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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. #

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SHORT TITLE

Review of veterinary professional competencies

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 summarise 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 1988-2015 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: 52 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-centred 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.

Keywords:

veterinary graduate attributes, non-technical competencies, professional competencies.

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-centred 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.

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 prioritise 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-prioritised 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 towards expansion of these '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 the US. 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 towards 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 etc.) 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 synthesise 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). 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)*

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 favourable professional outcome, or favourable 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 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 & Zecconi 2015). The databases and other sources searched are summarised 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

recognised as the first widely-used competency framework in veterinary education and marking a shift towards 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.

TABLE 1 NEAR HERE

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. 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, for example: 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 finalising 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 methodology, 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 less than 50% agree it is important; and

(2) a proportionate rank order from 0-1, 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 above 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 21919 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 the United States (21 studies), followed by the United Kingdom (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 the US (listed in Appendix 3, available online as Supplementary Material). All of the most highly cited studies (>30 citations) were completed in the US.

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.

FIGURE 1 NEAR HERE

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 behaviour 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.

TABLE 2 NEAR HERE

Stakeholder perceptions

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

TABLE 3 NEAR HERE

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 summarises 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 (prioritising) 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 behaviour, 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 recognise 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 & 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 & 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; Shaw et al. 2012; Kanji 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-centred 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-

centred 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 above, 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 & Silverman (1999) had limited

distribution outside the USA and neither the full report or 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 & 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-centred 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 (see Bartram & Baldwin 2010; Platt et al. 2012b 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 (*e.g.* 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 post-graduate 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 NCVEI 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; for example 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 for example 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 multiples 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 Tierarztliche 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 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.

BOX 1 NEAR HERE

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 underemphasise some competencies found to be important in this review, including critical thinking, empathy, and relationship-centred 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.

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Figure 1. Flow diagram of papers in the review.

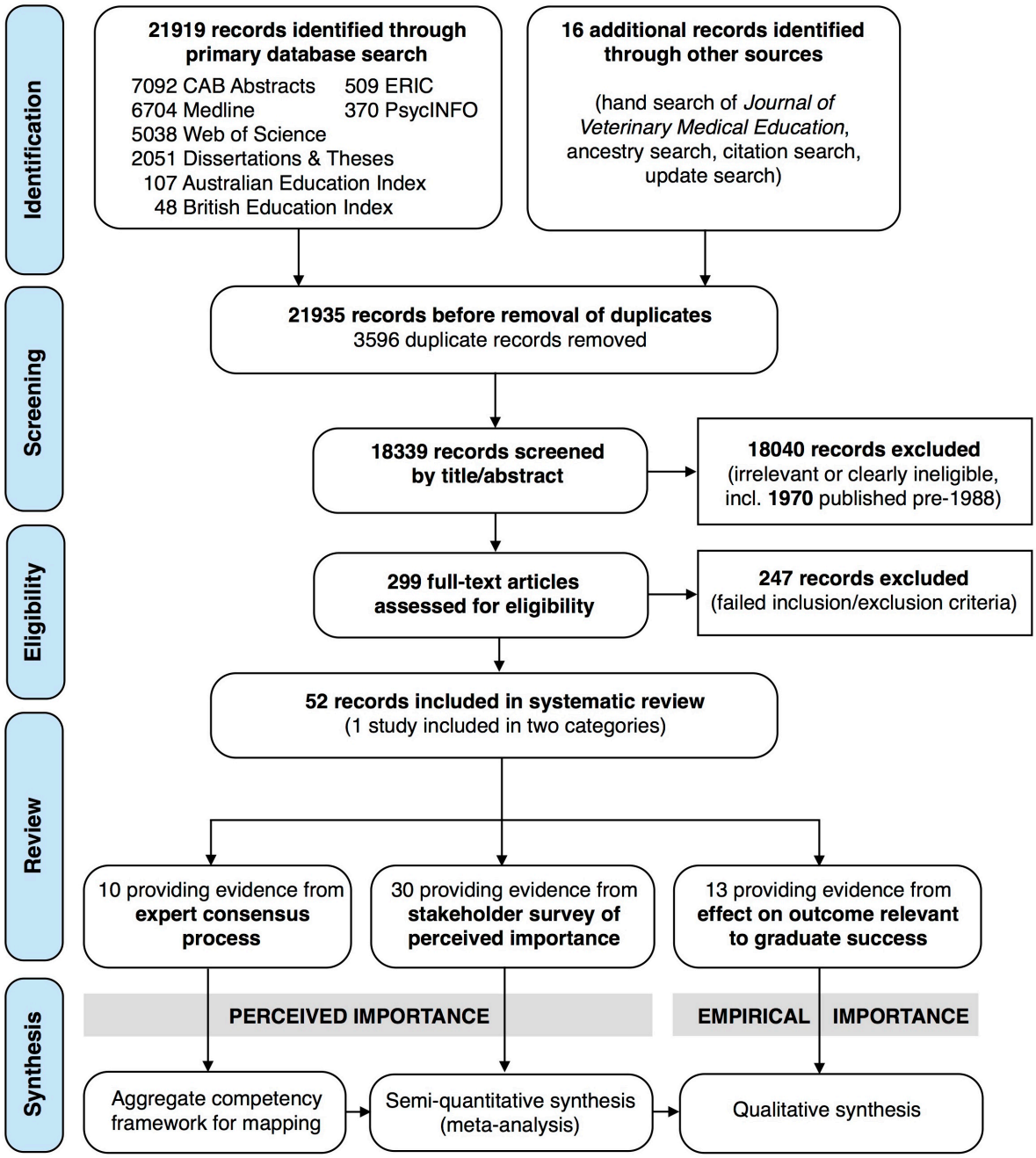

Table 1. Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Discipline	• Veterinary context only	• Veterinary nursing • Human medical education • Mixed health science studies including, but not separately reporting, veterinary cohorts
Publication date	• Studies published 1988-2015	• Studies published before 1988 (or 2001 for competence frameworks)
Language		• Languages other than English
Publication type		• Books or theses that proved unobtainable • News articles • Short-form conference abstracts • Letters
Nature of evidence	• Includes evidence of the importance of professional (non-technical) competencies, in one of the following forms:	• Opinion or review articles lacking original evidence, however influential or highly-cited
	1. Competence lists or frameworks developed by an expert consensus process	• 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)
	2. Survey or interview of relevant stakeholder group(s) regarding perceived importance	• Surveys reporting against only a single competency (since these do not provide evidence of *relative* importance)*

		• Surveys of perceived graduate preparedness, competence, deficiency, etc., in the absence of supporting evidence that deficiency caused a problem*
	3. Empirical studies demonstrating an effect or association between professional competencies and at least one outcome measure relevant to graduate success	• Studies with only indirect associations to relevant outcome measures, thus reliant on interposed assumptions*
Stakeholder groups	• Veterinary students, veterinary graduates (<3 yrs), veterinarians, veterinary employers, veterinary college faculty, veterinary clients (pet owners), veterinary professional or industry bodies	• Outcomes for veterinary nurses or technicians, or mixed groups including non-veterinarians (*i.e.* 'veterinary teams')*
Outcome measures	• 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	• Selection criteria for undergraduate admissions*

* Some excluded sources are reported in the Results as supporting or 'second tier' evidence.

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

CanMEDS : *Doctor as…*	***Common Taxonomy*** *(Englander et al. 2013)*	**Veterinary Professional Competency**	RCVS (2001, 2014, UK)	Walsh et al. (2001, US)	Lloyd & Walsh (2002, US)	Collins & Taylor (2002, Aus.)	Lewis & Klausner (2003, US)	Miller et al. (2004, US)	Bok et al. (2011, Neth.)	NAVMEC (2011, US)	OIE (2012,Internat.)	Vandeweerd et al. (2014, Europe)
Communicator & Collaborator	*Patient care*	Effective communication - clients	●	●	●	●	●	●	●	●	●	●
		Relationship-centred care		●	●	●	●	●	●	●		●
		Workflow management			●	●	●	●	●	●		●
	Interpersonal and communication skills	Empathy & bond recognition		●	●	●	○	●		●		●
		Emotional intelligence & self-awareness		○	●	●	○	○			●[c]	○
		Written communication & records	●	●	●	●	●	●		●	●[c]	●
	Interprofessional collaboration	Effective communication - colleagues	●	●	●	●	●	●	●	●	●	●
		Collaboration & teamwork	●	●	●	●	●	●	●	●		●
Scholar	*Knowledge for practice*	Critical thinking & problem-solving	○	●		●	○	●		●		○
		Research skills & practice	●	○		●[a]		●	**X**	●	●[c]	
	Practice-based learning and improvement	Lifelong learning	●	●	●	●	●	●		●		
		Information literacy & evidence-based approach	●	●		●[a]	○	●	●	●	●	●
		Information technology		●	●	●		●		○		○

		Educating others			●	○	●	○	**X**	●	●	
Professional		Reflection & goal-setting	●	●	●	●	●	●	●	●		
		Awareness of limitations	●[b]	●			○	●				●
	Professionalism	Professional values	●	●	●	●	●	●		●		
		Professional behaviour	●	●	●	●	●	●	●	●	●	●
		Cultural sensitivity & diversity		●	●	●	○	○		●		
		Commitment to animal welfare	○	●	●	○		●	●	●	●	
	Personal and professional development	Resilience	●	●	●		●	●		●		●
		Work-life balance			●	●	○	●		●		
		Adaptability	●	●	●	●	●	○		●		
		Self-efficacy & confidence					●	○				●
Leader		Leadership	○		●	●	●	●	●	●	○[c]	○
	Systems-based practice	Financial awareness	○	●	●	●	●	●		●		●
		Business & practice management	●	●	●	●	●	●	●	●	○[c]	●
Health Advocate		Health & welfare advocacy	○	●	●	●		●	●	●	●	

● = explicit; ○ = implied only; **X** = rejected in Delphi process. Aus.: Australia & New Zealand; Neth.: Netherlands. Notes: a: in context of public health & food safety only; b: RCVS (2001) but not RCVS (2014) states "This last item is considered to be one of the most important..."; c: 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 =*
		Mean	*Mode*	*P only*	*All items*	*studies/items*
Clearly more important	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
More important	Professional values	2.2	3	0.25	0.27	5/8
	Critical thinking & problem-solving	2.3	2	0.29	0.27	12/16
	Collaboration & teamwork	2.3	2	0.31	0.44	11/14
	Resilience	2.4	3	0.31	0.37	8/13
Important	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-centred care	2.8	3	0.44	0.37	12/19
	Professional behavior	2.8	3	0.44	0.52	11/20
	Financial awareness†	2.8	3	0.46	0.52	3/3
	Emotional intelligence & self-awareness	2.9	3	0.48	0.49	5/6
	Empathy & bond recognition	2.9	3	0.53	0.54	8/17
	Adaptability	2.9	3	0.56	0.54	6/10
	Self-efficacy & confidence	3.0	3	0.49	0.48	10/23
	Workflow management	3.1	3	0.53	0.60	12/21
	Information & evidence-based approach	3.1	3	0.58	0.63	9/10
	Reflection & goal-setting	3.1	3	0.61	0.59	5/5
	Written communication & records	3.3	3	0.63	0.65	10/10
	Work-life balance†	3.5	3	0.71	0.41	2/2
Less important	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 & diversity	3.7	4	0.69	0.82	5/6
	Health & welfare advocacy	3.8	4	0.78	0.74	6/11
	Business & practice management	3.9	5	0.74	0.79	13/17
Clearly less important	Research skills†	4.8	5	0.95	0.97	3/4

† = 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.

Which professional (non-technical) competencies are most important to the success of graduate veterinarians? A Best Evidence Medical Education (BEME) systematic review

Martin A. Cake, Melinda A. Bell, Julie Williams, Fiona Brown, Marshall Dozier, Susan M. Rhind & Sarah Baillie

SUPPLEMENTARY MATERIALS

APPENDIX 1

Database Search Histories

CAB Abstracts (Ovid) 1972-June 2014 (download date: 2014-06-30)

1. veterinar*.mp.
2. (non-technical adj3 (competenc* or skill*)).mp.
3. communication skills/
4. verbal communication/ or oral communication/
5. (nonverbal adj3 (communication or behavi*)).mp.
6. ((communicat* or interpersonal or writing or written) adj3 (skill* or effective* or interpersonal or successful*)).mp.
7. writing/ or writing skills/
8. (cultural adj3 (awareness or diversity)).mp.
9. (diversity.mp. or diversity/) and (client or cultural).mp.
10. ((cultural* or multicultural* or divers*) adj3 (competen* or sensitiv* or aware*)).mp.
11. (relationship and (client or owner)).mp. or employer employee relationships/
12. interpersonal.mp. or interpersonal relations/
13. customer relations/
14. ((relationship or rapport or trust) adj5 (client or owner)).mp.
15. (empathy or compassion).mp.
16. human-animal bond.mp.
17. collaboration.mp. or teamwork/ or adaptability/
18. ((ability or able) adj3 (collaborat* or team*)).mp.
19. ethics/
20. professional ethics/
21. professionalism/
22. professional competence/

23. ((professional* or ethic*) adj3 (value* or responsib* or aware* or practice or competenc* or behav* or judgment or leadership or standard* or duty)).mp.
24. ethology.mp.
25. integrity.mp.
26. ((law or legal or governance) adj2 (knowledg* or aware*)).mp.
27. animal welfare/ or animal welfare.mp.
28. work-life balance.mp.
29. stress management.mp. or stress management/
30. optimism.mp.
31. self-management.mp. or self management.sh.
32. emotional intelligence.mp.
33. (refle* adj3 (self or practice or critical)).mp.
34. (audit adj3 self).mp.
35. self-efficacy.mp.
36. self perception/ or role models/ or role perception/ or self esteem/
37. (management adj2 self).mp.
38. (confiden* adj2 self).mp.
39. (develop* adj2 (personal or professional)).mp.
40. resilience.mp.
41. ((innovat* or chang* or entrepreneur*) adj3 (capacity or capab* or think* or ability or able)).mp.
42. autonom*.mp.
43. leadership/ or leadership training/ or leadership.mp.
44. ((coach* or mentor* or motivat* or influenc*) adj2 (other* or colleague* or staff* or profession)).mp.
45. (life-long learning or lifelong learning).mp. or lifelong learning/ or Continuing education/
46. information management.mp.
47. critical thinking.mp.
48. scholar*.mp.
49. research skills.mp.
50. (problem adj2 solv*).mp.
51. numeracy.mp.
52. ((reason* or research) adj3 skill*).mp.
53. attributes.mp.
54. (recent* adj3 graduate*).mp.
55. attitudes/
56. aptitudes.mp.
57. (characteristic* adj5 student*).mp.
58. (competenc* adj5 student*).mp.

59. or/2-58
60. 1 and 59

Medline (Ovid) 1946-June 2014 (download date: 2014-06-30)

1. veterinar*.mp.
2. (non-technical adj3 (competenc* or skill*)).mp.
3. (nonverbal adj3 (communication or behavi*)).mp.
4. ((communicat* or interpersonal or writing or written) adj3 (skill* or effective* or interpersonal or successful*)).mp.
5. writing/ or writing skills/
6. (cultural adj3 (awareness or diversity)).mp.
7. (diversity.mp. or diversity/) and (client or cultural).mp.
8. ((cultural* or multicultural* or divers*) adj3 (competen* or sensitiv* or aware*)).mp.
9. (relationship and (client or owner)).mp. or employer employee relationships/
10. interpersonal.mp. or interpersonal relations/
11. ((relationship or rapport or trust) adj5 (client or owner)).mp.
12. (empathy or compassion).mp.
13. human-animal bond.mp.
14. collaboration.mp. or teamwork/ or adaptability/
15. ((ability or able) adj3 (collaborat* or team*)).mp.
16. ethics/
17. professional ethics/
18. professional competence/
19. ((professional* or ethic*) adj3 (value* or responsib* or aware* or practice or competenc* or behav* or judgment or leadership or standard* or duty)).mp.
20. ethology.mp.
21. integrity.mp.
22. ((law or legal or governance) adj2 (knowledg* or aware*)).mp.
23. animal welfare/ or animal welfare.mp.
24. work-life balance.mp.
25. stress management.mp. or stress management/
26. optimism.mp.
27. self-management.mp. or self management.sh.
28. emotional intelligence.mp.
29. (refle* adj3 (self or practice or critical)).mp.
30. (audit adj3 self).mp.

31. self-efficacy.mp.
32. self perception/ or role models/ or role perception/ or self esteem/
33. (management adj2 self).mp.
34. (confiden* adj2 self).mp.
35. (develop* adj2 (personal or professional)).mp.
36. resilience.mp.
37. ((innovat* or chang* or entrepreneur*) adj3 (capacity or capab* or think* or ability or able)).mp.
38. autonom*.mp.
39. leadership/ or leadership training/ or leadership.mp.
40. ((coach* or mentor* or motivat* or influenc*) adj2 (other* or colleague* or staff* or profession)).mp.
41. (life-long learning or lifelong learning).mp. or lifelong learning/ or Continuing education/
42. information management.mp.
43. critical thinking.mp.
44. scholar*.mp.
45. research skills.mp.
46. (problem adj2 solv*).mp.
47. numeracy.mp.
48. ((reason* or research) adj3 skill*).mp.
49. attributes.mp.
50. (recent* adj3 graduate*).mp.
51. attitudes/
52. aptitudes.mp.
53. (characteristic* adj5 student*).mp.
54. (competenc* adj5 student*).mp.
55. Clinical Competence/
56. Physician-Patient Relations/ or Communication/
57. Communication/
58. (communication adj3 (verbal or oral)).mp.
59. "Marketing of Health Services"/ or Public Relations/ or Consumer Satisfaction/ or Hospital-Patient Relations/
60. Ethics, Medical/ or "Attitude of Health Personnel"/ or Professional Practice/
61. or/2-60
62. 1 and 61

PsycINFO (Ovid) 1806-June 2014 (download date: 2014-06-30)

1. veterinar*.mp.
2. (non-technical adj3 (competenc* or skill*)).mp.
3. communication skills/
4. verbal communication/ or oral communication/
5. (nonverbal adj3 (communication or behavi*)).mp.
6. ((communicat* or interpersonal or writing or written) adj3 (skill* or effective* or interpersonal or successful*)).mp.
7. writing/ or writing skills/
8. (cultural adj3 (awareness or diversity)).mp.
9. (diversity.mp. or diversity/) and (client or cultural).mp.
10. ((cultural* or multicultural* or divers*) adj3 (competen* or sensitiv* or aware*)).mp.
11. (relationship and (client or owner)).mp. or employer employee relationships/
12. interpersonal.mp. or interpersonal relations/
13. customer relations/
14. ((relationship or rapport or trust) adj5 (client or owner)).mp.
15. (empathy or compassion).mp.
16. human-animal bond.mp.
17. collaboration.mp. or teamwork/ or adaptability/
18. ((ability or able) adj3 (collaborat* or team*)).mp.
19. ethics/
20. professional ethics/
21. professionalism/
22. professional competence/
23. ((professional* or ethic*) adj3 (value* or responsib* or aware* or practice or competenc* or behav* or judgment or leadership or standard* or duty)).mp.
24. ethology.mp.
25. integrity.mp.
26. ((law or legal or governance) adj2 (knowledg* or aware*)).mp.
27. animal welfare/ or animal welfare.mp.
28. work-life balance.mp.
29. stress management.mp. or stress management/
30. optimism.mp.
31. self-management.mp. or self management.sh.
32. emotional intelligence.mp.
33. (refle* adj3 (self or practice or critical)).mp.
34. (audit adj3 self).mp.
35. self-efficacy.mp.

36. self perception/ or role models/ or role perception/ or self esteem/
37. (management adj2 self).mp.
38. (confiden* adj2 self).mp.
39. (develop* adj2 (personal or professional)).mp.
40. resilience.mp.
41. ((innovat* or chang* or entrepreneur*) adj3 (capacity or capab* or think* or ability or able)).mp.
42. autonom*.mp.
43. leadership/ or leadership training/ or leadership.mp.
44. ((coach* or mentor* or motivat* or influenc*) adj2 (other* or colleague* or staff* or profession)).mp.
45. (life-long learning or lifelong learning).mp. or lifelong learning/ or Continuing education/
46. information management.mp.
47. critical thinking.mp.
48. scholar*.mp.
49. research skills.mp.
50. (problem adj2 solv*).mp.
51. numeracy.mp.
52. ((reason* or research) adj3 skill*).mp.
53. attributes.mp.
54. (recent* adj3 graduate*).mp.
55. attitudes/
56. aptitudes.mp.
57. (characteristic* adj5 student*).mp.
58. (competenc* adj5 student*).mp.
59. or/2-58
60. 1 and 59

Web of Science 1910 to June 2014 (download date: 2014-06-30)

1. veterinar*
2. non-technical NEAR/3 (competenc* or skill*)
3. verbal NEAR/3 comminicat*
4. oral NEAR/3 comminicat*
5. (nonverbal NEAR/3 (communication or behavi*)
6. (communicat* or interpersonal or writing or written) NEAR/3 (skill* or effective* or interpersonal or successful*)
7. writing
8. cultural NEAR/3 (awareness or diversity)
9. diversity and (client or cultural)
10. (cultural* or multicultural* or divers*) NEAR/3 (competen* or sensitiv* or aware*)
11. relationship and (client or owner)
12. employe* NEAR/3 relationship*
13. interpersonal
14. (relationship or rapport or trust) NEAR/5 (client or owner or customer)
15. empathy or compassion
16. human-animal bond
17. collaboration or teamwork or adaptability
18. (ability or able) NEAR/3 (collaborat* or team*)
19. ethics
20. professionalism
21. (professional* or ethic*) NEAR/3 (value* or responsib* or aware* or practice or competenc* or behav* or judgment or leadership or standard* or duty)
22. ethology
23. integrity
24. (law or legal or governance) NEAR/2 (knowledg* or aware*)
25. animal welfare
26. work-life balance
27. stress management
28. optimism
29. self management
30. emotional intelligence
31. refle* NEAR/3 (self or practice or critical)
32. audit NEAR/3 self
33. self efficacy or self-efficacy
34. self NEAR/2 (perception or esteem)
35. role NEAR/2 (model* or perception)
36. (management NEAR/2 self)
37. (confiden* NEAR/2 self)
38. develop* NEAR/2 (personal or professional)
39. resilience
40. (innovat* or chang* or entrepreneur*) NEAR/3 (capacity or capab* or think* or ability or able)
41. autonom*
42. leadership
43. (coach* or mentor* or motivat* or influenc*) NEAR/2 (other* or colleague* or staff* or profession)
44. (life-long learning or lifelong learning) or continuing education/
45. information management
46. critical thinking
47. scholar*

48. research skills
49. problem NEAR/2 solv*
50. numeracy
51. (reason* or research) NEAR/3 skill*
52. attributes
53. recent* NEAR/3 graduat*
54. attitudes
55. aptitudes
56. characteristic* NEAR/5 student*
57. competenc* NEAR/5 student*
58. or/2-57
59. 1 and 58

Australian Education Index 1977 to June 2014 (download date: 2014-06-30)

1. veterinar*

British Education Index 1986 to June 2014 (download date: 2014-06-30)

1. veterinar*

Dissertations and Theses 1637 to June 2014 (download date: 2014-06-30)

1. su (veterinary)

ERIC 1986 to June 2014 (download date: 2014-06-30)

1. veterinar*

APPENDIX 2

Review coding frame mapped to Englander et al. (2013)

Englander et al. Domain	Englander et al. Item	Veterinary interpretation for this review (BEME coding frame)	Includes (examples)
Patient care	1.2 Gather essential and accurate information… through history-taking 4.1 Communicate effectively with patients, families and the public, across a broad range of socioeconomic and cultural backgrounds	Effective communication – clients	Consultation, history-taking, listening, communicating ideas, explaining, dealing with clients, negotiation
	1.7 Counsel and educate patients and their families to empower them to participate in their care	Relationship-centred care	Empowering client participation, client relations/service, rapport-building, gain client respect/trust/confidence, personable, building relationships
	1.3 Organise and prioritise responsibilities….	Workflow management	Organisational skills, time management, self management, prioritizing responsibilities, mental organization, cleanliness, reliable, work ethic, persistent, patient, attention to detail, 'common sense', efficient, multitask
Interpersonal and communication skills	4.6 Demonstrate sensitivity, honesty and compassion in difficult conversations…	Empathy & bond recognition	Caring, compassion, affection for pet, gentle, kind, acknowledge human-animal bond
	4.7 Demonstrate insight and understanding about emotions and human responses to emotions to allow one to develop and manage	Emotional intelligence & self-awareness	EI, interpersonal skills, 'knowledge of human nature', 'people-handling'

Interprofessional collaboration	7.3 Communicate with other health professionals in a responsive and responsible manner… 4.2 Communicate effectively with colleagues…	Effective communication - colleagues	Negotiation, conflict resolution, communicate ideas
	7.1 Work with other health professionals to establish and maintain a climate of mutual respect, dignity, diversity, ethical integrity, and trust 4.3 Work effectively with others as a member or leader of a health care team…	Collaboration & teamwork	respect for others, team player
Knowledge for practice	2.1 Investigatory and analytic approach	Critical thinking and problem-solving	Independent thinking, investigative skills, logical, reasoning, deductive reasoning, analytical thinking
	2.6 Contribute to the creation, dissemination, application, and translation of new health care knowledge and practices	Research skills & practice	
Practice-based learning and improvement	3.2 Set learning and improvement goals	Lifelong learning	Self-directed/independent learner, continuing education
	2.3 Apply established and emerging … evidence-based health care 3.6 Locate, appraise, and assimilate evidence from scientific studies… 3.10 Continually identify, analyse, and implement new knowledge, guidelines, standards, technologies…	Information literacy & evidence-based approach	Information management, find & evaluate information, EBVM, critical appraisal
	3.7 Use information technology to optimize learning	Information technology	Computing, technology
	3.8 Participate in the education of … families, students, trainees, peers…	Educating others	Coaching, presenting, public speaking, training others

	3.4 Systematically analyse practice … and implement changes with the goal of practice improvement 3.5 Incorporate feedback into daily practice	Reflection/self-audit and goal-setting	Accepting criticism
	3.1 Identify strengths, deficiencies and limits in one's knowledge and expertise	Awareness of limitations	Seeking help or advice, knowing when to refer
Professionalism	5.1 Demonstrate compassion, integrity and respect for others 8.5 Demonstrate trustworthiness that makes colleagues feel secure…	Professional values	Honesty, integrity, trustworthiness, character, desire to do best
	5.6 Demonstrate a commitment to ethical principles… 5.3 Demonstrate respect for [client] privacy and autonomy 5.4 Demonstrate accountability to patients, society, and the profession	Professional behaviour	Ethical awareness/reasoning/principles, responsible, professional appearance, uphold profession, politeness, accountable,
	5.5 Demonstrate sensitivity and responsiveness to a diverse [client] population… 4.1 Communicate effectively …. across a broad range of socioeconomic and cultural backgrounds	Cultural sensitivity & diversity	Equality of access, tolerance, lack of discrimination
	5.2 Demonstrate responsiveness to patient needs that supersedes self-interest	Commitment to animal welfare	Subordination of self-interest, preventing cruelty
Personal and professional development	8.1 Develop the ability to use self-awareness … to engage in appropriate help-seeking behaviours 8.2 Demonstrate healthy coping mechanisms to respond to stress	Resilience	Positivity, self-esteem, cope with pressure, enjoyment, stress management, 'awareness of emotional climate'
	8.3 Manage conflict between personal and professional responsibilities	Work-life balance	

	8.4 Practice flexibility and maturity in adjusting to change… 8.8 Recognise that ambiguity is part of clinical health care and … dealing with uncertainty	Adaptability	Coping with uncertainty & change, creativity, flexibility, open mind, cope with contingencies
	8.7 Demonstrate self-confidence…	Self-efficacy and confidence	Initiative, autonomy, motivated, decisiveness, self-confidence
	8.6 Provide leadership skills that enhance team functioning, the learning environment, and/or the health care delivery system	Leadership	Delegation, HR management, motivating others
6. Systems-based practice	6.3 Incorporate considerations of cost-awareness and risk-benefit analysis…	Financial awareness	Numeracy, financial decision-making, awareness of costs, discusses costs
	6.5 Participate in identifying system errors and … solutions 6.6 Perform administrative and practice management responsibilities commensurate with one's role, abilities…	Business & practice management	Business skills, accounting, OHS, quality assurance
	6.4 Advocate for quality patient care…	Health & welfare advocacy	Public relations, outreach, social awareness/responsibility, community involvement

APPENDIX 3

Highly cited studies (>30 citations)

Source	Citation count (October 2015)
Brown & Silverman (1999)	232
Cron et al. (2000)	87
Lewis & Klausner (2003)	64
Walsh et al. (2001)	45
Case (1988)	39
Lue et al. (2008)	33
Lloyd & Walsh (2002)	31

APPENDIX 4

Included competence frameworks

Description of included consensus-based competence frameworks published 2001-2014, including development or consensus process.

Source	Process	Title
Royal College of Veterinary Surgeons (RCVS) 2001, 2014 (UK)	Developed by an expert working party, followed by modification after open consultation to the profession and professional bodies; subsequently endorsed and adopted by European Association of Establishments for Veterinary Education (EAEVE) and Australasian Veterinary Boards Council (AVBC). Revised and republished after open consultation in 2014.	Essential competences required of the new veterinary graduate "Day One Skills"
Walsh et al. 2001 (US)	Draft developed by faculty based on medical education framework, then reviewed by advisory panel of 17 veterinarians including professional bodies; subsequently endorsed by majority of 1042 veterinarians surveyed (Walsh et al., 2002)	Attributes expected of graduates of a veterinary program [University of California]
Lloyd & Walsh 2002 (US)	Structured workshop of 38 veterinary practice management educators and consultants	Template for a Recommended Curriculum in "Veterinary Professional Development and Career Success"
Collins & Taylor 2002 (Australia/NZ)	Workshop of 25 representatives of Australian/NZ veterinary faculty and professional bodies, plus follow-up review	Attributes of Australasian veterinary graduates
Lewis & Klausner 2003 (US)	Focus groups at 6 sites, 281 veterinary professionals nominated by universities and veterinary associations	Non-technical competencies underlying career success as a veterinarian

Miller et al. 2004 (US)	Structured workshops; 5 groups of 7-13 veterinarians representing production animal industry bodies	Practitioner-defined competencies required of new veterinary graduates in food animal practice
Bok et al. 2011 (Netherlands)	Focus group interviews with 35 recent graduates and 19 clients, validated by Delphi procedure with 6 clients and 23 experts representing the profession	The competency framework of the Veterinary Professional (the VetPro framework)
North American Veterinary Medical Education Consortium (NAVMEC) 2011 (US)	3 consultative meetings of approximately 400 stakeholders; reviewed by 9-member Board; feedback provided by 353 organisations and individuals	Core competencies of all graduating veterinarians
OIE (World Organisation for Animal Health) 2012 (international)	Series of workshops by 16 member *ad hoc* education group of international experts and senior faculty, plus stakeholder review	Competencies of graduating veterinarians ('Day 1 graduates') to assure National Veterinary Services of quality
Vandeweerd et al. 2014 (Belgium/France)	Phone interview of 210 veterinarians, followed by alignment of identified problems to competencies by the authors based on existing European frameworks, and stakeholder review	Competency framework based on families of professional situations

APPENDIX 5

Included stakeholder surveys

Surveys informing a meta-analysis of evidence for the relative perceived importance of professional (non-technical) veterinary competencies, across multiple stakeholder groups.

Study	Year	Origin	Survey sample[1]	Items[2] (P/total)	Survey question and method[3]
Case	1988	US	319 C	10/14	A good veterinarian should… (5-pt Likert)
Stone et al .	1992	US	200 V	12/15	Importance to provide formal training in … (telephone survey, 4-pt Likert)
Weigel et al.	1992	US	163 V, 38 E	5/10	Importance to successful practice of clinical veterinary medicine (5-pt Likert)
Heath et al.	1996	Aust.	103 S/G[4]	13/16	Characteristics of a successful veterinarian (4-pt Likert)
Coleman et al.	2000	Aust.	309 V (incl. 157 E)	10/19	Importance in BVSc graduates (3-pt Likert)
Heath & Mills	2000	Aust.	258 E	12/18	Importance in selecting a new graduate employee (4-pt Likert)
Hoppe & Trowald-Wigh	2000	Sweden	69 S, 16 F	6/6	Importance in training in veterinary medical education (3-pt Likert)
Walsh et al.	2001	US	68 S, 49 V	21/62	Importance for graduates of veterinary degree programs (5-pt Likert)
Bristol	2002	US	514 V	3/5	Most important skills needed for success in veterinary practice (ranked free response)
Kleine et al.	2002	US	106 V, 384 E, 51 F	26/31	Importance for veterinary schools to provide training in … (4-pt Likert)
Fitzpatrick & Mellor	2003	UK	391 G	3/33	Importance in present or past jobs (5-pt Likert)
**Greenfield et al.	2004	US	1328 V	17/38	Ten most important skills a new graduate should be proficient in on day of graduation (ranked free response)
Kogan et al.	2004b	US	428 S	19/24	Importance in defining a successful veterinarian (7-pt Likert)
Martin & Taunton	2006	US	415 V	9/10	Importance to private veterinary practice (points-based ranking question)

Doucet & Vrins	2009	Canada	617 V	28/71	Important “for my current primary professional activity” (4-pt Likert)
Lane & Bogue	2010	US	186 F	14/14	Importance for veterinary graduates (7-pt Likert)
**Mellanby et al.	2011	UK	407 C, 306 V	16/20	Importance of attributes in a veterinary surgeon (5-pt Likert)
**Rhind et al.	2011	UK	161 S, 90 G	36/42	Importance for easing the transition between student and new graduate/clinician (5-pt Likert)
Schull et al.	2012	Aust.	83 S, 30 E	46/47	Relative importance for new veterinary science graduates (5-pt Likert)
Bok et al.	2014	Internat.	1137 V	16/18	Importance “for a veterinarian in your country” (9-pt Likert)

** = best evidence (quality score 4 or 5). Notes: 1: S=students, G=graduates, V=veterinarians, E=employers, C=clients, F=faculty; 2: number of survey items, P=number of profession competencies / total number of survey items; 3: unless otherwise stated, all surveys were standard postal, paper or online questionnaires; 4: longitudinal study of one cohort.

APPENDIX 6

Included qualitative evidence from stakeholder surveys

Qualitative (or semi-quantitative) evidence from surveys or interviews of stakeholder perceptions of the importance of professional (non-technical) veterinary competencies.

Study	Origin	Sample[1]	Design	Limitations	Findings
Brown & Silverman 1999	US	V, E, C	Focus groups and surveys of veterinarians, employers, veterinary users incl. pet owners	Methodology not stated in this summary report, and full source report out of print and unavailable.	Most significant factors for pet owners when choosing a veterinarian are: (veterinarian is..) kind and gentle; respectful and informative. Problem-solving/critical thinking skills are in high demand across all employers. Business related skills are widely perceived by all employer groups as required skills to succeed in a traditional veterinarian job, as well broadening employment opportunities.
Riggs et al. 2001	UK	134 G, 106 V	Cross-sectional; postal survey	Methodology unclear in summary report.	Gaining commercial awareness, evaluating own performance, managing time (prioritizing, planning and organizing work), and coping with volume of work are perceived as more difficult aspects of work than technical aspects and client communication. Gaining commercial awareness, evaluating own performance are significantly more difficult for new graduates compared to experienced (6 yrs) veterinarians.
Routly et al. 2002	UK	76 G, 49 E (matched)	Interviews, postal survey	Methodology unclear in summary report.	Financial aspects of practice are a “particularly difficult” and prevalent (47%) problem for new graduates. Communicating with clients and learning to prioritise jobs are also problems for new graduates. Employers report initial employment based primarily on personality, communication skills and a perceived empathy for the job.

Davidson 2005	US	101 E	Survey and ranking questions	Limited context, specialty internships only.	Interpersonal and client communication skills are the most important skills in selection for internship (above written communication); positive, strong work ethic, and team player are the most important attitudes (above flexible, sense of humour, self-confidence).
Coe et al. 2007, Coe et al. 2008	Canada	32 C, 24 V	Focus group interviews	Limited sample; exploratory studies	Veterinary-client communication is a "key area" of expectation, including client education, providing choices, listening, and respectful partnership. Clients expect veterinarians to initiate discussions about costs of care.
Hubbell et al. 2008	US	846 V (equine)	Electronic survey	Low response rate; included few professional competencies	Expected level of graduate proficiency (for equine practice) is higher for client communication and record-keeping, compared to business skills (developing and communicating estimates, understanding business costs).
Roder et al. 2012	UK	65 V/F, 418 S	Online survey and ranking exercise	Limited sample (clinical staff and students of single institution)	Interpersonal competence (communication and teamwork) consistently ranked highly, commercialism (business principles) consistently ranked lowly.
Bachynsky et al. 2013	UK	48 G, 63 E	Cross-sectional; postal survey	Low sample size and response rate	Client communication skills, and dealing with various financial aspects of practice (confidence to charge appropriately and communicating costs) are most frequently expressed difficulties for new graduates.
Stoewen et al. 2014	Canada	43 C	Structured interviews	Limited sample; very specific context (tertiary oncology referral)	Clients expect information (regarding cancer treatment) to be communicated with positivity, compassion and empathy.

Notes: 1: S=students, G=graduates, V=veterinarians, E=employers, C=clients, F=faculty

APPENDIX 7

Included empirical studies

Studies within the veterinary domain demonstrating empirical evidence of an effect of a professional (non-technical) competency on a measurable veterinarian, client or patient-care outcome.

Study	Origin	Sample[1]	Design	Primary outcomes	Weaknesses	Competency	Findings
Case 1988	US	319 C	Cross-sectional; pre/post questionnaire	Client satisfaction	Non-validated satisfaction scale. Localised sample (3 SA clinics).	Effective communication – clients	Client-evaluated communication and affective care are stronger predictors of client satisfaction than vet-pet interaction.
Greenberg et al. 1992	US	258 C	Phone survey	Client satisfaction	University hospital setting. Potential evaluation bias (phone survey by stakeholders); non-validated instrument; analysis methodology not stated.	Effective communication – clients Professional behaviours	Clients rated the ability to provide a clear explanation as most important to their perception of satisfaction. "Professional and personable" veterinarians provided the highest client satisfaction.
Cron et al. 2000	US	4392 V	Cross-sectional postal survey	Income	Regression methodology (*e.g.* control for covariates) not stated in summary report.	Business & practice management Self-efficacy & confidence	Financial acumen (ability to define financial terms) correlated with income (*n.b.* practice owners only). High self-esteem & low fear of negative evaluation correlated with income.
Woodcock & Barleggs 2005	UK	183 C	Paper questionnaire	Client satisfaction	Limited sample (pilot validation study)	Effective communication – clients	Veterinarian communication subscale (incl. items empathy, relationship-centred care) rated significantly higher by clients who reported recommending the practice.

Volk et al. 2005	US	2655 V	Cross-sectional; online & postal survey	Income	Methodology not stated in summary report.	Business & practice management Leadership	Behaviours linked to business orientation (e.g. use of financial concepts) and leadership (e.g. challenging others to excel), were among business practices most strongly correlated with income.
**Lue et al. 2008	US	2000 C	Phone interview & follow-up phone survey	Vet-client bond; adherence	Methodology poorly detailed, e.g. question wording and quantification methods	Effective communication – clients	Communication skills "by far the most crucial component" of a strong client-vet bond. Clients who believe vet is a very good communicator are more likely to state they follow recommendations.
**Danielson et al. 2012	US	75 E	Cross-sectional, online survey	Employer satisfaction	Limited size & scope of sample; employers of new graduates of single institution only.	Effective communication Critical thinking & problem-solving Business & practice management	'Interpersonal skills' (subscales = effective communication & teamwork), problem solving & business skills strongly correlated with employer satisfaction.
**Shaw et al. 2012	Can.	50 V	Cross-sectional descriptive; RIAS	Veterinarian satisfaction	Localized sample. Positively skewed scales.	Effective communication – clients Self-efficacy & confidence Empathy & bond recognition	Lower verbal dominance (i.e. listening), self-esteem (Rosenberg scale) associated with vet satisfaction in wellness visits. Self-assessed empathetic concern associated with vet satisfaction in problem visits.
**Kanji et al. 2012	Can.	19 V, 83 C	Cross-sectional; RIAS	Adherence	Limited sample. Dental/surgical context only.	Effective communication – clients Relationship-centred care	Clear recommendation increases adherence 7-fold compared to ambiguous recommendation. Relationship-centred care score (proportion of client-centred talk) associated with adherence & client satisfaction.
Platt et al. 2012	UK	21 V	Interviews	Suicide ideation & behavior	Small sample size; exploratory study.	Workflow management Work-life balance	Study participants (with a history of suicidal ideation or behavior) identified

							number of hours and volume of work (12/21), and unsociable hours (8/21) as contributing factors.
**McArthur & Fitzgerald 2013	Aust.	24 V, 64 C	Cross-sectional; RIAS	Client satisfaction	Small sample size; low vet response rate. Non-validated satisfaction scale.	Effective communication – clients Empathy & bond recognition	Use of empathic statements toward client, strongly associated with client satisfaction. Friendliness/warmth (tone of voice), interactivity associated with client satisfaction.
**Mastenbroek et al. 2014a	Neth.	860 V	Cross-sectional, online questionnaire	Work engagement, work performance	Cross-sectional, causality unclear; personal resources self-reported. Localised sample (single college).	Reflection & goal-setting Self-efficacy & confidence	Personal resources (reflective behaviour, proactive behaviour, self-efficacy) have a mediating and initiating role in explaining work engagement and performance.
**Mastenbroek et al. 2014b	Neth.	727 V	Cross-sectional, online questionnaire	Burnout (exhaustion, cynicism), work engagement	Cross-sectional, causality unclear; personal resources self-reported. Localised sample (single college).	Self-efficacy & confidence Resilience	Self-efficacy, optimism, assertiveness were personal resources making strongest contribution to lower exhaustion and cynicism; self-efficacy and proactive behavior made strongest positive contribution to work engagement.

** = best evidence (quality score 4 or 5). Notes: 1: V=veterinarians, E=employers, C=clients. Can.=Canada

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