NORTH AMERICAN VETERINARY LICENSING EXAMINATION (NAVLE®)

VETERINARY PROFESSION PRACTICE ANALYSIS 2017

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I. BACKGROUND AND OVERVIEW

The role of practice analysis in the development of credentialing examinations is well documented in the assessment literature (APA, Kane 1982, Raymond & Luecht 2013). Given the importance of licensing examinations—to prospective veterinarians, to veterinary medicine in general, to both animal and human health, as well as to the public—it is imperative, for both legal and scientific reasons, that such examinations are job-related. This is ensured by developing examination content specifications that are based on practice analysis. Valid practice analysis results guide test design activities such as determining the knowledge and skills required for successful performance, selecting appropriate assessment methods and approaches, designing the best-practice–related examination items and other assessment tasks, and defining score categories that serve as the basis for feedback. In other words, a high-quality, valid practice analysis will inform key decisions about test blueprints and content for an examination such as the NAVLE and thus become the cornerstone of a professional licensing system.

To ensure that licensure examinations required for the practice of veterinary medicine remain highly job-related, the International Council for Veterinary Assessment (ICVA) has periodically conducted practice analyses, with the most recent completed in 2003 and 2010. Those studies administered questionnaires to large samples of North American veterinarians regarding the types of diagnoses they typically encounter and the frequency with which they perform various activities. The present analysis updates previous studies by asking an even larger, more representative sample of North American veterinarians about the species they see in their practices and the diagnoses in cases they are required to manage. In addition, the present study extends previous practice analyses in two important ways: (1) by incorporating elements of competency modeling and (2) by systematically identifying the basic science knowledge foundational to all of veterinary medicine. Each is briefly described below.

Over the past two decades, competency modeling has gained prominence as a way for businesses to guide activities related to personnel selection, training, and other human

resource functions. That influence recently has extended into professional associations in disciplines such as accounting, engineering, medicine, nursing, psychology, as well as veterinary medicine. For example, the Royal Veterinary College (*Bachelor of Veterinary Medicine Day One Skills*, 2007) published a list of competencies required of veterinarians at entry into practice. More recently, the North American Veterinary Medical Education Consortium (NAVMEC 2013), composed of leading organizations in the profession, published a comprehensive list of clinical and professional core competencies required at entry into and across the whole career span of veterinary practice.

The practice analysis questionnaires developed for the present study included multiple competencies obtained from numerous documents created by various organizations since 2007 (Appendix G). The current analysis sought to determine the frequency with which these competencies were required in work/practice and their importance to successful outcomes. The current study also investigated the relationships among competencies to determine a useful framework or model for organizing them.

Additionally, the current study extended previous efforts by beginning the process of confirming how foundational sciences are incorporated and required for successful veterinary practice. To this end, an extensive search of relevant textbooks and veterinary curricula was completed and formatted into a list of academic disciplines, as well as some specific topics within each discipline. This list will be used by the NAVLE Examination Committee and other groups of subject matter experts (SMEs) when coding new NAVLE content. NBME staff will track the proportion of content covering each of these topics. Ultimately, when considering content coverage on the exam, NAVLE collaborators will use this information to help inform decisions about the degree of emphasis to allocate to various basic science disciplines (eg, microbiology, parasitology, anatomy) and specific topics within disciplines (eg, bacteriology, virology, nematodes, anterior cruciate ligament).

Survey Rationale

The current analysis obtained information about the following characteristics of veterinary practice: (a) work context, (b) animal species and diagnoses managed, (c) clinical

and professional competencies required for success, and (d) foundational and basic veterinary sciences knowledge required to effectively perform the responsibilities of effective practice. Each of these characteristics provides important considerations when designing and developing an examination's blueprint and overall content.

A key challenge in creating and conducting a large survey that produces information about each of these characteristics is keeping the survey concise enough so that participants will respond to and complete the entire questionnaire. The 2010 job analysis had a less-than-ideal, although acceptable, response rate of 13.8%.

The present study employed two strategies to optimize response and completion rates. The first was to split the survey into multiple sections such that no one person would see all sections. For any given section, only those groups most qualified to provide the type of information sought were targeted. The second strategy was to develop the longest part of the survey—animal species and diagnoses managed—such that respondents would complete only those diagnoses relevant to their practice. This was done by administering an online, web-based survey that used logic algorithms to route respondents only to certain sections: If, for example, clinicians indicated that they work primarily with canine and feline patients, they would complete only those diagnoses associated with those species.

With the above as an introduction and overview, the remainder of this report is organized as follows: The next section explains the survey methodology by describing questionnaire development, sampling, and survey administration. Then, key results are presented, followed by a discussion of their implications for design and content of NAVLE.

II. SURVEY DEVELOPMENT

ICVA representatives met with NBME staff in December 2014 to discuss the components and logistics of a high-quality professional practice analysis, to articulate its goals, and to begin the planning process. The group then spent January and February 2015 developing a detailed project plan. Project staff spent the next several months reviewing the relevant literature to assist with developing the sections of the practice analysis survey instrument.

Key documents used to develop the survey included the NAVMEC (2013) report "Enduring Contributions," the OIE (World Organisation for Animal Health), and the current NAVLE diagnoses lists, as well as activity codes and various demographic appraisals and labor market reports published by the American Veterinarian Medical Association (AVMA). Key publications used as reference materials are included in Appendix G.

A meeting was scheduled for May 11-12, 2015, to establish a panel of Subject Matter Experts (SMEs) to outline and design various sections of the large survey instrument. Appendix F lists the SMEs who participated in both the meeting and the activities leading up to it. Key Project Staff (Appendix D) and SMEs collaborated via a secure online portal in advance of the meeting to develop rough drafts of the content required for the different survey sections.

Three groups of SMEs worked independently during the first day of the meeting refining the content to be addressed in the individual sections of the survey. Each of the groups presented their sections to the larger group on the second day of the meeting in order to gather additional comments and further refine the content of the survey.

At the end of the meeting, draft lists of diagnoses by species and competencies were shared with the whole team of SMEs via a secure online portal. The SMEs worked with project staff over the next few months to finalize the content to be administered in the pilot, after which a draft survey for pilot testing was provided to and approved by the ICVA board in October 2015.

Survey Structure and Content

The final practice analysis survey consisted of three sections: Demographics and Practice Characteristics, Species and Diagnoses, and Clinical and Professional Competencies. These sections are described below in further detail. Each respondent was asked to evaluate specific species and/or competency statements based on their responses to demographic questions at the beginning of the survey. In the interest of brevity, a decision was made not to include any foundational veterinary science components in the main survey instrument but to address the basic veterinary sciences in a later supplemental activity.

Demographics and Practice Context

The purpose of the first section was to gather relevant individual participant demographic and practice information in order to (1) route respondents to specific sections of the questionnaire based on practice sector and particular types of species encountered; (2) gather required information for validity, generalizability, and data interpretation, that is, to verify that the sample is comparable to known US and Canadian veterinary demographics; and (3) to compare groups of participants based on practice type, gender, or other factors. The demographic questions included on the survey are included in Appendix E.

Animal Species and Diagnoses

The purpose of the second section was to evaluate individual species and diagnoses in order to estimate how often veterinarians in clinical practice encounter particular diagnoses. This section of the survey contained a total of 1,034 diagnoses spanning 23 animal species. The species considered by the survey are listed in Table 1. Within each species, diagnoses were further categorized by organ system (eg, cardiovascular, gastrointestinal).

Table 1

Species and Other Animal Patients

Species	
Aquatics	Hamsters
Bovine	Iguanas
Camelids	Mice
Canine	Ovine
Caprine	Pet Birds
Cervidae	Porcine
Chelonians	Poultry
Chinchilla	Primates
Equine	Rabbits
Feline	Rats
Ferrets	Snakes
Guinea Pigs	

Respondents were also asked to indicate the frequency with which they encountered a diagnosis in the practice of veterinary medicine. The possible frequency response options were *Daily, Weekly, Monthly, Rarely,* and *Never*.

The frequency with which a diagnosis was encountered serves as one indicator of the importance of including a diagnosis in an assessment blueprint. However, it is also necessary to consider the criticality of a diagnosis and its impact on a patient or client. That is, a diagnosis may be common but have minimal impact because it is uncomplicated or requires minimal or no treatment. Conversely, a rarely seen diagnosis can have enormous consequences if it is missed (eg, rabies, foot and mouth disease, terminal malignancy). Therefore, the study also obtained judgments about the criticality or level of importance of each diagnosis for competent practice. As described later in this report in "IV. Supplemental Practice Analysis Activities," these judgments were obtained from an independent panel of SMEs through a separate exercise.

Clinical and Professional Competencies

This section of the survey gathered data to determine the relative contribution of distinct competencies for safe and effective practice. Competency models have been

proposed by various veterinary groups, but to date there is limited objective data to support which clinical and professional competencies are required of veterinarians as they perform their daily responsibilities.

This section consisted of 103 work activities spanning both clinical and professional behaviors. The competencies were initially organized into eight groups based on similarity of content.

Table 2

Major Categories of Clinical and Professional Behavior

Professional Activities	Clinical Activities
Communication	Professionalism
Leadership	Health Management
Lifelong Learning	One Health Concepts
Practice Management	Epidemiology

Respondents were asked to indicate the response that most closely reflected the frequency with which he or she performed each behavior as they practiced veterinary medicine. The response options were *Daily, Weekly, Monthly*, and *Quarterly* or *Less*. Respondents could also indicate "*I do not do this*."

As with diagnoses, "frequency of performing an activity" is just one indicator of its overall importance; it is also necessary to consider the impact of an activity on competent performance. Therefore, these same 103 activities were later evaluated by an independent panel of SMEs who were asked to rate each activity in terms of its criticality for veterinary practice. This exercise is described in a later section, "IV. Supplemental Practice Analysis Activities."

III. SURVEY SAMPLING AND ADMINISTRATION

Pilot Survey

Sample

The AVMA provided project staff with a random sample of 200 veterinarians to use for the pilot test. An additional 65 veterinarians volunteered to assist with piloting the survey.

The Practice Analysis Survey was piloted during the fall of 2015. This pilot was used to confirm that the routing logic was working appropriately and to determine the amount of time required to complete the survey. The programming logic of the survey assigned some respondents to the diagnoses section and some others to the competencies section. For those routed to the diagnoses section, the logic also ensured that they received questions only about species relevant to their practice. Veterinarians who reported that they did not work with animals directly were routed to respond to rate competencies only.

Analysis of the pilot responses showed that respondents were spending less time rating competencies than originally estimated. Adjustments were then made to add the rating of competencies to respondents who worked with two or fewer species. Some other minor modifications were also made to some of the survey elements as a result of the pilot.

Live Survey Sampling and Administration

Canadian Sample

In March 2016, the Canadian Veterinarian Medical Association (CVMA) contacted 3,564 of its members to complete the survey on behalf of the ICVA. The sample size of CVMA members was selected to provide stable estimates while reflecting the larger population with respect to age, gender, location, and practice characteristics. The survey and all communications (survey invitation and two reminders) were translated into French in order to include French-speaking veterinarians.

US Sample

The AVMA provided contact information for 16,000 of its members. This sample included 15,000 individuals selected to reflect the current population of veterinarians in the

United States with respect to age, gender, location, and practice characteristics. The AVMA also provided an additional sample of 1,000 veterinarians who had graduated from veterinary school in the last five years.

Administration

During late April 2016, the ICVA sent initial e-mail invitations to the sample alerting participants that a survey would be sent out. In early May 2016, a link to the web-based survey was sent. All respondents had until May 20, 2016, to complete the survey. During this time frame, non-responders received up to three reminders.

The web-based survey used the responses from the demographic questions to tailor the content to respondents' areas of practice so no respondent was exposed to the whole survey instrument. Any respondents who indicated that they did not work with animals directly were asked to rate all of the competency statements.

Those respondents who worked with only one or two species were asked to rate the diagnoses for those species, as well as the competency statements. Respondents who worked with three or more species were randomly assigned either to complete one of those species and the competency statements or to score diagnoses for those three species. The survey logic randomly selected the species to present, if a respondent indicated that they worked with more than three species. Since the competencies had not been part of any previous practice analysis, there was particular interest in ensuring that that section was completed by a very large and representative subsample; therefore, approximately half of all respondents were randomly assigned to provide ratings on the competencies.

Including the responses from piloting activities, a total of 6,975 responses were determined to be sufficiently complete to contribute to survey analysis. Additional information about the sample and the response rate can be found in Table 3. The overall usable response rate for this practice analysis was 35%, significantly higher than previous practice analyses conducted for NAVLE.

Table 3

Response Rates for Practice Analysis Survey Including the Pilot Study

	Respondent Group (N)		
	Canadian	**United States**	**Total**
Invitations Sent	3,564	16,265	19,829
Total Respondents	1,719	6,086	7,805
Usable Responses	1,385	5,590	6,975
Response Rate	**39%**	**34%**	**35%**

IV. SUPPLEMENTAL PRACTICE ANALYSIS ACTIVITIES

Some critical information required for developing the new NAVLE blueprint was not gathered through the practice analysis survey. A few supplemental survey activities were completed, and an additional SME meeting was convened to assist with finalizing recommendations for NAVLE specifications. Those activities are described below.

Survey of Competency Criticality Activity

The purpose of the survey of competency criticality was to gather expert opinion on the potential impact of the activities that appeared in the clinical and professional competencies section of the practice analysis survey. This information would later be used in conjunction with the frequency information obtained through the practice analysis survey to determine content coverage for the new NAVLE competency-based blueprint.

Invitations to participate in this electronic survey were sent via e-mail in early July 2016 to 25 subject matter experts who are familiar with the ICVA and the purpose of the NAVLE. This group consisted of current Examination Development Advisory Board (EDAB) members and current ICVA board members.

Unlike the practice analysis survey, the competency statements were not presented in groups based on similarity. The 103 competencies were broken into ten groups and were randomly ordered within each group. The random ordering enabled us to present each respondent with a unique sequence of competencies to reduce autocorrelation or order effects.

Each respondent was asked to rate the criticality or importance of each competency to the well-being of animal patients, clients, and people in the work area, as well as to public health and environmental impact. Figure 1 shows the question and response options that accompanied each group of competencies.

If the activity were performed incorrectly or not at all, what would be the risk of adverse consequences, such as injury, complications, or financial loss?

No risk of adverse consequences if performed incorrectly or not at all
Slight risk of adverse consequences if performed incorrectly or not at all
Moderate risk of adverse consequences if performed incorrectly or not at all
High risk of adverse consequences if performed incorrectly or not at all

Figure 1. Criticality of competency question stem and response options

Card-sorting Activity

SMEs also engaged in a sorting exercise to judge the similarity among the 103 activities. Similarity judgments served as the basis for a framework to organize the competencies. The same 25 SMEs described above were also asked to evaluate each of the competency statements and to sort them into meaningful groups based on perceived similarity. The results of the sorting exercise were subjected to multivariate analyses (cluster analysis or factor analysis) and SME review to develop a competency framework to serve as input for the NAVLE blueprint.

Criticality of Diagnoses by Species Survey

In designing the NAVLE, the importance of including a particular diagnosis is impacted by the frequency of that diagnosis in practice, as well as its criticality. The criticality of each diagnosis was not evaluated during the initial survey. The supplemental survey activity was used to evaluate the criticality of diagnosis by species to ensure that our veterinary practice analysis study reflects the most accurate level of importance for each diagnosis potentially encountered by an entry-level veterinarian.

A panel of 130 SMEs known to the ICVA was used for this activity. This group consisted of current and former Examination Development Advisory Board (EDAB) members, item writers, form review participants, and board members. Five additional SMEs in certain species were contacted to provide an adequate number of respondents for each species.

The diagnoses presented in the survey were the same 1,034 diagnoses organized by the 23 species and organ systems evaluated as part of the practice analysis. Respondents were

first asked to select the species for which they were comfortable providing an opinion; then they were routed to evaluate diagnoses for some or all of their selected species and were asked to rate the significance or consequence of each diagnosis. Significance or consequence is defined by the potential public health impact,the economic magnitude of overlooking a diagnosis or neglecting to make one, or an adverse patient outcome, such as mortality. Figure 2 shows the question and response options that accompanied the diagnoses and activities.

Question:

Please use the scale below to rate the criticality or importance of each diagnosis to the well-being of animal patients, clients, or people in your work area, as well as to public health or environmental impact.

If the diagnosis were missed, what would be the risk of adverse consequences, such as injury, complications, or financial loss?

Response Options:

No Risk, Slight Risk, Moderate Risk, High Risk, and *Unsure*

Figure 2. Criticality of diagnosis question stem and response options

Foundational Science Knowledge and Skills

There is a need to determine how much emphasis should be allocated to each of the various foundational science disciplines covered on the NAVLE blueprint. However, we recognize that obtaining judgments regarding the importance of different knowledge domains is also a challenging and tedious activity that is prone to positive response bias. We determined that the best way to address this would be to identify a group of SMEs currently employed in academic settings who would be asked to review the foundational science disciplines identified by SMEs in May of 2015.

ICVA worked with faculty at AVMA-accredited veterinary schools to identify a group of SMEs who represented all of the foundational science disciplines. These individuals were asked to evaluate the foundational science topics to determine how much content should be allocated to each of the content areas on a future assessment to be used for licensure.

This foundational science information was partitioned into ten major academic disciplines with two to four subtopics within each discipline. The list was formatted into a hierarchical, two-stage questionnaire. At stage 1 respondents are asked to rate the importance of each major discipline by assigning a percentage such that the percentages sum to 100 across all 10 major disciplines. At stage 2 respondents indicate the percentages for each of the specific topics within each major discipline.

June 2017 SME Meeting

An additional meeting of 11 SMEs was convened in Philadelphia, PA on June 7-8, 2017, and was attended by most of those who participated in the SME meeting in May of 2015. The primary objective of this meeting was to build consensus around the high-level blueprint for the diagnosis and competency dimensions. This meeting was also used to flesh out the details regarding what diagnoses to include on the NAVLE, the emphasis of the diagnoses, and to further refine competencies.

The main activity of the first day of the meeting was to review and finalize the list of diagnoses by species, looking for any duplicates or topics that could be combined. The SMEs also were asked to evaluate and grade each of the diagnoses. The scale used for this activity was “A” – Essential: include items covering this diagnosis on every test form; “B” – Important: cover on some test forms; or “C” – Less important: keep on test blueprint but not essential to include items on test forms.

The SMEs also reviewed the proposed draft blueprint for the diagnosis dimension. Each SME was asked to provide input relative to what the content distribution should be on the new NAVLE. SMEs were given the draft blueprint based on the data resulting from the survey to assist them with this activity. SMEs felt that there was a missing category from this proposed blueprint on the species dimension: multi-species or non-species specific.

The second day of the meeting focused on the clinical and professional competencies. SMEs reviewed each of the competencies and were asked to add any content that may have been missed during initial development. They were also asked to determine what competencies can be assessed by the current multiple choice question (MCQ) assessment

format and what competencies may need to be addressed by other assessment item types in the future.

At the conclusion of the June meeting, staff worked to incorporate revisions and develop a final proposed blueprint based on the species, organ system, and the clinical and professional competency domains. This blueprint was shared with the ICVA board on June 24, 2017.

V. RESULTS

Demographics

Experience

The purpose of a valid practice analysis is to provide a systematic approach to help shape and enhance the current assessment process and examination for entry-level veterinarians. The activities of those who were recently licensed are of particular interest because they most accurately reflect the activities of newly licensed veterinarians. However, data from more experienced veterinarians were also collected in order to examine any shifts in practice that may have occurred either in the natural course of gained experience for a veterinarian or as a result of any recent shifts in the veterinarian practice environment. Recently licensed veterinarians were defined as those with up to 10 years of experience. This included those who were initially licensed between 2006 and 2016 (n=2,709). Experienced veterinarians were defined as practitioners with more than 10 years of experience or those who were initially licenced before 2006 (n=4,074). All analyses for the main survey in this report will present results for recently licensed veterinarians, experienced veterinarians, and the total group.

Table 4

Breakdown by Experience Classification

	N	**%**
Recently Licensed	2,709	38.8
Experienced Veterinarians	4,074	58.4
Missing License Year	192	2.8
Total	**6,975**	

Gender

Among the 6,975 participants, the percentage of respondents specifying their gender as male was 42%, the same as for the combined population of US and Canadian veterinarians. Similar to the results of the 2013 US Veterinary Workforce Study conducted by the AVMA, the percentage of female respondents was higher for those who were recently licensed.

Table 5

Gender by Experience Level

	Experience Level (%) (N=6,963)		
Gender (N)	**Experienced Veterinarians**	**Recently Licensed**	**Total**
Female (4,015)	52	67	58
Male (2,902)	47	33	42
Different identity (1)	0	>1	>1
I prefer not to answer (45)	1	1	1

Age

The average age of respondents was 46 years. This is a slightly younger population than reported in the workforce study report, for which the average age was 53. The age distribution of the respondents is displayed in Figure 3. Please note that 267 individuals did not respond to this question.

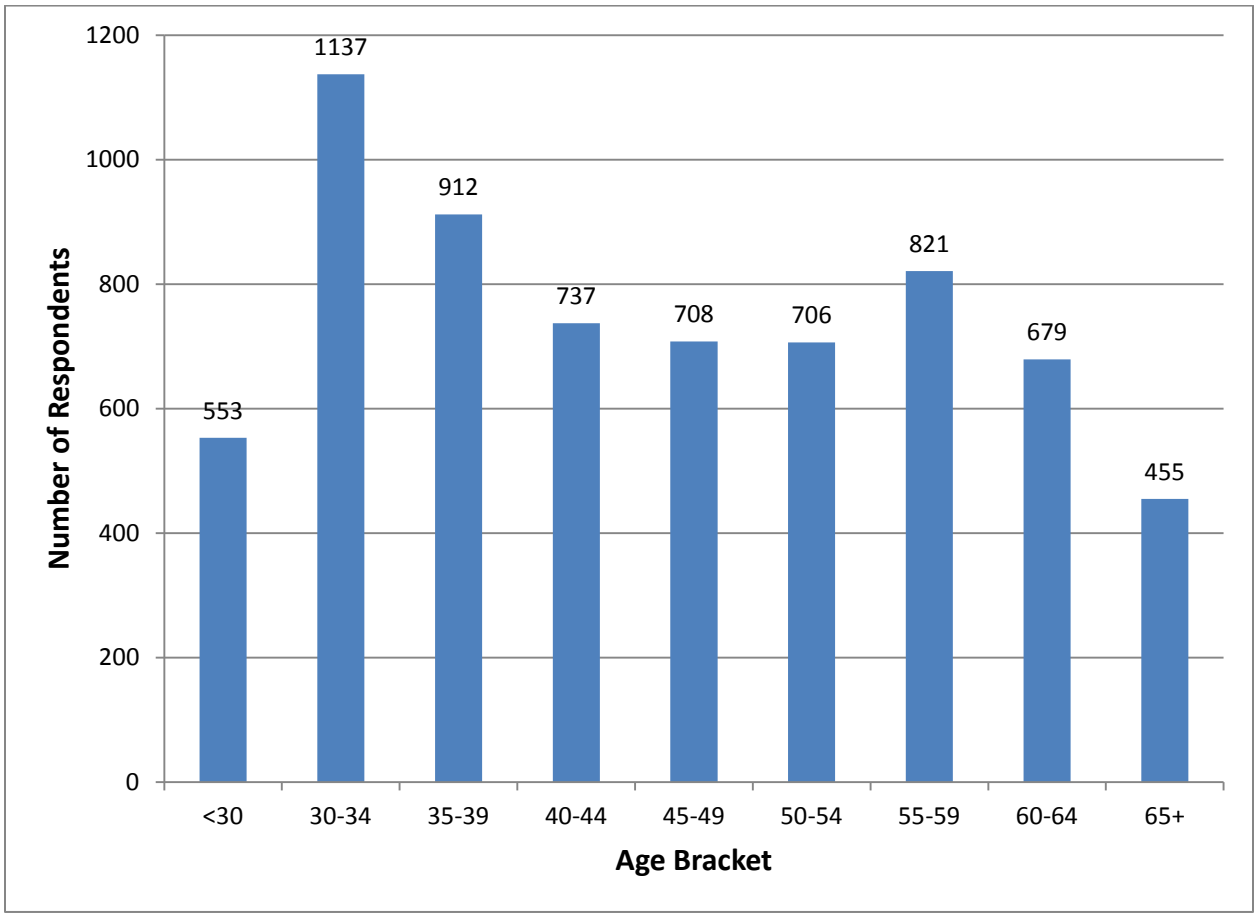

Figure 3. Age distribution of practice analysis respondents

Racial or Ethnic Group

The last demographic question on the survey asked respondents to indicate the racial or ethnic group with which they most closely identify. A response to this question was not required, but approximately 5,100 respondents answered (Table 6). A majority of the total group of respondents identified as white (89%). Any differences between experienced veterinarians and those who were recently licensed were negligible for all categories.

Table 6
Race/Ethnicity by Experience Level

	Experience Level (%) (N=5,085)		
Race/Ethnicity	**Experienced Veterinarians**	**Recently Licensed**	**Total**
Asian	2	5	3
Black or African American	2	2	2
Middle Eastern/Arab	<1	<1	<1
Hispanic, Latino, or Spanish origin	3	4	3
Native American or Alaskan Native	1	1	1
Native Hawaiian or Other Pacific Islander	<1	<1	<1
White	90	87	88
Other	2	1	1
I prefer not to respond	3	3	3

Note: Respondents were instructed to select all that apply.

Practice Context

Hours Worked

Overall, about 70% of respondents indicated that they worked 40 or more hours per week. That percentage increases to 80% for all of those who were recently licensed and 88% for men who were recently licensed (Figure 4). For both the recent and the experienced groups, women are more likely than men to work fewer than 40 hours per week.

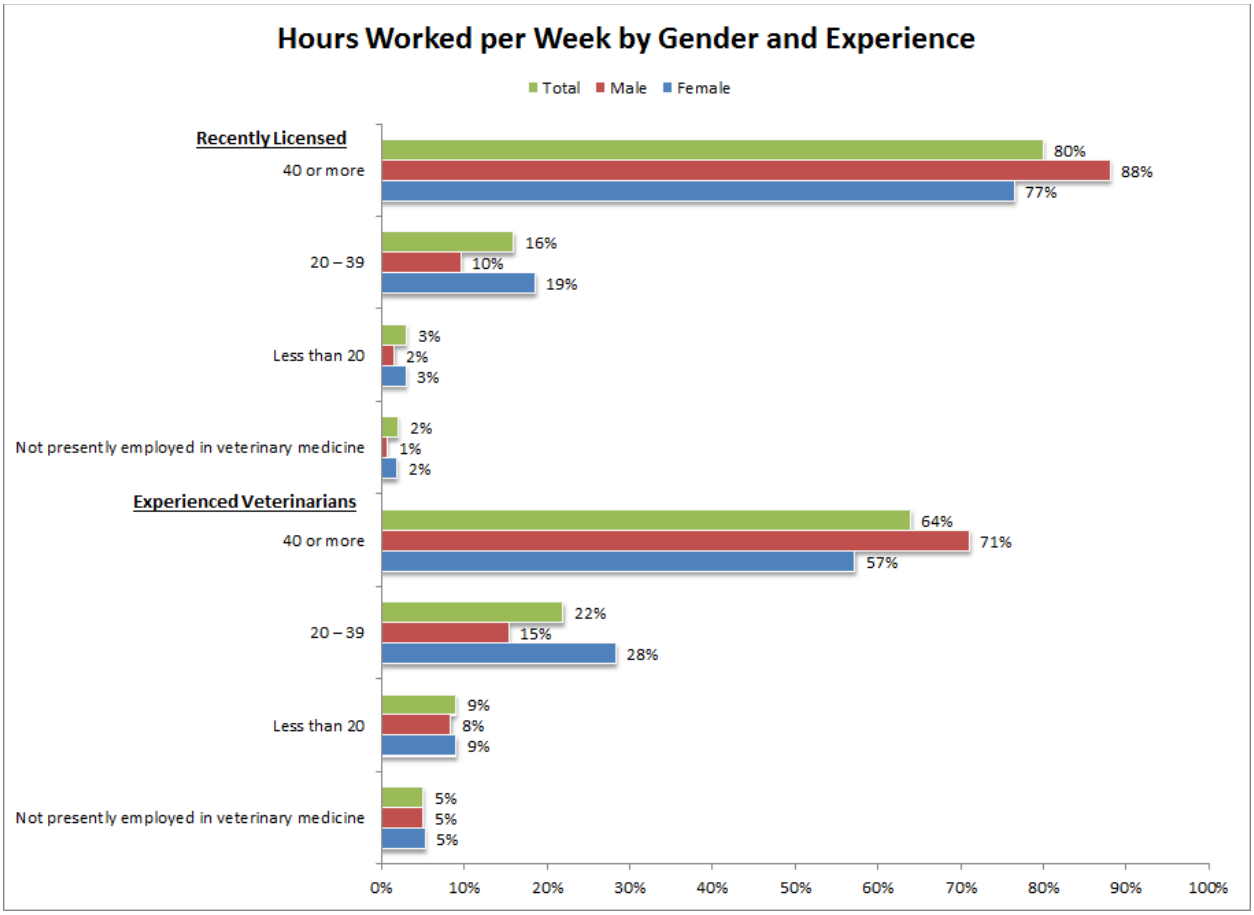

Figure 4. Hours worked by experience level and gender. Please note that the sum of the percentages may not add up to 100 due to rounding.

Employment Sector

Respondents estimated the amount of time they spent working in different employment sectors (Table 7). Respondents who spent 75% or more of their time in one sector were classified as having a primary employment sector. Private practice (58%) was the most common employment sector, followed by academia (16%). The current respondent group is similar to what was reported by the AVMA in 2015, which showed 60% of US veterinarians in private practice. Those who were recently licensed were much more likely to work in private practice (74%) when compared with experienced veterinarians (50%).

Table 7
Practice Analysis Respondents by Primary Employment Sector
(N=6,975)

	Experience Level (%)		
Primary* Employment Sector	**Experienced Veterinarians**	**Recently Licensed**	**Total**
Private Practice	50	74	58
Academia	18	12	16
Commercial/Industry	10	3	8
Government	9	4	7
Other Sector	4	2	3
Multiple Sectors	4	2	3
Not for Profit	3	3	3
Military	1	2	1

*Primary indicated by 75% or more of time in a particular sector. The sum of the columns may not add up to 100 due to rounding.

Primary Clinical Practice Area

Overall, the majority of respondents (86%) indicated that they worked directly with animals.Those who were recently licensed were more likely to work with animals (92%) when compared with experienced veterinarians (83%). Those respondents who worked with animals were asked to identify their primary clinical practice area (Table 8). Over half of respondents (55%) described their practice as companion animals only.

Table 8
Clinical Practice Classification
(N=6,923)

	Experience Level (%)		
Self-classification	**Experienced Veterinarians**	**Recently Licensed**	**Total**
Companion animals only	51	64	55
Food animals only	7	5	6
Mixed animals	13	17	15
Equine only	4	4	4
Other*	25	11	20

*Other responses were classified into Laboratory Animal, Regulatory, Academia, Pathology, Industry, Wildlife, and Other. The sum of the columns may not add up to 100 due to rounding.

Time Spent by Species

Respondents also provided estimates of the amount of time spent with different species. Using the criteria outlined by the AVMA to classify veterinarians by species, 70% of respondents were classified as predominantly or exclusively companion animal veterinarians (Table 9). This is greater than the 59% reported by the AVMA.

Table 9

Classification of Respondents by Time Spent with Species

(n=5,944)

	Experience Level (%)		
Classification by time	**Experienced Veterinarians**	**Recently Licensed**	**Total**
Companion animal, exclusively	60	69	63
Companion animal, predominantly	6	7	7
Food animal, exclusively	9	5	8
Food animal, predominantly	4	3	3
Mixed animal	5	6	6
Equine	6	5	6
Not classified*	10	5	7

*More than half (60%) of those unclassified respondents spent the majority of their time with laboratory animals. An additional 15% of the unclassified respondents spent the majority of their time with species not listed on the questionnaire.

Summary of Demographic and Practice Characteristics

Based on a comparison of the present data to population estimates from other sources (eg, AVMA, other workforce studies), the sample of respondents for the practice analysis is generally representative and comparable to the population of veterinarians in terms of gender, employment sector, and clinical practice areas. The present sample differs from the population of veterinarians in some respects, in that it includes a higher proportion of

younger veterinarians, owing in part to the intentional over-sampling of more recent graduates. This, in turn, may affect other statistics such as the proportion who work primarily with companion animals.

Practice Analysis Activities Related to Species and Diagnoses Managed

Species Classification

Clinical activities were grouped by species and organ system within species, for most species. Similar species were grouped together for the purposes of analyses. Table 10 presents the way in which species were combined and the number of diagnoses for each species group.

Table 10

Species Groups for Analyses

Species Group	Included Species	Number of Diagnoses Rated
Canine	Canine	172
Equine	Equine	157
Feline	Feline	142
Other Small Animals	Chinchillas, Ferrets, Guinea Pigs, Hamsters, Primates, Rabbits, Rats, Mice	108
Bovine	Bovine	107
Camelids/Cervidae	Camelids, Cervidae	89
Porcine	Porcine	76
Ovine/Caprine	Ovine, Caprine	53
Pet Birds	Pet Birds	44
Reptiles	Iguanas, Snakes, Chelonians	37
Poultry	Poultry	36
Aquatics	Aquatics	13

Table 11 shows the number of respondents per species for the criticality evaluation exercise that occurred in the spring of 2017. The average criticality for each species group is also provided. Consideration of the criticality information for each diagnosis was part of the SME exercise for the June 7-8 meeting. SMEs used this information in conjunction with the frequency information to evaluate the individual diagnoses within each organ system to further refine the species diagnoses with the goal of setting targets within organ systems. Note how criticality scores were relatively consistent across species.

Table 11

Number of Respondents and Average Criticality Ratings by Species Group

Species Group	Number of Respondents	Average Criticality
Canine	23	3.3
Feline	26	3.3
Equine	13	3.4
Bovine	21	3.1
Porcine	8	3.1
Other Small Animals	6	3.1
Ovine/Caprine	10	3.3
Camelids/Cervidae	4	2.9
Pet Birds	5	3.1
Poultry	5	3.2
Reptiles	4	3.1
Aquatics	2	3.3

Note: Criticality ratings range from 1 to 4, with 4 being the “most critical”

Table 12

Competency Domains Resulting from the Card-sorting Activity

Major Domain	Number of Competencies	Domain	Number of Competencies
Clinical Practice	28	Clinical Practice	28
Communication	31	Communications with Clients	19
		Communications with Veterinary and Other Professionals	12
Professionalism, Practice Management, and Wellness	20	Professional Development and Lifelong Learning	9
		Veterinary Practice Management	11
Preventive Medicine and Animal Welfare	24	Animal Welfare Issues and Concerns	6
		Environmental Health and Safety	8
		Veterinary Public Health	10

Table 13
Frequency of Performance for Each Major Competency Domain

	Experience Level					
	Experienced Veterinarians		Recently Licensed		Total	
Competency Domain	% Perform	Times per week	% Perform	Times per week	% Perform	Times per week
Clinical Practice	68	2.2	82	2.9	72	2.4
Communication	65	1.6	73	2.0	66	1.7
Professionalism, Practice Management, and Wellness	63	0.6	53	0.6	59	0.6
Preventive Medicine and Animal Welfare	44	0.5	40	0.5	42	0.5

Frequency of Competency

The response options from the survey of competency frequency were converted to represent the number of times per week a respondent indicated performing that specific competency (*Daily* = 5, *Weekly* = 1, *Monthly* = .25 and *Quarterly* or *less* = .05). The "mean number of times per week" was computed for each competency where the denominator was the total number of respondents who rated all of the competencies. This method of computation results in an index that answers the question, "How frequently does the practitioner engage in that activity?"

The column labeled "Times per week" represents the average frequency with which a practitioner performs any single activity in that competency domain. The average "times per week" for clinical practice is 2.4. This does not mean that the average practitioner only engages in activities related to clinical practice 2.4 times a week. In reality, there are 28 competencies for clinical practice. If a practitioner engages in, on average, 2.4 activities related to clinical practice each week, then the practitioner actually engages in 67 clinical activities per week, on average.

Similar to the previously presented results, those who were recently licensed are more likely to perform activities related to clinical practice (82%) than are more experienced veterinarians (68%). The same relationship holds with respect to competencies related to communication. Activities within the other two competency domains were performed with considerably less frequency by both experienced veterinarians and those who were recently licensed.

Table 14

Criticality of Competencies by Domain

Major Domain	Average Criticality
Clinical Practice	3.5
Communication	3.1
Professionalism, Practice Management, and Wellness	2.3
Preventive Medicine and Animal Welfare	3.2

Criticality of Competency

Average criticality ratings (ranging from 1 to 4) show that the competencies comprising the clinical practice domain are viewed as the most critical (average = 3.5). Closely following the clinical practice domain are the preventive medicine and animal welfare (average = 3.2) and the communication (average = 3.1) domains. Professionalism, practice management, and wellness competencies were considered to be less critical (average = 2.3).

VI. IMPLICATIONS FOR TEST DESIGN/TEST BLUEPRINT

Based on the activities described above, project staff developed a draft for the future NAVLE blueprint. This draft blueprint can be described as "problem-based," where each test item corresponds to a particular problem that a veterinarian is called upon to address. Most problems can be described in terms of three facets: (1) the diagnosis presented in the item and the species within which it occurs (eg, equine aspergillosis), (2) the primary competency required to solve that problem (eg, diagnostic acumen; communication skills), and (3) the requisite foundational science knowledge (eg, pathology).

Accordingly, the proposed blueprint consists of three dimensions: diagnoses (nested within species), competency, and foundational science. Every test item can receive three codes, one for each dimension. While it is often possible to give an item more than one code for each dimension, as a practical matter in dealing with the mechanics of building test forms, we need to assign it just one primary code.

Based on the results of the practice analysis survey and subsequent activities, project staff drafted a blueprint for two of the three dimensions: diagnosis and competency. This draft blueprint was reviewed and further refined by SMEs and ICVA board members during meetings held in June 2017. These deliberations resulted in a final high-level blueprint that identifies the major categories for each dimension and the amount of emphasis (number of test items) allocated to each category.

Proposed Blueprint for Species

As a consequence of the practice analysis, early drafts of the blueprint for species consisted only of specific classes of animals. Two concerns were expressed about this early draft. The first concern was that the blueprint could not accommodate test items that were about diagnoses that affect multiple species or test items that were not about any particular disease or species (eg, items about basic sciences or disease outbreaks). After receiving additional feedback from SMEs and the ICVA board, this shortcoming was addressed by adding a category called "non-species specific."

The second potential limitation was that the species dimension of the newly proposed blueprint did not explicitly include a separate category for public health. Since public health has its own category on the current blueprint, this was considered a problem. However, it was explained that test items about public health would get covered under the competency dimension. In particular, such content is covered by the domains called “veterinary public health” and “environmental health and safety,” both of which fall under the major domain of “preventive medicine and animal welfare.” In addition, the major competency domain of “clinical practice” includes activities related to public health. For example, a test item about a disease outbreak affecting commercial layer flocks would get coded under the competency dimension of “preventive medicine and animal welfare” and under “poultry.” The addition of the “non-species specific” category to the “species” dimension also helped address this problem in that those public health items that are trans-species can be coded under “non-species specific.”

Topic weights for each species category were based on multiple sources of empirical information and SME judgements, including: the percentage of veterinarians who work with each species, the percentage of time a veterinarian spends with each species, the frequency with which each diagnosis is encountered in practice, and the criticality of each diagnosis. In addition, the weights for the current test blueprint were also considered. SMEs were asked to integrate this information and assign weights as part of a two-stage exercise completed during the meeting in June 2017. Project staff considered all of these results and proposed the weights as summarized in the right-most column of Table 15 and in Appendix A.

Other notable adjustments were to combine Camelids and Cervidae into one category, similar to how Ovine and Caprine are currently combined, and to separate the current “other small animal” category into two separate groups: mammals and reptiles. The new blueprint will also incorporate a new content area to address aquatics.

Table 15

Current and Recommended Blueprint for Species

Species	Current Blueprint (%)	Recommendation Based on Practice Analysis Results (%)	Recommendation Based on SME Activity in June 2017 (%)	Final Blueprint (%)
Canine	23.3	26.7	26	25.6
Feline	22.7	25	25	24.3
Equine	15.7	15	15	14.7
Bovine	15	13.3	13.7	13.3
Porcine	5.7	5	4.8	5.0
Other Small Animals	3.3	3.3	3.6	3.3
Ovine/Caprine	3.3	3.3	3.3	3.3
Camelids/Cervidae	1.4	1.7	1.8	1.7
Pet Birds	3.3	1.7	2.3	2.3
Poultry	2	1.7	2	2
Reptiles	N/A	1.7	1.5	1.5
Fish	N/A	1.7	1	1
Non-Species Specific	2	N/A	N/A	2

Proposed Blueprint for Competencies

Topic weights for the competency domains were based on a combination of empirical survey results and SME decisions. The specific sources of empirical information included the frequency with which the competency activity is performed and the criticality rating. Given those results, SMEs completed a competency rating activity during the June 2017 meeting. In addition, weights from the current test blueprint were estimated. These estimates were gross approximates in some instances because the current blueprint is not based on the same competencies as the proposed new blueprint. Based on these various sources of information and on the ability of the test-item bank to support each content area, staff proposed the blueprint topic weights summarized in the right-most column of Table 16 and in Appendix B.

The most notable difference between the proposed new blueprint and the results of the practice analysis and SME decisions is for the “communication” domain. At present, and for the near future, the NAVLE is a multiple-choice test. It is generally recognized that communication and related skills are not adequately assessed with multiple-choice items; thus it was necessary to limit the number of test items allocated to that domain for the near future. The ICVA Board

of Directors has undertaken an exploratory effort to ensure that such skills are addressed as part of the licensure process in the years ahead.

Table 16

Competency Specifications

Competency Domain	Current Blueprint	Practice Analysis Proposed %	SME Proposed %	Final %
Clinical Practice*	**88**	**49**	**53**	**70**
Data Gathering and Interpretation	43	25	__	35
Health Maintenance and Prevention	43	24	__	35
Communication	**4**	**37**	**27**	**8**
Communication with Clients	—	25	17	5
Communication wth Veterinary and Other Professionals	—	12	10	3
Professionalism, Practice Management, and Wellness	**3**	**7**	**7**	**7**
Professional Development and Lifelong Learning	—	3	4	3
Veterinary Practice Management	—	4	3	4
Preventive Medicine and Animal Welfare	**5**	**7**	**13**	**15**
Environmental Health and Safety	—	3	4	5
Veterinary Public Health	—	2	3	4
Animal Welfare Issues and Concerns	—	2	6	6

***Clinical Practice was not subdivided at the time of the June 2017 SME meeting**

APPENDIX A

Blueprint and Diagnosis Counts Based on Species

Species	Number of Diagnoses	Blueprint %	Number of Items
Canine	169	25.6	77
Feline	140	24.3	73
Equine	152	14.7	44
Bovine	91	13.3	40
Porcine	67	5.0	15
Other Small Mammals	107	3.3	10
Ovine/Caprine	50	3.3	10
Pet Birds	44	2.3	7
Poultry	37	2.0	6
Non-Species Specific	—	2.0	6
Camelid/Cervidae	85	1.7	5
Reptiles	37	1.5	4
Aquatics	15	1.0	3

APPENDIX B

Blueprint Based on Competencies

Competency Domain	Number of Competencies	Blueprint %	Number of Items
Clinical Practice	**38**	**70**	**210**
Data Gathering and Interpretation	19	35	105
Health Maintenance and Prevention	19	35	105
Communication	**33**	**8**	**24**
Communication with Clients	21	5	15
Communication with Veterinary and other Professionals	13	3	9
Professionalism, Practice Management, and Wellness	**21**	**7**	**21**
Professional Development and Lifelong Learning	9	3	9
Veterinary Practice Management	21	4	12
Preventive Medicine and Animal Welfare	**26**	**15**	**45**
Environmental Health and Safety	8	5	15
Veterinary Public Health	11	4	12
Animal Welfare Issues and Concerns	7	6	18

APPENDIX C

Foundational Science Coding

1. Gross Anatomy
2. Microscopic Anatomy (Histology)
3. Embryology
4. Cellular & Molecular Biology
5. Cytology
6. Hematology
7. Immunology
8. Genetics
9. Physiology
10. Neurology
11. Endocrinology
12. Bacteriology
13. Virology
14. Mycology
15. Pathology
16. Parasitology
17. Pharmacology
18. Toxicology
19. Nutrition/Metabolism
20. Biochemistry
21. Epidemiology/Biostatistics

APPENDIX D

Key Project Staff

While numerous ICVA Board and Committee members contributed to the project, key project staff included the following individuals from ICVA and NBME:

ICVA

Heather Case, DVM, MPH, DACVPM, CAE, advisor and veterinary liaison
Gary Gackstetter, DVM, MPH, PhD, DACVPM, Co-Principal Investigator

NBME

Amy Baker, Analyst
Melissa Billings, Editorial Consultant
Amy Crowe, Project Assistant
Gerry Dillon, PhD, NBME Advisor
Melissa Dudlick, Editorial Consultant
Janine Hawley, Project Director
Janet Mee, Measurement Consultant and Data Analyses
Mark Raymond, PhD, Co-Principal Investigator

APPENDIX E

NAVLE Practice Analysis: Demographic and Practice Questions

Introduction to demographic questions necessary for analyses:

The first section of this survey is designed to gather information that will facilitate meaningful comparisons among respondents. Your responses to the following questions will also help to make sure that veterinarians with different backgrounds are adequately represented in the results.

1. How do you describe yourself?
   - o Female
   - o Male
   - o Different identity
   - o I prefer not to answer.

2. In what year were you born?
   - Drop down list from 1910 - 2000

3. Are you currently licensed to practice veterinary medicine?
   - o Yes → Go to question 5, then question 7
   - o No → Go to question 4
   - o Unsure

4. Have you ever been licensed to practice veterinary medicine?
   - o Yes → Go to question 5, then question 6
   - o No
   - o Unsure

5. In what year did you <u>first</u> obtain your license to practice veterinary medicine?
   - o Drop down list from 1930 – 2015

6. In what year did you cease to have a license to practice veterinary medicine?
   - o Drop down list from 1930 – 2015

7. Are you currently certified by a specialty board?
   - o Yes
   - o No

8. About how many hours per week do you work in veterinary medicine?
   - Less than 20
   - 20 – 39
   - 40 or more
   - not presently employed in veterinary medicine

9. Where do you do most of your work as a veterinarian?
   - o Canada
   - o United States
   - o Outside of North America

10. In which of the following regions do you do most of your work as a veterinarian?
    - o Canada
      - o Alberta
      - o British Columbia
      - o Manitoba
      - o New Brunswick
      - o Newfoundland and Labrador
      - o Northwest Territories
      - o Nova Scotia
      - o Ontario
      - o Prince Edward Island
      - o Quebec
      - o Saskatchewan
      - o Yukon

    - o United States
      - o New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)
      - o Middle Atlantic (New Jersey, New York, Pennsylvania)
      - o East North Central (Indiana, Illinois, Michigan, Ohio, Wisconsin)
      - o West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota)
      - o South Atlantic (Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia)
      - o East South Central (Alabama, Kentucky, Mississippi, Tennessee)
      - o West South Central (Arkansas, Louisiana, Oklahoma, Texas)
      - o Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming)
      - o Pacific (Alaska, California, Hawaii, Oregon, Washington)
      - o Caribbean Territories
      - o Pacific Territories

    - o Outside of North America
      - o Africa
      - o Australia, New Zealand
      - o Asia

- o Caribbean
- o Central America
- o Europe
- o Middle East
- o South America

11. What best describes the area where you perform most of your work as a veterinarian?
    - o Rural
    - o Suburban
    - o Urban

12. Employment Sector: Please indicate the approximate amount (%) of your *compensated* working time you spend in each sector of veterinary medicine. Your percentages should add to 100%.

    _____% Private clinical practice

    _____% Academia (college or university)

    _____% Commercial/Industrial

    _____% Government (nonmilitary)

    _____% Military

    _____% Other not-for-profit organization (e.g., shelter)

    _____% Other, please specify _____

    100 %

13. Do you currently work directly (both compensated and volunteer) with animals ?
    - o Yes
    - o No
    - o Unsure

14. Over the past year, about what percent of your work time (both compensated and volunteer) was spent working with each of the following species?

    _____ % Aquatic

    _____ % Bovine (Dairy)

    _____ % Bovine (Beef)

    _____ % Camelidae

    _____ % Canine

    _____ % Cervidae

    _____ % Equine

    _____ % Feline

_____ % Laboratory animals

_____ % Other small animals (e.g., rabbits, ferrets, hamsters, mice, Guinea pigs, snakes, iguanas, primates)

_____ % Ovine/Caprine

_____ % Pet birds

_____ % Porcine

_____ % Poultry

_____ % Wildlife not specified above

_____ % Other _____(specify)

_____ % Other _____(specify)

100 %

15. Please select all of the species with which you have worked in the past year.

- ☐ Chinchillas
- ☐ Ferrets
- ☐ Fish
- ☐ Guinea Pigs
- ☐ Hamsters
- ☐ Iguanas
- ☐ Primates
- ☐ Rabbits
- ☐ Rats/Mice
- ☐ Snakes
- ☐ Turtles

Research Question

The following questions will be used for research purposes only. Responses will be analyzed in an aggregated format only.

What is your race or ethnic origin? Select all that apply.

- o Asian
- o Black or African American
- o Middle Eastern / Arab
- o Hispanic, Latino or Spanish origin
- o Native American or Alaskan Native
- o Native Hawaiian or Other Pacific Islander
- o White
- o Not listed, Other _____
- o I prefer not to respond

APPENDIX F

NAVLE Practice Analysis Subject Matter Expert Meeting

May 11-12, 2015

Dr. Heather Case, ICVA CEO
Dr. Benjamin J. Darien, EDAB, Equine
Dr. Gary Gackstetter, ICVA Board, Public Health
Dr. William B. Epperson, AVMA COE, Pathobiology/Population Medicine
Dr. Cary Hashizume, Canadian NEB, Companion Animal
Dr. Norman LaFaunce, EDAB, Bovine/Food Animal
Dr. Robert Lester, AAVMC, Leadership, Communication, and Practice Management
Dr. Katie Steneroden, EDAB, Public Health
Dr. Rick Tubbs, EDAB, Swine
Dr. Helen Tuzio, EDAB, Feline
Dr. Julia Wilson, AAVSB, Equine

November 11, 2015 Focus Group

Dr. Ken Andrews, Meeting Facilitator
Dr. Heather Case, ICVA CEO
Dr. Kristin Chaney, AAVMC
Dr. Vito DelVento, AAVSB
Dr. Gary Gackstetter, ICVA Board/PA Co-Principal Investigator
Dr. Marty Greer, AAVSB
Dr. Lizette Hardie, AAVMC
Dr. Kent Hecker, AAVMC
Dr. Jennifer Hodgson, AAVMC
Dr. Jan Ilkiw, AAVMC
Dr. John King, AAVSB
Dr. Mark Nunez, AAVSB
Dr. Jan Robinson, AAVSB

NAVLE Practice Analysis Subject Matter Expert Meeting

June 7-8, 2017

Dr. Heather Case, ICVA
Dr. Benjamin J. Darien, EDAB, Equine
Dr. Gary Gackstetter, ICVA Board, Public Health
Dr. Cary Hashizume, Canadian NEB, Companion Animal
Dr. Norman LaFaunce, EDAB, Bovine/Food Animal
Dr. Robert Lester, AAVMC, Leadership, Communication, and Practice Management
Dr. Karen Rosenthal, Avian/Exotics/Reptiles

Dr. Katie Steneroden, EDAB, Public Health
Dr. Rick Tubbs, EDAB, Swine
Dr. Helen Tuzio, EDAB, Feline
Dr. Patricia Wakenell, Poultry
Dr. Julia Wilson, AAVSB, Equine

Card-sorting Participants

Dr. Rebecca Archer, Canadian NEB
Dr. Jon Betts, ICVA Board, Companion Animal
Dr. Mike Chaddock, ICVA Board, Public Health/Food Animal
Dr. Kristin Chaney, AAVMC, Equine
Dr. Bob Cherenson, ICVA Board, Bovine/Small Ruminant/Cervidae
Dr. Allan Corber, Feline/Canine/Companion Animal
Dr. Benjamin Darien, Equine
Dr. Cheryl Dhein, Companion Animal/Pet Bird
Dr. Julie Fixman, Companion Animal
Dr. Gary Gackstetter, ICVA Board, Public Health
Dr. Meg Glattly, CVAGC Chair, Companion Animal
Dr. Marty Greer, AAVSB, Canine
Dr. Cary Hashizume, Canadian NEB, Companion Animal
Dr. Jay Hedrick, ICVA Board, Companion Animal
Dr. Mark Hilton, EDAB, Bovine
Dr. Jennifer Hodgson, Microbiology
Dr. Norman LaFaunce, EDAB, Bovine/Food Animal
Dr. Karen Lehe, ICVA Board, Porcine
Dr. Bruce Louderback, ICVA Board, Companion Animal
Dr. Fernando Marques, EDAB, Equine
Dr. Katie Steneroden, EDAB, Public Health
Dr. Rick Tubbs, EDAB, Swine
Dr. Jack Wilson, ICVA Board, Companion Animal

Basic Science Topic Weighting Activity Participants

Dr. Marie-Odile Benoit-Biancamano, Pathology
Dr. Guraa Bergkvist, Anatomy
Dr. John Bolton, Large Animal Medicine
Dr. Jennifer Burr, Pharmacology
Dr. Pete Christopherson, Pathology
Dr. David Cross, Anatomy
Dr. John Dodam, Physiology & Pharmacology
Dr. Kathy Earnest-Koons, Microbiology
Dr. Julie Engiles, Microbiology

Dr. Virginia Fajt, Pharmacology
Dr. Mat Gerard, Anatomy
Dr. Kenitra Hammac, Microbiology
Dr. James Herman, Physiology
Dr. Jennifer Hodgson, Microbiology
Dr. Megan Jacob, Microbiology
Dr. Gagandeep Kaur, Physiology
Dr. Wael Khamas, Anatomy
Dr. Martha Littlefield, Anatomy
Dr. Puliyur Mohan Kumar, Physiology
Dr. Sheba Mohan Kumar, Pharmacology
Dr. Mandy O'Hara, Pathology
Dr. Leticia Reyes, Microbiology
Dr. Wayne Schwark, Pharmacology
Dr. Teresa Southard, Pathology
Dr. Greg Weiland, Pharmacology

APPENDIX G

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