

Guideline and
Recommendation
Veterinary Education



Developing veterinary basic clinical skill items based on Korean Veterinary Entrustable Professional Activity

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ABSTRACT

Importance: Developing clinical skills is an essential element of veterinary education to ensure the competency of veterinary graduates. Although the Korean Veterinary Education Graduation Competencies were established in 2016, reflecting domestic needs and international trends in competency-based veterinary education, they have yet to be implemented in Korean veterinary education.

Objective: This study aimed to establish the basic veterinary clinical skills required to ensure graduates of Korean veterinary universities have the day-one competency to independently perform their professional duties.

Methods: The Education Committee of the Korean Association of Veterinary Medical Colleges, composed of veterinary school professors and an experienced veterinarian in the clinic, reviewed domestic and international veterinary education-related materials to define basic clinical skills.

Results: The Korean Veterinarian Entrustable Professional Activities (KVEPA) was introduced, followed by the subsequent development of 54 essential clinical skills based on the KVEPA.

Conclusions and Relevance: The veterinary basic clinical skills established through this study can be used as a specific guide for clinical education in Korean veterinary school, and is expected to play an important role in meeting the needs of the educational sector of the veterinary education accreditation standards.

Keywords: Competence; day one skill; veterinary education

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INTRODUCTION

Graduation, or day-one, competencies refer to the knowledge, skills, and attributes required by veterinary students upon graduation to ensure that they are ready to enter into their first professional role, practicing veterinary medicine safely and self-sufficiently [1,2]. It is imperative the veterinary schools develop the clinical skills of students to ensure their competence.

Medical education in Korea often involves a systematic approach with an apparent educational aim and standardized teaching materials of 'basic clinical skills' to enable medical students to have practical competencies [3-5]. The World Organization for Animal Health (WOAH) has recently proposed the concept of competency-based veterinary education (CBVE) [6,7], while veterinary education in America includes designated entry-level clinical skills as its core competencies. The Association of American Veterinary Medical Colleges (AAVMC) has established CBVE, ensuring a competency-based veterinary education system (CBVE framework), entrustable professional activities (CBVE EPAs), and achievement milestones (CBVE milestones) [8-10]. One study evaluating the performance of this CBVE [11] revealed that the CBVE Model (comprising the AAVMC CBVE framework, EPAs, entrustment scales, and milestones) has either been successfully implemented or is going to be implemented to support faculty and institutions for efficient veterinary practical education. In addition, EPAs, which are core elements of practice-oriented competency-based medical and veterinary education, can provide not only a shared mental model among students and programs, but also a competency-based curriculum design.

Currently, veterinary education in Korea, including clinical skills education, largely depends on the capabilities of individual instructors, and has unclear educational goals. Moreover, pedagogical methods and content that do not fit the minimum level of education and do not provide a strong aim for practical training, which is not suitable for the veterinary practice of competence among new veterinarians, is widespread. This variation in teaching strategies and standards makes it difficult to ensure the minimum level of veterinary services. Therefore, the Korean Veterinary Education Graduation Competencies (KVEGC) proposed by the Korean Association of Veterinary Medical Colleges (KAVMC) covers five domains, 13 core competencies, and 39 achievement standards that new veterinarians in Korea are expected to meet [12,13]. A follow-up study by the Education Committee of the KAVMC presented 66 clinical symptoms across 13 areas, 172 final learning outcomes, and 388 related learning goals [14].

With reference to the requirements and underlying principles of the UK's Royal Veterinary College's One-Day Competences [15], and the concept of learning outcomes in Korean medical education, the KVEGC suggested that learning outcomes be divided into three fields: veterinary medicine, veterinary concepts and principles, and professionalism [16]. The results presented by the KAVMC cannot be directly applied to veterinary education institutes because this organization lacks consensus, in addition to the lack of influence required to enable universities and instructors to engender practical changes. Therefore, research on basic veterinary clinical skills that enhance veterinary clinical education is urgently needed to standardize and substantialize veterinary clinical education by presenting minimal clinical skills and ensuring that veterinary students receive the most basic practical education.

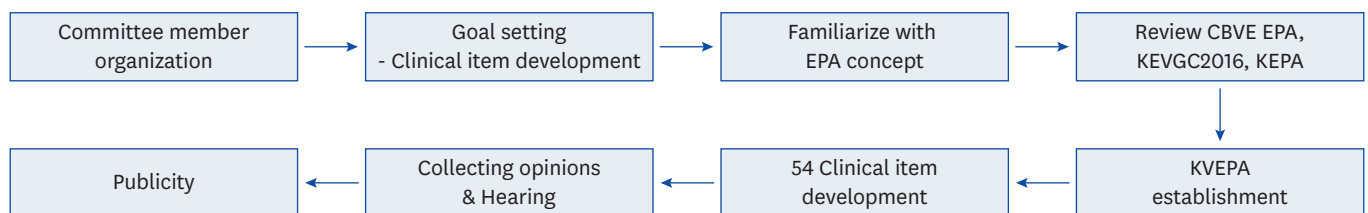
METHODS

To develop veterinary student’s basic clinical skills, the Education Committee of the KAVMC organized a research planning committee comprising eight members, including veterinary school professors representing the faculty councils of each clinical specialty, and experienced veterinarian in the field of clinics and clinical education (**Table 1**). The entire process, from the composition of the committee to the establishment of the 54-item clinical skills guidelines, is summarized in a diagram (**Fig. 1**). Most importantly, the committee members closely examined the KVEGC 2016 and the achievement standards for CBVE. The CBVE EPAs of the AAVMC were also scrutinized as this CBVE series is considered an international veterinary education model [8-10].

Table 1. The background, specialties, position and role of research members

No.	Role	Sex	Background/Specialties	Position
1	Research Director	Male	OIE Ad hoc Group on Veterinary Education, <i>Journal of Veterinary Medical Education</i> (Guest editor), <i>Editor-in-Chief of Journal of Veterinary</i> , Chairperson of the KAVMC education committee/Basic Science	Emeritus professor
2	Research Member	Male	Chairperson of Korean Animal Hospital/Clinical Science	Veterinary Clinics Director
3	Research Member	Male	President for Korean Veterinary Theriology Professor Association, Researcher at Japan RIKEN/Veterinary Theriology	Professor
4	Research Member	Male	President for Korean Veterinary Basic Science Professor Association/Basic Science	Professor
5	Research Member	Male	President for Korean Veterinary Medical Imaging Professor Association/Veterinary Medical Imaging	Professor
6	Research Member	Female	President of the Korean Veterinary Internal Medicine Professor Association/Veterinary Internal Medicine	Professor
7	Research Member	Male	President of the Korean Veterinary Surgery Professor Association/Veterinary Surgery	Professor
8	Research Member	Male	President of ABOVEK/Basic Science	Emeritus professor
9	Advisor	Male	KVMA	Secretary general
10	Advisor	Female	Head of Medical Education of Inje Medial School/Surgery	Professor
11	Advisor	Male	Cohead of veterinary related media (Dailyvet News)	Representative reporter

OIE, Office International des Epizooties; KAVMC, Korean Association of Veterinary Medical Colleges; ABOVEK, Accreditation Board of Veterinary Education in Korea; KVMA, Korean Veterinary Medical Association.



No.	KVEPA
1.	Gather a history, perform an examination, and create a prioritized differential diagnosis list.
2.	Develop a diagnostic plan and interpret results.
3.	Develop and implement a management/treatment plan.
4.	Recognize patients requiring urgent or emergent care and initiate evaluation and management.
5.	Formulate relevant questions and retrieve evidence to advance care.
6.	Perform a common surgical procedure on a stable patient, including pre-operative and post-operative management.
7.	Perform general anaesthesia and recovery of a stable patient, including monitoring and support.
8.	Formulate recommendations for preventive healthcare.

Fig. 1. Diagram of the entire development process of the 54-item clinical skills guideline and overview of the KVEPA.

EPA, entrustable professional activity; CBVE, competency-based veterinary education; KEVGC, Korean Veterinary Education Graduation Competencies; KVEPA, Korean Veterinary Entrustable Professional Activities.

First, the committee tried to establish a Korean version of the EPA that would fit the current state of veterinary education in Korea. Medical education experts from a medical school in Korea were therefore invited to conceptualize the definition of EPA and present examples set by clinical skills and medical specialties. International references from a medical educator, Ten Cate, and EPA materials for CBVE set by the AAVMC, as well as the EPA in Korean medical education were subsequently reviewed [1,8-10,17]. Overall, the committee members realized that EPA is not an individual competency that an individual should possess, but rather an aspect of veterinary care activities that must be performed; as such, it serves as a basis for deriving clinical skills and medical performance items that should be included in graduation competencies. Furthermore, the members affirmed that the EPA for veterinary education in Korea should be tailored to the specific needs of the Korean veterinary industry. It should also be aligned with the learning outcome model of graduation competency from 2016 and 2019.

The CBVE EPA established by a working group composed of veterinary education experts from the USA, Europe, and Australia led by the AAVMC was also examined. Moreover, the survey results of the Veterinary Occupation Distribution and essential competencies in the field of disease control (Livestock Disease Control and Prevention Headquarters), as well as animal hygiene laboratories were reviewed. Besides veterinarians working in veterinary clinics, those who work in public officials, veterinary companies, and academia are in charge of tasks related to clinical practice or disease prevention and treatment; as such, it was confirmed that veterinary practice activities are the duties that most veterinarians perform on a daily basis.

Considering the necessary performance of graduates based on global standards, strategies established by top veterinary education specialists worldwide could serve as a crucial reference in shaping the Korean veterinary education program. As a result, the AAVMC's CBVE competency framework can be incorporated into the Graduation Competency 2016 framework. This integration has introduced eight Korean Veterinarian Entrustable Professional Activities (KVEPA) into competency-based Korean veterinary education.

A draft list of the clinical skills related to each EPA activity was prepared and reviewed. The EPA-specific draft clinical skills were reviewed for multifaceted suitability, such as whether they were deemed essential skills for undergraduate graduates. Clinical skills should be limited to the minimum number of core skills that can be presented as graduation competencies; the method and depth of expression should be consistent; the contents should be easily guessed from the name of the list; the species should not be specified; and education should be realistic. The target animal species was not specified, allowing the university to choose it. This is because the medical treatment of dogs and cats is the basis; however, the educational conditions for other animals may vary from university to university. Based on these principles, 54 clinical practice criteria were established. The collection of opinions on the 54 items of the confirmed clinical trial was conducted with the help of Veterinary News Media and the opinions of various stakeholders. Opinions were collected by e-mail from professors and external experts at veterinary colleges across the country and to veterinarians in the general field through Veterinary News Media. The final opinions were collected and confirmed through public hearings.

Based on the planning committee's considerations, all clinical professors at veterinary colleges across Korea were consulted on a draft for the establishment of mandatory clinical

skill items. The items for each clinical specialty were reviewed and revised by the faculty council. All professors of the College of Veterinary Medicine were notified for review, and students' opinions were voiced by a representative from the Korean Veterinary College Student Association. Before finalizing the practical items, professors, students, and various related organizations all participated in a public hearing at which the research results were presented.

RESULTS

KVEPA

The KVEPA was developed in accordance with the reality of Korean veterinary medicine, based on the competencies and achievement standards established in the KVEGC 2016 amendment, as well as the components of the AAVMC-CBVE EPA. The eight KVEPA domains are listed in **Fig. 1**, and included basic clinical approach, basic emergency care, common surgical performance, anesthesia, and public healthcare.

Generally, the professional scope of graduates of Korean veterinary schools is not significantly different from those of graduates of North American-European-Australasian universities, as such, the guidelines set by the world's leading veterinary education experts, namely the CBVE competency framework of AAVMC, the CBVE EPA, and the CBVE achievement milestones, were used as reference in establishing the Korean veterinary education system. The 32 competencies of the AAVMC's CBVE competency system were reflected in conjunction with the 5 areas, 13 core competencies, and 39 achievement levels of the Graduation Competency 2016.

As a result, the committee decided to incorporate the AAVMC's CBVE competency framework into the Graduation Competency 2016 framework. In the case of Graduation Competencies 2016, the content of the first domain, 'health and disease management,' was deemed to be too broad, making it difficult to include related competencies in more detail. The five areas of Graduation Competency 2016 were retained, but the contents of the CBVE competency system were revised to reflect the competencies, core competencies, and achievement standards of the Graduation Competency 2016 Revised Competency 2016 EPA for the eight Korean CBVE programs.

Basic veterinary clinical skill items based on the KVEPA

Based on the KVEPA, clinical skill items were defined and limited to the minimum essential, trainable, and evaluable items included in the graduation competencies. The items were finalized with advice from all clinical faculty members, and were based on survey inputs from students and practicing veterinarians. Of the eight KVEPA items, Items 5 and 8 were excluded as they did not directly correlate with the essential skills and items. Finally, 54 basic clinical skills were established to achieve six core competencies (**Table 2**).

DISCUSSION

This study established 54 clinical skills that undergraduate veterinary students must possess prior to graduation. These items were decided based on the revised KVEGC 2016 achievement standards, reflecting domestic and international veterinary environments and the KVEPA. This list is significant, as it outlines the essential clinical skills that graduates must master.

Table 2. Basic veterinary clinical skills based on the KVEPA domains

KVEPA 1	KVEPA 2	KVEPA 3	KVEPA 4	KVEPA 6	KVEPA 7
1. Animal restraint	16. Lymph nodes examination	32. Biopsy	35. Injection	42. Surgical site shearing and disinfection	51. Use of respiratory anesthesia machine
2. Weighing	17. Auscultation (heart, pulmonary, digestive sounds)	33. Microscope operation	36. Endotracheal intubation	43. Covering with a surgical cloth (draping)	52. Use of anesthetized patient monitoring device
3. Body temperature measurement	18. Use of an electrocardiogram	34. Bandage method	37. Intravenous catheterization	44. Opening the surgical pack	53. Local anesthesia administration
4. Respiratory rate measurement	19. Using a radiography machine		38. Basic CPR	45. Hand washing before surgery	54. Injectable anesthesia administration
5. Pulse rate and heart rate measurement	20. Restraint for radiography		39. Urethral catheterization	46. Wearing surgical gowns/surgical gloves	
6. Capillary filling time measurement	21. Chest X-ray presentation		40. Oral medication administration	47. Tissue incision	
7. Dehydration assessment	22. Abdominal X-ray presentation		41. Gastric tube insertion	48. Vascular ligation and hemostasis	
8. Blood pressure measurement	23. Musculoskeletal X-ray presentation			49. Knots and sutures	
9. Eye examination	24. Urinalysis and testing			50. Dressing application	
10. Ear examination	25. Fecal examination				
11. External genitalia examination	26. Smear specimen production and inspection				
12. Oral examination	27. Neurological examination				
13. Rectal examination	28. Orthopedic examination				
14. Intravenous blood sampling	29. Abdominal puncture				
15. Skin examination	30. Thoracentesis				
	31. Blood cross-reactivity test				

The KVEPA domain 5 and 8 do not contain practical clinical skills.
KVMA, Korean Veterinary Medical Association; CPR, cardiopulmonary resuscitation.

To establish basic clinical skills in veterinary medicine from an objective and scientific point of view, it is necessary to first establish the concept of an EPA, after which appropriate EPAs for Korea's veterinary educational environment must be determined. First, committee members should address the unfamiliar perception of EPA to facilitate and solidify the development of basic clinical skills. The EPA concept, which serves as the basis for establishing clinical skill items, was first proposed by the Dutch medical educator in 2005. The EPA theory is at the core of competency-based medical education, including veterinary education [17]. The strategies and experiences required to establish EPAs and apply them in educational settings have previously been introduced [18-20]. EPAs refer to the essential activities of professionals that can be performed without direct supervision in a specific medical environment. Specifically, in this context, EPAs are tasks that new veterinary school graduates must be able to perform independently [20,21]. EPAs can be used to provide determinative and collective evaluation opportunities for students, and to support assessment programs. EPAs are the most powerful and effective tool for veterinary education when they are used across clinical exercise practices in a diverse range of contexts and in assessing the longitudinal advance of an individual apprentice.

An EPA must have a defined beginning and end. Furthermore, it must be independently executable to achieve a defined clinical outcome, observable in process, and measurable in outcome. It conducts work essential to the profession. Only qualified personnel can perform EPAs, because they require knowledge, skills, and/or attitudes acquired through rigorous training [22].

EPAs are used to develop graduate competencies that accurately reflect the local medical context, meaning that the necessary skills can be derived more systematically. One CBVE working group comprising veterinary education experts from global standards established the 8-item CBVE EPA based on the 13-item CBME core EPAs established by the US medical education community [2]. CBVE EPAs, CBVE competency systems, EPAs, and achievement milestones all represent guidelines established collaboratively by leading veterinary education experts across North America, Europe, and Oceania, and are currently the most authoritative international veterinary education models for CBVE.

The KVEPA was introduced based on the revised KVEGC 2016. This work borrows nine EPAs established by the AAVMC by the collaboration of veterinary education experts from North America, Europe, and Oceania that are also pertinent to Korean veterinary education [7]. One important feature of this system is that it includes EPAs for clinical care activities that are not included in the CBME core EPAs, namely, surgery (EPA 6) and anesthesia (EPA 7). This considers the fact that the majority of veterinarians enter practice immediately after graduation without undergoing specialist training [2,3], whereas the majority of medical graduates enter a specialist program upon completing their basic medical education. Just as the AAVMC working team established CBVE EPAs that differed from those of the medical community, due to the distinct nature of the veterinary education context in leading countries in veterinary education, so too do the EPAs for veterinary education in Korea reflect the Korean context.

Globally, the veterinary curricula share a common set of standards. The WOA (previously the Office International des Epizooties) provided a core curriculum to attain basic competencies [4]. This governing body established a core curriculum related to graduation competencies and held four international conferences between 2009 and 2016 to standardize veterinary education in member countries. Subsequently, Korea's KAVMC established and announced the KVEGC in 2016, which offered a competency framework covering five areas: animal health and disease management, health expertise, communication and cooperation, research and learning, and professionalism [12]. However, because the clinical competency aspect of this mandate was oversimplified, and some of the content was declarative rather than practical, it was difficult to compare it to the UK's Royal Veterinary College's Day One Competencies, or the AAVMC's competency system.

When a similar problem previously arose in medical education, the medical education community responded by establishing basic medical graduation outcomes in addition to defining the role of Korean doctors [23]. In consideration of this, in the present study, AAVMC's nine competency domains were included in the 2016 graduation competencies, reflecting the role of Korean veterinary doctors. The original five graduation competency domains from 2016 were maintained; however, the core competencies and achievement standards were revised [12]. The revised KVEGC 2016 is significant in that it sets more reasonable goals for establishing a competency-centered curriculum, as an achievement standard (under the second domain, one health expertise—2.2.2 practicing and promoting ecological citizenship) was listed to cope with the destruction of the natural environment and climate crisis. This is expected to become a leading feature of Korean veterinary graduate competencies.

The AAVMC addresses nine competency domains: clinical reasoning and decision-making, individual animal care and management, animal population care and management, public health, communication, collaboration, professionalism and professional identity, financial

and practice management, and scholarship [8]. Unlike the competencies established by the UK and North America, Korea's graduation competencies based on the KVEGC 2016 are overtly connected to medicine, and are believed to be influenced by the 'Korean doctor image,' which contains a significant amount of declarative and abstract content [24].

The environment for veterinary education in Korea may differ in some ways from that of other countries. As of now, a veterinary specialist system has not been established in Korea, so most graduates start practicing immediately. The Competency-Based Veterinary Education Programmatic Accreditation (CBVE EPAs) were carefully reviewed and adapted from the Korean Veterinary Education Programmatic Accreditation (KVEPA) to better fit the reality of Korean veterinary education. Over time, the KVEPA is expected to be updated to better suit the Korean situation based on new developments or accumulated experience.

The KVEPA presented in this study is a model proposed by the KAVMC; however, each college can modify the content of the eight KVEPA items, augmenting them as necessary. This is the first Korean guideline to reflect on the graduation competencies required by veterinarians in their day-to-day clinical work. The KVEPA can be used as a foundation to set attainment levels and evaluation standards in undergraduate veterinary clinical education. However, this system is not prescriptive. For example, expertise in aquatic animals and insects can be added to the ninth KVEPA, as required.

The 54 clinical skill items based on the KVEPA proposed in this study were finalized only after several revisions by collecting opinions from veterinary school professors, students, and stakeholders. Veterinarians treat a diverse array of animals; therefore, the listed clinical techniques must cover a wide range of species. Although the species veterinarians deal with are highly variable globally [25], the clinical skills in this study were initially based on canines and bovines, as they are the primary species encountered by veterinarians in Korea. Canines and bovines are also considered teaching species because many skills are transferable. In the future, clinical skill items will need to address a wider variety of species. Furthermore, public health aspects need to be supplemented, and an additional review of the difficulty and risks of each skill will be necessary.

The clinical skill items established in this study clarify the details of graduation competencies, and further provide a curriculum based on competency-based education theory, along with learning outcomes in the background knowledge field proposed in the 2017–2019 period at each veterinary school across the country. This list offers practical support for the implementation of practical clinical courses in veterinary education.

The various guidelines for competency-based curricula are meaningful only when implemented. Therefore, evaluation criteria should be provided to determine whether individual students attain the KVEPA and their corresponding clinical practice capabilities. Future research is required on the evaluation standards for individual students' achievement levels in educational settings.

The limitations of this study were as follows. Firstly, this research borrowed from prior research in the US and medical education, but was not able to provide a more thorough analysis of the fact that veterinary and medical education in the US is contextually different, as domestic veterinary schools will have trouble competing in terms of scale and financial resources. In addition, there is a concern that these basic practical skills will not be taught in

practice; the extent to which students receive basic clinical skills education at each university and the extent to which the clinical skills education environment is prepared have not yet been investigated. Simultaneously, it is necessary to set goals in line with the country's veterinary education environment. New graduates must be able to perform their professional duties independently.

This study provides an opportunity to implement global standards' latest competency-based educational theories and guidelines in veterinary and medical education in the Korean veterinary education system. Further studies should investigate the development of more detailed content for these 54 items. Furthermore, educational policies need to be changed to strengthen the capacity of instructors to introduce CBVE courses into classes. To launch a CBVE effectively, each university must establish an educational infrastructure suitable for the given conditions in advance and continue its differentiated efforts. Furthermore, the Korea Accreditation Institute for Veterinary Medical Education needs to reflect the efforts of those universities in evaluating and accrediting their curricula.

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