Collaborative Development of Core Entrustable Professional Activities for Veterinary Education

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ABSTRACT

Entrustable professional activities (EPAs) have been proposed as a practical framework for the implementation of competency-based education. As veterinary education moves toward a competency-based approach, core EPAs provide a context for assessment of workplace activities. This article reports on the development of eight core clinical EPAs for veterinary education created through multi-institutional collaboration, with international input from veterinary educators and veterinary educational leaders. These core EPAs are intended as minimal expectations for clinical activities that should be assessed for every graduate of Association of American Veterinary Medical Colleges member institutions. Adoption of the core EPAs and the associated Competency-Based Veterinary Education (CBVE) framework by veterinary schools is intended to promote Day One graduate competence and thereby enhance patient care and client service.

Key words: entrustable professional activities, competency-based veterinary education, competency-based medical education, inter-institutional collaboration, clinical assessment, EPA, workplace-based assessment

INTRODUCTION

This article is the second of a two-part series describing an inter-institutional collaboration to develop resources for competency-based veterinary education (CBVE). The companion article in this issue details the concurrent development of a competency framework for veterinary education;[1] this article describes the development of core clinical entrustable professional activities (EPAs) for veterinary students linked to the CBVE framework. The combination of competencies, their developmental milestones, and the EPAs, through which many of the competencies can be assessed in the clinical workplace, form the foundational components of competency-based veterinary education.[2,3]

The concept of EPAs was first proposed by ten Cate as a practical framework for implementing competency-based medical education (CBME).[4,5] An EPA is defined as "an essential task of a discipline (profession, specialty or sub-specialty) that an individual can be trusted to perform without direct supervision in a given health care context, once sufficient competence has been demonstrated."[4(p. 583)] EPAs operationalize observable competencies in a practical setting because several competencies from multiple domains must be integrated simultaneously to execute the EPA.[5] Although the competency framework is considered the analytic framework that details competencies within broader domains of competence, EPAs are considered the synthetic framework that details how competencies are integrated in the context of workplace activities.[2,6]

EPAs have multiple benefits for evaluating learner competence in the workplace. Because EPAs represent the routine work of the professional, they help to provide a readily applicable organizational structure that may be used by clinicians for observation, feedback, and assessment.[7] In addition, EPAs broaden the focus of assessment decisions beyond observing a learner's proficiency in a single competency to observing the learner performing essential professional work in a given context by integrating multiple competencies.[8] This supports assessment of behaviors such as conscientiousness, discernment, truthfulness, self-confidence, habits of self-evaluation, and knowing how to identify and correct mistakes.[9,10] Moreover, clinicians have been shown to make more reliable judgments regarding trainee level of independence (i.e., entrustability) than observed competence.[11]

Despite the benefits of EPAs in providing a competency-based framework for assessing learner performance in the workplace, development of core EPAs for clinical veterinary practice has lagged. At the time that the work described in this article was undertaken, there were no published reports of core EPAs for veterinary education. With the goal of supporting the implementation of a competency-based approach to veterinary education, this article describes the inter-institutional, collaborative process involved in developing eight core EPAs for clinical practice that are linked to the CBVE framework.

METHODS

As part of the shift toward competency-based education in veterinary medicine, educators from Association of American Veterinary Medical Colleges (AAVMC) member schools convened in 2015 to discuss developments in CBME and their potential applications in veterinary education. Educators participating in this meeting recognized the benefit of a collaborative effort to develop common tools for outcomes assessment based on a shared educational framework. This led to the genesis of the AAVMC CBVE Working Group (henceforth, working group), a 10-member international team of educational leaders convened to create a modern, shared competency framework that would support the development of learner assessment tools and outcomes assessment programs. The working group designed a CBVE framework consisting of 32 competencies grouped under 9 domains of competence.[1,12] In early 2017, while the CBVE framework was being refined, the working group began to develop core EPAs for veterinary education.[13] The goal of the working group was to identify core EPAs that every student enrolled in an AAVMC member institution should be able to perform competently at the time of graduation. Because the majority of veterinary graduates enter clinical practice after graduation, the working group focused on activities that all veterinarians should be able to perform competently at graduation to ensure quality patient care and client service.

A review of the literature when this effort began in 2017 yielded no published reports of EPAs for veterinary education. The Association of American Medical Colleges (AAMC) had developed Core EPAs for Entering Residency that closely paralleled the skills that veterinary graduates should be able to perform at graduation.[9,14,15] The working group assessed each of the AAMC's 13 core EPAs for its relevance to veterinary practice. To qualify as an EPA, the activity had to be commonly performed in veterinary clinical practice, require integration of multiple competencies from different domains, and function as a stand-alone activity that is not routinely part of another professional activity. Likewise, the student had to have opportunities to practice and be assessed while performing the activity in a workplace setting during the educational program.

The working group developed an initial list of 11 potential core EPAs by reviewing the AAMC core EPAs and considering the essential workplace activities of the clinical veterinarian.[9] The first two AAMC EPAs (AAMC EPA 1, "Gather a history and perform a physical examination," and AAMC EPA 2, "Prioritize a differential diagnosis following a clinical encounter") are activities that veterinarians in clinical practice perform daily. Because these activities are performed as a unit, they were combined into a single EPA for veterinary practice: CBVE EPA 1, "Gather a history, perform an examination, and create a prioritized differential diagnosis list." AAMC EPA 3, "Recommend and interpret common diagnostic and screening tests," was expanded to "Develop a diagnostic plan and interpret results." AAMC EPA 7, "Form clinical questions and retrieve evidence to advance patient care," was rewritten as "Formulate relevant questions and retrieve evidence to advance care." AAMC EPA 10, "Recognize a patient requiring urgent or emergent care and initiate evaluation and management," was considered directly applicable to veterinary practice and included as is.

AAMC EPA 11, "Obtain informed consent for tests and/or procedures," was expanded to "Explain the diagnostic and therapeutic options to enable the client to make a decision and ensure informed consent based on animal needs and client preferences." AAMC EPA 12, "Perform general procedures of a physician," was expanded to "Develop and implement a management/treatment plan," and specific EPAs for surgery and anesthesia were developed because these are commonly performed in veterinary practice. Likewise, preventive health care and discussing end-of-life issues with clients are important components of veterinary practice, and EPAs addressing them were also developed. AAMC EPA 8, "Give or receive a patient handover to transition care responsibly," was thought to not be relevant to current veterinary clinical practice. The remaining AAMC EPAs (e.g., EPA 5, "Document a clinical encounter in the patient record") were considered to be competencies rather than activities. Tekian has analyzed the AAMC 13 core EPAs for entering residency and proposed that some do not fit the criteria for a true EPA.[16]

Because veterinarians may practice on any species after graduation, the EPAs were written to be applicable to multiple species and, when appropriate, to individual animals or herds or flocks. For example, in population medicine situations, individual physical examinations may not be performed but the herd is examined, so the term *examination* was used rather than *physical examination.*

After the list of proposed core EPAs was created, a five-person subgroup of the working group (JEI, SAM, EKR, BRR, SKS) developed each EPA by writing a description of the activity along with a commentary that provided context for the activity. This was achieved through individual work that was reviewed by the subgroup in bi-weekly videoconferences (1–2 hours each) over the course of approximately 9 months. Feedback on the developing EPAs was periodically sought from the entire working group through videoconferences (1–2 hours each) and face-to-face meetings (1–2 days each), which allowed the working group to work through differences in opinion and develop a shared mental model for each EPA.

As the initial 11 EPAs were elaborated by describing the activity and its elements and linking the elements to specific competencies, it was determined that two—"Explain the diagnostic and therapeutic options to enable the client to make a decision and ensure informed consent based on animal needs and client preferences" and "Explain patient management instructions to other veterinary professionals or staff"—were routinely performed as part of other EPAs. For example, client consent must be obtained when determining a diagnostic plan or a therapeutic plan (which emerged as CBVE EPAs 2 and 3, respectively, in the final set of core EPAs). Consequently, these two initial EPAs were eliminated and incorporated as elements of other EPAs.

The remaining nine proposed core EPAs were presented in a workshop to primary care veterinary educators and in a webinar followed by a survey to associate deans and educators in AAVMC member veterinary schools. Feedback indicated that eight of the nine proposed EPAs were appropriate for graduating veterinary students. Concern was expressed about the EPA "Guide a client regarding end-of-life decisions." Some of those participating in the webinar and survey did not believe that every veterinary student would

be given the opportunity to interact with a client in an end-of-life situation because of the sensitive nature and sporadic occurrence of these events. After investigating and reflecting on this feedback, the working group determined that "Guide a client regarding end-of-life decisions" was a subcompetency of CBVE Competency 5.2 (adapts communication style to colleagues and clients) rather than an independent EPA. Therefore, conversations regarding end-of-life care were included as an example in the illustrative subcompetency on difficult conversations for Competency 5.2 in the CBVE framework. In addition, euthanasia was specified as a therapeutic intervention in CBVE EPA 3 ("Develop and implement a management/treatment plan").

The consensus reached by the working group on which EPAs should be core for all graduating veterinary students was affirmed by the associate deans and educators who participated in the webinar and the survey. The survey asked whether any EPAs were missing as core EPAs. Some respondents suggested there should be an EPA addressing public health. In response, the working group developed an EPA based on a public health situation. This EPA was reviewed in the context of the other core EPAs, and the decision was made that public health issues could be included in other EPAs rather than being an independent EPA.

RESULTS

The working group adapted the CBME definition for an EPA to create a definition suited to the veterinary education context:[4]

> **Entrustable Professional Activity:** An essential task of a discipline that a learner can be trusted to perform with limited supervision in a given context and regulatory requirements, once sufficient competence has been demonstrated.[17]

The collaborative development and refinement process resulted in eight core EPAs for veterinary clinical practice, which were released to the academic leadership at the AAVMC annual meeting in March 2018.[17] Each EPA includes a short title, description, and detailed commentary about the activity and is mapped to the most relevant (primary) and secondary (supporting) domains of competence from the nine domains in the CBVE framework.[12] Next, a list of the elements in the activity is provided, with each element mapped to one or more specific competencies within the relevant domains of competence. The eight core EPAs for clinical practice are presented in Tables 1–8. Graphics with color-coded icons facilitated visualization of the inter-relationships among EPAs and competencies (Figure 1).

Table 1: CBVE EPA 1—gather a history, perform an examination, and create a prioritized differential diagnosis list

Description of activity	Perform a history and exam on an individual animal or herd/flock and assimilate the information collected to derive a prioritized differential diagnosis.
Commentary	The history and examination should be tailored to the clinical situation and specific patient encounter. This data gathering serves as the foundation for evaluation and management. Expectations include integration of the scientific foundations of medicine with clinical reasoning skills to guide information gathering.
Most relevant domains	1: Clinical reasoning and decision making 5: Communication
Secondary domains	2: Individual animal care and management 6: Collaboration 8: Financial and practice management

Elements within activity

Consultation	• Obtain a complete and accurate history in an organized fashion (1.1). • Demonstrate client-centered interview skills (establish rapport, attentive to verbal and nonverbal cues, client culture, socioeconomic factors, demonstrate active listening skills) (5.1, 5.2). • Identify the client complaint (1.1). • Identify pertinent history elements associated with common conditions (1.1). • Demonstrate cultural competence in interactions with clients, recognizing the potential for bias (5.2, 6.4).
Examination	• Perform exam (individual animal or herd) (1.1). • Communicate findings (5.1). • Attend to patient welfare and client safety and comfort (1.4, 2.2, 8.3).
Determining differential diagnosis	• Create a problem list (1.2). • Justify prioritized differential diagnosis(es) (1.2). • Consult or refer as needed based on limitations (1.7).
Documentation	• Document findings in the medical record (5.3).

Note: The domains refer to the nine domains of the CBVE framework. The numbers in parentheses refer to individual competencies of the CBVE framework; the first number refers to the competence domain, and the second number refers to the specific competency in that domain.[12]

CBVE = competency-based veterinary education; EPA = entrustable professional activity.

Table 2: CBVE EPA 2—develop a diagnostic plan and interpret results

Description of activity	Integrate individual animal or herd data to create a prioritized differential diagnostic list and determine a diagnostic plan, obtain consent for diagnostic testing, and interpret results.
Commentary	Developing a diagnostic action plan is an iterative, reflective process that requires continuous adaptation to avoid common errors of clinical reasoning.
Most relevant domains	1: Clinical reasoning and decision making 5: Communication
Secondary domains	6: Collaboration 9: Scholarship
Elements within activity	• Use clinical reasoning skills to create a prioritized differential diagnosis list (1.2, 9.2). • Select initial diagnostic tests or procedures (1.3, 9.1). • Explain working diagnosis and rationale for further testing (1.3, 5.1, 9.2). • Develop a financial estimate and obtain and document informed consent (1.4, 5.2, 5.3, 6.1). • Interpret test results (1.1). • Update working diagnosis, diagnostic plan, and client consent as new information is obtained (1.3, 5.2, 9.2) • Document diagnostic plan in medical record (5.3).

Note: The domains refer to the nine domains of the CBVE framework. The numbers in parentheses refer to individual competencies of the CBVE framework; the first number refers to the competence domain, and the second number refers to the specific competency in that domain.[12]

CBVE = competency-based veterinary education; EPA = entrustable professional activity.

Table 3: CBVE EPA 3—develop and implement a management or treatment plan

Description of activity	Use working diagnosis and client considerations to formulate a management or treatment plan for an individual animal or herd (including referral or euthanasia when warranted); implement the plan and adjust on the basis of response.
Commentary	Developing a management or treatment plan is an iterative, reflective process that requires synthesis of medical, ethical, legal, and economic factors, as well as knowledge of the strengths and limitations of the client, veterinarian, team, and facilities. Implementation of the plan includes performance of veterinary procedures, team collaboration, and client education.
Most relevant domains	1: Clinical reasoning and decision making 2: Individual care and management 5: Communication 7: Professionalism and professional identity 8: Practice and financial management
Secondary domains	3: Animal population care and management 6: Collaboration 9: Scholarship
Elements within activity	• Use clinical reasoning skills to integrate medical, ethical, legal, and economic factors and client desires to create a management or treatment plan (1.3, 1.4, 3.1, 7.1, 8.2, 9.2). • Act in the face of ambiguity resulting from gaps in available information (1.3, 1.6, 7.3). • Explain treatment options to client and respond to questions (1.4, 5.1, 5.2). • Perform therapeutic interventions, including euthanasia when warranted (2.1). • Educate client or team to provide ongoing care for patient, and recognize changes or concerns that trigger additional action (1.3, 5.1, 9.3). • Integrate new information as it is available to update management or treatment plan (1.3, 9.2). • Recognize limitations of personal veterinary skills, team, or facilities, and arrange for referral on the basis of client circumstances (1.7, 6.1). • Follow-up with clients or team to determine change in patient status, compliance with recommendations, and/or capability to implement treatment plan (5.2, 6.3).

Note: The domains refer to the nine domains of the CBVE framework. The numbers in parentheses refer to individual competencies of the CBVE framework; the first number refers to the competence domain, and the second number refers to the specific competency in that domain.[12]

CBVE = competency-based veterinary education; EPA = entrustable professional activity.

Table 4: CBVE EPA 4—recognize a patient requiring urgent or emergent care and initiate evaluation and management

Description of activity	Recognize a patient or situation that requires urgent or emergent care and triage on the basis of severity. Initial emergency management should include procedures that support vital functions.
Commentary	This activity requires both application of knowledge and psychomotor skills as well as the ability to function as part of a team, to know one's limitations, and to seek help when necessary. Initial evaluation of individual should include level of consciousness and adequacy of ventilation and circulation.
Most relevant domains	1: Clinical reasoning and decision making 2: Individual care and management 6: Collaboration 7: Professionalism and professional identity
Secondary domains	5: Communication

Elements within activity	• Quickly assess a situation to identify patients that might require urgent or emergent treatment (1.1, 1.5).
	• In the case of multiple patients, effectively triage patient care according to severity of condition (1.5).
	• Evaluate patient status to determine and triage urgent problems (1.1, 1.5, 7.2).
	• Update client on the urgency of the patient's status and immediate management plans (5.1, 5.2).
	• As necessary, initiate emergency management to support vital functions (2.1), such as
	  ○ Provide oxygen.
	  ○ Secure an airway and effective ventilation.
	  ○ Establish effective circulation.
	  ○ Provide effective pain relief and sedation for safe patient handling.
	  ○ Correct life-threatening alterations (e.g., hypoglycemia, hypothermia).
	  ○ Control hemorrhage.
	  ○ Stabilize fractures.
	• Identify potential underlying etiologies for the urgent or emergent patient status, and determine initial management plan (1.2, 1.3).
	• Discuss patient status and initial management plan (including euthanasia when warranted) with client, and identify client expectations (1.3, 1.4, 5.1, 5.2, 7.1).
	• Optimize patient care by engaging team members, determining when to function as a leader or team member, and working within personal limitations (1.7, 6.1, 6.2).
	• Document initial patient assessment, necessary interventions, possible diagnoses and management plan, and client communication in the medical record (5.3).

Note: The domains refer to the nine domains of the CBVE framework. The numbers in parentheses refer to individual competencies of the CBVE framework; the first number refers to the competence domain, and the second number refers to the specific competency in that domain.[12]
CBVE = competency-based veterinary education; EPA = entrustable professional activity.

Table 5: CBVE EPA 5—formulate relevant questions and retrieve evidence to advance care

Description of activity	Identify questions and information resources. Critique the quality of the evidence and assess the applicability to the clinical situation.
Commentary	The use of evidence-based practices and self-awareness are essential to identify and remedy or correct knowledge gaps. Lifelong learning is an essential professional practice to promote quality patient and population care.
Most relevant domains	1: Clinical reasoning and decision making 7: Professionalism and professional identity 9: Scholarship
Elements within activity	• Formulate focused, pertinent questions on the basis of the situation evaluation (9.2). • Appraise sources of information to evaluate the quality of the content (9.1). • Assess applicability and generalizability of published studies to specific clinical situations (1.6, 9.1, 9.2). • Identify resources and use information technology to assess accurate and reliable online medical information and retrieve animal or herd information (7.4, 9.1). • Evaluate animal or herd response to interventions, and use available evidence to adjust care plan (1.3).

Note: The domains refer to the nine domains of the CBVE framework. The numbers in parentheses refer to individual competencies of the CBVE framework; the first number refers to the competence domain, and the second number refers to the specific competency in that domain.[12]
CBVE = competency-based veterinary education; EPA = entrustable professional activity.

Table 6: CBVE EPA 6—perform a common surgical procedure on a stable patient, including pre-operative and post-operative management

Description of activity	Perform a surgical procedure, including pre-operative preparation of the patient and the surgeon and post-operative care.
Commentary	Attention to patient preparation to minimize contamination, knowledge of the procedure and regional anatomy, manual dexterity to competently and efficiently complete the procedure, reflection and response to changes, and post-operative care.
Most relevant domains	1: Clinical reasoning and decision making 2: Individual care and management 6: Collaboration
Elements within activity	• Formulate surgical plan (2.1). • Direct the veterinary team to assist in procedure (6.2). • Prepare self and surgical site to perform procedure (2.1). • Perform surgical procedure (2.1). • Apply principles of tissue handling, hemostasis, asepsis, and surgical skills (2.1). • Recognize own limitations and ask for assistance when required (1.7). • Respond to changes in patient status (1.3, 1.5). • Formulate analgesic and post-operative care plan (1.3, 2.1).

Note: The domains refer to the nine domains of the CBVE framework. The numbers in parentheses refer to individual competencies of the CBVE framework; the first number refers to the competence domain, and the second number refers to the specific competency in that domain.[12]
CBVE = competency-based veterinary education; EPA = entrustable professional activity.

Table 7: CBVE EPA 7—perform general anesthesia and recovery of a stable patient including monitoring and support

Description of activity	Induce, maintain, and recover a stable anesthetic patient (ASA 1 or 2), including monitoring vital functions and providing supportive care. Evaluate patient status, and determine a suitable anesthetic and analgesic protocol.
Commentary	Apply knowledge of anatomy, physiology, pharmacology, and the procedure as well as psychomotor skills to execute the protocol safely. Recognize and manage complications.
Most relevant domains	1: Clinical reasoning and decision making 2: Individual care and management 5: Communication 6: Collaboration 8: Practice and financial management

Elements within activity	• Evaluate patient on the basis of history, physical examination, results of diagnostic tests, and procedure for suitability for anesthesia (ASA status 1 or 2—a normal, healthy patient or a patient with mild systemic disease that does not result in functional limitations) (1.1, 1.3).
	• Formulate a general anesthetic and analgesic protocol including premedication, induction, maintenance, and recovery. Select drugs and equipment (1.3).
	• Share plan with team members and answer questions (6.1).
	• Execute anesthesia and recovery safely (2.1). This includes:
	  ○ Select and prepare anesthetic, support, and monitoring equipment.
	  ○ Prepare patient for anesthesia.
	  ○ Administer premedication to patient.
	  ○ Induce anesthesia and establish airway.
	  ○ Maintain anesthesia.
	  ○ Monitor vital signs including blood pressure and respond to common complications associated with either anesthesia or the procedure.
	  ○ Recover patient from anesthesia, including assessment of pain and administration of analgesic drugs if necessary.
	• Collaborate with others to update plan as needed (6.1).
	• Follow legal requirements for use of controlled substances (8.2).
	• Maintain an anesthetic record including drugs, doses, route and time of administration, vital signs, important anesthetic and procedure events, and complications (5.3).

Note: The domains refer to the nine domains of the CBVE framework. The numbers in parentheses refer to individual competencies of the CBVE framework; the first number refers to the competence domain, and the second number refers to the specific competency in that domain.[12]
CBVE = competency-based veterinary education; EPA = entrustable professional activity; ASA = American Society of Anesthesiologists.

Table 8: CBVE EPA 8—formulate recommendations for preventive health care

Description of activity	Create a preventive health care plan, considering the animal or herd needs, the client's capabilities, and the care setting, to optimize health and welfare and prevent spread of disease.
Commentary	Prevention of disease is a core veterinary activity that protects the health of animals and the public.
Most relevant domains	2: Individual care and management 3: Animal population care and management 5: Communication
Secondary domains	1: Clinical reasoning and decision making 9: Scholarship
Elements within activity	• Evaluate individual animal or herd needs, considering age, health status, and exposure risk (1.1, 2.2, 3.1). • Make recommendations regarding disease screening (1.1, 2.2, 3.1, 5.1). • Educate clients and stakeholders on disease prevention measures (2.2, 3.1, 3.3, 5.1, 5.2, 9.3). • Perform preventive health care measures (2.1). • Document recommendations and procedures in the record (5.3).

Note: The domains refer to the nine domains of the CBVE framework. The numbers in parentheses refer to individual competencies of the CBVE framework; the first number refers to the competence domain, and the second number refers to the specific competency in that domain.[12]

CBVE = competency-based veterinary education; EPA = entrustable professional activity.

DISCUSSION

This work is the result of inter-institutional, international collaboration sponsored by the AAVMC to develop core EPAs that could serve as a shared resource to advance assessment in veterinary education. The membership of the CBVE Working Group was intended to be broadly representative of the AAVMC member institutions by including members from various geographical areas of the United States, Canada, and Europe, as well as Australasia through the experience of several members. Regularly scheduled working group videoconferences were essential to maintain momentum. Scheduling meetings was challenging because of time zones that spanned 9 hours. Meetings were scheduled to include as many members as feasible, and it was not realistic to expect every member to participate in every meeting. Periodic face-to-face meetings of 1–2 days duration greatly enhanced progress by enabling the working group to work through difficult concepts and develop shared mental models of EPAs. Subgroups were formed to tackle different aspects of work concurrently. Co-leaders who were able to manage multi-institutional collaboration were essential to the group's success. The engagement of a consultant with expertise in competency-based education and assessment (JSF) greatly enhanced the working group's progress by setting goals and guiding the group's direction.

The core EPAs are intended as minimal expectations of clinical activities that should be assessed for every veterinary graduate. Individual schools may choose to create additional EPAs that are specific to their mission and context. EPAs are intentionally not prescriptive regarding species to allow schools flexibility for implementation in their individual context. Moreover, EPAs can be adopted in first-opinion and specialty practice settings.

The EPA development process described in this article highlights several steps that may be of value to others engaging in developing EPAs for their institutions. These steps include the value of critically evaluating existing published literature as a foundation for new work, soliciting frequent feedback from collaborators and stakeholders, and concurrently developing both EPAs and the competency framework on which they are based. Critical evaluation of the literature can identify a foundation for developing EPAs, as the working group used the AAMC 13 core EPAs for entering residency in developing the CBVE EPAs.[9,14] The feedback solicited by the EPA subgroup from the CBVE working group, and by the working group from the broader group of AAVMC associate deans and educators, was crucial in refining the initially proposed list of 11 EPAs to the final 8 core clinical EPAs, as shown by the elimination of the EPA "Guide a client regarding end-of-life decisions." Finally, concurrent development of the EPAs and the CBVE framework enabled synergistic refinement of both components.

Consensus regarding which EPAs should be core for all veterinary graduates is reflected in a recently published article on EPAs for competency-based veterinary education in farm animal health from educators at Utrecht University.[18] Duijn and colleagues identified seven core EPAs with 29 sub-EPAs.[18] A comparison of their seven core EPAs with the eight core CBVE EPAs shows great similarity. Six of the Utrecht EPAs are identical or very similar to six of the core CBVE EPAs. Utrecht EPA 6, "Intercollegial communication of case relevant information," was similar to one of the initially proposed core EPAs, "Explain patient management instructions to other veterinary professionals or staff." This initial EPA was eliminated because it was deemed an element of other EPAs. The two CBVE EPAs that are not included in the Utrecht core EPAs are CBVE EPA 5 and 7. One could argue that CBVE EPA 5, "Formulate relevant questions and retrieve evidence to advance care," should not be included as an independent EPA but rather as an element of other EPAs; however, the working group retained it as a unique EPA because of the importance of this activity for providing the highest level of patient care.

EPA 3

Develop and implement a management/treatment plan

DESCRIPTION OF ACTIVITY	Utilize working diagnosis and client considerations to formulate a management/treatment plan for an individual animal or herd (including referral or euthanasia when warranted), implement the plan and adjust based on response.
COMMENTARY	Developing a management/treatment plan is an iterative, reflective process that requires synthesis of medical, ethical, legal and economic factors, as well as knowledge of the strengths and limitations of the client, veterinarian, team and facilities. Implementation of the plan includes performance of veterinary procedures, team collaboration and client education.
MOST RELEVANT DOMAINS	1: Clinical Reasoning & Decision-making ■ 2: Individual Care & Management ■ 5: Communication ■ 7: Professionalism & Professional Identity ■ 8: Practice & Financial Management ■
SECONDARY DOMAINS	3: Animal Population Care & Management ■ 6: Collaboration ■ 9: Scholarship ■
ELEMENTS WITHIN ACTIVITY	• Use clinical reasoning skills to integrate medical, ethical, legal and economic factors, and client desires, to create a management/treatment plan [1.3; 1.4; 3.1; 7.1; 8.2; 9.2] ■ ■ ■ ■ ■ • Act in the face of ambiguity resulting from gaps in available information [1.3; 1.6; 7.3] ■ ■ • Explain treatment options to client and respond to questions [1.4; 5.1; 5.2] ■ ■ • Perform therapeutic interventions, including euthanasia when warranted [2.1] ■ • Educate client or team to provide ongoing care for patient, and recognize changes or concerns that trigger additional action [1.3; 5.1; 9.3] ■ ■ ■ • Integrate new information as it is available to update management/treatment plan [1.3; 9.2] ■ ■ • Recognize limitations of personal veterinary skills, team or facilities and arrange for referral based upon client circumstances [1.7; 6.1] ■ ■ • Follow-up with clients or team to determine change in patient status, compliance with recommendations, and/or capability to implement treatment plan. [5.2; 6.3] ■ ■

Figure 1: CBVE EPA 3—Develop and implement a management or treatment plan (see the online version for the color figure)
CBVE = competency-based veterinary education; EPA = entrustable professional activity.

CBVE EPA 7, "Perform general anesthesia and recovery of a stable patient including monitoring and support," is probably less important in farm animal practice than in other areas of veterinary practice because of the frequent use of local and regional anesthesia in farm animals. Nevertheless, the working group proposed that all veterinary graduates, even those focusing on farm animals, should be able to safely anesthetize and recover a stable patient, in part because veterinarians are licensed to practice on any species, regardless of career path, and general anesthesia is an important activity in farm animal practice that focuses on small ruminants and pot-bellied pigs. In addition,

anesthesia is included in the clinical competencies required for accreditation by the AVMA Council on Education.[19]

In human medicine, EPAs were first implemented in graduate medical education to define professional activities in the various specialties.[5] While trying to standardize the outcomes of residency programs, residency directors noted that newly graduated doctors were entering residencies with widely varying skill levels. Englander and colleagues noted the lack of standards that defined the skills that medical students must demonstrate on graduation.[14] In 2013, the AAMC convened a panel of experts in undergraduate and graduate medical education to define professional activities that every resident should be able to do without direct supervision on the first day of their residency, which is synonymous with the completion of medical school. This resulted in the publication in 2014 of 13 core EPAs for entering residency.[9] Concurrently, medical educators in Utrecht developed and implemented an EPA-based undergraduate medical curriculum.[20]

The AAMC commissioned a pilot consisting of teams from 10 US medical schools to investigate implementation of the 13 core EPAs in undergraduate medical education, starting with the entering class of 2015. To date, three articles have reported early findings from this collaboration.[15,21,22] Lomis and colleagues provided guidance to other institutions planning to implement the core EPA framework.[15] They presented an organizational structure for the teams and focused on four main concepts: formal entrustment, assessment, curriculum development, and faculty development. Brown and colleagues provided detailed information about formal entrustment and assessment.[21] They noted that for learners to be trustworthy, they must know their limits (discernment), communicate honestly (truthfulness), and fulfill their commitments (conscientiousness). They also commented that clinical experiences may need to be modified to create longitudinal relationships that are needed to inform summative entrustment decisions. Most US veterinary schools have short clinical rotations of 2 or 3 weeks. The clinical training model in veterinary education may need to be modified to support summative entrustment decisions. Favreau and colleagues described a shared mental model for entrustment to serve as a guide for faculty development efforts in undergraduate medical education.[22] The information in each of these articles is highly relevant to veterinary schools as they embark on implementation of EPAs.

Robust faculty development will be essential to helping faculty develop appropriate teaching methods and learn how to use direct observation to provide useful coaching feedback.[15] Faculty need to be trained in appropriate assessment methods and documentation of student performance. This requires resources, which has been a challenge for some medical schools.[21] The same will be true for veterinary schools. Various methods have been explored for faculty development, including the use of standard-setting videos to train faculty in assessing learners performing an EPA.[23]

Medical education faces the challenge of inconsistent use of terminology for CBME and EPAs. In a scoping review of EPAs in undergraduate medical education, lack of consistent terminology and confusion of concepts were cited as impediments to assessing the effectiveness of EPAs.[24]

Veterinary medical education can learn from this challenge by clearly defining terminology and concepts. The much smaller community of veterinary educators compared with that of medical educators makes this a realistic goal.

EPAs are a relatively intuitive approach to determine competency because clinical educators make ad hoc entrustment decisions multiple times a day. Consequently, EPAs have the potential to be readily embraced by veterinary clinical educators. The challenges will be determining how to train clinical educators to develop shared mental models of each EPA and creating assessment tools that are reliable and practical in the clinical environment. Faculty need training to be astute observers of learners and to provide specific coaching feedback. A manageable mechanism needs to be developed for making summative entrustment decisions that are reliable and based on many observations from multiple sources.

Adopting a set of core EPAs in veterinary education provides opportunities for students to practice workplace activities and receive frequent, in-the-moment coaching feedback in a low-stakes setting. In-the-moment feedback helps to guide student development and allows students to learn in a safe environment where mistakes can be immediately addressed.[25] Coaching feedback is essential for student development of competencies, and direct observation of student performance is needed to provide specific feedback.[26,27] Direct observation of the student performing an EPA is essential to make an entrustment decision. Some CBVE EPAs, such as EPA 1, have multiple components that may be challenging for assessment and ad hoc entrustment decisions to be determined in a single interaction. "Gather a history, perform an examination and create a prioritized differential diagnosis list" may occur over a period of time, making it impractical for a clinician to directly observe all components of the EPA on the same patient. As EPAs are implemented, it may be necessary to identify sub-EPAs or nested EPAs to allow entrustment decisions on portions of the core EPAs.[27]

LIMITATIONS

The eight core CBVE EPAs were created from the perspective of AAVMC member institutions, which provides primarily a North American–European–Australasian perspective. These core EPAs may need to be modified for veterinary schools in other areas of the world because of differing societal needs.

Most of the 32 competencies in the CBVE framework map to at least one EPA, and several map to multiple EPAs. Five competencies, such as 8.1, "Weighs economic factors in personal and business decision-making," do not map to core clinical EPAs. These competencies may be best evaluated in the pre-clinical curriculum or through other means of assessment. We should also note that best practices in assessment include multiple methods of assessment by multiple assessors.[28]

CONCLUSION

The eight core CBVE EPAs developed by an international, multi-institutional team of veterinary educators are a resource for veterinary schools implementing competency-based

veterinary education. Adoption of the core EPAs and the associated AAVMC CBVE framework by veterinary schools is intended to add value to veterinary education by creating a shared, robust set of resources for schools to better describe and measure outcomes to support the training and assessment of competent graduates. Adoption of core EPAs linked to the CBVE framework may improve the assessment of veterinary graduates' competence and thereby improve the quality of patient care. As experience is gained during implementation and over time, these core EPAs will need to be reviewed and are likely to be revised. The next step is to determine how EPAs can be entrusted in veterinary education and create shared assessment tools that could be applied consistently by faculty across multiple schools. The working group is currently enrolling schools in a multi-institutional clinical trial using the core CBVE EPAs to evaluate an entrustment scale.

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DECLARATION OF INTEREST

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