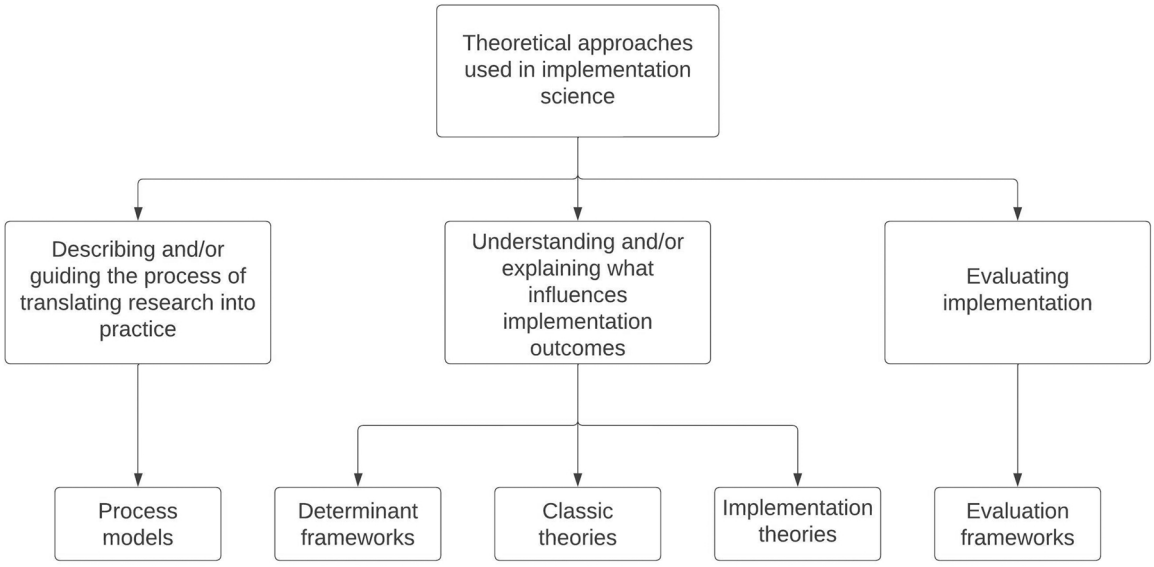


Fig. 1. Three aims of the use of theoretical approaches in implementation science and the five categories of theories, models, and frameworks. From (Nilsen, 2015).

available in the veterinary field and to determine any gaps in the existing knowledge base. As such, a scoping review was chosen as the optimal method for identifying and synthesising the available evidence (Lockwood et al., 2019; Munn et al., 2022) rather than a systematic review.

1.2. Objectives

The review's primary objective was to answer the question: 'What TMFs have been used to inform uptake of EBP (implementation) in veterinary medicine?'. As such the key elements of the review were:

- Population – Not applicable
- Concept – TMF used to inform implementation
- Context – Veterinary medicine

A secondary objective was to explore how the TMFs have been used to inform implementation, including the focus of the study (species, area of veterinary concern, EBP), details of TMF(s) used and whether the use of the TMF was directly related to the recorded implementation of an intervention(s).

2. Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018), in conjunction with the JBI Manual for Evidence Synthesis (Peters et al., 2020) was used to guide the conduct of this review. See Fig. 2 for the flowchart detailing the review process followed.

2.1. Protocol and registration

The objectives, eligibility criteria and methods for this scoping review were specified in advance and documented in an a priori protocol available on the website of the Centre for Evidence-based Veterinary Medicine (www.nottingham.ac.uk/cevm/) and registered on the website of Systematic Reviews for Animals and Food (SYREAF) (www.syreaf.org).

2.2. Eligibility criteria

To be included in the review, papers needed to use a theory, model and/or framework (TMF) to guide, understand/explain and/or evaluate the introduction or increased adoption of a research finding or evidence-based practice (EBP).

Articles were included if:

- they featured gathering of novel data or novel analysis (articles that were opinion pieces or commentary were excluded).
- had an abstract available in English.
- their main focus was relevant to veterinary medicine (Box 1).
- used a TMF(s) to inform implementation (introduction or increased adoption) of an EBP (Box 1).

To allow a comprehensive search, no limits were placed on date of publication up to the date of the initial database search or language of full text, however a full text needed to be available through open access, the University of Nottingham library or the British Library. Articles were excluded if they focused on animals in the wild, animal models of human disease or veterinary education, only used models that were mathematical/numerical or if the focus of the use of the TMF was not humans e.g., where the authors applied a TMF to understand animal behaviour, rather than human behaviour. For clarity, the definitions shown in Box 1 were used.

During the screening process, specific challenges were encountered in following the eligibility criteria, therefore further clarification was made in several areas to ensure consistent interpretation:

- To meet the eligibility criterion of "introduction or increased adoption of a research finding or EBP":
  - It had to be clear from the paper that the main focus of the research involved either introduction or increasing the uptake of a practice.
    - NB, papers that dealt with 'de-implementation' were also included. De-implementation is the reduction of use of a practice evidence has shown to be unnecessary or detrimental.
  - The practice must be evidence or research based - there should have been clear research evidence that demonstrated the benefit of its use.

- To meet the eligibility criterion of "used a TMF":
  - The following criteria were used to define the type of constructs that could be used:
    - Theory – A set of ideas/ principles that attempts to explain the causal mechanisms of implementation – usually implies some sort of predictive capacity (Nilsen, 2015).
    - Model – simplified description of a system or process, used to describe and/or guide the process of translating research into practice (Nilsen, 2015).
    - Framework - A basic structure underlying a system or concept. Has a descriptive purpose by pointing to factors believed or found to influence implementation outcomes (Nilsen, 2015).
  - In some cases, terminology was used in a paper that was the same as used to name a TMF, however, this did not always mean that a TMF had been used. There were two common examples of this:
    - 'Critical success factors' can refer to a framework but also can be used in a less structured context. To be included, papers that named this approach must have classified factors into defined categories, ensuring the process (of uncovering/describing critical success factors) fitted into a defined structure.
    - 'Participatory Action Research' can encompass a style of approach or a formal model. To be included, papers that used this term were required to have detailed the system or process used, giving specifics of the steps/processes that were followed.
- For papers to have a "main focus relevant to veterinary medicine":
  - The 'main focus' was taken to be the single or clearly most significant aim or objective of the paper.
    - Articles that looked at, for example, 'livestock farming' from a holistic whole farm perspective, where animal welfare was a component, but other factors such as economics, staff management, supply chain management etc. were also equally considered, were excluded.
    - To meet the criteria of "the prevention of transmission of animal disease to people" in this study, the behaviours being looked at and/or the stage of transmission had to be directly related to the live diseased animals themselves (and therefore the prevention of transmission of disease from these animals). Studies looking at factors once the products had been removed from the live animal stage – i.e., food preparation, human hygiene practices etc. were excluded.

2.3. Information sources

2.3.1. Databases searched

The initial search involved searching three electronic databases: CAB

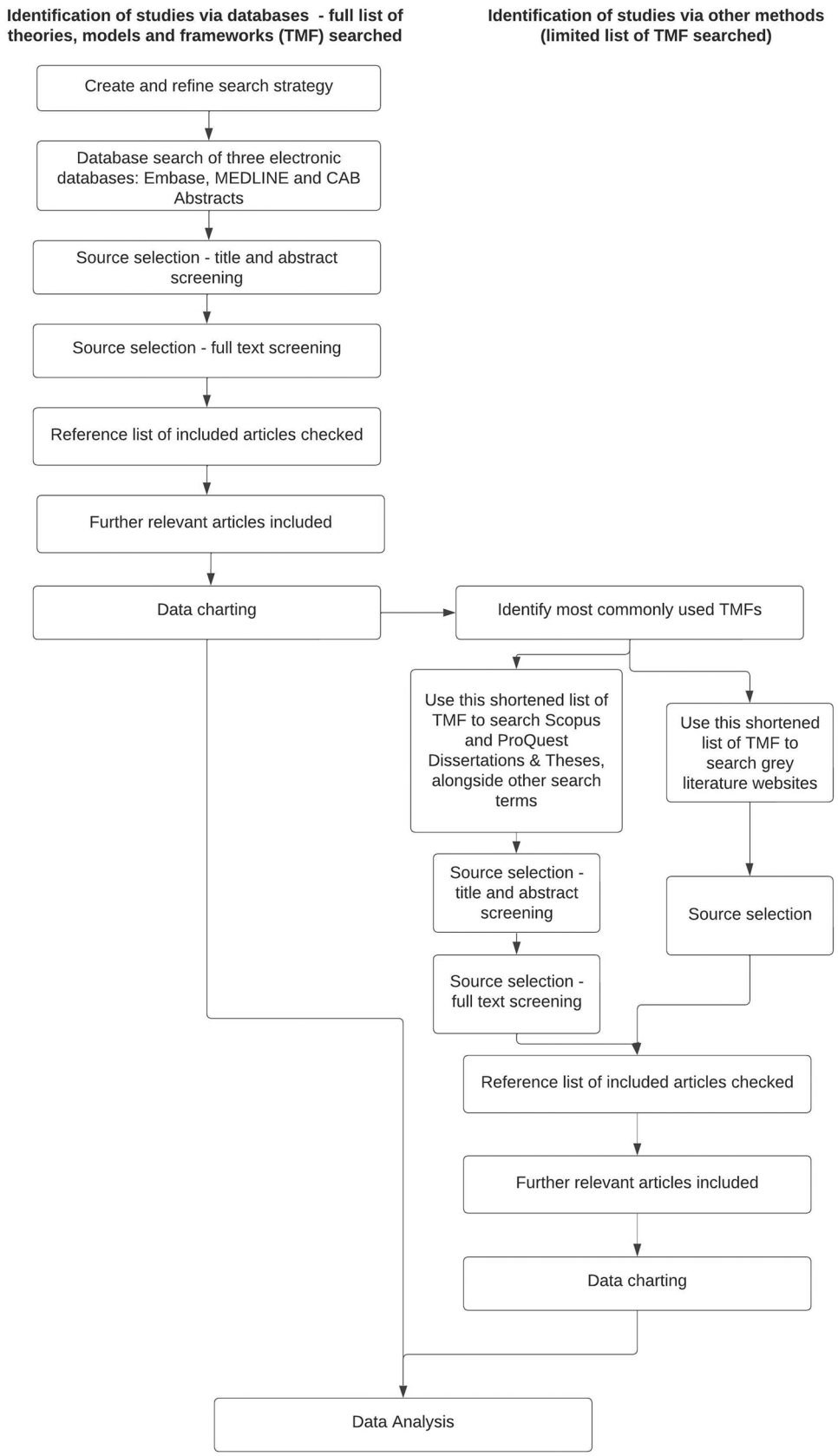


Fig. 2. Flowchart outlining the process followed from search strategy through to data analysis of a scoping review focused on the identification of studies using a theory, model, and/or framework to inform the uptake of evidence-based practices in veterinary medicine.

Box 1
Definitions of three key terms used in eligibility criteria.

Term	Definition
Implementation	The systematic uptake (introduction or increased adoption) of research findings and other EBPs into routine practice (Eccles and Mittman, 2006).
TMF used to inform implementation	Formal constructs that seek to do one or more of three things: (1) describe and/or guide the process of implementation, (2) understand and/or explain what influences implementation outcomes and/or (3) evaluate implementation (Nilsen, 2015)
Veterinary medicine	The maintenance of health of animals through the diagnosis, treatment, prevention and control of diseases or injuries, the promotion of animal well-being and welfare and the prevention of transmission of animal diseases to people. Caveat – to give a feasible scope to the search, animal species were limited to common domestic species – namely chickens, cows, sheep, goats, horses, donkeys, aquaculture, dogs, cats, and rabbits.

Abstracts, MEDLINE and Embase via the Ovid interface. CAB Abstracts was chosen as it gives broad coverage of veterinary journals (Grindlay et al., 2012), with Embase and MEDLINE giving good coverage of medical literature, as well as some veterinary literature (Bramer et al., 2018). Initially, PsycINFO was used to aid in creating the search strategy (see below) however for the scoping review Embase was determined to be a more suitable database. The search strategy is described below, and an example of the search strategy used in Embase is shown in the supplementary file. Following the initial database search, selection and extraction, the most common TMFs used were identified. These TMFs were then run as a search in Scopus alongside the generic implementation terms and the veterinary medicine terms (see Fig. 2 and the supplementary file). Reference lists for all included papers were also checked to identify any further relevant articles (Horsley et al., 2011).

2.3.2. Search of grey literature

To identify relevant grey literature, the websites of UK/international organisations known to have produced work in this area were searched utilising the list of most common TMFs, (see the supplementary file) alongside ProQuest Dissertations & Theses.

2.4. Generation of search strategies and execution of searches

An approach adapted from Bramer et al. (2018) was followed to formulate the search strategy and an experienced librarian (AA) advised on the drafting of the final search protocol.

The approach of many reviews exploring TMFs that inform implementation has been to utilise search terms involving generic 'implementation' terminology such as 'implementation model', 'dissemination' or 'implementation' (Mitchell et al., 2010; Albers et al., 2017; Dadich et al., 2021; Huybrechts et al., 2021). However, there is a lack of consistent use of terminology to describe 'implementation' in the veterinary literature, therefore this approach was not deemed appropriate. Instead, an approach based on that used by Tabak et al. (2012) and Strifler et al. (2018) where a list of named TMF were searched was adopted and modified.

To create a suitable list of TMFs to become a component of the search strategy, the following steps were followed:

1. An initial list of TMFs was created by consulting six existing review articles involving assessment of dissemination and implementation, knowledge transfer or implementation TMFs in human healthcare (Tabak et al., 2012; Moullin et al., 2015; Strifler et al., 2018; Esmail et al., 2020; Fixsen et al., 2021; Huybrechts et al., 2021) and www.dissemination-implementation.org - the latter of which has a list of TMFs which forms the basis of a tool for assisting implementation researchers.
2. Three databases were then searched in November 2021 (MEDLINE, CAB Abstracts and PsycINFO) using the following strategy:
   i. "implementation model*" OR "implementation theor*" OR "implementation framework*" OR subject heading/MeSH 'Implementation Science'
   ii. Limit to last 5 years
   iii. Exclude articles that were not health/medical context (i.e. computer science, economics)
3. Titles and abstracts were then manually screened to identify further TMFs:

   This resulted in a final list of 591 TMFs. For each named TMF, a search term was created using appropriate syntax for the Ovid interface (see the supplementary file). Each term was individually searched on Embase to ensure that it was effective at capturing relevant papers – i.e. that papers identified by utilising that search term did contain the named TMF being searched for. Where necessary, terminology was intentionally broad to ensure a comprehensive search.

   The final search strategy consisted of search terms relevant to the list of 591 TMFs, combined with more generic 'implementation' terminology to ensure that the search was comprehensive. This was searched alongside terminology relevant to 'veterinary medicine' to form the full search query (see the supplementary file).

2.5. Selection of sources of evidence

Individual database search results were imported into Endnote X9 (The EndNote Team, Philadelphia, PA) and duplicates removed. The full reference list was then imported into Rayyan (www.rayyan.ai), a software programme that aids collaboration amongst reviewers, for source selection. Selection of sources of evidence occurred in two stages. Title and abstracts were screened initially, with any studies identified as potentially relevant based on the eligibility criteria being reviewed at full text.

Study selection was done following an approach adapted from Pollock et al. (2018). Two reviewers (RR and CS) reviewed the title and abstracts for a random selection of 10% of the citations. Agreement between reviewers was assessed and any discrepancies discussed with the wider team (MB and IR), resulting in minor adjustments to the screening criteria to improve clarity. Subsequently it was agreed that the same two reviewers should review a further 10% of citations and if agreement was at least 95% with these refined criteria then subsequent screening of titles and abstracts would be performed by one reviewer only. Any disagreements were resolved by discussion with the wider

team (MB and IR). The agreement reached was 95% and therefore one reviewer (RR) screened the remaining titles and abstracts. Discussion with the full research team then led to further refining of the eligibility criteria prior to commencing full text screening.

The next stage of selection was to review the full texts of the remaining articles. Taking the approach by Pollock et al. (2018), two reviewers (RR alongside either MB or IR) independently screened 10% of the citations with disagreements being resolved by discussion between the reviewers. Agreement between reviewers was assessed and any discrepancies discussed with the full research team, resulting in alterations to the screening criteria and clarifications of the definitions. The same reviewers then reviewed a further 10% of citations, an agreement of 95% was reached and therefore one reviewer (RR) completed the remainder of the source selection, consulting with the other two reviewers as necessary.

Reviewers were not blinded to title or authors of papers. Although not orchestrated, the random selection of articles reviewed by each reviewer never contained articles for which they were a named author on.

Source selection at all stages was done following a prescribed set of selection criteria set out as questions in a flowchart relevant to that stage (see the supplementary file). To aid consistency between reviewers, a Microsoft Form version of the flowchart was also created for the full text screening stage of the process.

For sources from the grey literature, a similar process was followed – with articles from the search of ProQuest Dissertations & Theses undergoing title and abstract screening followed by full text screening. Articles identified from other websites were assessed at full text level. In all cases source selection was guided by the eligibility criteria.

2.6. Data charting

Following screening, data were extracted from included articles using a Microsoft Form predesigned by RR and then downloaded into an Excel sheet (see the supplementary file). The form was pre-tested by RR using a random sample of 10 studies, and improvements were made as necessary. The data charting approach adopted was based on that used by Allen et al. (2019) where one reviewer (RR) completed the entirety of the data charting, and a second reviewer (IR) charted the data for a random sample of 20 studies (29%) to check that data extraction had been consistent and accurate. Discussion between reviewers (RR and IR) was used to resolve any discrepancies, including a third reviewer (MB) where necessary.

2.7. Data items

For each included article, the following data items were identified and extracted.

- Article characteristics - e.g., date of publication, country where study conducted.
- Focus of study - e.g., species, area of veterinary concern, EBP.
- Details of TMF(s) used - e.g. name of TMF, classification (process model, determinant framework, classic theory, implementation theory, evaluation framework (Nilsen, 2015)), use for data collection and/or analysis.
- Whether the use of the TMF was directly related to the recorded implementation of an intervention(s) – e.g., the TMF was being used with the aim of aiding the implementation (introduction/improved uptake) of a specific intervention, and the implementation of that intervention was described either in that paper or in another paper that was clearly referenced.

Studies that met this final criterion were then further explored and the following additional data items identified and extracted:

- Healthcare providers involved – e.g. farmer, animal owner, veterinarian.
- Levels of the socio-ecological model (SEM) involved (individual, interpersonal, community, organisational, policy). Briefly, the levels of the SEM were defined as follows (Oludoye et al., 2021):
  - o Individual
    - ■ Concerned with an individual's knowledge and skills – knowledge about a disease, skills etc.
    - ■ Other characteristics that could influence behaviour change such as age, sex, finances etc.
  - o Interpersonal
    - ■ To do with a person's relationships with other people e.g., how other people influence them/ how they can influence other people. Includes social networks and social support systems.
  - o Organisational
    - ■ Things individual organisations can do – e.g., farms, veterinary practices, educational institutions as well as how this can influence how successfully interventions are delivered.
  - o Community
    - ■ Culmination of the impact of various organisations in an area e.g., group of farms, combination of vet practices and farms etc. including the relationships between businesses, organisations etc.
  - o Policy maker
    - ■ Impact/influence from governing bodies (including government but also authorities such as milk supplier, contract holders etc.), inclusive of provision of services, funding etc.

- Implementation stages covered by the TMF – development, communication, exploration, installation, operation, sustainability (Moullin et al., 2015; Greenhalgh et al., 2004):
  - o Development
    - ■ Innovation creation, refinement, and impact evaluation.
  - o Communication
    - ■ Process by which people share information about a new innovation to increase awareness.
  - o Exploration
    - ■ The innovation-decision process, whereby the end-user(s) appraise the innovation to decide whether to adopt.
  - o Installation
    - ■ The course of preparation, prior to use.
  - o Operation
    - ■ Active and planned efforts to mainstream an innovation within an organisation.
  - o Sustainability
    - ■ Making an innovation routine until it reaches obsolescence.

2.8. Synthesis of results

The findings were summarised using a narrative approach, with results presented via a combination of tables, graphs, figures, and descriptive text. The studies were examined as individual entities based on the data as reported in each paper. The data with respect to the type of EBP practice being studied were grouped into 12 groups based on topic area as detailed in the supplementary file.

3. Results

3.1. Selection of sources of evidence

The search of CAB Abstracts, MEDLINE and Embase was conducted on 16th February 2022 and gave 5335 citations. The search of Scopus

gave 1431 citations, giving a total of 6766 citations. Once duplicates had been removed, 4429 unique citations remained. Three hundred and eighty-seven full texts remained after title and abstract screening. Of these, 7 full texts could not be retrieved and therefore were not assessed for inclusion. A further 317 articles were excluded following full text screening (Fig. 3).

Checking reference lists of included articles identified a further 5 articles. Searching of relevant websites for grey literature did not identify any further articles for inclusion. A search of ProQuest Dissertations & Theses identified 2 potential further articles, but it was not possible to obtain the full text of these through the channels available. Full details on study characteristics of the 68 included studies is available in the supplementary file.

3.2. Locations of where studies were conducted, and date published

The studies included were conducted in 41 different countries (Fig. 4). Of the 67 studies that specified countries, 17 (25%) of these studies were conducted in the United Kingdom. Using the United Nations classification system for country status (United Nations, 2022), most studies (n = 45, 67%) were conducted in countries with developed economies, and 33% of studies (n = 22) were conducted in countries with developing economies.

The earliest included papers were published in 2006, with 67% (n = 45) published in the last 6 years (2016 onwards) (Fig. 5).

3.3. Species, area of veterinary concern and evidence-based practice (EBP) studied

All but one study specified the species of interest (n = 67, 99%) (Fig. 6). The majority (n = 53, 78%) of studies dealt with animals kept for production and/or to support livelihoods, with only 22% (n = 15) of studies looking at animals kept as companions. The most common production animal species were cattle (n = 38, 56%), with pigs and sheep (each n = 18, 27%) also well represented. With regards to animals kept as companions, dogs featured most often (n = 11, 16%).

The included studies covered a diverse range of 31 different areas of veterinary concern (Table 1). The most studied area was animal welfare (including, but not limited to, environmental enrichment, group housing, responsible ownership etc., n = 10, 15%), with antibiotic resistance (n = 8, 12%), and rabies (n = 7, 10%) also featuring commonly. Interestingly, a reasonable number of studies (n = 25 – 37%) dealt with conditions that have a potential to impact human health, such as zoonotic diseases or antimicrobial resistance.

Alongside a diverse range of conditions, there was also a diverse range of EBPs studied, which were grouped into 12 broad categories (Fig. 7, Supplementary file). The most common EBP studied was vaccination (n = 18, 26%), including for rabies (n = 8, 12%) and bluetongue (n = 3, 4%), alongside a range of other infectious diseases. Management changes (including, but not limited to; exercise, movement, culling etc.) were also focused on in a large number of studies (n = 16, 24%), with changes to housing and environment and antimicrobial stewardship also being commonly studied (n = 8, 12% and n = 9, 13% respectively). Interestingly, the majority of studies looked at EBPs that can be described as preventive medicine practices (n = 39, 57%).

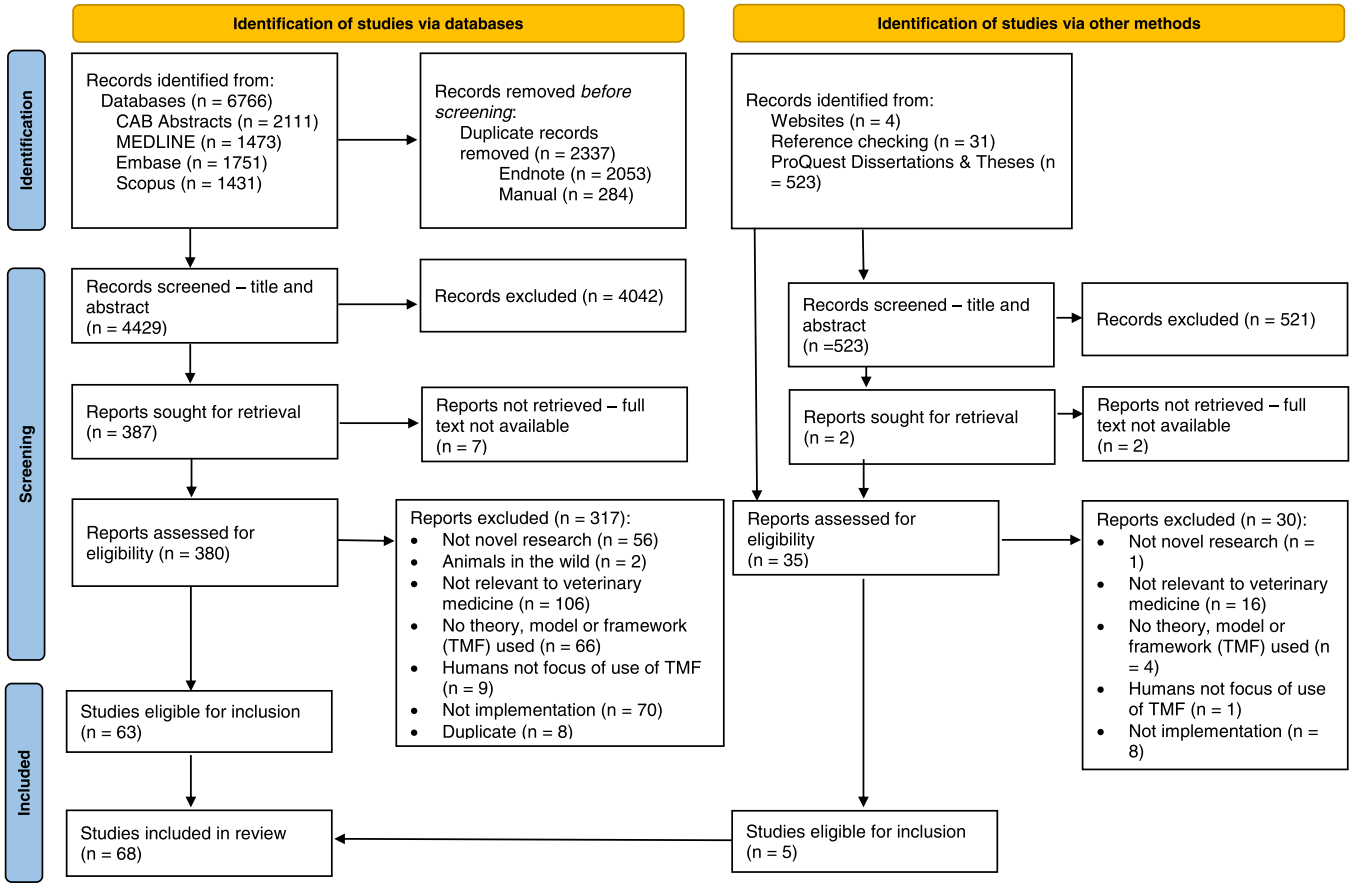


Fig. 3. PRISMA flowchart detailing study selection process for a scoping review identifying studies utilising a theory, model, and or/framework to improve the uptake of evidence-based practices in veterinary medicine.
Adapted from (Page et al., 2021).

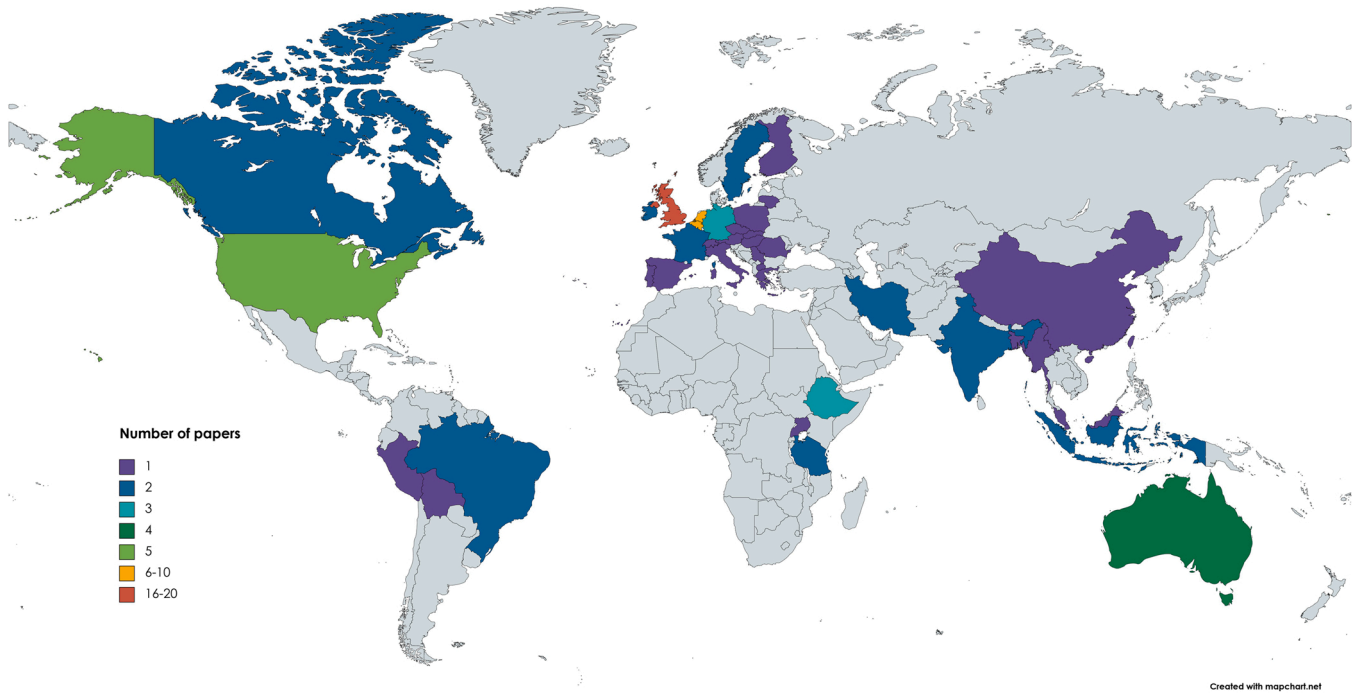


Fig. 4. Worldwide distribution of study location of the 67 studies that specified location of the study identified by a scoping review that utilised a theory, model and/or framework to inform uptake of evidence-based practices in the context of veterinary medicine. Some studies were conducted in more than one country.

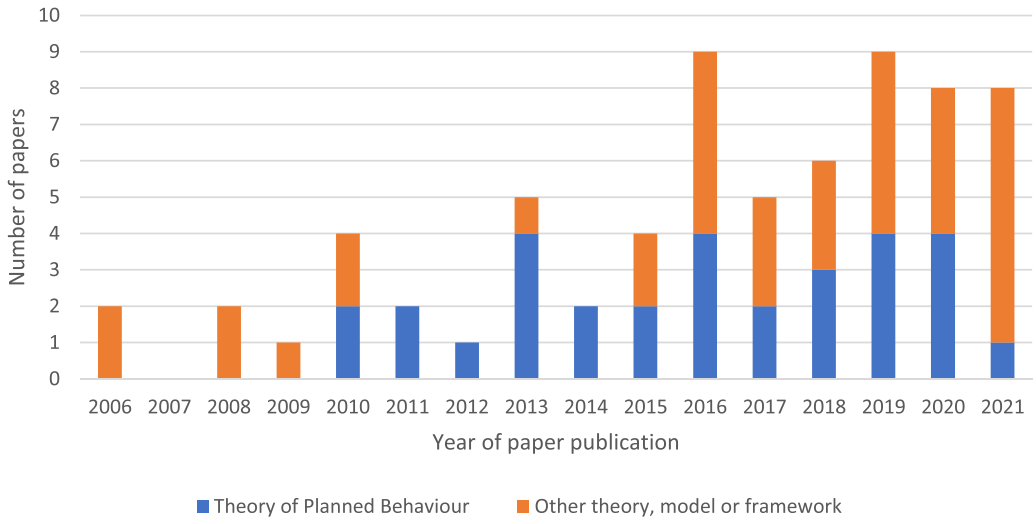


Fig. 5. Bar chart highlighting the number of the 68 studies identified by a scoping review of studies utilising a theory, model and/or framework (TMF) to inform uptake of evidence-based practices in the context of veterinary medicine by year published, including details of whether the TMF used was the Theory of Planned Behaviour or another TMF. Some studies used more than one TMF.

3.4. Theories, models and/or frameworks (TMFs) used to inform implementation

Twenty-eight different TMFs were used in the included studies, although half of these (n = 14, 50%) were only used in one study each (Table 2). By far the most commonly used TMF was the Theory of Planned Behaviour (TPB) (with or without extending the basic theory), which was used in 31 studies (46%).

The majority of studies used TMFs with the aim to understand and/or explain what influences implementation outcomes (n = 65, 96%), with classic theories being the most common (n = 55, 81%), followed by determinant frameworks (n = 9, 13%). There was only a single example of use of an implementation framework (Normalisation Process Theory). A small number of studies used a process model (Intervention Mapping) (n = 2, 3%) or evaluation frameworks (PRECEDE-PROCEED and Realistic Evaluation) (n = 3, 4%).

A number of studies (n = 14; 21%) used a TMF solely to analyse data that had been gathered – either by that study or from pre-existing data sources. However, in most studies (n = 53; 78%) the TMFs were used both to influence data gathering as well as data analysis. In only one study was a TMF used solely to plan data gathering, but not for analysis (Fig. 8).

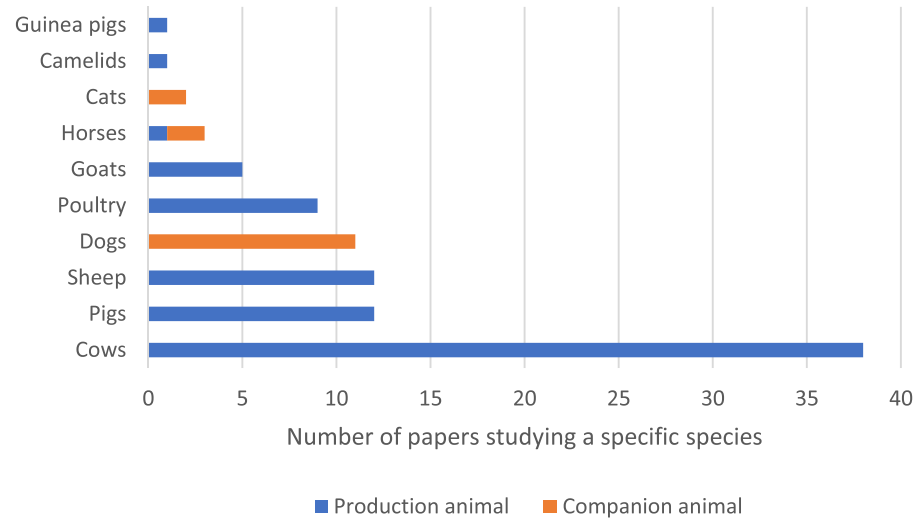


Fig. 6. Bar chart demonstrating 67 studies identified by a scoping review of studies utilising a theory, model and/or framework to inform uptake of evidence-based practices in the context of veterinary medicine by species studied, including division into production or companion animals. Many papers stated more than one species, however one paper included in the review did not state a specific species, and so is not included in this figure.

Table 1
Table showing the 31 different areas of veterinary concern studied in the 68 papers identified by a scoping review that utilised a theory, model and/or framework to inform uptake of evidence-based practices in the context of veterinary medicine, including the number of studies featuring that area of veterinary concern. Some papers featured more than one area of veterinary concern so add up to more than 68.

Area of veterinary concern	Number of studies	Percentage of studies
Animal welfare	10	15%
Not specified	8	12%
Antibiotic resistance	8	12%
Rabies	7	10%
Gastrointestinal nematodes	4	6%
Foot and mouth disease	4	6%
Bluetongue	3	4%
Canine obesity	3	4%
Brucellosis	2	3%
Fertility	2	3%
Highly pathogenic avian influenza	2	3%
Mastitis (cattle)	2	3%
Psoroptic mange	2	3%
Newcastle disease	2	3%
Calf scour	1	1%
Bovine viral diarrhoea	1	1%
Cutaneous adverse food reactions	1	1%
Failure of passive transfer	1	1%
Feline heart disease	1	1%
Fly strike	1	1%
Foot health	1	1%
Footrot	1	1%
General performance and health	1	1%
Hendra virus	1	1%
Hepatitis E	1	1%
Lamb mortality	1	1%
Sleeping sickness	1	1%
Salmonella	1	1%
Taenia solium	1	1%
Anthrax	1	1%
Swine Fever	1	1%

3.5. Use of TMF(s) to directly inform the recorded implementation of an intervention(s)

Only a small number of studies (n = 8, 12%) reported the use of a TMF alongside/in conjunction with the actual implementation of an intervention(s) (Table 3). In comparison to the main body of studies, the aims and therefore categories of TMFs used in this subset of studies were more varied, including evaluation frameworks (n = 3, 38%), classic theories (n = 3, 38%), a determinant framework (n = 1, 13%) and a combination of a process model and classic theory (n = 1, 13%).

In terms of the healthcare providers involved, all but one of the subset of eight studies (n = 7, 88%) included a focus on the animal owner or farmer - the exception to this was a single study just on veterinarians. Only one study included a policy maker (Fig. 9).

The eight studies that reported the use of a TMF alongside/in conjunction with the actual implementation of an intervention(s) were also examined for the levels of the socio-ecological model (SEM) that they covered (Fig. 10).

Lastly, the subset of eight studies that reported the use of a TMF alongside/in conjunction with the actual implementation of an intervention(s) covered a reasonably large range of implementation stages, with all studies (n = 8, 100%) covering operation, alongside installation (n = 7, 88%), communication (n = 6, 75%), development (n = 5, 63%) and exploration (n = 5, 63%). However, none of the studies covered the sustainability (i.e. long term maintenance of usage) aspect of implementation. All studies included more than one level of implementation, with a median of four levels of implementation covered by each study (IQR 2–4.25).

4. Discussion

This scoping review sought to characterise and map existing uses of theories, models and/or frameworks (TMFs) to inform the uptake of evidence-based practices (EBPs) in veterinary medicine. To the authors' knowledge, it is the first review in any field to generate such an extensive list of existing TMF and this alone is likely to be a useful resource. The review found 68 studies that met the eligibility criteria, representing a moderate body of evidence. As has been found previously in human behaviour reviews related to veterinary medicine (Biesheuvel et al., 2021), the body of literature has increased primarily over the last 5–10 years. This likely reflects a growing appreciation in recent years of the value of psychological and sociological concepts in veterinary medicine and signposts to the likely future potential of utilising implementation science approaches in this discipline. This review focused specifically on studies where a TMF was utilised to inform implementation. As such it did not address studies where implementation of an EBP was conducted without use of a TMF. It is interesting to note that work by other authors that include looking at aspects of the implementation process in veterinary medicine – for example the recent review by Biesheuvel et al.

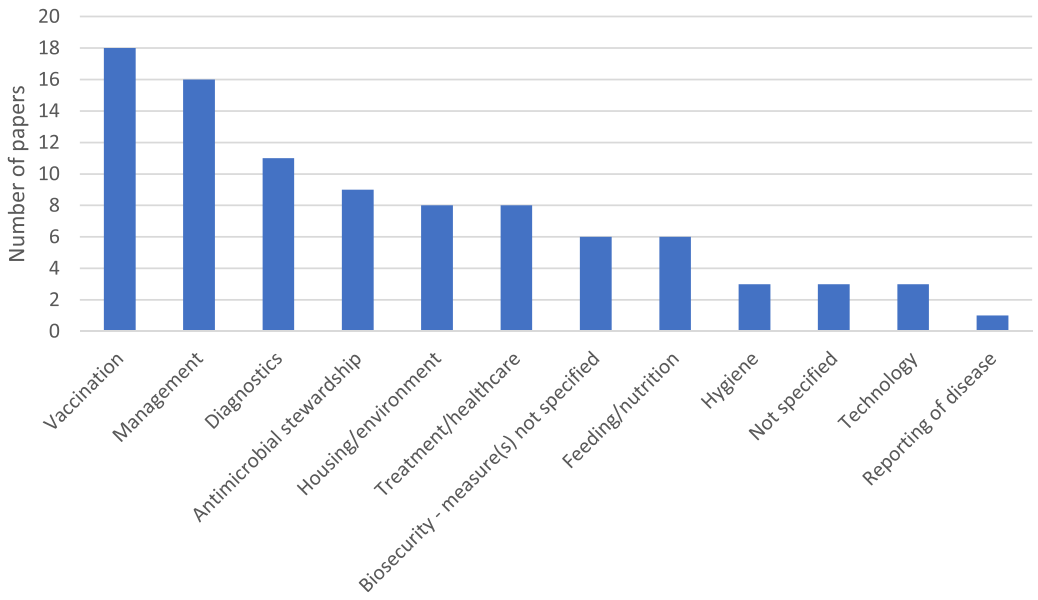


Fig. 7. Bar chart demonstrating the number of the 68 papers identified by a scoping review of studies utilising a theory, model and/or framework to inform uptake of evidence-based practices in the context of veterinary medicine by evidence-based practice studied, as classified into 12 groups. Details of the grouping are set out in the supplementary file. Some papers studied more than one evidence-based practice.

Table 2
Table illustrating the 28 different theories, models and frameworks used to inform uptake of evidence-based practices in the context of veterinary medicine featuring in the 68 studies identified by a scoping review. Some studies used more than one theory, model and/or framework.

Theory, model or framework (TMF)	Number of studies utilising this TMF	Percentage of studies utilising this TMF
Theory of Planned Behaviour	31	46%
Health Belief Model	7	10%
Reasoned Action Approach	4	6%
Theory of Reasoned Action	4	6%
Diffusion of Innovations	3	4%
SWOT	3	4%
PRECEDE-PROCEED	2	3%
Intervention Mapping	2	3%
Social Cognitive Theory	2	3%
Pathway to Disease Control Model	2	3%
Framework of Vande Velde 2015	2	3%
Social-Ecological Model	2	3%
Protection Motivation Theory	1	1%
Realistic Evaluation	1	1%
RESET Mindset Model	1	1%
Normalisation Process Theory	1	1%
PESTEL	1	1%
Systems Engineering in Patient Safety (SEIPS) Framework	1	1%
Self Determination Theory	1	1%
Implementation Intentions	1	1%
Control Theory	1	1%
Technology Acceptance Model	1	1%
Transtheoretical Model of Behaviour Change	1	1%
A framework for socio-anthropological engagement in NTD intervention effectiveness research and programme planning	1	1%
Analytical framework linking factors that influence farmers' disease risk management behaviour	1	1%
Model of factors influencing AMU	1	1%

(2021) – has shown that the majority of studies lack use of a theoretical framework.

There was significant diversity in the focus of the studies – including study location, area of veterinary concern and the EBPs studied. This suggests a sporadic nature to the existing research. However, there were some clear trends. Production animals were studied much more than companion animals, with preventive medicine practices being the most common type of EBP featured. Alongside this, this presents a clear gap in the use of these approaches to aid veterinary medicine involving companion animals, as well as to explore non-preventive practices such as selection of evidence-based approaches to treatment.

The majority of studies used a TMF to inform data collection, which is a similar proportion to the results found by Birken et al. (2017) in relation to human health. However, in human health the most used TMFs include the consolidated framework for implementation research (CFIR), theoretical domains framework (TDF) and reach, effectiveness, adoption, implementation, maintenance (RE-AIM) (Birken et al., 2017; Dadich et al., 2021). These TMFs cover a variety of different categories (Nilsen, 2015). Conversely, our review highlighted that the usage to date in veterinary medicine has chiefly focused on longstanding classic theories – with the Theory of Planned Behaviour (TPB) featuring in the majority of studies. The clear advantage of employing long standing TMFs is the proven value and applicability of their usage (Birken et al., 2018). However, classic theories such as the TPB, the Theory of Reasoned Action and the Health Belief Model chiefly incorporate psychological variables, without considering any practical factors that can influence behaviour. The usage of the TPB in human health behaviour change research reached a peak in popularity in 2007–2012 (Dotzauer, 2017). Critical commentaries from psychologists such as Sniehotta et al. (2014) then led to the focus moving on to newer TMFs that consider practical variables as well as psychological ones (Kaufman et al., 2021). It is proposed that the usage of TMFs in veterinary medicine needs to similarly move on from older, classic theories, to embrace the newer, more complex, and potentially more valuable TMFs that are now available and gathering a persuasive evidence base (Sniehotta et al., 2014). Promisingly, this shift may have started, with 2021 representing the first year since 2009 where less than 40% of included studies utilised the TPB.

Following on from this, our review has highlighted that the usage of TMFs to understand and/or explain what influences implementation outcomes, including barriers and facilitators, was exceptionally common. This can be highly valuable in providing information and explanations about factors influencing uptake of EBP and hence the

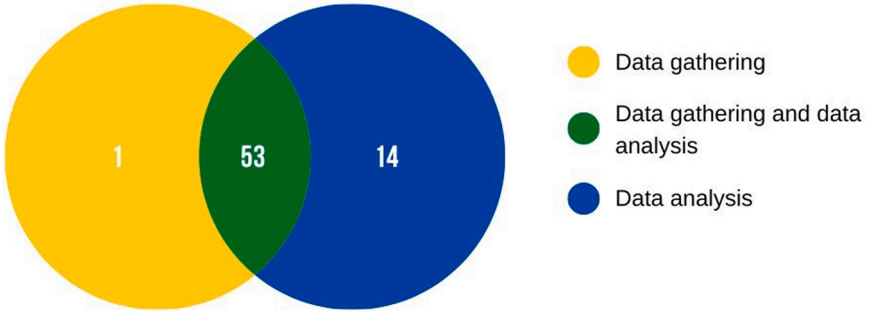


Fig. 8. Venn-diagram demonstrating the number of the 68 studies identified by a scoping review that used a theory, model and/or framework(s) for data gathering and/or data analysis to inform uptake of evidence-based practices in veterinary medicine.

Table 3
Table detailing the eight studies identified by a scoping review that used a theory, model and/or framework to inform uptake of evidence-based practices alongside recording the actual implementation of an intervention in a veterinary context.

Paper	Theory, model and/or framework (s) (TMF) used	Category of TMF (s)	Healthcare providers involved	Level (s) of socio-ecological model considered	Implementation stages covered
Bahadori et al. (2021)	PRECEDE-PROCEED	Evaluation framework	Animal owner/farmer	Individual	Development Communication Installation Operation
Koralesky et al. (2021)	Realistic Evaluation	Evaluation framework	Animal owner/farmer, Other farm staff	Individual Interpersonal Organisational	Exploration Installation Operation
Rees et al. (2021)	Self Determination Theory	Classic theory	Veterinarian	Individual Interpersonal Organisational	Development Communication Installation Operation
Bowman et al. (2020)	Diffusion of Innovations	Classic theory	Animal owner/farmer, Extension agents	Individual Interpersonal Organisational	Communication Exploration Installation Operation
Gautam et al. (2020)	Intervention Mapping, Social Cognitive Theory, Theory of Planned Behaviour	Process model, Classic theory	Veterinarian, Animal owner/farmer, Non-animal owning associated humans, Policy maker	Individual Organisational Community	Development Communication Exploration Installation Operation
Webb et al. (2018)	Control Theory, Theory of Implementation Intentions, Theory of Planned Behaviour	Classic theory	Animal owner/farmer	Individual	Development Operation
Lam et al. (2017)	RESET Mindset Model	Determinant framework	Animal owner/farmer, Veterinarian, Veterinary para-professional	Individual Interpersonal Organisational Policy maker	Development Communication Exploration Installation Operation
Ngowi et al. (2009)	PRECEDE-PROCEED	Evaluation framework	Animal owner/farmer, Extension agents	Individual Interpersonal Organisational Community	Communication Exploration Installation Operation

popularity of this approach is not surprising. However, a persistent focus on solely understanding and/or explaining what influences implementation outcomes is at the expense of studies utilising other categories of TMF – namely process models and evaluation frameworks. Process models aim to facilitate the process of translating evidence into practice. Their value is in providing a guide through the often complex and varied steps that are necessary to consider if sustainable uptake of an EBP is to be realised (Nilsen, 2015). A criticism of process models could be that they may lack the capacity to fully understand factors that influence implementation outcomes, however this can be overcome by using process models alongside TMFs that aid in understanding and/or explaining what influences implementation outcomes – as was done in both studies utilising process models included in this review (Campbell et al., 2017; Gautam et al., 2020). Evaluation frameworks cover the essential study of the success of implementation of an intervention. As such they are the chief informer of whether applying other TMFs has proven effective, particularly if considering the important aspect of ensuring sustainability of uptake of EBPs (Nilsen, 2015). This is an area of growing focus in the broader field of implementation science (Nadalin Penno et al., 2019), highlighting the value that could be gained from more consideration of this approach in veterinary medicine implementation efforts.

Very few studies featured the use of a TMF(s) directly related to the recorded implementation of an intervention(s). Given that this review attempted to identify usage of TMFs across the whole field of veterinary medicine, this number is remarkably small. Furthermore, it is consistent with what Glanville et al. (2020) found when looking at approaches of human behaviour change studies in animal care – that only a small number of studies go beyond explaining behaviour to trialling an intervention. There are several possible explanations for this. Potentially the most likely reason is that the approach of using TMFs to inform uptake of EBPs is unfamiliar to researchers in the veterinary field, and therefore the usage of a TMF alongside an implementation effort, which is a complex process, could be beyond the existing knowledge and

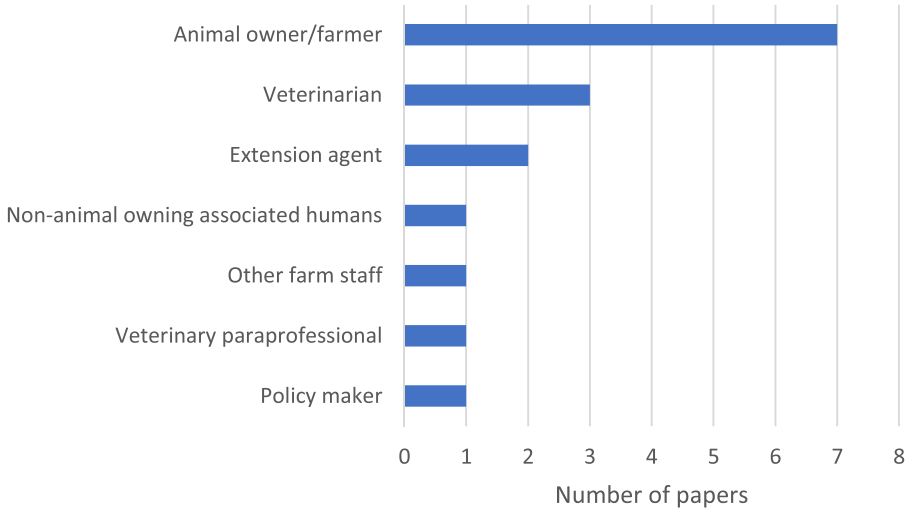


Fig. 9. Bar chart showing healthcare provider(s) involved in the eight studies identified by a scoping review that utilised a theory, model and/or framework to inform uptake of evidence-based practices alongside the recorded implementation of an intervention in veterinary medicine. Some studies involved more than one type of healthcare provider.

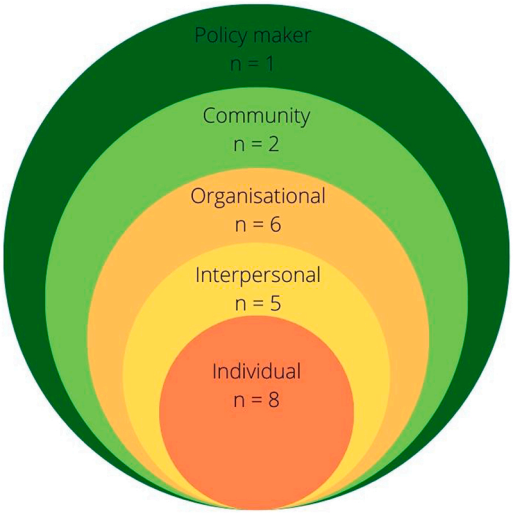


Fig. 10. Diagram illustrating the number of papers covering each level of the socio-ecological model from the subset of eight studies identified in a scoping review that utilised a theory, model and/or framework to inform uptake of evidence-based practices where theory, model and/or framework use was directly associated with the recorded implementation of an intervention. All studies covered more than one level of the socio-ecological model.

skillset of many researchers. Another significant factor could be resource availability – it is much more straightforward and economical to conduct an attitudinal study rather than an intervention trial (Glanville et al., 2020). There is potential that utilising learnings from human health implementation research could assist veterinary researchers to design and execute implementation research studies (i.e., studies that involve implementing an intervention that seeks to improve the uptake of an EBP) that are both informative and reasonably resource light.

The actual implementation of an intervention can be a lengthy and complex process, requiring multiple stages and often involving multiple levels of healthcare providers in a diverse range of settings (Bauer et al., 2015). There was a significant trend for studies here to focus on the animal owner/farmer. Whilst the direct carer of an animal is clearly highly relevant when it comes to improving uptake of an EBP, it is widely recognised that factors beyond the individual carer are also highly influential (Urquhart et al., 2014). A similar pattern is seen when analysing the levels of the socio-ecological model covered by the study – with the majority of studies focusing on individual, interpersonal and organisational levels, and much less focus on community or policy maker levels. Whilst this focus on more personal levels can provide valuable insights, in order to achieve sustainable behaviour change, consideration of wider contextual levels (community and policy maker) need to also be included (Michie et al., 2011; Biesheuvel et al., 2021). This issue is similarly reflected when looking at the stages of implementation covered. None of the included studies sought to support or evaluate the sustainability of an intervention once it had been implemented. This represents a significant gap in the existing research, and whilst the initial implementation of an EBP is clearly significant, maintaining the usage of that EBP is equally, if not more valuable in achieving sustainable positive impacts on animal health and welfare.

4.1. Limitations

Although significant attempts were made to create a comprehensive search strategy, the approach used does have some potential limitations. The list of TMFs searched may not be fully comprehensive, the lack of consistency in terminology used to name certain TMFs may have led to search terms being incomplete, and the search strategy required the TMF to be named in specific fields. Thus, it is possible that some studies were inadvertently missed. However, the approach used was deemed the most optimised for a topic without unique search terms (e.g., 'implementation') by the researchers which included an information specialist, and to the authors' knowledge is the first review in any field to use such an extensive list of TMF.

A further potential limitation is reflected in the eligibility criteria used. Studies were required to have a main focus on veterinary medicine. This led to the exclusion of a number of studies that took a wider viewpoint, particularly of farming situations, where relevant veterinary topics were explored alongside other aspects such as productivity, sustainability, or economics. It is possible that this also led to the exclusion of valuable information that was relevant to veterinary medicine. Similarly, the eligibility criteria stated that studies had to report that the intention was to improve the uptake of an EBP. It was noted that in some cases, papers did not clearly specify the reason or intention of the research work. As such these articles were excluded from this review.

Additionally, there were some necessary deviations from the a priori protocol (see the supplementary file). These included adjustments to the review objective, eligibility criteria, source selection and data charting processes. The adjustments in objective and eligibility criteria and the

inclusion of only obviously relevant studies were intended to improve the research's ability to answer the aim of the review.

Despite the limitations, this body of work is the first to provide evidence of significant gaps in the use of TMFs to inform uptake of EBPs within veterinary medicine. Recognition of this is critical for improving many areas of focus for animal health and welfare, where there is an existing consistent challenge of poor implementation of proven EBPs.

5. Conclusion

Existing use of theories, models and/or frameworks (TMFs) to improve uptake of evidence-based practices (EBPs) in veterinary medicine are diverse, and have been used in many countries and areas of veterinary concern. However, usage does appear to be sporadic. There are few examples where previous research is built on to inform further research. Furthermore, existing studies primarily utilise classic theories to understand and/or explain factors influencing uptake of EBPs without addressing the later stages of the implementation process (e.g., actual implementation, monitoring or evaluation). Without applying this factorial information to an actual implementation effort, the potential benefit cannot be realised. There is a need for veterinary researchers to develop better interdisciplinary collaborations with human implementation experts to gain from those more experienced in this emerging field, including understanding and incorporating more recently developed TMFs and further utilisation of process models and evaluation frameworks. Future work also needs to consider wider contextual levels including the role of community and policy makers, whilst considering the sustainability of interventions to improve the usage of EBPs.

Data Access Statement

No new data were created during this study.

Funding

Rosemary Reyneke's PhD is funded by the Biotechnology and Biological Sciences Research Council (BBSRC) and MSD Animal Health. The study design, analysis, interpretation of the results, decision to publish and writing of the paper were undertaken independently of the funders of this work.

Declaration of Competing Interest

The authors have no conflict of interest to declare. The study design, analysis, interpretation of the results, decision to publish and writing of the manuscript were undertaken independently of the funders of this work.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.prevetmed.2023.105928.

References

Albers, B., Mildon, R., Lyon, A.R., Shlonsky, A., 2017. Implementation frameworks in child youth and family services - results from a scoping review. Child. Youth Serv. Rev. 81, 101–116. https://doi.org/10.1016/j.childyouth.2017.07.003.

Allen, L.M., Palermo, C., Armstrong, E., Hay, M., 2019. Categorising the broad impacts of continuing professional development: a scoping review. Med. Educ. 53, 1087–1099. https://doi.org/10.1111/medu.13922.

Bahadori, F., Ghofranipour, F., Zarei, F., Ziaei, R., Ghaffarifar, S., 2021. Application of the precede - proceed model in prevention of brucellosis focused on livestock vaccination process. BMC Vet. Res. 17, 384. https://doi.org/10.1186/s12917-021-03099-y.

Balas, E.A., Boren, S.A., 2000. Managing clinical knowledge for health care improvement. Yearb. Med. l Inf. 9, 65–70.

Bauer, M.S., Damschroder, L., Hagedorn, H., Smith, J., Kilbourne, A.M., 2015. An introduction to implementation science for the non-specialist. BMC Psychol. 3, 32-32. https://doi.org/10.1186/s40359-015-0089-9.

Beyene, T.J., Mindaye, B., Leta, S., Cernicchiaro, N., Revie, C.W., 2018. Understanding factors influencing dog owners' intention to vaccinate against rabies evaluated using health belief model constructs. Front. Vet. Sci. 5, 159. https://doi.org/10.3389/fvets.2018.00159.

Biesheuvel, M.M., Santman-Berends, I., Barkema, H.W., Ritter, C., Berezowski, J., Guelbenzu, M., Kaler, J., 2021. Understanding farmers' behavior and their decision-making process in the context of cattle diseases: a review of theories and approaches. Front. Vet. Sci. 8. https://doi.org/10.3389/fvets.2021.687699.

Birken, S.A., Powell, B.J., Shea, C.M., Haines, E.R., Alexis Kirk, M., Leeman, J., Rohweder, C., Damschroder, L., Presseau, J., 2017. Criteria for selecting implementation science theories and frameworks: results from an international survey. Imp. Sci. 12, 124. https://doi.org/10.1186/s13012-017-0656-y.

Birken, S.A., Rohweder, C.L., Powell, B.J., Shea, C.M., Scott, J., Leeman, J., Grewe, M.E., Alexis Kirk, M., Damschroder, L., Aldridge, W.A., Haines, E.R., Straus, S., Presseau, J., 2018. T-CaST: an implementation theory comparison and selection tool. Imp. Sci. 13, 143. https://doi.org/10.1186/s13012-018-0836-4.

Bowman, B.A., Denny, M.D., Stone, A.E., 2020. Exploring producer innovation adoption using an extension-led trialing program. J. Ext. 58.

Bramer, W.M., de Jonge, G.B., Rethlefsen, M.L., Mast, F., Kleijnen, J., 2018. A systematic approach to searching: an efficient and complete method to develop literature searches. J. Med. l Libr. Assoc. 106, 531.

Campbell, J., Dwyer, J.J.M., Coe, J.B., 2017. Intervention mapping to develop a print resource for dog-walking promotion in Canada. J. Vet. Med. Educ. 44, 234–246. https://doi.org/10.3138/jvme.1115-189R.

Dadich, A., Piper, A., Coates, D., 2021. Implementation science in maternity care: a scoping review. Imp. Sci. 16, 16. https://doi.org/10.1186/s13012-021-01083-6.

Dotzauer, D., 2017. . Health behaviour change–theories and models: Current application and future directions for reliable health behavior change. Staats-und Universitätsbibliothek Hamburg Carl von Ossietzky,.

Eccles, M.P., Mittman, B.S., 2006. Welcome to implementation science. Imp. Sci. 1, 1. https://doi.org/10.1186/1748-5908-1-1.

Esmail, R., Hanson, H.M., Holroyd-Leduc, J., Brown, S., Strifler, L., Straus, S.E., Niven, D. J., Clement, F.M., 2020. A scoping review of full-spectrum knowledge translation theories models and frameworks. Imp. Sci. 15, 11. https://doi.org/10.1186/s13012-020-0964-5.

Fixsen, A.A., Aijaz, M., Fixsen, D.L., Burks, E., Schultes, M.-T., 2021. Implementation frameworks: An analysis. Active Implementation Research Network (Ed.),, Chapel Hill, NC.

Garforth, C., Rehman, T., McKemey, K., Tranter, R., Cooke, R., Yates, C., Park, J., Dorward, P., 2004. Improving the design of knowledge transfer strategies by understanding farmer attitudes and behaviour. J. Farm Manage. 12, 17–32.

Gautam, V., Bhardwaj, P., Saxena, D., Kumar, N., Dileepan, S., 2020. Multisectoral approach to achieve canine rabies controlled zone using intervention mapping: preliminary results. PLoS ONE 15. https://doi.org/10.1371/journal.pone.0242937.

Glanville, C., Abraham, C., Coleman, G., 2020. Human behaviour change interventions in animal care and interactive settings: a review and framework for design and evaluation. Animals 10. https://doi.org/10.3390/ani10122333.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., Kyriakidou, O., 2004. Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Q 82 (4), 581–629. https://doi.org/10.1111/j.0887-378X.2004.00325.x.

Grindlay, D.J., Brennan, M.L., Dean, R.S., 2012. Searching the veterinary literature: a comparison of the coverage of veterinary journals by nine bibliographic databases. J. Vet. Med. Educ. 39, 404–412. https://doi.org/10.3138/jvme.1111.109R.

Hamilton, L., 2018. Bridging the divide between theory and practice: taking a co-productive approach to vet-farmer relationships. Food Ethics 1, 221–233.

Horsley, T., Dingwall, O., Sampson, M., 2011. Checking reference lists to find additional studies for systematic reviews. Cochrane Database Syst. Rev. 2011, Mr000026. https://doi.org/10.1002/14651858.MR000026.pub2.

Huybrechts, I., Declercq, A., Verté, E., Raeymaeckers, P., Anthierens, S., 2021. The building blocks of implementation frameworks and models in primary care: a narrative review. Front. Public Health 9. https://doi.org/10.3389/fpubh.2021.675171.

Jemberu, W.T., Mourits, M.C., Hogeveen, H., 2015. Farmers' intentions to implement foot and mouth disease control measures in Ethiopia. PLoS ONE 10, e0138363. https://doi.org/10.1371/journal.pone.0138363.

Kaufman, J., Tuckerman, J., Bonner, C., Durrheim, D.N., Costa, D., Trevena, L., Thomas, S., Danchin, M., 2021. Parent-level barriers to uptake of childhood vaccination: a global overview of systematic reviews. BMJ Glob. Health 6, e006860. https://doi.org/10.1136/bmjgh-2021-006860.

Kirk, M.A., Kelley, C., Yankey, N., Birken, S.A., Abadie, B., Damschroder, L., 2015. A systematic review of the use of the consolidated framework for implementation research. Imp. Sci. 11, 1–13.

Koralesky, K.E., Mills, K.E., Keyserlingk, M.A.Gv, Weary, D.M., 2021. Using Realistic Evaluation to understand how interventions work on dairy farms. Animal 15. https://doi.org/10.1016/j.animal.2021.100233.

Lam, T., Jansen, J., Wessels, R.J., 2017. The RESET Mindset Model applied on decreasing antibiotic usage in dairy cattle in the Netherlands. Ir. Vet. J. 70, 5. https://doi.org/10.1186/s13620-017-0085-x.

Lockwood, C., dos Santos, K.B., Pap, R., 2019. Practical guidance for knowledge synthesis: scoping review methods. Asian Nurs. Res. 13, 287–294. https://doi.org/10.1016/j.anr.2019.11.002.

Michie, S., van Stralen, M.M., West, R., 2011. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Imp. Sci. 6, 42. https://doi.org/10.1186/1748-5908-6-42.

Mitchell, S.A., Fisher, C.A., Hastings, C.E., Silverman, L.B., Wallen, G.R., 2010. A thematic analysis of theoretical models for translational science in nursing: mapping the field. Nurs. Outlook 58, 287–300. https://doi.org/10.1016/j.outlook.2010.07.001.

Moullin, J.C., Sabater-Hernández, D., Fernandez-Llimos, F., Benrimoj, S.I., 2015. A systematic review of implementation frameworks of innovations in healthcare and resulting generic implementation framework. Health Res. Policy Syst. 13, 16. https://doi.org/10.1186/s12961-015-0005-z.

Moullin, J.C., Dickson, K.S., Stadnick, N.A., Rabin, B., Aarons, G.A., 2019. Systematic review of the exploration preparation implementation sustainment (EPIS) framework. Imp. Sci. 14, 1–16. https://doi.org/10.1186/s13012-018-0842-6.

Munn, Z., Pollock, D., Khalil, H., Alexander, L., Mclnerney, P., Godfrey, C.M., Peters, M., Tricco, A.C., 2022. What are scoping reviews? providing a formal definition of scoping reviews as a type of evidence synthesis. JBI Evid. Synth. 20, 950–952. https://doi.org/10.11124/jbies-21-00483.

Nadalin Penno, L., Davies, B., Graham, I.D., Backman, C., MacDonald, I., Bain, J., Johnson, A.M., Moore, J., Squires, J., 2019. Identifying relevant concepts and factors for the sustainability of evidence-based practices within acute care contexts: a systematic review and theory analysis of selected sustainability frameworks. Imp. Sci. 14, 108. https://doi.org/10.1186/s13012-019-0952-9.

Ngowi, H.A., Mlangwa, J.E.D., Mlozi, M.R.S., Tolma, E.L., Kassuku, A.A., Carabin, H., Willingham III,, A.L., 2009. Implementation and evaluation of a health-promotion strategy for control of Taenia solium infections in northern Tanzania. Int. J. Health Promot. Educ. 47, 24–34. https://doi.org/10.1080/14635240.2009.10708154.

Nilsen, P., 2015. Making sense of implementation theories models and frameworks. Imp. Sci. 10, 53. https://doi.org/10.1186/s13012-015-0242-0.

Oludoye, O.O., Robson, M.G., Siriwong, W., 2021. Using the socio-ecological model to frame the influence of stakeholders on cocoa farmers' pesticide safety in Nigeria: Findings from a qualitative study. Risk Manag. Healthc. Policy 14, 2357–2368. https://doi.org/10.2147/rmhp.S311223.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P., Moher, D., 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 372, n71. https://doi.org/10.1136/bmj.n71.

Peters, M., Godfrey, C., McInerney, P., Munn, Z., Tricco, A.C., Kahil, H., 2020. Chapter 11: Scoping reviews (2020 version). In: Aromataris, E., Munn, Z. (Eds.), JBI Manual for Evidence Synthesis. JBI.

Pollock, A., Campbell, P., Struthers, C., Synnot, A., Nunn, J., Hill, S., Goodare, H., Morris, J., Watts, C., Morley, R., 2018. Stakeholder involvement in systematic reviews: a scoping review. Syst. Rev. 7, 208. https://doi.org/10.1186/s13643-018-0852-0.

Presseau, J., Byrne-Davis, L.M.T., Hotham, S., Lorencatto, F., Potthoff, S., Atkinson, L., Bull, E.R., Dima, A.L., van Dongen, A., French, D., Hankonen, N., Hart, J., ten Hoor, G.A., Hudson, K., Kwasnicka, D., van Lieshout, S., McSharry, J., Olander, E.K., Powell, R., Toomey, E., Byrne, M., 2021. Enhancing the translation of health behaviour change research into practice: a selective conceptual review of the synergy between implementation science and health psychology. Health Psychol. Rev. 1–28. https://doi.org/10.1080/17437199.2020.1866638.

Rees, G.M., Bard, A., Reyher, K.K., 2021. Designing a national veterinary prescribing champion programme for welsh veterinary practices: the Arwain vet Cymru project. Antibiotics 10. https://doi.org/10.3390/antibiotics10030253.

Rogers, E.M., Singhal, A., Quinlan, M.M., 2014. Diffusion of innovations. An integrated approach to communication theory and research. Routledge,, Oxfordshire, UK, pp. 432–448.

Sniehotta, F.F., Presseau, J., Araújo-Soares, V., 2014. Time to retire the theory of planned behaviour. Health Psychol. Rev. 8, 1–7. https://doi.org/10.1080/17437199.2013.869710.

Strifler, L., Cardoso, R., McGowan, J., Cogo, E., Nincic, V., Khan, P.A., Scott, A., Ghassemi, M., MacDonald, H., Lai, Y., Treister, V., Tricco, A.C., Straus, S.E., 2018. Scoping review identifies significant number of knowledge translation theories models and frameworks with limited use. J. Clin. Epidemiol. 100, 92–102. https://doi.org/10.1016/j.jclinepi.2018.04.008.

Tabak, R.G., Khoong, E.C., Chambers, D.A., Brownson, R.C., 2012. Bridging research and practice: models for dissemination and implementation research. Am. J. Prev. Med. 43, 337–350. https://doi.org/10.1016/j.amepre.2012.05.024.

Tricco, A.C., Lillie, E., Zarin, W., O'Brien, K.K., Colquhoun, H., Levac, D., Moher, D., Peters, M.D., Horsley, T., Weeks, L., 2018. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann. Intern. Med. 169, 467–473.

United Nations. 2022. World economic situation and prospects 2022 - statistical annex. Available at: ⟨https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/WESP2022_ANNEX.pdf⟩ [Accessed 12th August 2022].

Urquhart, R., Porter, G.A., Sargeant, J., Jackson, L., Grunfeld, E., 2014. Multi-level factors influence the implementation and use of complex innovations in cancer care: a multiple case study of synoptic reporting. Imp. Sci. 9, 121. https://doi.org/10.1186/s13012-014-0121-0.

Webb, T.L., Krasuska, M., Toth, Z., du Plessis, H.R., Colliard, L., 2018. Using research on self-regulation to understand and tackle the challenges that owners face helping their (overweight) dogs lose weight. Prev. Vet. Med. 159, 227–231. https://doi.org/10.1016/j.prevetmed.2018.08.017.

Wolf, R., Barkema, H.W., De Buck, J., Orsel, K., 2015. Factors affecting management changes on farms participating in a Johne's disease control program. J. Dairy Sci. 98, 7784–7796. https://doi.org/10.3168/jds.2015-9610.