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BEME GUIDE

## Which professional (non-technical) competencies are most important to the success of graduate veterinarians? A Best Evidence Medical Education (BEME) systematic review: BEME Guide No. 38

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### ABSTRACT

**Background:** Despite the growing prominence of professional (non-technical) competencies in veterinary education, the evidence to support their importance to veterinary graduates is unclear.

**Aim:** To summarize current evidence within the veterinary literature for the importance of professional competencies to graduate success.

**Methods:** A systematic search of electronic databases was conducted (CAB Abstracts, Web of Science, PubMed, PsycINFO, ERIC, Australian and British Education Index, Dissertations & Theses) from 1988 to 2015 and limited to the veterinary discipline (veterinar\* term required). Evidence was sought from consensus-based competence frameworks, surveys of stakeholder perceptions, and empirical evidence linked to relevant outcomes (e.g. employability, client satisfaction or compliance). Data extraction was completed by two independent reviewers and included a quality assessment of each source.

**Results:** Fifty-two sources were included in the review, providing evidence from expert frameworks (10 sources), stakeholder perceptions (30 sources, including one from the previous category), and empirical research (13 sources). Communication skills were the only competency to be well-supported by all three categories of evidence. Other competencies supported by multiple sources of empirical evidence include empathy, relationship-centered care, self-efficacy, and business skills. Other competencies perceived to be relatively more important included awareness of limitations, professional values, critical thinking, collaboration, and resilience.

**Conclusions:** This review has highlighted the comparatively weak body of evidence supporting the importance of professional competencies for veterinary graduate success, with the exception of communication skills. However we stress this is more indicative of the scarcity of high-quality veterinary-based education research in the field, than of the true priority of these competencies.

### Introduction

Despite the reality that time and resources in veterinary curricula are finite, and thus the investment into one topic must come at the expense of another, the subsequent need to prioritize more important learning outcomes or competencies over less important ones is rarely acknowledged. Similarly as accreditation guidelines and curricula evolve to include new or increased emphasis on issues of emerging importance, this is rarely balanced by explicit downgrading of another aspect. The challenge of addressing comprehensive yet un-prioritized lists of competencies all deemed to be “essential”, and constant evolution in the nature of included competencies, adds a substantial burden to the curricular processes of veterinary colleges worldwide, and on undergraduate students navigating their learning by these frameworks (May 2008).

As in human medicine, one such change has been the progressive inclusion and increased emphasis on professional or “non-technical” competencies, in addition to more traditional outcomes of discipline-based knowledge and technical skills. Notably, the North American Veterinary Medical Education Consortium “Roadmap” report (NAVMEC 2011) signaled a significant shift toward expansion of these

### Practice points

- Evidence for the importance of professional (non-technical) competencies for veterinary graduate success is limited, and strengthening this evidence base should be regarded as a research priority.
- Only a single competency, communication skills, is supported by evidence from expert frameworks, stakeholder perceptions, and high-quality empirical evidence linked to relevant outcome measures.
- Several other competencies are supported by multiple studies providing empirical evidence (empathy, relationship-centered care, self-efficacy, business skills), or are perceived of relatively higher importance in stakeholder surveys (awareness of limitations, professional values, critical thinking, collaboration, resilience), but not both.
- A clear example of mismatch between perceptions and empirical evidence (for business skills) provides a warning to educators that perceived importance does not reliably predict actual importance for graduate success.

“soft” skills within core graduate-level competencies (Hodgson et al. 2013). This report ended a formative decade during which the American Veterinary Medical Association (AVMA) convened the National Commission on Veterinary Economic Issues (NCVEI) to conduct a needs assessment for the future economic health of the profession in USA. This process concluded that veterinarians were lacking in some crucial skills, and a study was commissioned to define a list of professional competencies underlying career success (Lewis & Klausner 2003). The same period is notable for the introduction of the UK Royal College of Veterinary Surgeons (RCVS) “Day One Competences” (RCVS 2001), which then marked a major shift toward an outcome-based approach to skills development in veterinary education. This document was subsequently adopted by other accrediting bodies including the European Association of Establishments for Veterinary Education (EAEVE), and the Australasian Veterinary Boards Council (AVBC).

However, despite obvious and growing consensus around the importance of professional skills, there is little published empirical evidence to support the status of non-technical competencies in veterinary competency frameworks. While many professional competencies are intuitively *thought* to be important, few have been shown to have a measurable association with any tangible professional outcome for veterinary graduates. Further, what little evidence exists is overwhelmed by a profusion of un-evidenced opinion, while failure to distinguish between different professional stages (e.g. undergraduate, new graduate, senior veterinarian) adds to the confusion. To the best of our knowledge, there have been no previous systematic reviews of evidence supporting the inclusion of non-technical competencies in undergraduate veterinary curricula.

### Review aims

The guiding aims of this systematic review were:

- to aggregate and synthesize currently available evidence for the importance of veterinary professional (non-technical) competencies, using the rigorous “best-evidence” protocols established by the Best Evidence Medical Education (BEME) collaboration
- to inform an evidence- and consensus-based ranking of their relative importance, to guide priority where there are competing demands for curriculum time or resources
- to identify gaps or mismatches in the evidence, and flag these as potential issues for education or priority areas for future research; and
- to promote “best-evidence” approaches in the education of veterinary undergraduates for future professional success.

### Methods

The review team developed a protocol based on the methodology recommended by the Best Evidence Medical and Health Professional Education (BEME) collaboration ([www.bemecollaboration.org](http://www.bemecollaboration.org)). The protocol was subjected to external peer-review through BEME, as well as frequent internal review throughout the project. Changes from the initial approved protocol were minor and are detailed below.

### Research question and approach

The review addressed the question:

*Which professional (non-technical) competencies are most important to the success of graduate veterinarians?*

Predominantly from two lines of evidence:

- a. consensus of stakeholder opinion (*perceived importance*) and
- b. effect on a relevant outcome measure (*empirical importance*).

In further framing this review question, we used the following definitions:

- *Professional (non-technical) competencies* were primarily defined by exclusion, as those veterinary competencies that are not discipline-specific technical knowledge or technical psychomotor skills. Partial synonyms used elsewhere include generic skills, non-cognitive competencies, medical professionalism, “soft” skills, core skills, life skills, human factors, or sometimes “the art of veterinary medicine”. We agree with Nestel et al. (2011) that, despite its wide usage, the term “non-technical skills” is misleading and inaccurate, unhelpfully implies primacy of technical skills, and should be replaced by another mutually understood term; we use “professional competencies” here to mean the same suite of skills. Hodgson et al. (2013) similarly preferred the term “professional competencies” for consistency with NAVMEC, defined as those competencies that go “beyond the medical, surgical, and technical knowledge and skills traditionally emphasized in veterinary training”.
- *Success* was defined broadly as any favorable professional outcome, or favorable personal outcome likely to be influenced by veterinary employment.
- *Graduate veterinarian* was taken as the first few (<3 years) of work as a veterinarian employed in a clinical setting.

### Literature search

The review team developed a comprehensive list of veterinary professional (non-technical) attributes by iterative aggregation of keywords from known published lists, including those of accrediting bodies and expert groups (RCVS 2001; Lewis & Klausner 2003; NAVMEC 2011). The review team members and specialist librarians at the University of Edinburgh used this list to construct appropriate search strategies. Searches were restricted to the veterinary domain by inclusion of *veterinary* or *veterinarian* (truncated to *veterinar\**) as a required word. The search strings used are shown in Appendix 1, available online as Supplementary Material. The primary database search (performed in June 2014) was supplemented by a combination of hand searches of key sources (principally *Journal of Veterinary Medical Education*) and the researchers’ own files, ancestral searches of cited references, and supplementary electronic searches (Google Scholar). Grey literature (e.g. commissioned industry reports published in the public domain) was appraised where possible, notably four competence frameworks developed by accrediting bodies included on account of their global

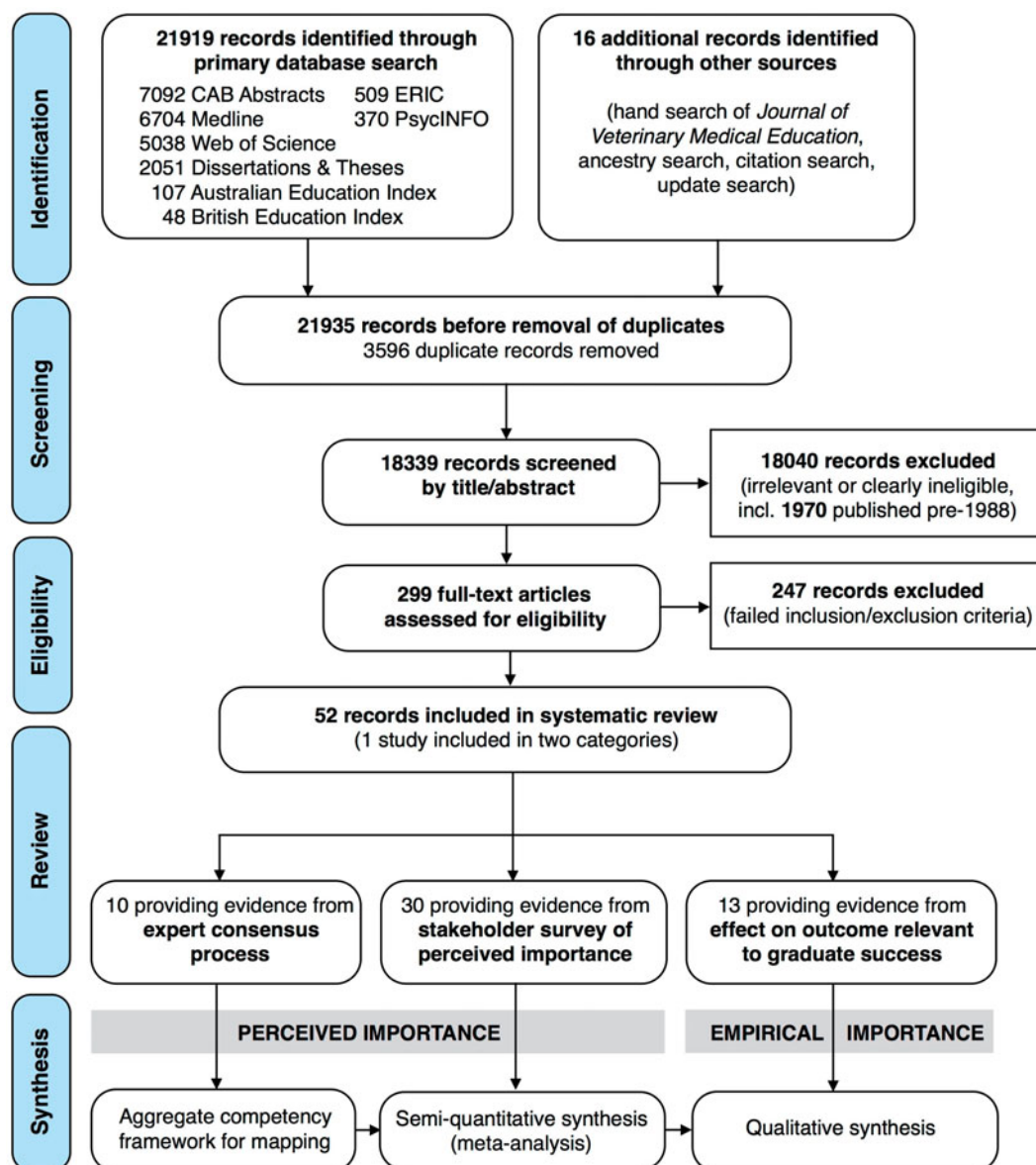


Figure 1. Flow diagram of papers in the review.

influence rather than quality of evidence. An update hand and electronic search (CAB Abstracts) was performed in October 2015 and yielded one additional article for inclusion (Stoewen et al. 2014) and another providing supporting evidence (Cipolla & Zeconi 2015). The databases and other sources searched are summarized in the flow diagram shown in Figure 1, and detailed in Appendix 1, available online as Supplementary Material.

### Screening and selection of sources

Databases searches were imported to EndNote X7.4 reference management software (Thomson Reuters, Philadelphia) for screening. Initial screening was conducted by one reviewer (MC) to first exclude irrelevant titles, then sequentially screened by abstracts then finally the full papers were checked against the inclusion and exclusion criteria detailed in Table 1. A subsample of sources excluded by abstract (10%) or full paper (20%) was checked by a second reviewer (MB), with complete agreement. Although the search was not initially limited by year of publication, to ensure relevance a cut-off date for inclusion of 1988 was later applied

(chosen to approximate the shift in veterinary education coinciding with the influential Pew Report, Pritchard 1988). For consensus-based frameworks, a cut-off date of 2001 was used to exclude lists preceding the RCVS Day One Skills (RCVS 2001), generally recognized as the first widely used competency framework in veterinary education and marking a shift toward outcomes-based education (Duncan et al. 2011). For logistical reasons, sources in languages other than English were excluded. The review was intentionally limited to the veterinary discipline; though there is undoubtedly much relevant evidence to inform the review question within the medical and health sciences education literature, the intention was to evaluate only the scope of evidence developed within this particular disciplinary context.

### Critical appraisal

A detailed coding sheet was developed by the review team early in the review, but was replaced prior to coding by a simplified coding sheet better suited to compilation and remote sharing of data via Microsoft Excel spreadsheet.

Table 1. Inclusion and exclusion criteria.

	Inclusion criteria	Exclusion criteria
<i>Discipline</i>	<ul style="list-style-type: none"> <li>• Veterinary context only</li> </ul>	<ul style="list-style-type: none"> <li>• Veterinary nursing</li> <li>• Human medical education</li> </ul>
<i>Publication date</i>	<ul style="list-style-type: none"> <li>• Studies published 1988–2015</li> </ul>	<ul style="list-style-type: none"> <li>• Mixed health science studies including, but not separately reporting, veterinary cohorts</li> <li>• Studies published before 1988 (or 2001 for competence frameworks)</li> </ul>
<i>Language</i>		<ul style="list-style-type: none"> <li>• Languages other than English</li> </ul>
<i>Publication type</i>		<ul style="list-style-type: none"> <li>• Books or theses that proved unobtainable</li> <li>• News articles</li> <li>• Short-form conference abstracts</li> <li>• Letters</li> </ul>
<i>Nature of evidence</i>	<ul style="list-style-type: none"> <li>• Includes evidence of the importance of professional (non-technical) competencies, in one of the following forms:               <ol style="list-style-type: none"> <li>1. Competence lists or frameworks developed by an expert consensus process</li> <li>2. Survey or interview of relevant stakeholder group(s) regarding perceived importance</li> <li>3. Empirical studies demonstrating an effect or association between professional competencies and at least one outcome measure relevant to graduate success                   <ul style="list-style-type: none"> <li>• Veterinary students, veterinary graduates (&lt;3 years), veterinarians, veterinary employers, veterinary college faculty, veterinary clients (pet owners), veterinary professional or industry bodies</li> </ul> </li> </ol> </li> <li>• Any measure of success including employability, employer satisfaction, income, ease of transition to practice, client satisfaction, client compliance, quality of patient care or patient outcomes, job or life satisfaction, health and well-being</li> </ul>	<ul style="list-style-type: none"> <li>• Opinion or review articles lacking original evidence, however influential or highly cited</li> <li>• Competence lists applying to a single veterinary college, unless evaluated by external stakeholders and formally published as a case study (since most veterinary colleges maintain unique competence lists)</li> <li>• Surveys reporting against only a single competency (since these do not provide evidence of <i>relative</i> importance)<sup>a</sup></li> <li>• Surveys of perceived graduate preparedness, competence and deficiency, in the absence of supporting evidence that deficiency caused a problem<sup>a</sup></li> <li>• Studies with only indirect associations to relevant outcome measures, thus reliant on interposed assumptions<sup>a</sup></li> <li>• Outcomes for veterinary nurses or technicians, or mixed groups including non-veterinarians (i.e. “veterinary teams”)<sup>a</sup></li> <li>• Selection criteria for undergraduate admissions<sup>a</sup></li> </ul>
<i>Stakeholder groups</i>		
<i>Outcome measures</i>		

<sup>a</sup>Some excluded sources are reported in the “Results” as supporting or “second tier” evidence.

The coding process captured information on inclusion criteria, nature of evidence, outcomes measured or inferred, career stage referenced (new graduate (“Day One”), graduate (1–3 years), or generic veterinarian), sample size and demographics of study population, country of origin, and key conclusions.

Coding for quality of evidence was performed for all included papers by at least two independent reviewers. One reviewer (MC) assessed and scored all papers for continuity. Since the review team included subject experts who had authored publications relevant to the review, care was taken to prevent self-review of a paper by a co-author. In a process influenced by the quality criteria of Harden et al. (1999) and clarified by discussion early in the review process, each paper was rated on a scale of 1–5 for:

- i. quality of study design
- ii. quality of sampling (including response rates) and implementation
- iii. quality of analysis.

Global strengths and weaknesses of the study were also recorded as qualitative comments. Indicators of quality included, e.g. large sample sizes, multiple cohorts or sites, high response rates, absence of bias, clearly defined outcomes, use of pre-tested or validated instruments, adequately described methods (repeatable), appropriate statistics (e.g. mixed effects models), in generalizable context or settings, and conclusions clearly supported by results. These assessments, moderated by relevance (transferability) of the evidence to the research question, were used to derive a global quality of evidence score from 1 to 5, where 1 = weak; 2 = ambiguous, a trend; 3 = sufficient evidence, conclusions probably supported; 4 = clear evidence; and 5 = very strong or unequivocal evidence (Harden et al. 1999). Inter-rater agreement was quantified by the Kappa statistic comparing global quality scores from the first two reviewers. Where there was disagreement between the initial reviewers, global scores were moderated after comparison of each reviewer’s qualitative comments, in most cases with additional input from a third independent reviewer.

### Synthesis

The evidence from the three source categories was aggregated separately and by different methods prior to synthesis in the form of a structured narrative referencing the stated review question. Particular attention was given to congruency between consensus of opinion, and strength of empirical evidence. Since inclusion of stakeholder perception and consensus opinion within a best-evidence review was challenging, the review team developed the (largely constructivist) epistemological position that:

- some competencies or attributes are relatively more important to veterinary graduate success than others (a premise notably absent from published competence frameworks).
- in assessing the relative importance of an attribute, quality outcomes-based evidence is more objectively valid than stakeholder opinion or perception.
- *however*, since (i) stakeholder opinion may directly or indirectly influence graduate outcomes (e.g. employer

perceptions will influence employment and employer satisfaction), (ii) most self-evaluated outcome measures for “success” are clearly subject to bias from personal perception; and (iii) stakeholder opinion is likely to be, at least in part, based on experiential evidence, perception and evidence cannot be disentangled, or causality determined.

- *therefore*, in the absence of objective outcomes-based evidence, consensus of opinion among multiple stakeholders is useful knowledge, because (i) it provides surrogate or indirect evidence of the likely “true” importance of an attribute that may be very difficult to measure objectively, and (ii) perceptions are to some extent self-fulfilling through their influence on outcomes.

### Competence frameworks

Aggregation of recent (post-2001) veterinary competence frameworks was performed with two guiding objectives. Firstly, since such frameworks are usually developed by consensus of expert opinion, comparison of included items across diverse lists allowed aggregation of international expert opinion, compiled from multiple contexts. Secondly, iterative aggregation of these lists allowed the evolution of a unique framework for the purpose of mapping other reviewed evidence, since imposition of a pre-existing framework (e.g. RCVS “Day One Skills”) would otherwise bias the evidence synthesis. The wording of included competence frameworks was distilled by informal thematic analysis through several rounds of iterative aggregation of thematic keywords, to develop by consensus a master list of sufficiently discrete and “fine-grained” items for utility in subsequent coding. Competencies based on disciplinary knowledge or technical/psychomotor skills were omitted. Notably, this excluded several competency domains often associated with or grouped with professional competencies in curricula (e.g. knowledge of legislation, public health or “One Health”). As we found it difficult to eliminate bias using a completely naïve approach, the final version of the list was structured with reference to the established CanMEDS medical competence framework (Frank et al. 2015), and a “common taxonomy” for health professions published during the review (Englander et al. 2013) which proved useful, requiring only minor reinterpretation to fit a veterinary context. An outline mapping the taxonomy developed by Englander et al. (2013) to various synonyms encountered in veterinary frameworks and survey items is shown in Appendix 2, available with the Supplementary Materials. After finalizing the coding framework, the wording of each included competence framework (plus any associated explanatory notes or preamble) was reassessed by two or more reviewers to determine whether it included each competency domain, and whether this was explicit or only implied in the document wording.

### Surveys of stakeholder perception

Studies reporting quantitative results (thus allowing relative ranking), and studies reporting qualitative or poorly quantitative results were treated separately. To allow aggregation of multiple quantitative surveys using different methodologies, a meta-analysis was performed using two methods:

1. a semi-quantitative relative importance score of 1–5, where 1 = clearly more important, e.g. top 10% of a ranked list; 2 = relatively more important, e.g. top 1/3rd of a ranked list; 3 = somewhat important, e.g. middle-ranked or ranking unclear; 4 = relatively less important, e.g. bottom 1/3rd of a ranked list; and 5 = clearly less important, e.g. bottom 10% of a ranked list, or <50% agree it is important; and
2. a proportionate rank order from 0 to 1, calculated as  $R = (r - 1)/(n - 1)$  (where  $r$  = deduced rank order in list, and  $n$  = number of list items).

Where survey items combined multiple competencies from the reference framework (e.g. “written and oral communication”), these were duplicated and allocated equal importance. Negatively phrased survey items were reversed. For lists including a mix of non-technical and technical competencies, relative rank was calculated separately for professional competencies only, then for all competency items. The final list was sequenced to approximate order of importance based on these three results in priority order. Qualitative and exploratory studies, or those that were found to be impossible to rank were compiled into a descriptive table along with key conclusions.

### Empirical evidence

This category of evidence was appraised with respect to the frequency (i.e. number of sources independently corroborating findings), strength, quality, and utility of evidence linking graduate-relevant outcome measures to the application or degree of development of a given competency. Though initially intended, it proved difficult to fit the diverse success outcomes in included papers to Kirkpatrick’s hierarchy of outcomes (Harden et al. 1999). As only a small number of sources in this category were identified, meta-analysis of this evidence was not appropriate and analysis occurred mostly via drafting of a narrative synthesis drawing out implications for practice, which was then discussed and reviewed by the review team.

In drawing together the overall findings of the review, particular focus was given to the concept of consensus, and any potential mismatch between perceptions and evidence. As noted earlier, we made only a limited attempt to integrate these findings with published opinion or comparison with findings in related health science disciplines – both of which may constitute relevant evidence in the broader context (Harden et al. 1999) – and the reader is referred elsewhere for these as appropriate.

## RESULTS

### Search results and overview

The primary database search yielded 21,919 records, which were sequentially screened and assessed for inclusion as indicated in Figure 1. Another 16 publications not found by the primary search were identified for assessment, 10 of which were included in the review; this included four competence frameworks published by accrediting bodies, that were automatically included on the basis of global influence and not included in the quality scoring process. The most frequent country of origin of included studies was USA (21 studies), followed by UK (9 studies), Australia and Canada (6

studies each), and the Netherlands (4 studies). The majority of included studies were published in *Journal of the American Veterinary Medical Association* (19 studies), *Journal of Veterinary Medical Education* (12 studies), or *Veterinary Record* (7 studies). Some studies were highly cited, particularly several commissioned industry reports from USA (listed in Appendix 3, available online as Supplementary Material). All of the most highly cited studies (>30 citations) were completed in USA.

Inter-rater agreement on the global quality of evidence scale between the two initial reviewers was good (80%), with a weighted kappa coefficient of 0.767. The majority of included studies (38 studies) were judged to provide lower quality evidence (score 2 or 3), with common deficiencies including poor detail of methodology, small or geographically limited sampling, low response bias, or poor relevance to the research question. More than half of the evidence in the empirical category was published since 2012, most of which was of high quality.

### Competence frameworks

Ten competence frameworks published since 2001 met the inclusion criteria as detailed in Appendix 4, available online as Supplementary Material. One framework (RCVS 2001) was updated and republished (RCVS 2014) during this review. Though the process used to develop the frameworks was rarely explicit, most appear to have been derived from consensus developed in workshops or focus groups (6 frameworks), or by open consultation following initial development by an expert panel (3 frameworks). Only one study (Bok et al. 2011) described a formal consensus-finding process, using a Delphi voting procedure. This and one other framework (Walsh et al. 2001) were subsequently validated by formal stakeholder survey (Walsh et al. 2002; Bok et al. 2014). The relative utility of key frameworks was compared on the basis of semi-structured interviews by one included study (Vandeweerd et al. 2014).

Communication skills and professional behavior were the only competencies explicit in all frameworks (Table 2). Competencies with substantial agreement (i.e. appearing in nearly all frameworks) included written communication and records, collaboration and teamwork, and business and practice management. Psychological constructs such as emotional intelligence and self-awareness, and self-efficacy and confidence were sparsely represented. No frameworks suggested hierarchy or priority order (thus evidence of relative importance), with the exception of the original RCVS “Day One Skills” list (RCVS 2001), which included the commentary that “...[awareness of personal limitations] is considered to be one of the most important, and should guide all new veterinary graduates when undertaking their professional duties”. Details of Delphi voting provided in Bok et al. (2011) show rejection of two items “design and conduct scientific research” and “educate and teach using didactically sound approaches” after failing to achieve consensus of relevance (<80%) among Delphi panel members.

### Stakeholder perceptions

The review identified 20 studies informing the review question via quantitative evidence of stakeholder perceptions (Appendix 5, available online as Supplementary Material)

Table 2. Professional (non-technical) veterinary competencies listed in published, consensus-based competence frameworks since 2001, mapped against two medical competence taxonomies.

CamMEDS: Doctor as...	Common taxonomy (Englander et al. 2013)	Veterinary professional competency	RCVS (2001, 2014, UK)	Walsh et al. (2001, USA)	Lloyd and Walsh (2002, USA)	Collins and Taylor (2002, Aus.)	Lewis and Klausner (2003, USA)	Miller et al. (2004, USA)	Bok et al. (2011, Neth.)	NAVMEC (2011, USA)	OIE (2012, Internat.)	Vandeweerd et al. (2014, Europe)
Communicator and Collaborator	Patient care	Effective communication – clients	●	●	●	●	●	●	●	●	●	●
		Relationship-centered care		●	●	●	●	●	●	●	●	●
		Workflow management		●	●	●	●	●	●	●	●	●
Scholar	Interpersonal and communication skills	Empathy and bond recognition		●	●	●	○	●	●	●	●	●
		Emotional intelligence and self-awareness		○	●	●	●	○	●	●	● <sup>c</sup>	○
		Written communication and records	●	●	●	●	●	●	●	●	●	●
Professional	Interprofessional collaboration	Effective communication – colleagues	●	●	●	●	●	●	●	●	●	●
		Collaboration and teamwork	●	●	●	●	●	●	●	●	●	●
		Critical thinking and problem-solving	○	●	●	●	○	●	●	●	●	○
Leader	Knowledge for practice	Research skills and practice	●	○	●	● <sup>a</sup>	●	●	●	●	● <sup>c</sup>	○
		Lifelong learning	●	●	●	●	●	●	●	●	●	●
		Information literacy and evidence-based approach	●	●	●	● <sup>a</sup>	●	○	●	●	●	●
Health advocate	Practice-based learning and improvement	Information technology		●	●	●	●	●	●	○	●	○
		Educating others		●	●	○	●	○	●	●	●	○
		Awareness of limitations	●	●	●	●	●	○	●	●	●	●
Professionalism	Professionalism	Professional values	●	●	●	●	●	●	●	●	●	●
		Professional behavior	●	●	●	●	●	●	●	●	●	●
		Cultural sensitivity and diversity	●	●	●	●	○	●	●	●	●	●
Personal and professional development	Personal and professional development	Commitment to animal welfare	○	●	●	○	●	●	●	●	●	●
		Resilience	●	●	●	●	●	●	●	●	●	●
		Work-life balance		●	●	●	●	●	●	●	●	●
Leader	Systems-based practice	Adaptability	●	●	●	●	○	○	●	●	○	●
		Self-efficacy and confidence	○	○	●	●	○	○	○	●	○	○
		Leadership	○	○	●	●	○	○	○	●	○	○
Health advocate	Health and welfare advocacy	Financial awareness	○	●	●	●	●	●	●	●	○	●
		Business and practice management	○	●	●	●	●	●	●	●	○	○
		Health and welfare advocacy	○	●	●	●	●	●	●	●	●	●

●: explicit; ○: implied only; X: rejected in Delphi process; Aus: Australia and New Zealand; Neth: Netherlands.

<sup>a</sup>In context of public health and food safety only.

<sup>b</sup>RCVS (2001) but not RCVS (2014) states "This last item is considered to be one of the most important. ...".

<sup>c</sup>OIE "Advanced Competencies", only general awareness and appreciation required at graduation.



**Table 3.** Relative perceived importance of professional (non-technical) veterinary competencies, in deduced rank order, from meta-analysis of 321 survey items in 20 published surveys of various stakeholder groups (detailed in Appendix 5, available online as Supplementary Material).

Competency	Importance		Mean rank		N = studies/items
	Mean	Mode	P only	All items	
<b>Clearly more important</b>					
Effective communication – clients	1.8	1	0.22	0.25	16/25
Effective communication – colleagues	1.9	1	0.22	0.25	13/16
Awareness of limitations	1.9	1	0.25	0.30	6/8
<b>More important</b>					
Professional values	2.2	3	0.25	0.27	5/8
Critical thinking and problem-solving	2.3	2	0.29	0.27	12/16
Collaboration and teamwork	2.3	2	0.31	0.44	11/14
Resilience	2.4	3	0.31	0.37	8/13
<b>Important</b>					
Commitment to animal welfare	2.7	3	0.40	0.47	5/6
Lifelong learning	2.8	3	0.38	0.46	6/6
Relationship-centered care	2.8	3	0.44	0.37	12/19
Professional behavior	2.8	3	0.44	0.52	11/20
Financial awareness <sup>a</sup>	2.8	3	0.46	0.52	3/3
Emotional intelligence and self-awareness	2.9	3	0.48	0.49	5/6
Empathy and bond recognition	2.9	3	0.53	0.54	8/17
Adaptability	2.9	3	0.56	0.54	6/10
Self-efficacy and confidence	3.0	3	0.49	0.48	10/23
Workflow management	3.1	3	0.53	0.60	12/21
Information and evidence-based approach	3.1	3	0.58	0.63	9/10
Reflection and goal-setting	3.1	3	0.61	0.59	5/5
Written communication and records	3.3	3	0.63	0.65	10/10
Work-life balance <sup>a</sup>	3.5	3	0.71	0.41	2/2
<b>Less important</b>					
Information technology	3.6	3	0.72	0.70	6/6
Educating others	3.6	4	0.73	0.73	5/5
Leadership	3.6	4	0.77	0.78	9/11
Cultural sensitivity and diversity	3.7	4	0.69	0.82	5/6
Health and welfare advocacy	3.8	4	0.78	0.74	6/11
Business and practice management	3.9	5	0.74	0.79	13/17
<b>Clearly less important</b>					
Research skills <sup>a</sup>	4.8	5	0.95	0.97	3/4

<sup>a</sup>Limited data (fewer than four studies evaluating competency).

P only: rank within professional competencies only; All items: rank in mixed professional and technical or knowledge-based skills; 0: ranked highest; 1: ranked lowest.

including surveys of veterinary students (6 studies), veterinary graduates (3 studies), veterinarians (10 studies), veterinary employers (6 studies), veterinary college faculty (3 studies), and clients (2 studies). Three of these studies (Greenfield et al. 2004; Mellanby et al. 2011; Rhind et al. 2011) were judged to represent best-evidence, i.e. quality score of 4 or 5. Most studies were standard postal, paper, or electronic questionnaires using Likert-scaled ratings against pre-defined items, though one study used a deliberate item-ranking methodology (Martin & Taunton 2006), and two studies included lists of “most important” skills from frequencies of compiled responses to free-response survey questions (Bristol 2002; Greenfield et al. 2004). Most survey questions were framed in the context of a generic veterinarian (10 studies) or graduate (4 studies), with a minority referencing new graduates (3 studies) or undergraduate training (3 studies). Four studies made “success” explicit in the survey question. Eight of the surveys included statistical cohort comparisons. Of particular note is a longitudinal cohort study (Heath et al. 1996), which found that first-year students provided lower ratings for the importance of communication and interpersonal skills than when the same individuals were re-surveyed as final-year students and second-year graduates.

Aggregation of deduced relative importance and item rank order from each study allowed meta-analysis of an overall relative importance and approximate rank order (Table 3). Communication skills were perceived to be clearly more important overall, particularly by veterinarians and employers, though possibly less so from client surveys. Survey items around “awareness of limitations” were collectively ranked

more important than similar items around reflection, self-audit or acceptance of criticism, including when compared directly within a study (Rhind et al. 2011; Schull et al. 2012). Items allocated to “relationship-centered care” were diverse and suggested an internal split between highly ranked items around “gain respect and confidence of clients”, and more lowly ranked personality items such as friendliness, cheerful disposition, good sense of humor, likeable or outgoing personality (Mellanby et al. 2011; Schull et al. 2012). Research skills were ranked as clearly least important by this meta-analysis; although some caution is required due to the low quantity of evidence (four items from three surveys), this bottom-most ranking was replicated independently by all three studies, across a range of stakeholder groups. Leadership skills were also overall ranked of relatively lower importance, including on six survey items explicitly including the word “leadership”. Business and practice management skills were similarly ranked overall as relatively less important (17 items in 13 surveys), with the notable exception of the three studies not using Likert-scaled methodology (Bristol 2002; Greenfield et al. 2004; Martin & Taunton 2006), which conversely found this class of skills to be relatively more important.

Ten studies provided qualitative (or only semi-quantitative) evidence from surveys or interviews of stakeholder perceptions (listed in Appendix 6, available online as Supplementary Material). These were mostly rated as lower quality evidence. One highly cited US publication (Brown & Silverman 1999) provided limited evidence, which was rated of low quality due the lack of supporting detail in the published executive summary, which summarizes a longer report

that is out of print and could not be obtained for this review. Several surveys of UK graduates (Riggs et al. 2001; Routly et al. 2002; Bachynsky et al. 2013) provided consistent though lower quality evidence that dealing with financial aspects of practice, client communication, and managing time and volume of work (prioritizing) are significant problems for new graduates in the transition to work.

### Supporting (excluded) evidence

One large survey, using a paired comparison instrument to rank the importance of 11 attributes “in determining who should be admitted to the DVM [Doctor of Veterinary Medicine] program” (Conlon et al. 2012), was felt to be too far from the research question for inclusion; top-ranked attributes included ethical behavior, sound judgment, communication, and critical and creative thinking. A number of studies reported surveys of stakeholder perceptions against a single competency, and were excluded on the basis they do not provide reliable evidence of comparative importance. These included findings that 89% of students at a US college rated the One Health initiative (public health advocacy) as very important (Wong & Kogan 2013), and that nearly all graduates completing a US course on client relations felt that these skills were important to self-fulfillment, client loyalty, and financial success (Kogan et al. 2004a). Another study found that 97% of 415 US veterinarians agreed that veterinarians who recognize and facilitate the human-animal bond in their practices will be more successful than those who do not (Martin & Taunton 2006). A number of studies were excluded on the basis that they surveyed stakeholders only with regard to perceived graduate competence/preparedness (e.g. Butler 2003; Jaarsma et al. 2008; Schull et al. 2011) or deficiency (Walsh et al. 2002), since lack of competence in a given skill does not necessarily signify its importance. The most frequent responses by US employers when asked a free-response question about “major deficiencies” (thus arguably implying importance) included improved knowledge of practice management, communication and interpersonal skills (Walsh et al. 2002). Similarly, Heath and Mills (1999) found the most frequent responses from 258 Australian employers to the question “where do new graduates need most help?” included communication and interpersonal skills, financial and business aspects of practice, and personal and professional self-image. Cipolla and Zecconi (2015) surveyed 81 Italian dairy farmers and found their perceptions of veterinary communication skills were significantly below the desired level, contributing to their dissatisfaction with services.

### Empirical evidence

The review included 13 studies providing “empirical” evidence through association or correlation of a veterinary competency with improvement of an outcome measure relevant to success (detailed in Appendix 7, available online as Supplementary Material). Seven of these studies (Lue et al. 2008; Danielson et al. 2012; Kanji et al. 2012; Shaw et al. 2012; McArthur & Fitzgerald 2013; Mastenbroek et al. 2014a, 2014b) were assessed to be “best evidence”, i.e. global quality score of 4 or 5. Outcomes measured included client satisfaction (4 studies), client compliance or adherence to recommendations (2 studies), employer satisfaction

(1 study), veterinarian satisfaction (1 study), veterinarian income (2 studies), and aspects of psychological well-being (3 studies). These studies provide multiple lines of evidence particularly for the importance of client communication skills, from outcomes including client satisfaction (Case 1988; Greenberg et al. 1992; Woodcock & Barleggs 2005; McArthur & Fitzgerald 2013), adherence to recommendations (Lue et al. 2008; Kanji et al. 2012), employer satisfaction (Danielson et al. 2012), and veterinarian satisfaction with consultations (Shaw et al. 2012). Some of these studies include evidence specifically for the importance of empathic or relationship-centered elements of client communication. Other competencies supported by multiple empirical studies and multiple outcomes include self-efficacy and confidence (Cron et al. 2000; Shaw et al. 2012; Mastenbroek et al. 2014a, 2014b), and business and practice management skills (Cron et al. 2000; Volk et al. 2005; Danielson et al. 2012). Recent studies in Dutch veterinarians (Mastenbroek et al. 2014a, 2014b) provide high-quality evidence for the personal resources (self-efficacy, reflective practice, optimism) most important in supporting personal wellbeing and work engagement.

### Supporting (excluded) evidence

A recent study concluding that the effectiveness of a veterinary team significantly influences team members’ job satisfaction and burnout (Moore et al. 2014) did not meet the inclusion criteria, since only 70 of 274 participants were veterinarians. Nevertheless this study empirically provides high-quality supporting evidence for the importance of teamwork in the veterinary workplace environment. Other studies of veterinary communication have shown prevailing deficiencies including underuse of open questions (Shaw et al. 2004b) and client-centered communication approaches (Nogueira Borden et al. 2010; Dysart et al. 2011) that, if extrapolated against similar findings in medical physician–patient studies (Shaw et al. 2004a), may be assumed to negatively influence outcomes including efficiency, client satisfaction and adherence, and healthcare outcomes. Included studies reporting the importance of communication skills to client adherence (Lue et al. 2008; Kanji et al. 2012) appear to be supported by a frequently cited industry report (AAHA 2003) that could not be obtained for this review. A brief follow-up report concluding a strong correlation between medication adherence and veterinary communication (AAHA 2009) was excluded on quality criteria. However evidence to support oft-repeated claims that deficient communication skills are frequent causes of malpractice complaints and litigation could not be found in this review, with the exception of a footnote reference to local (Ontario) data in Shaw et al. (2004a).

## Discussion

When considered altogether, this review found a fairly sparse evidence base from within the veterinary discipline to support the relative importance of professional (non-technical) competencies for veterinary graduate success. The majority of this evidence was of lower quality, and reported only subjective stakeholder perceptions rather than “empirical” associations with defined outcomes – though, as noted earlier, the perceptions of stakeholders

(e.g. employers, clients) may influence outcomes, and can arguably provide useful indirect evidence of the “true” importance of a competency. Further, the most highly cited evidence does not match well with the best quality evidence as reviewed here. Several widely cited US reports were based on extensive survey work, but appear in the literature only as executive summaries lacking sufficient detail of methodology and results to provide confidence in their conclusions. By far the most highly cited report, Brown and Silverman (1999) had limited distribution outside USA and neither the full report nor an abridged version could be obtained for this review (including directly from the AVMA, who confirmed these are now out-of-print).

The specificity of available evidence relative to the review question is also weak. Only a minority of surveys are specifically framed in the context of a new or recent graduate, while the only empirical evidence in this context is from the graduate employer study of Danielson et al. (2012). This distinction is significant, since a competency important in later career stages may be developed not only during undergraduate training, but also through postgraduate training, experience, and mentoring. Similarly few studies clearly state the outcome(s) for which a given competency might be important, either in the general context of “success” or a specifically identified outcome measure. The outcomes defining veterinary professional success were explored by Lewis and Klausner (2003), who distilled discussions from focus groups into six themes of personal fulfillment, helping others, a balanced lifestyle, respect and professional recognition, personal goal achievement, and satisfactory economic compensation. Of these the last item is likely less important, since multiple studies have shown income does not strongly influence job satisfaction for veterinarians (Brown & Silverman 1999; Cron et al. 2000; Kogan et al. 2004b), thus casting some doubt on its validity as a measure of success. No included studies measured healthcare (patient) outcomes as occur in more recent medical education research, although several studies included client adherence that might be expected to influence patient outcomes.

Our meta-analysis of multiple surveys shows that competencies traditionally included within the broader suite of “veterinary professionalism” (Mossop & Cobb 2013) are generally thought to be of greater importance than those probably perceived as less frontline clinical skills. When aligned to the medical CanMEDS framework (Frank et al. 2015) the broad roles of *communicator*, *collaborator*, and *professional* seem to be valued above those of *scholar*, *health advocate* and *leader*. However, only a single competency, communication skills, was found to have both strong consensus of perceived importance, and high-quality evidence of an effect on outcome measures relevant to graduate success. Our analysis thus shows communication skills are currently the only professional competency that can be confidently and evidentially diagnosed as highly important to veterinary graduate success, perhaps unsurprisingly given the growing focus on communication in both veterinary education and research over the last two decades or more. This aligns with the view of Hodgson et al. (2013) that of the seven professional competencies cited in the NAVMEC report, communication is arguably the best integrated, taught, and assessed competency within current veterinary curricula. Our review suggests since the importance of “communication skills” is now well-established, a priority for future work should be to

build the evidence-base and profile of underpinning competencies within this broad umbrella (as well as the even broader “interpersonal skills”). Such underpinning competencies include empathy, relationship-centered care approaches and self-confidence, which are suggested to be important from some empirical evidence, as well as fundamental psychological constructs such as emotional intelligence and self-awareness, which are hardly studied in the veterinary context.

Resilience was found to be a relatively more important competency by our meta-analysis but currently lacking a strong evidence base linked to graduate outcomes, beyond the *prima facie* assumption that logically follows from adopting personal well-being as a measure of graduate success. A related argument for the importance of resilience can be mounted from the relative severity of its absence, in terms of mental health morbidity and suicide, for which veterinarians are at elevated risk compared to the general population (Bartram & Baldwin 2010; Platt et al. 2012 for review), and an issue of emerging importance in veterinary education. The related competency of work-life balance is less clearly supported by the evidence as reviewed here, but may similarly be deduced from the consistent finding (Meehan & Bradley 2007) that veterinarians working excessive hours and overtime experience poorer psychological health. The recent studies of Mastenbroek et al. (2014a, 2014b) provide important evidence for the role of personal resources (reflective practice, optimism, self-confidence) in protecting from burnout, but we recommend further outcomes-based research in this area as a priority well aligned to the current needs of the profession.

When appraising the evidence for mismatch between stakeholder perceptions versus empirical outcome-linked evidence, the clearest example was the importance of business and practice management skills, which is supported by multiple lines of evidence despite their typically lower ranking in Likert-scaled surveys. This mismatched evidence has been comprehensively reviewed elsewhere by the review team as a supplementary output of this BEME project (Cake et al. 2014; available from the corresponding author on request), and may be attributable to “evaluation apprehension bias”, or subconscious guilt for valuing the monetary aspects of veterinary services. However, the expected level of business skills varied widely between different frameworks, suggesting the need for undergraduate educators to clearly define appropriate graduate-level outcomes such as those recommended by Bachynsky et al. (2013), and defer the development of more advanced business skills to postgraduate training. This mismatch provides a clear example of the risk of relying on survey-based evidence of stakeholder perceptions to establish curriculum priorities. In an opposite example of mismatch, “awareness of limitations” was found to be perceived as clearly more important, despite the only evidence empirically assessing this (as “knows when/how to refer”) finding a significant *negative* effect on employer satisfaction (Danielson et al. 2012), though this was confounded by interaction with other non-technical skills and did not suggest a simple inverse relationship.

With the exception of business skills, the competencies perceived to be relatively less important across our survey meta-analysis also lack empirical evidence supporting their importance for graduates. These include several competencies – information technology, leadership, health and

welfare advocacy, cultural competency, research – highlighted as priorities by the NCVI and subsequently prominent as top-level core competencies in the NAVMEC framework (NAVMEC 2011). While these competencies may indeed be important for the future success of the veterinary profession in meeting evolving societal needs and financial challenges (NAVMEC 2011; Hodgson et al. 2013), there is not currently clear evidence for their importance for the individual success of a recent graduate, and we recommend that authorities elaborate a clear alternative rationale to support their inclusion in undergraduate curricula.

One reason for under-valuing these competencies may be misinterpretation of the language used; e.g. while the competency of “leadership” is thought less important, other qualities commonly attributed to leaders are more valued. While “thought leaders” interviewed by Lloyd et al. “. . . strongly agreed that to meet societal needs in the future, leadership is needed at every level of the veterinary profession” (Lloyd et al. 2005, p. 1063), they defined the expected qualities of a leader as including emotional intelligence and self-awareness, resilience, self-efficacy and confidence, adaptability, honesty, self-audit, adaptability, and “well-developed interpersonal skills” (*ibid.*, p. 1064). Similarly in their mixed-methods study, Rhind et al. (2011) found from focus groups that the term “research skills” was typically interpreted to mean bench-based laboratory work, but was more valued when interpreted more broadly to include, e.g. problem-solving abilities. This was reflected in other stakeholder surveys, in which “research skills” were clearly valued less than component skills such “critically appraise scientific publication” or “managing scientific information” (Kleine et al. 2002; Bok et al. 2014). Our findings suggest it may be more fruitful for educators to advance the importance of constituent competencies in their own right, rather than bundled as sub-elements of “leadership” or “research skills”, and to be explicit in defining collective terms prone to different interpretation.

### Strengths and weaknesses of the review

Strengths of this review include its broad scope (allowing simultaneous comparison of multiple professional

competencies), its triangulating approach from multiple categories of evidence (competence frameworks, surveyed opinion, and empirical research), and its multidisciplinary review team bringing experience from previous (Rhind et al. 2008) and current BEME projects. We view our approach restricting evidence to the veterinary discipline as a strength, since veterinary education too often relies on evidence from other disciplines, but we acknowledge this is a somewhat artificial imposition that will undoubtedly have excluded relevant evidence from other health sciences, and may limit the transferability of our findings.

Multiple limitations of the current review are acknowledged. Our inclusion and exclusion criteria, particularly limitation to English language publications, may have excluded relevant evidence particularly from European journals frequently publishing veterinary education content such as *Tijdschrift voor Diergeneeskunde* (Dutch) and *Deutsche Tierärztliche Wochenschrift* (German). The aggregate framework developed for this review, though designed to avoid pre-existing bias, may inevitably have imposed its own bias on the aggregation process used for meta-analysis and synthesis. We acknowledge our survey meta-analysis methodology is only semi-quantitative and has only approximately determined the rank order of perceived importance across all stakeholders. We acknowledge the ranking determined by this methodology does not include all evidence of stakeholder perceptions, which includes valid qualitative evidence, e.g. from focus groups. Finally, we acknowledge this review has focused on the *relative* importance of professional competencies as a subset, and not their *absolute* importance or relative ranking within the full suite of learning outcomes typically found in veterinary curricula.

### Conclusions

In conclusion, this systematic review highlights the comparatively weak body of evidence supporting the inclusion of various professional (non-technical) competencies in contemporary veterinary curricula and accreditation standards, and yields implications for future practice and research (Box 1). Only a single competency (communication) demonstrates validity from both strong stakeholder consensus of perceived

#### Box 1. Implications for practice and research.

- Communication skills are currently the only veterinary professional competency with both strong stakeholder consensus, and strong outcomes-based evidence in support of relatively high importance to graduate success.
- Most other veterinary professional competencies enjoy inconsistent or weaker evidence of their importance. This yields the implications for practice that:
  - *Educators* should aim to strengthen the perceived importance of lower ranked competencies known to be important from empirical evidence (most notably entry-level business skills, which are supported by a comparatively strong evidence base but are consistently perceived from Likert-scaled survey evidence as of lesser importance); and
  - *Researchers* should aim to strengthen the evidence base for competencies perceived to be of high importance, ideally by pursuing empirical studies based on relevant outcome measures, or at least high-quality stakeholder studies designed specifically to build this case.
- Mismatches between perceptions and evidence (e.g. business skills) provide a warning to educators that consensus of perceived importance does not reliably provide evidence of actual importance, except in the sense that stakeholder perceptions may influence real outcomes (e.g. where employer perceptions influence employability).
- For competencies lacking both perceived and empirical evidence of importance to graduate success, the *prima facie* implications for practice are that these should either be viewed as lower priorities for undergraduate curricula, or that a clear rationale for their inclusion should be developed against outcomes other than graduate success. Where competencies are less important from the graduate perspective but are argued as important for the broader veterinary profession (e.g. leadership, cultural competence, public advocacy, conduct of research), educators and accreditors should build a convincing alternative rationale for undergraduates to justify their priority in curricula.
- The RCVS “Day One Competences” (RCVS 2014), currently the default reference framework for student outcomes under Australasian and UK/European accreditation procedures, potentially underemphasize some competencies found to be important in this review, including critical thinking, empathy, and relationship-centered care.
- The most frequently cited sources for the importance of veterinary professional competencies do not match well with the sources providing higher quality “best-evidence” as reviewed here. In particular, some widely cited executive summaries of industry reports represent weak evidence when assessed by BEME criteria, and educators should ideally seek higher quality evidence from other sources.
- In line with the Best-Evidence ethos promoted by BEME, we encourage veterinary educators to measure authentic outcomes rather than rely on stakeholder perceptions, and to habitually question the evidence base for policy decisions in veterinary education and accreditation, and within their own teaching practice.

importance, and strong empirical evidence linked to outcome measures relevant to graduate success. Meta-analysis of multiple stakeholder surveys shows that many competencies typically considered to be key elements of “veterinary professionalism” (Mossop & Cobb 2013) are thought to be relatively important, including effective communication, awareness of limitations, professional values, critical thinking, collaboration, and resilience. However, our review has shown only scattered and generally sparse empirical evidence to support stakeholder perceptions; one clear mismatch between perceptions and empirical evidence (business skills); and a cluster of competencies often argued to be important for the profession, yet enjoying neither perceived or empirical evidence in support. The scarcity of “empirical” evidence supporting professional competencies in the veterinary literature should be of concern to educators. Veterinary education as a discipline should strive to strengthen this evidence base from high-quality, outcomes-driven research, and to develop a more refined and “best-evidence”-lead discourse around the importance of professional (non-technical) competencies for graduate veterinarians.

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