EBVM Toolkit 1

Asking an answerable clinical question

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM). This handout offers advice on how to carry out the first step.

1. **Asking an answerable clinical question**
2. Finding the best available evidence to answer the question
3. Critically appraising the evidence for validity
4. Applying the results to clinical practice
5. Evaluate performance

The first step in searching for literature is to define your question, phrasing it in a way that it will help you find all relevant articles and reduce the chance of you leaving anything important out.

A well formed answerable question will also make it relatively straightforward to identify appropriate search terms and to combine them in the search strategy.

One way of identifying the key concepts is to use **The PICO Method**

Patient or **P**opulation	Who is the relevant patient or population? Be as specific as possible e.g. puppies, geriatric patients, pregnant bitches, spaniels?
Intervention	How? What intervention are you interested in? E.g. what is the management strategy, diagnostic test or type of food, drug or surgical procedure that you are testing?
Comparison/**c**ontrol	What is the main alternative? E.g. is there a control or alternative management strategy or intervention that you are particularly interested to compare? Sometimes, when you want to know if the intervention above is better than doing nothing, the comparator will be "no intervention".
Outcome	What are you trying to achieve, measure, improve, effect? E.g. what are the patient-relevant consequences of the intervention? Be as clear as you can here.

Note you may not need to use all of PICO - it depends on what you want to find out.

How does PICO work?

You can see how this works in the following example[1]:

Scenario: A client says they have heard that neutering bitches reduces the risk of mammary tumours and asks you if there is any evidence to back up this claim.

Turning that into an answerable question could look like this:

In **adult bitches** does **neutering** versus **non neutering** reduce the risk of **mammary tumours?**

Taking the key concepts from the question and transforming the question into PICO format would look like this:

Patient or Population	adult bitches
Intervention	neutering
Comparison/control	"no intervention"
Outcome	mammary tumours

---

[1] Adapted from Beauvais, W., Cardwell, J.M. and Brodbelt, D.C. (2012) The effect of neutering on the risk of mammary tumours in dogs – a systematic review. *Journal of Small Animal Practice* 53(6) pp314-322

See *EBVM Toolkit 2: Finding the best available evidence* for information on how to search for literature.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

EBVM Toolkit 2

Finding the best available evidence

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM). This handout offers advice on how to carry out the second step.

1. Asking an answerable clinical question
2. **Finding the best available evidence to answer the question**
3. Critically appraising the evidence for validity
4. Applying the results to clinical practice
5. Evaluate performance

Identifying synonyms

Once you have used PICO to identify the key concepts you are searching for, the next step is to identify synonyms and other related terms. Different authors may use different words to refer to the same concept so it is important to search for a variety of terms in order to reduce the chance of missing important research.

e.g. One piece of research might refer to **bitches** but another might refer to **dogs.**

Thinking about example in _EBVM Toolkit 1: Asking an answerable clinical question_ an extended PICO could include the following keywords:

		Synonyms and other relevant keywords		
Patient or **P**opulation	adult bitches	dog bitches	dogs canine	bitch
Intervention	neutering	spaying ovariectomy	neutering gonadectomy	ovariohysterectomy
Comparison/**C**ontrol	"no intervention"	not applicable		
Outcome	mammary tumours	mammary cancer mass	breast neoplasia lump	tumour neoplasm carcinoma

Truncation

You then need to select the key search terms, remembering to think of alternative spellings and the different endings to words e.g. plurals that may have been used. See below where an asterisk indicates truncation.

See page 4 for more information on using truncation symbols

For example

Patient or Population	dog	dogs	bitch*	canine
Intervention	spay*	spey*	neuter*	ovariohysterectom*
	ovariectom*	gonadect*		
Comparison/control				
Outcome	mammar*	breast*	tumour*	tumor*
	cancer	cancers	neoplas*	mass
	masses	lump	lumps	carcinom*

Combining keywords

Then we need to think about how we would combine the keywords using AND, OR and NOT.

See page 3 for more information on combining keywords.

For example

Patient or Population	(dog OR dogs OR bitch* OR canine)
Intervention	(spay* OR spey* OR neuter* OR ovariohysterectom* OR ovariectom* OR gonadect*)
Comparison/control	
Outcome	(mammar* OR breast*) AND (tumour* OR tumor* OR cancer OR cancers OR neoplas* OR mass OR masses OR lump OR lumps OR carcinom*)

You need to be careful how you combine the keywords as different combinations will produce different results.

Some databases have an advanced search option which allows you to save searches and combine them to construct more complicated searches line by line.

Building the search line by line helps you to minimise errors and capture the thought process. The table below shows how to do this

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

Search line	Search strategy	Result will retrieve		
1	(dog or dogs or bitch* or canine)	references containing keywords:		
		dog	dogs	bitch
		bitches	canine	
2	(spay* or spey* or neuter* or ovariohysterectom* or ovariectom* or gonadect*)	references containing keywords		
		spay	spaying	spayed
		spey	speying	speyed
		ovariohysterectomy	ovariohysterectomized	ovariohysterectomised
		ovariohysterectomies	gonadectomy	gonadectomized
		gonadectomize	gonadectomised	gonadectomise
3	(mammar* or breast*)	references containing keywords		
		mammary	mammaries	breast
		breasts		
4	(tumour*or tumor* or cancer or cancers or neoplas* or mass or masses or lump or lumps or carcinom*)	references containing keywords		
		tumour	tumours	tumor
		tumors	cancer	cancers
		neoplasm	neoplasms	neoplasia
		mass	masses	lump
		lumps	carcinoma	carcinomas
Combining the search lines will give you different sets of results		**Result will retrieve**		
	1 and 2 and 3 and 4	will give references containing all the listed keywords concerning neutered dogs with mammary tumours		
	1 and 2 and 4	will give references containing all the listed keywords concerning neutered dogs with tumours but not necessarily mammary		
	1 and 3 and 4	will give references containing all the listed keywords concerning dogs with mammary tumours but not necessarily those that have been neutered		
	1 and 2	will give references containing all the listed keywords concerning neutering and dogs		
	(1 and 2) or (1 and 3 and 4)	will give references on neutering and dogs or dogs with mammary tumours		

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

Boolean operators

Boolean operators allow you to combine or exclude terms in a search. This will save time and effort by eliminating unsuitable or inappropriate hits from the results

AND	both terms need to be in the record before it is returned, it therefore **narrows** a search	animal **AND** cruelty
OR	either (or both) terms will be in the record, it therefore **broadens** a search	kidney **OR** renal
NOT	the first term is searched and then any records containing the term after the NOT are excluded, it therefore **narrows** a search. Care should be taken as it is easy to exclude good records	horse* **NOT** horseradish
Parenthesis	use brackets **( )** to group order of search	dialysis **AND (**kidney **OR** renal**)**

Other search tools

Most databases and search engines offer other tools that allow you to search more effectively, for example: truncation symbols, wildcards, etc.

The following is a selection of commonly used tools.   If they do not work as expected you should check the "help" or "search tips" of the database you are using.

Phrase searching	use quote marks " " to find exact phrases	"foot and mouth" will return results containing the exact phrase "foot and mouth" but not those just containing "foot" or "mouth"
Truncation	using an asterisk * at the end of a word will return all words that start with the stem	transplant* will return transplant, transplantation, transplanted, transplanting etc
	using an asterisk * at the beginning of a word will return all words that end with the stem	*glycemia will return hyperglycemia, hypoglycemia
Wildcard	use ? in place of a single unknown character

use ?? in place of 2 characters | leuk?mia will return leukemia

leuk??mia will return leukaemia |

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

Choosing which databases to search

Once you have defined your search strategy you then need to decide which databases to search. Research[1] shows that the coverage by bibliographic databases of veterinary journals and journals that regularly have veterinary content varies greatly. CAB Abstracts has the highest coverage (90.2%) whilst Medline (PubMed) only has 36.5%.

Therefore to ensure that you retrieve as much of the published evidence on your topic as possible you should use CAB Abstracts and then at least one other database of your choosing. If you only use Medline (PubMed) you risk ignoring 64.5% of all journals with veterinary content. If you only use Google or Google Scholar you will probably get thousands of hits of very little relevance to you.

If you are carrying out a search as part of a review or critical appraisal of available literature for publication you should check if the publisher has minimum requirements for databases searched. For example a search for a Knowledge Summary for publication in _Veterinary Evidence_ must include CAB Abstracts 1973-current and PubMed as a minimum.

Databases with veterinary coverage

Name of database	Publisher	Description
CAB Abstracts	CABI	Applied life sciences database covering veterinary sciences, agriculture, environment, applied economics, food science and nutrition
Medline (PubMed)	US National Library of Medicine	Life Sciences database covering biomedicine. Often referred to as PubMed as freely available via the PubMed website. Includes links to full text content from PubMed Central where available.
Scopus	Elsevier	Multidisciplinary bibliographic and citation database
VetMed Resource	CABI	Veterinary Sciences database containing the bibliographic records from CAB Abstracts, full text documents, specially written reviews etc
Web of Science	Thomson Reuters	Multidisciplinary bibliographic and citation database including Science Citation Index, and other content

---

[1] Grindlay, D.et al (2012) Searching the veterinary literature: a comparison of the coverage of veterinary journals by nine bibliographic databases _Journal of Veterinary Medical Education_ 39 (4) pp404-412)

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

Locating full-text articles

In order to critically appraise the evidence for validity (step 3 of EBVM), you should examine the full-text article rather than relying on the abstract. Reading the abstract may tell you whether an article is relevant but it will not tell you whether the methodology and conclusions are reliable. *EBVM Toolkit Numbers 3 through to 11* will show you how to appraise the evidence

Where can you find the full-text article?

Is it free?

Some articles can be found **free on the web** e.g. by searching Pubmed or Google Scholar. Some full-text articles are also available from publishers' websites and Open Access repositories. However, the majority of veterinary articles are behind paywalls and cannot be accessed without a subscription.

Does your institution or employer provide access?

If you are a member of an academic institution or professional association, you may be able to access full-text articles using their library resources. Additionally, some employers will subscribe to journals on their employees' behalves.

Do you have an individual subscription?

In some cases you may have a personal subscription to the journal. However, personally subscribing to all relevant journals is costly and likely to be an uneconomical way of practicing EBVM.

Have you tried the RCVS Knowledge Library and Information Service?

Members of RCVS Knowledge Library have access to most veterinary journals, including *Veterinary Clinics of North America, JAVMA* and *Veterinary Surgery*, Membership of RCVS Knowledge Library gives you an economical and efficient way of accessing the evidence you need.

If we do not provide access to the article you need, we can usually get it from another library (your academic institution may also provide this service). Even if you're not a member, RCVS Knowledge Library can provide you with copies of articles at a cheaper rate than most pay-per-article options on publisher websites.

Further assistance

If you need further help then contact RCVS Knowledge Information Specialists on library@rcvsknowledge.org or 020 7202 0752.

Literature searching workshops

We offer workshops (on-site or online) on a one-to-one basis covering how to focus a search question, database searching and making the most of our resources

If you are interested, please contact us at library@rcvsknowledge.org to arrange a time suitable to you.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

EBVM Toolkit 3

Introduction to "Levels of evidence" and study design

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).

1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity**
4. Applying the results to clinical practice
5. Evaluate performance

This handout explains how different types of study design can affect the "levels of evidence" a study provides.
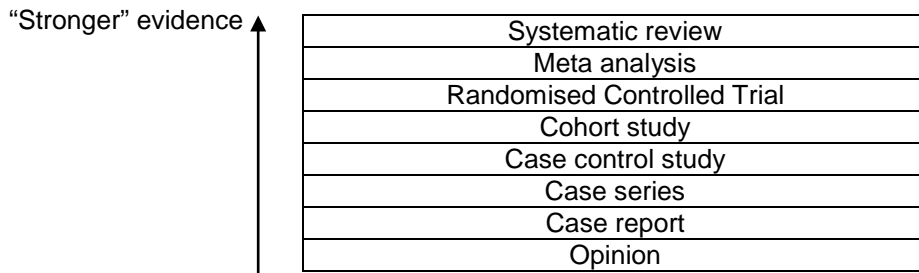
Introduction

Critical appraisal is a process which is used to help you identify the strengths and weakness of a research paper and how likely the results of the paper are to be biased, how appropriate the study design is for the answer we seek, how well the methods were carried out and how good the reporting in the paper is.

Levels of evidence

Research studies in veterinary science can be designed in a variety of ways, depending on the type of question they are trying to answer. These different study designs are often arranged into a hierarchy known as the 'levels of evidence' with practitioners encouraged to find the highest level of evidence possible to answer their clinical question.

Whilst the idea of 'levels of evidence' suggests that there is a hierarchy of quality between the different types of studies it should be noted that each type of study has its own strengths and limitations. For example, a case-control study is a perfectly appropriate way to study the aetiology of a disease and a qualitative study would appropriately address questions regarding the quality of life of a patient after an intervention. Randomised controlled trials are often celebrated as high quality evidence because their methodological design inherently reduces bias, but you should remember that their strength lies in their ability to address the efficacy of a given intervention.

The table on page 2 shows a broad categorisation of studies arranged according to the level of evidence. As you move up the table the study design corresponds to increasing quality and reliability of the evidence. The higher the level the more confident you can be in the accuracy of the results with less chance of statistical error or bias.

"Stronger" evidence ▲

Systematic review
Meta analysis
Randomised Controlled Trial
Cohort study
Case control study
Case series
Case report
Opinion

This evidence hierarchy is designed to help you to concentrate your efforts on sources that are most likely to provide a reliable answer. It is important to remember though that the hierarchy is based on study design and you should always critically appraise the individual studies. A poorly designed Randomised Controlled Trial (RCT) may provide lower level evidence than a good cohort study.

Types of study design

Experimental

Experimental studies are those where there is an intervention (e.g. treatment, drug therapy, surgical method, exposure to a chemical etc) and a researcher responsible for designing the intervention and deciding which animals are exposed to the intervention.

Experimental studies include:
- **Randomised controlled trials** (RCTs) can either be experimental laboratory studies or clinical trials. RCTs have two important features:
  - there are at least two groups - a treatment group and a control group
  - patients are randomly assigned into the two groups.
  Randomised control trials are considered the 'gold standard' when assessing the efficacy of a treatment because they minimise the chance of bias.

- **Non-randomised controlled trials.** Not every intervention can, or should, be randomised. Non-randomised controlled trials can detect associations between an intervention and an outcome but they cannot rule out the possibility that the association was caused by a third factor linked to both intervention and outcome.
- **Cross over trials** comprise the administration of two or more interventions one after the other in a specified or random order to the same group of patients.

Observational

Observational studies are those where the researcher examines the outcomes of an intervention within two groups without having any influence on which animals get the intervention. They "only" observe. e.g.: a researcher could consider the rate of complication following different types of surgery by looking back at all the surgical cases and analysing those that resulted in complications.

Observational studies include:

- **Case-control studies** are where animals which have a disease condition are identified and any causal or risk factors are compared to a control group. Information regarding the exposure is historical. The study starts with groups that already have the outcome (e.g. diabetes) and it looks back to examine what might have been the exposure factors (e.g. obesity).

- **Cohort studies** identify a group of animals and follows them over a period of time to see how their exposures affect their outcomes compared to another group (either the general population or another cohort of animals) that were not exposed to that factor. A cohort study can be prospective (looking forward) or retrospective (looking backwards)

- **Cross-sectional studies** are studies that describe the characteristics of sample groups of animals. Data is collected at one point in time and two groups are identified – usually animals with a specified disease and those without. The relationships within the groups to given parameters are then considered. The relationships are usually expressed as an odds ratio. As the data is taken at one point in time causal links cannot be established.

- **Controlled Before-and-After/Interrupted Time Series** are studies that measure the characteristics of a group of animals before and after an event or intervention. The two sets of data are then compared to judge the effect of the event or intervention.

Descriptive studies

Descriptive or non-comparative studies are designed to record what is seen – they give a picture of what is happening in a population but do not attempt any comparison to a control group: These studies have value if the aim of the paper is to highlight a dramatic finding, or report a rare occurrence. Descriptive studies will not be able to prove causation, so when using this type of study care should be taken to avoid over-interpreting the findings by making conclusions regarding causal links.

Descriptive studies include:

- **Case reports** which are reports on a single patient. They describe the presentation and/or course of a disease.

- **Case series** which are collections of case reports and can provide descriptive quantitative data.

Reviews

These are studies which review the literature or accepted practice and include:

- **Systematic reviews** are comprehensive surveys of a topic in which all the primary studies of the highest level evidence have been systematically identified, selected, appraised and summarised according to explicit, and reproducible, methodologies.

- **Meta analyses** are surveys in which the designs of all the included studies are similar enough statistically that the results can be combined and analysed as if they were a single study. Analyses of this type are normally accompanied by some sort of graphical representation e.g. a forest plot

- **Narrative reviews** lack specific search protocols or explicit criteria for which papers are included or excluded. They may mention a generic search but they rely on experts to draw conclusions based on the papers *they* find more relevant or interesting

- **Opinion pieces** are not based on a literature search. Instead the authors give their opinions without any explicit appraisal of existing literature though they may mention a couple of journal articles to substantiate their claims.

EBVM Toolkit 4

What type of study is it?

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).

1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity.**
4. Applying the results to clinical practice
5. Evaluate performance

This handout offers advice on how to identify the design of a study.

Identifying study design

The information needed to identify the type of study design is normally found in the methodology (i.e. in the methods section of the paper). It is good practice not to rely solely on the abstract when identifying study design as it rarely gives sufficient information for you to be sure that the description is accurate. For example, the abstract may say the study was 'a randomised controlled trial' but you would need to read the methodology to see how the randomisation was achieved in order to confirm if this was indeed the case.

The following questions, which are presented both diagrammatically as an algorithm and in a table with accompanying notes, will help you identify the type of study design in the paper you are reading and the relevant critical appraisal checklist.

You should work your way through the questions until you are satisfied with the answer and that you have identified a study design. If you reach the end and are still unsure please contact us at ebvm@rcvsknowledge.org and we will try and help you

Study Design Algorithm

This diagram is meant to help you identify different types of study design. As always, this does not substitute your judgement, and is merely intended as an aid. Start by answering question 1 and follow through until you are satisfied with the answer.

QUESTION 1: Does the researcher have control over which animals are exposed to the intervention from the start?

```
    Question 1  ──── NO ────►  Go to Question 2
        │
       YES
        │
        ▼
  Is there a
  comparison or control  ──── NO ────►  This is a
  between interventions* ?                NON COMPARATIVE STUDY
        │                                 (case study, case series, etc)
       YES
        │
        ▼
  Were the interventions*  ──── NO ────►  This is a
  randomly allocated?                      NON RANDOMISED CONTROLLED-
        │                                  TRIAL
       YES                                 (blinded or non-blinded)
        │                                  Use EBVM Toolkit 6:
        ▼                                  Controlled trial checklist
  This is a
  RANDOMISED CONTROLLED
  TRIAL
  (blinded or non-blinded)
  Use EBVM Toolkit 6:
  Controlled trial checklist
```
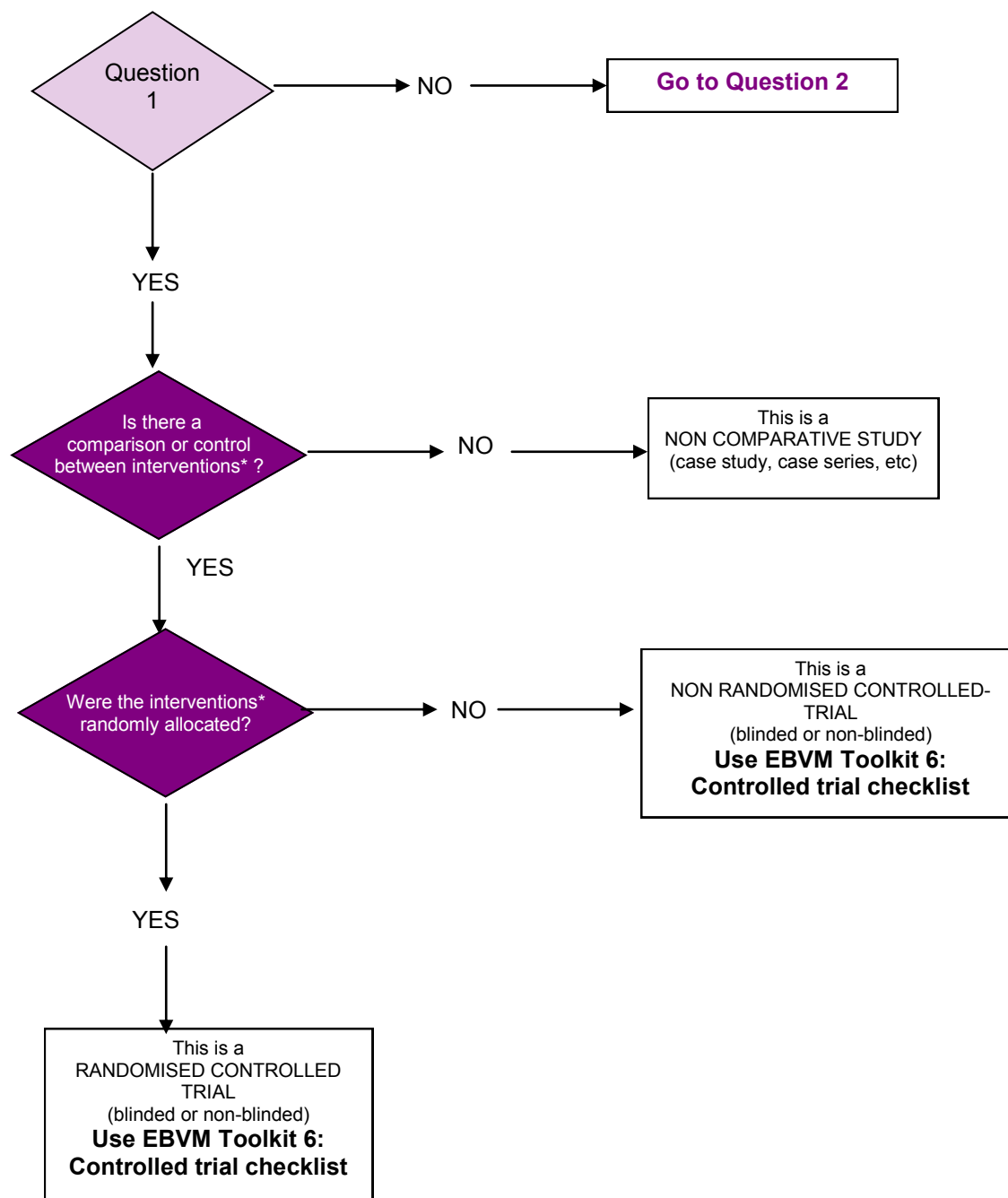
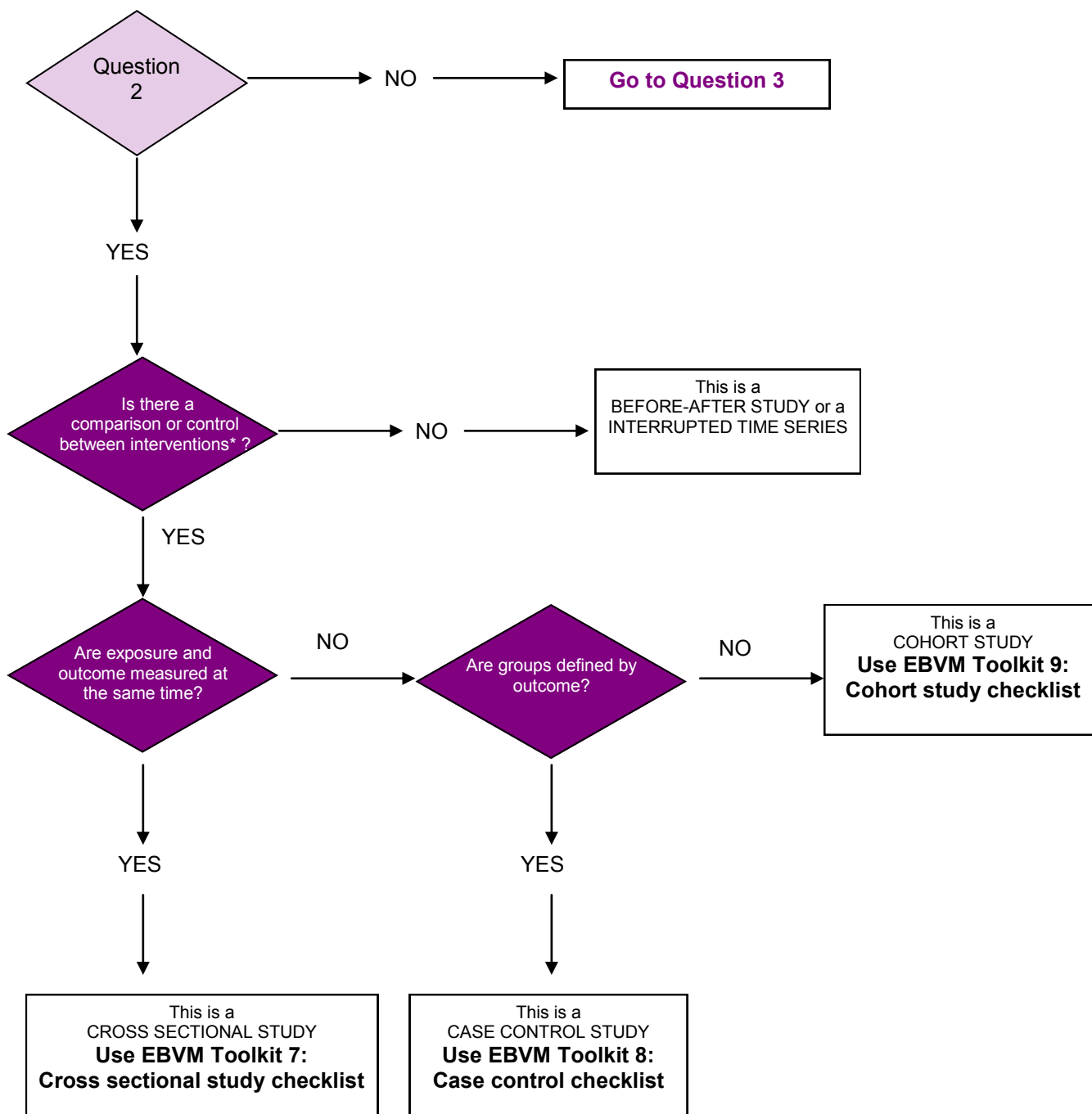***intervention:** in this context *intervention* describes a wide range of activities from drug treatments and other clinical therapies, to lifestyle changes (e.g. diet or exercise) and social activities (e.g. an education program). Interventions can include individual patient care or population health activities.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

QUESTION 2: Is the researcher looking for an association between variables by observing the situation, or the patients, without directly intervening?

Question 2 → NO → **Go to Question 3**

YES ↓

Is there a comparison or control between interventions* ? → NO → This is a BEFORE-AFTER STUDY or a INTERRUPTED TIME SERIES

YES ↓

Are exposure and outcome measured at the same time? → NO → Are groups defined by outcome? → NO → This is a COHORT STUDY **Use EBVM Toolkit 9: Cohort study checklist**

YES ↓

This is a CROSS SECTIONAL STUDY **Use EBVM Toolkit 7: Cross sectional study checklist**

Are groups defined by outcome? YES ↓

This is a CASE CONTROL STUDY **Use EBVM Toolkit 8: Case control checklist**

QUESTION 3: Is the aim of the study to validate a test, tool or diagnostic method?

```
        ┌─────────┐
       ╱           ╲
      ╱  Question   ╲ ──────────  NO  ──────────►  ┌──────────────────┐
      ╲     3       ╱                                │ Go to Question 4 │
       ╲           ╱                                 └──────────────────┘
        └────┬────┘
             │
            YES
             │
             ▼
    ┌────────────────────────┐
    │       This is a        │
    │ DIAGNOSTIC VALIDITY STUDY │
    └────────────────────────┘
```

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org
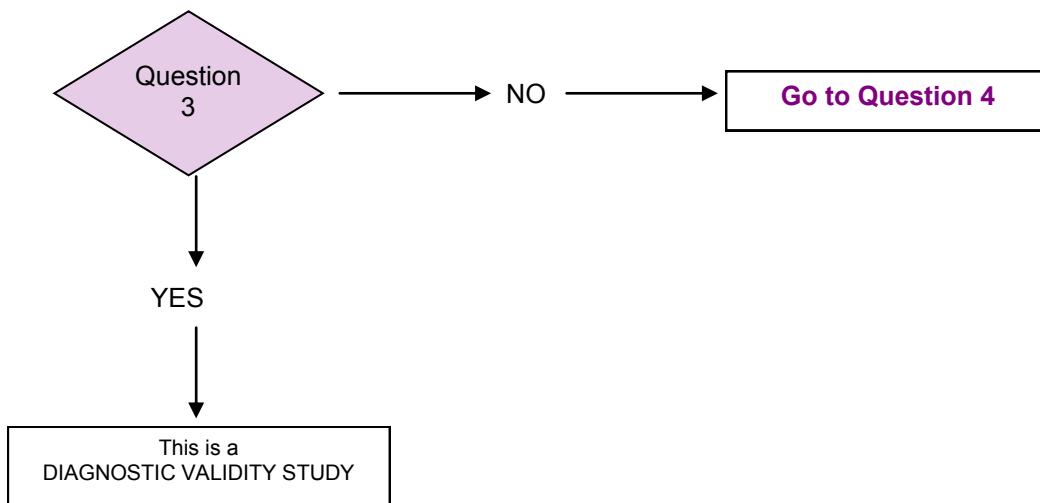
QUESTION 4: . Is the aim of the study to review the literature or to give advice?

```
   ┌─────────┐
  ╱ Question  ╲ ───────── NO ─────────►  ┌──────────────────────────────┐
 ◄   4       ►                           │ Begin again with Question 1 or │
  ╲         ╱                            │       ask us for help          │
   └────┬────┘                           │   ebvm@rcvsknowledge.org       │
        │                                └──────────────────────────────┘
       YES
        │
        ▼
   ┌─────────────┐
  ╱ Was there an  ╲ ──── NO ────►  ┌──────────────────────┐
 ◄ explicit mention►                │      This is a        │
  ╲ of a literature╱                │   OPINION ARTICLE     │
   ╲  search ?    ╱                 └──────────────────────┘
        │
       YES
        │
        ▼
   ┌─────────────┐
  ╱ Is the search ╲ ──── NO ────►  ┌──────────────────────┐
 ◄ comprehensive  ►                │      This is a        │
  ╲ and explicit? ╱                │   NARRATIVE REVIEW    │
   └──────┬──────┘                 └──────────────────────┘
        │
       YES
        │
        ▼
   ┌─────────────┐
  ╱ Is the data   ╲ ──── NO ────►  ┌───────────────────────────────┐
 ◄ from different  ►               │           This is a            │
  ╲ papers combined╱               │     SYSTEMATIC REVIEW**         │
   ╲statistically?**╱              │   **Use EBVM Toolkit 10:**      │
        │                          │ **Systematic review checklist** │
       YES                         └───────────────────────────────┘
        │
        ▼
┌───────────────────────────────┐
│           This is a            │
│        META-ANALYSIS**         │
│    **Use EBVM Toolkit 10:**    │
│ **Systematic review checklist**│
└───────────────────────────────┘
```

** a systematic review can include a meta-analysis and a meta-analysis might not be a systematic review. In this context, 'systematic review' will refer to the entire process of collecting, reviewing and presenting all available evidence, while the term 'meta-analysis' will refer to the statistical technique involved in extracting and combining data to produce a summary result.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

Question	Answer
1. Does the researcher have control over which animals are exposed to the intervention from the start?	This question divides studies into experimental and observational**.** **YES:** This is an **experimental study** where there is an intervention and a researcher responsible for designing the intervention and deciding which animals are exposed/not exposed to the intervention**.** Go to **question 1a** **NO:** This is an **observational study** where the researcher examines the outcomes of an intervention within two groups without having any influence over which animals get the intervention. Go to **question 2**. **Tip:** Does the methodology say anything about the researchers determining which groups of animals got the intervention (e.g. drug treatment, clinical therapy, lifestyle change etc) and which did not? Or does it refer to the researchers looking backward (or forward) following a particular group of animals and observing what happens.
1a. Is there a comparison or control between interventions?	**YES**: This means that there was an alternative to the intervention, i.e. there was a control group that received no treatment or other intervention. The researchers made their conclusions by comparing two (or more) different scenarios. Go to **question 1b**. **NO**: If there was no comparison or control group then the study is a **Descriptive or non-comparative study**. Case studies and case series are examples of non-comparative studies.
1b. Were the interventions randomly allocated?	**YES:** This is a **Randomised Controlled Trial** where the animals were assigned to different groups by an explicit random process. Use **EBVM Toolkit 6** : **Controlled trial checklist** **NO:** This is a **Non-randomised Controlled Trial** where the allocation of interventions was not a randomised process. Use **EBVM Toolkit 6** : **Controlled trial checklist** **Tip:** The method of randomisation should be described in the methodology (computer randomisation, pot luck, etc.)
2. Is the researcher looking for an association between variables by observing the situation, or the animals, without directly intervening?	This question establishes if the study is observational, or if you are dealing with a diagnostic validity study or a review. **YES:** This is an **Observational study** where the researchers do not manipulate the group or provide an intervention but they do have hypotheses about the relationship between two variables. Go to **question 2a** **NO:** The study does not address an intervention observed by researchers. Go to **Question 3**.
2a. Is there a comparison or control between interventions?	**YES:** If there was a control group that received no treatment or other intervention then the researchers made their conclusions by comparing different scenarios. **Go to question 2b** **NO**: This is a **Controlled Before-and-After (CBA) study** or **an Interrupted Time Series (ITS).** Both can be useful to study changes in a major service delivery.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

2b. Are exposure and outcome measured at the same time?	**YES**: This is a **cross sectional study**. This means that the study is like a snapshot in time of a defined situation. In this case, the researchers go to the subjects only once to collect data. For example, if the researchers collected information on the exposure (diet intake) and the outcome (weight) at the same time. Use **EBVM Toolkit 7**: **Cross sectional study checklist** **NO:** If the researchers collected information more than once, at different points in time, Go to **question 2c**
2c. Are the groups defined by outcome?	This question separates a Cohort study from a Case control study. Consider whether the comparison groups are based on the outcome (e.g. weight) or the exposure (e.g. diet intake). **YES**: **This is a Case control study**. This means that the study starts with groups that already have the outcome (e,g,diabetes) and it looks back to examine what might have been the exposure factors (obesity). Use **EBVM Toolkit 8: Case control checklist** **NO**: **This is a Cohort study**. This means that the study starts with groups that have been exposed to the same risk factor (e.g. obesity) and then considers if there is any association between that exposure and the outcome (e.g. diabetes). Cohort studies can be prospective (looking forward) or retrospective (looking backwards) Use **EBVM Toolkit 9: Cohort study checklist** **Tip:** The rule of thumb is if the researcher starts with a group of "sick" animals and then examines the risks they have been exposed to, then it is a case control study. If the researcher follows a group of animals that have been exposed to a risk to see if they got "sick" then it is a cohort study.
3. Is the aim of the study to validate a test, tool or diagnostic method?	**YES:** This is a **Diagnostic Validity Study.** This study evaluates the "performance" of a diagnostic test. It might look at how well the test identifies "sick" animals, how reliable the test is or how well it compares with the existing "gold standard". **NO:** Go to **Question 4**.
4. Is the aim of the study to review the literature or to give advice?	**YES:** This is likely to be a review paper. A review paper analyses published literature rather than attempting to test a hypothesis. Its aim is to analyse the current state of knowledge. This can be done by seeking the views of experts or by interrogating the available literature (or both). Go to **question 4a** **NO** Begin again with Question 1 or ask us for help ebvm@rcvsknowledge.org
4a. Was there an explicit mention of a literature search?	Some reviews analyse the issue at stake through a narrative that references other work that the authors consider to be important. Other reviews set out to analyse all the published references that are found by using specific keywords to search one or more databases. This question separates the two types of search. **YES:** In the methodology the author stated the databases searched and the keywords used. Go to **question 4b** **NO:** This is an **opinion article**. This means that the authors have not carried out a thorough search of the literature, though they may mention a couple of journal articles to substantiate their claims. Opinion, by definition is subject to bias – therefore an opinion article is the lowest level of evidence.

We welcome comments and suggestions for improvement to this guide. Please email
ebvm@rcvsknowledge.org

4b. Is the search comprehensive and explicit?	**YES:** The authors clearly stated which keywords were used and the databases searched. This is provided in a way that means others could perform the same search and obtain the same results. The papers selected for review were based on a set of inclusion/exclusion criteria which are clearly identified. **Go to question 4c**
	NO: This is a **narrative review**. The authors mention a generic search and then proceed to draw conclusions based on the papers *they* find more relevant or interesting.
4c. Is the data from different papers combined statistically?	**YES**: This is a **Meta-analysis** which is a statistical technique for combining the findings from two or more studies. Use **EBVM Toolkit 10** :**Systematic review checklist**
	NO: This is a **Systematic Review** which s a literature review that tries to identify, appraise and synthesise all high quality papers relevant to a research question according to an explicit and reproducible methodology. Use **EBVM Toolkit 10**:**Systematic review checklist**
	Tip: A meta-analysis is not necessarily part of a systematic review. It may be part of a smaller review of a few studies that were not chosen systematically as part of a thorough literature search

If you get to the end of the questions and are still unsure about the type of study design please email ebvm@rcvsknowledge.org and we will try to help you identify the study design and find a checklist that will allow you to appraise the paper.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

EBVM Toolkit 5

Is this paper worth my time?

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).
1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity**
4. Applying the results to clinical practice
5. Evaluate performance

In veterinary medicine many papers are published each week and it would be impossible to read them all. By defining your clinical question using the PICO method and using that as the basis of your search strategy you will have reduced the number of papers that you will need to read.

You can screen the papers further by considering the following questions before carrying out a full critical appraisal. To answer the questions you will not need to read the whole paper instead you can focus on the sections indicated.

1. Does the paper address your clinical question?

Look at the paper's **Introduction** to see if the research question being asked in the paper is relevant to your clinical question e.g. i*s the population of the study similar to your patient?* Be wary of relying on the title and abstract because these do not always reflect the content of the paper.

2. Is the study design appropriate for the question being asked?

Consult the **Methodology** or **Methods** section of the paper for information about the study design. Different types of study provide different types of evidence (see EBVM Toolkits 3 and 4 for more information on Study Design). This means that your question will best be answered by a particular type of study e.g. A Randomised Controlled Trial (RCT) is the most appropriate study for answering questions about the efficacy of interventions.

Next step

If the paper addresses your clinical question and the study is designed appropriately, then you will need to critically appraise the quality of the study. EBVM Toolkits 6-11 provide checklists for the different types of study to help you do this.

Further reading

Dean R. (2013) How to read a paper and appraise the evidence. *In Practice* **35**:282-5
Greenhalgh, Trisha (2014) *How to Read a Paper: The Basics of Evidence-Based Medicine*. 5th ed.
Wiley Blackwell

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

EBVM Toolkit 6

Controlled trial checklist

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).
1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity**
4. Applying the results to clinical practice
5. Evaluate performance

This handout is designed to help you appraise the report of a controlled trial. Answering the questions will help you to reflect on how valid the results might be, how well reported they are and whether they are applicable to your local circumstances.

	Yes	No	Not sure	Reason
Did the trial address a clearly focused issue? Is there a clear question, can the PICO be identified?				
Was the assignment of animals to treatments randomised? Look for the term randomised and for details of how the randomisation was achieved (Controlled trials will not all be randomised)				
Were all of the animals who entered the trial properly accounted for at its conclusion? Was follow up complete? Were animals analysed in the groups to which they were allocated?				

Were animals and study personnel 'blind' to treatment including any study personnel who assessed outcomes? Look for the terms blinding, double blind, or masking. For animal studies this may be less important for the animals but could be significant when for example an injection is compared to an oral product. In this case a so-called double-dummy design is ideal where animals receive both an injection and an oral product, one being active and the other placebo.				
Were the groups similar at the start of the trial? Important issues include age, severity of the condition, species, breed, possibly gender.				
Aside from the experimental intervention, were the groups treated equally?				
How large was the treatment effect? What outcomes were measured?				
How precise was the estimate of the treatment effect? Look for confidence intervals				
Can the results be applied to your practice? Are the animals similar to your population? Does your setting differ significantly?				

Were all clinically important outcomes considered? Were the outcomes the ones you would choose? If not the trial may be less valuable				
Are the benefits worth the harms and costs? This probably won't be in the trial but a rough evaluation should be done to help you decide if you want to use this intervention in practice				

Want to try it out?

You could use the following paper to try out the questions:

Suputtamongkol, Y, et al. (2011) Efficacy and safety of single and double doses of ivermectin versus 7-day high dose albendazole for chronic strongyloidiasis. *PLoS Neglected Tropical Diseases*, 5(5):e1044.

.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

EBVM Toolkit 7

Cross sectional study checklist

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).
1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity**
4. Applying the results to clinical practice
5. Evaluate performance

This handout is designed to help you appraise the report of a cross sectional study. Answering the questions will help you to reflect on how valid the results might be, how well reported they are and whether they are applicable to your local circumstances.

	Yes	**No**	**Not sure**	**Reason**
Did the study address a clearly focused issue? Is there a clear question, can the PICO be identified?				
Was an appropriate method used to answer the question? Is the use of a cross sectional study method appropriate?				
Were the subjects recruited in an appropriate way? Did the subjects represent a defined population? Was there a reliable system for selecting the subjects? Was the sample representative of a defined population?				

Were outcomes accurately measured to reduce bias? Were the measures objective or subjective? Does it matter? Were the measures appropriate and validated?				
Was the data collected in a way that addresses the research issue? Can you tell how the data were collected e.g use of interviews, questionnaire, and professional diagnosis? Were the methods explicit?				
Was the study large enough to be sure of a reliable result? Look for confidence intervals, very wide confidence intervals should raise concern. Was a power calculation carried out to estimate how many subjects would be needed?				
How are the results presented and what are the main results? Are results presented as a proportion or relative risk or are they mean or median differences? How large is it? What is the bottom line result?				
Was the data analysis rigorous? Is there a description of what was done? Is there enough data to support the bottom line?				
Is there a clear statement of findings? Is there a discussion on the meaning and credibility of the findings? Are the findings put into the context of the original research question?				

Can the results be applied to your local population? Are the subjects similar to your population? Does your setting differ significantly? Can you gauge benefit and harm for your local situation?				
Do the results fit with other available evidence? Consider evidence from other study designs for consistency.				

Want to try it out?

You could use the following paper to try out the questions:

Wylie, C.E. et al (2013) Demographics and management practices of horses and ponies in Great Britain: a cross-sectional study *Research in Veterinary Science,* 95 (2) pp 410-417.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

Belgravia House
62 - 64 Horseferry Road
London
SW1P 2AF

T +44 (0) 20 7202 0721
F +44 (0) 20 7202 0751
E info@rcvsknowledge.org
🐦 twitter.com/rcvsknowledge

rcvsknowledge.org

EBVM Toolkit 8

Case control checklist

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).
1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity**
4. Applying the results to clinical practice
5. Evaluate performance

This handout is designed to help you appraise the report of a case control study. Answering the questions will help you to reflect on how valid the results might be, how well reported they are and whether they are applicable to your local circumstances.

	Yes	No	Not sure	Reason
Did the study address a clearly focused question? Are the patient/population and risk factors clearly stated? Is the study looking for a beneficial or harmful effect?				
Was an appropriate method used to answer the question? Is the use of a case control method, which is usually only used for rare conditions or harmful outcomes, appropriate?				
Were the cases recruited in an appropriate way? Is there a clear definition of the cases? Did the cases represent a defined population? Was there a reliable system for selecting cases? Was the timescale relevant? Was there a sufficient number of cases. Was there a power calculation?				

Were controls selected in an appropriate way? Look for any bias in the selection which could compromise the results. Were the controls representative of the defined population? Were the controls matched or randomly selected? Were there a sufficient number of controls?				
Was the exposure accurately measured to minimise bias? Was the exposure clearly defined and accurately measured? Have the measures been validated? Were the measurements used the same for both the cases and controls?				
What confounding factors have the authors accounted for? List the ones you think are important. Can you think of any that have been missed? Confounding occurs when the link between exposure and outcome is distorted by another factor				
Have potential confounding factors been taken into account in the design and or analysis?				
What are the results of the study? What outcomes were measured? How strong is the association between exposure and outcome? Is the analysis appropriate?				
How precise was the estimate of risk? Look for confidence intervals				

We welcome comments and suggestions for improvement to this guide. Please email
ebvm@rcvsknowledge.org

Do you believe the results? A large effect has to be taken seriously. Can the result be due to chance? Have you spotted flaws that make the results unreliable?				
Can the results be applied to your practice? Are the subjects similar to your population? Does your setting differ significantly? Can you gauge benefit and harm for your local situation?				
Do the results fit with other available evidence? Consider evidence from other study designs for consistency.				

Want to try it out?

You could use the following paper to try out the questions:

Hayes, H. et al (1991) Case control study of canine malignant lymphoma. *Journal of the National Cancer Institute*, 83 (17) pp 1226-31

EBVM Toolkit 9

Cohort study checklist

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).
1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity**
4. Applying the results to clinical practice
5. Evaluate performance

This handout is designed to help you appraise the report of a cohort study. Answering the questions will help you to reflect on how valid the results might be, how well reported they are and whether they are applicable to your local circumstances.

	Yes	No	Not sure	Reason
Did the study address a clearly focused issue? Are the patient/population and risk factors clearly stated? Is the study looking for a beneficial or harmful effect?				
Was the cohort recruited in an appropriate way? Was the cohort representative of a defined population? Was there anything special about the cohort? Were all animals included who should have been?				
Was the exposure accurately measured to minimise bias? Were the measurements objective or subjective? Were the measurements able to detect what was expected? Have the measurements been validated? Were the subjects classified into exposure groups using the same procedure?				

Was the outcome accurately measured to minimise bias? Were the measurements objective or subjective? Were the measurements able to detect what was expected? Have the measurements been validated? Was there a reliable system for detecting all the cases? Were the measurement methods similar in the different groups? Were the subjects and/or outcome assessors blinded to the exposure? Is this important?				
What confounding factors have the authors accounted for? List any that you think important				
Have confounding factors been taken into account in the design and or analysis Confounding occurs when the link between exposure and outcome is distorted by another factor. These should be in the methods section. Look for factors that were not considered according to your clinical judgment. A study that does not address confounding should be rejected.				
How adequate was the follow up of the subjects? Was it complete enough? Long enough? Were all the subjects accounted for at the end? Do you think that those lost to follow up may have had different outcomes?				

What are the results of the study?	
What are the bottom line results? How strong is the association between exposure and outcome? Is there a relative risk? What is the absolute risk reduction? If not presented can you calculate it from the results presented**?**	
How precise was the estimate of risk? Look for confidence intervals	

Do you believe the results?				
A large effect has to be taken seriously. Can the result be due to chance? Have you spotted flaws that make the results unreliable? Was a cohort study the best method to answer the question?				
Can the results be applied to your practice? Are the subjects similar to your population? Does your setting differ significantly? Can you gauge benefit and harm for your local situation?				
Do the results fit with other available evidence? Consider evidence from other study designs for consistency				

We welcome comments and suggestions for improvement to this guide. Please email
ebvm@rcvsknowledge.org

What are the implications of this study for your practice? Is the evidence from this study robust enough to make a decision? Recommendations from observational studies are stronger when supported by other evidence.	

Belgravia House
62 - 64 Horseferry Road
London
SW1P 2AF

T +44 (0) 20 7202 0721
F +44 (0) 20 7202 0751
E info@rcvsknowledge.org
🐦 twitter.com/rcvsknowledge

rcvsknowledge.org

EBVM Toolkit 10

Systematic review checklist

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).
1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity**
4. Applying the results to clinical practice
5. Evaluate performance

This handout is designed to help you appraise a systematic review. Answering the questions will help you to reflect on how valid the results might be, how well reported they are and whether they are applicable to your local circumstances.

	Yes	No	Not sure	Reason
Did the review address a clearly focused question? Is there a clear question, can the PICO be identified?				
Did the authors select the right papers? Did the papers address the question and have an appropriate study design?				
Do you think the search would have found all the relevant important papers? Look for search methods, databases used, reference list use, inclusion of unpublished studies etc				

RCVS Knowledge is the charity partner of the Royal College of Veterinary Surgeons. Registered charity No. 230886.

Registered as a company limited by guarantee in England & Wales No. 598443

Did the authors do enough to assess the quality of included studies? Is there evidence of an assessment of potential bias? Is the process of assessment described?				
If the results of the studies have been combined was it reasonable to do so? Were the results sufficiently similar in design to combine? Are the results of the included studies clear? Are the reasons for any variations discussed?				
What are the overall results of the review? Are you clear about the 'bottom line' results? How are the results expressed (odds ratios, relative risk etc)?				
How precise are the results? Have confidence intervals been presented?				
Can the results be applied to your practice? Is the review relevant to your patient population? Can you gauge benefit and harm for your local situation?				
Were all the important outcomes considered? Are there any questions that you would consider important that were not addressed in the review?				
Are the benefits described worth the harms and costs? What are the possible adverse effects of the intervention? What are the costs?				

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

Want to try it out?

You could use the following paper to try out the questions:

Nuttall, T. and Cole, L. (2007) Evidence based veterinary dermatology: a systematic review of interventions for the treatment of Pseudomonas otitis in dogs, *Veterinary Dermatology,* 18(2) pp 69-77.

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

EBVM Toolkit 11

Qualitative study checklist

There are five key steps to follow in Evidence-based Veterinary Medicine (EBVM).
1. Asking an answerable clinical question
2. Finding the best available evidence to answer the question
3. **Critically appraising the evidence for validity**
4. Applying the results to clinical practice
5. Evaluate performance

This handout is designed to help you appraise the report of a qualitative study. Answering the questions will help you to reflect on how valid the results might be, how well reported they are and whether they are applicable to your local circumstances.

Introduction

Few papers overtly use qualitative methods in veterinary medicine. While some see qualitative methods to be inferior to quantitative research, the two can happily co-exist and answer different questions. Qualitative research is particularly concerned with making sense of phenomena in terms of the meanings that people bring to them. As qualitative research frequently involves interview techniques it will have limited application in veterinary medicine. An example is a study by Litva (2010) investigating owners' perceptions of the causes of crib biting or wind sucking behaviour in their horses[1]

	Yes	No	Not sure	Reason
Was the sample used in the study appropriate to its research question? Have the right animals been included in the study? Sample size may not be as important as in quantitative research but sufficient participants should have been included in order to gain an understanding of the issues.				

Was the data collected appropriately? The methods of data collection should be described with some justification of the methods used.				
Was the data analysed appropriately? There should be a description of the methods. Did participants have an opportunity to check the findings?				
Can the results of the study be applied to your own setting? Are the subjects similar to your population? Does your setting differ significantly? Can you gauge benefit and harm for your local situation?				
Does the study adequately address any potential ethical issues, including reflexivity? Was the study ethical? Were potential issues if reflexivity considered? Reflexivity is about the influence a researcher can have on the data collected and should be addressed.				

We welcome comments and suggestions for improvement to this guide. Please email ebvm@rcvsknowledge.org

Overall: is what the researchers did clear? Does what was done make sense?				

References

1: Litva, A., Robinson C.S. and Archer D.C. .(2010) Exploring lay perceptions of the causes of crib-biting/windsucking behaviour in horses, *Equine Veterinary Journal*,42 (4) pp 288-293

Want to try it out?

You could use the following paper to try out the questions:

Lastein, D., Vaarst, M. and Enevoldsen, C. (2009) Veterinary decision making in relation to metritis – a qualitative approach to understand the background for variation and bias in veterinary medical records. *Acta Veterinaria Scandinavica* 51: 36