Job Analysis for Cardiology

Conducted on behalf of

American College of Veterinary Internal Medicine (ACVIM)
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July 25, 2023

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ACKNOWLEDGEMENTS

We would like to thank the many individuals who provided invaluable assistance throughout the conduct of the ACVIM's Cardiology Job Analysis Study.

Above all, we thank the many dedicated professionals who generously contributed their time and expertise. Over 150 individuals participated in different phases of the job analysis including Task Force members, survey pilot test participants, survey respondents, and Test Specifications members.

At the ACVIM, Nicole Finn, Senior Director, Certification & Accreditation, provided excellent support throughout the project.

At Prometric, Thomas Fiske, Assessment Design Specialist and Jillian Nelson, Senior Test Developer, provided oversight and guidance throughout the job analysis process.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The American College of Veterinary Internal Medicine's (ACVIM) mission is "Being the trusted leader in veterinary education, discovery and medical excellence."[1] The ACVIM requested a Job Analysis Study from Prometric for the Cardiology Exam.

A job analysis study is designed to obtain descriptive information about the tasks performed on a job and the knowledge needed to adequately perform those tasks. The purpose of the job analysis study was to:

- validate the tasks and knowledge important for VETERINARY CARDIOLOGY; and,
- develop test specifications for the ACVIM CARDIOLOGY Exam.

Conduct of the Job Analysis Study

The job analysis study consisted of several activities: background research, collaboration with subject matter experts to ensure representativeness of the tasks and knowledge statements; survey development; survey dissemination; compilation of survey results; and test specifications development. The successful outcome of the job analysis study depended on the excellent information provided by veterinary cardiology professionals.

Survey Development

Survey research is an effective way to identify the tasks and knowledge that are important for veterinary cardiology. The task and knowledge statements included on the survey covered seven domains of practice. The development of the survey was based on a draft of task and knowledge statements developed from a variety of resources, including the existing content outline provided to Prometric by ACVIM.

Survey Content

The survey, disseminated in July and August of 2022, consisted of five sections. ACVIM distributed the survey to veterinary cardiology professionals.

Survey Sections
Section 1: Background and General Information
Section 2: Tasks
Section 3: Knowledge
Section 4: Recommendations for Test Content
Section 5: Comments

[1] About (acvim.org) retrieved 6/22/2023.

Results

Survey Response

A total of 106 veterinary cardiology professionals submitted completed surveys. Based on the analysis of survey responses, a representative group of veterinary cardiology professionals completed the survey in sufficient numbers to meet the requirements for statistical analysis of the results. This is evidenced by review of the responses for each of the background and general information questions as well as confirmation by the Test Specifications Committee.

Survey Ratings

Participants were asked to rate the task statements by the importance for a veterinary cardiology using a five-point scale (0 = Of no importance to 4 = Very Important). Participants were asked to rate the knowledge statements by the importance for veterinary cardiology using a five-point scale (0 = Of no importance to 4 = Very Important).

Content Coverage

Evidence was provided for the comprehensiveness of the content coverage within the domains. If the task and knowledge statements within a domain are adequately defined, then it should be judged as being well covered. Respondents indicated that the content within each task and knowledge domain was well covered, thus supporting the comprehensiveness of the defined domains.

Test Specifications Development

In the summer of 2022, a Test Specifications Committee convened to review the results of the job analysis and to create the test content outline that will guide the development of the ACVIM Cardiology examinations.

Summary

In summary, this study used a multi-method approach to identify the tasks and knowledge that are important to the competent performance of veterinary cardiology. The job analysis process allowed for input from a representative group of veterinary cardiologists and was conducted within the guidelines of professionally sound practice. The results of the job analysis can be used by the ACVIM to develop the ACVIM Cardiology Exam.

RESULTS AT A GLANCE

WHO COMPLETED THE SURVEY

A total of 106 responses were used for analysis. The majority of respondents worked full time in private practice.

TASK IMPORTANCE RATINGS

A total of 38 of the 44 tasks achieved high importance ratings for the overall group.

KNOWLEDGE IMPORTANCE RATINGS

A total of 50 of the 56 knowledge statements achieved high importance ratings for the overall group.

INTRODUCTION

The ACVIM's mission is "Being the trusted leader in veterinary education, discovery and medical excellence."[2] The ACVIM requested a Job Analysis Study from Prometric for the ACVIM Cardiology Exam.

This report describes the job analysis study including the:

- rationale for conducting the job analysis study;
- methods used to define tasks and knowledge;
- types of data analyses conducted and their results; and
- results and conduct of the test specifications meeting.

Job Analysis Study and Adherence to Professional Standards

A job analysis study refers to procedures designed to obtain descriptive information about the tasks performed on a job and the knowledge, skills, or abilities requisite to the performance of those tasks. The specific type of information collected during a job analysis study is determined by the purpose for which the information will be used.

For purposes of developing ACVIM Cardiology examinations, a job analysis study should identify important tasks, knowledge, skills, or abilities deemed important by veterinary cardiology.

The use of a job analysis study (also known as practice analysis, role and function study, or role delineation) to define the content domain(s) is a critical component in establishing the content validity of the certification. Content validity refers to the extent to which the content covered by an examination is representative of the task and knowledge of a job (tasks, knowledge, skills, or abilities).

A well-designed job analysis study should include the participation of a representative group of subject matter experts who reflect the diversity within the profession. Diversity refers to regional or job context factors and to factors such as experience, gender, and race/ethnicity. Demonstration of content validity is accomplished through the judgments of subject matter experts. The process is enhanced by the inclusion of large numbers of experts who represent the diversity of the relevant areas of expertise.

The Standards for Educational and Psychological Testing[3] (2014) (*The Standards)* is a comprehensive technical guide that provides criteria for the evaluation of tests, testing practices, and the effects of test use. It was developed jointly by the American Psychological Association (APA), the American Educational Research Association (AERA), and the National Council on Measurement in Education (NCME). The guidelines presented in *The Standards*, by professional consensus, have come to define the necessary components of quality testing. As a consequence, a testing program that adheres to *The Standards* is more likely to be judged to be valid and defensible than one that does not.

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2 About (acvim.org) retrieved 6/22/2023.

3 American Educational Research Association, American Psychological Association, National Council on Measurement in Education. (2014). *The Standards for Educational and Psychological Testing*. Washington, DC: American Psychological Association.

As stated in Standard 11.13,

> "The content domain to be covered by a credentialing test should be defined clearly and justified in terms of the importance of the content for credential-worthy performance in an occupation or profession. A rationale and evidence should be provided to support the claim that the knowledge or skills being assessed are required for credential-worthy performance in that occupation and are consistent with the purpose for which the credentialing program was instituted…. Typically, some form of job or practice analysis provides the primary basis for defining the content domain…" (pp 181-182)

The job analysis study for the ACVIM Cardiology Exam was designed to follow the guidelines presented in *The Standards* and to adhere to accepted professional practice.

METHOD

The job analysis study for veterinary cardiology involved a multi-method approach that included meetings with subject-matter experts and a survey. This section of the report describes the activities conducted for the job analysis study.

First, experts identified the tasks and knowledge they believed were important to the practice of veterinary cardiology. Then, a survey was developed and disseminated to veterinary cardiology professionals. The purpose of the survey was to obtain verification (or refutation) that the tasks and knowledge identified by the experts are important to the work of veterinary cardiology.

STEPS OF THE JOB ANALYSIS STUDY

1. Conduct of a planning meeting
2. Development of the survey instrument
3. Dissemination of the survey
4. Analysis of the survey data
5. Development of the test specifications

Survey research functions as a "check and balance" on the judgments of the experts and reduces the likelihood that unimportant areas will be considered in the development of the test specifications. The use of a survey is also an efficient and cost-effective method of obtaining input from large numbers of experts and makes it possible for analysis of ratings by appropriate subgroups of respondents.

The survey results provide information to guide the development of test specifications and content-valid examinations. What matters most is that a certification examination covers the important knowledge needed to perform job activities.

The steps of the job analysis study are described in detail below:

1. Conduct of a Planning Meeting

In April 2022, ACVIM representatives and the Prometric staff responsible for the conduct of the job analysis held a planning meeting via web conference. During the planning meeting, the selection of the Task Force Committee members and Test Specifications Committee members, meeting dates and logistics, and survey delivery were topics of discussion.

2. Development of the Survey

Conduct of the Job Analysis Study Task Force Meeting

The Task Force Committee was comprised of a representative group of veterinary cardiology. In total, ten veterinary cardiology comprised the committee. A list of the Task Force Committee members appears in Appendix A. The Task Force meeting was conducted via web conference in April and May of 2022. The purpose of the meeting was to develop the survey content. Prometric staff facilitated the meeting.

Activities conducted during the meeting included reviewing and, as needed, revising the major domains, task and knowledge that are necessary for the competent performance of veterinary cardiology. The draft list presented to the Task Force was developed using the existing examination blueprint. Survey rating

scales and background and general information questions were presented, discussed, and revised as needed.

Survey Construction

Upon the completion of the Task Force Meeting, Prometric staff constructed the draft survey. The survey covered the following task and knowledge domains:

Tasks:

1. History and Physical Examination
2. Laboratory Tests
3. Diagnostic Procedures
4. Procedures
5. Therapeutic Intervention
6. Management

Knowledge:

1. Normal Cardiovascular Anatomy
2. Normal Cardiovascular Physiology
3. Diagnostic Studies
4. Pharmacologic and Non-pharmacologic Management of Cardiovascular Disease (includes mechanism of action, classification, side effects, indication, drug interactions)
5. Cardiovascular Pathophysiology
6. Cardiovascular Disease
7. Statistics and Research

Survey Review by Task Force Committee

Each Task Force member received a copy of the draft survey. The purpose of the review was to provide the Committee with an opportunity to view their work and recommend any revisions.

Comments provided by the Task Force Committee for the online survey were compiled by Prometric staff and reviewed with the Task Force members via web conference in June of 2022. Refinements, as recommended by the Task Force, were incorporated into the online survey in preparation for a pilot test.

Survey Pilot Test

The purpose of the small-scale pilot test was to have professionals in the field who had no previous involvement in the development of the survey, review and offer suggestions to improve the instrument. Sixteen participants received the survey link, thirteen of whom completed the survey.

Pilot participants reviewed the survey for clarity of wording, ease of use, and comprehensiveness of content coverage. Comments were compiled by Prometric staff and reviewed via web conference with the Task Force members. The Task Force revised and finalized the survey based on the review of the pilot test comments.

Final Version of the Survey

The final version of the online surveys consisted of five sections: Section 1: Background and General Information; Section 2: Tasks; Section 3: Knowledge; Section 4: Recommendations for Test Content; and, Section 5: Write in Comments.

In Section 1: Background and General Information, survey participants responded to general and background information about themselves and their professional activities.

In Section 2: Tasks, survey participants rated the statements using the importance scale shown below.

Tasks
Importance: How important is this task for a veterinary cardiologist?
0 = Of no importance
1 = Of little importance
2 = Of moderate importance
3 = Important
4 = Very important

In Section 3: Knowledge, survey participants rated the statements using the importance scale shown below. Additionally, participants were asked to rate the level of knowledge required at the time of certification.

Importance: How important is the knowledge for a veterinary cardiologist?
0 = Of no importance
1 = Of little importance
2 = Of moderate importance
3 = Important
4 = Very important

Survey participants were asked to provide a rating measuring the representativeness of each knowledge and task domain. Respondents made their judgments using the five-point rating scale shown below.

Content Coverage
How well do the statements in Domain (#) cover important aspects of (the domain)?
1 = Very Poorly
2 = Poorly
3 = Adequately
4 = Well
5 = Very Well

Respondents could note any topics that were not covered within a specific domain in an open response field.

In Section 4: Recommendation for Test Content, survey participants indicated the content weights that the knowledge areas below should receive on the exam:

1. Normal Cardiovascular Anatomy
2. Normal Cardiovascular Physiology
3. Diagnostic Studies

4. Pharmacologic and Non-pharmacologic Management of Cardiovascular Disease (includes mechanism of action, classification, side effects, indication, drug interactions)
5. Cardiovascular Pathology and pathophysiology
6. Cardiovascular Disease
7. Statistics and Research

This was accomplished by distributing 100 percentage points across the 7 knowledge areas. These distributions represented the allocation of examination items survey participants believed should be devoted to each knowledge area.

In Section 5: Write in Comments, survey respondents were given the opportunity to answer open-ended questions: "What additional professional development and/or continuing education could you use to improve your performance in your current work role?" and "How do you expect your work role to change over the next few years? What tasks will be performed and what knowledge will be needed to meet changing job demands?"

3. Dissemination of the Survey

ACVIM distributed the survey to members in Summer/Fall of 2022. Appendix B contains a copy of the online survey.

4. Analysis of the Survey Data

As previously noted, the purpose of the survey was to validate the tasks and knowledge that relatively large numbers of veterinary cardiology judged to be relevant (verified as important) to their work. This objective was accomplished through an analysis of the mean importance ratings for task and knowledge statements. The derivation of test specifications from those statements verified as important by the surveyed veterinary cardiologists provides a substantial evidential basis for the content validity of credentialing examinations. For the purposes of this study, the overall group was included in the analysis.

Based on information obtained from the survey, data analyses by respondent subgroups (e.g., practice setting) are possible when sample size permits. A subgroup category is required to have at least 30 respondents to be included in the mean analyses. This is a necessary condition to ensure that the mean value based upon the sample of respondents is an accurate estimate of the corresponding population mean value.

The following quantitative data analyses were produced:

- Means, standard deviations, and frequency (percentage) distributions for task and content coverage ratings
- Means, standard deviations, and frequency (percentage) distributions for knowledge statements and content coverage ratings
- Means and standard deviations for test content recommendations
- Index of agreement values for designated subgroups

Criterion for Interpretation of Mean Importance Ratings

Since a major purpose of the survey is to ensure that only validated task and knowledge statements are included in the development of test specifications, a criterion (cut point) for inclusion needs to be established.

A criterion used in similar studies is a mean importance rating that represents the midpoint between moderately important and important. For the importance rating scale used across many studies, the value of this criterion is 2.50.

This criterion is consistent with the intent of content validity. Therefore, for this job analysis, Prometric recommended the value of this criterion should be set at 2.50. Accordingly, the task and knowledge statements were grouped into one of three categories: Pass, Borderline, or Fail as determined by their mean importance ratings. The skill criticality ratings used the same criterion.

Definition of Pass, Borderline and Fail Categories for Task and Knowledge Importance Mean Ratings

	Means
Pass:	**At or above 2.50**
Borderline:	**2.40 to 2.49**
Fail:	**Less than 2.40**

- The Pass Category contains those statements whose mean ratings are at or above 2.50 and are eligible for inclusion in the development of test specifications.
- The Borderline Category contains those statements whose mean ratings are between 2.40 and 2.49. The Borderline Category is included to provide a point of discussion for the Task Force to determine if the statement(s) warrant(s) inclusion in the test specifications.
- The Fail Category contains those statements whose mean ratings are less than 2.40. It is recommended that statements in the Fail Category be excluded from consideration in the test specifications.

5. Development of the Test Specifications

A meeting was facilitated by Prometric staff to develop the test specifications based on the job analysis study results. The meeting was conducted in November and December 2022 via multiple web conference. meetings focused on:

- finalizing the task statements for inclusion based on the survey results;
- finalizing the knowledge that are important for inclusion based on the survey results;
- establishing the percentage test content weights for each area on the examination; and,
- creating a linkage between the task and knowledge.

These percentage test weights guide examination development activities.

RESULTS

Survey Responses

A total of 154 participants completed the survey. 106 responses were used for analysis. Because the survey link was distributed to an unknown number of participants, a response rate cannot be calculated.

Based on the analysis of survey responses, a representative group of veterinary cardiologists completed the survey in sufficient numbers to meet the requirements to conduct statistical analysis. This was evidenced by the distribution of responses for each of the background information questions and was confirmed through discussion with the Committee.

Demographic Characteristics of Survey Respondents

The profile of survey respondents is below. All responses to the background and general information section of the survey are provided in Appendix C1. Write in responses to "Other, please specify" options are provided in Appendices C2 through C5. The results in the figures below reflect the sample size used for analysis of 106.

Figure 1. *Demographic Question *1. Which type of practice do you primarily currently work in?*

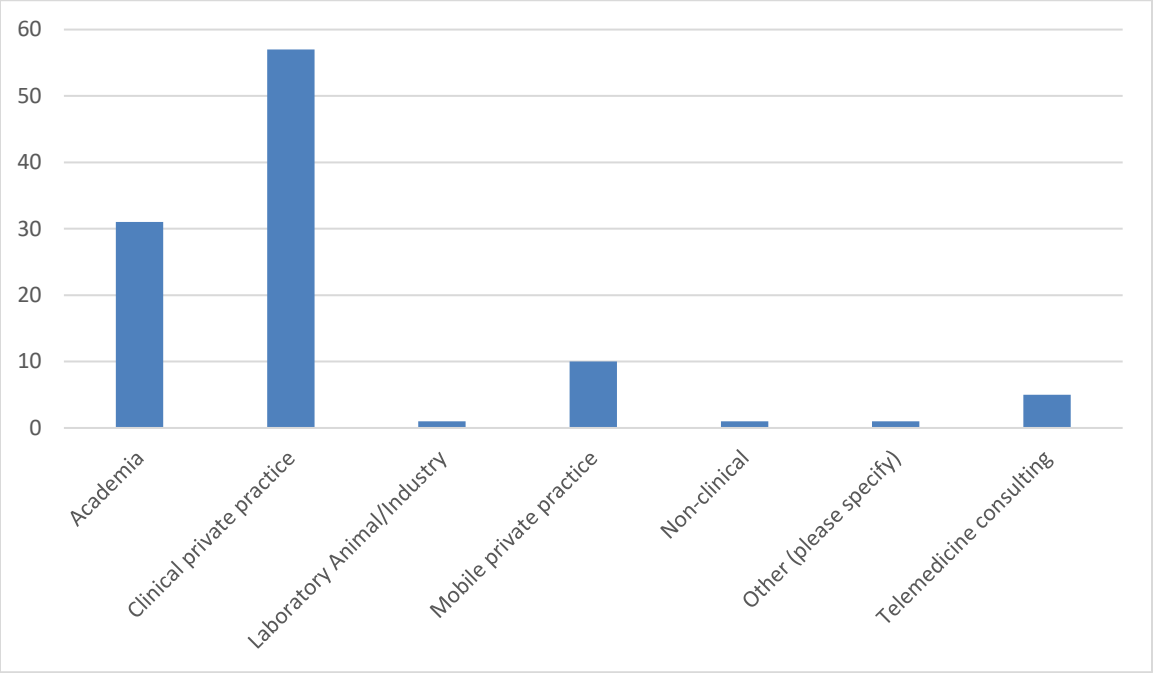


Figure 2. *Demographic Question *1A. What is your clinical appointment?*

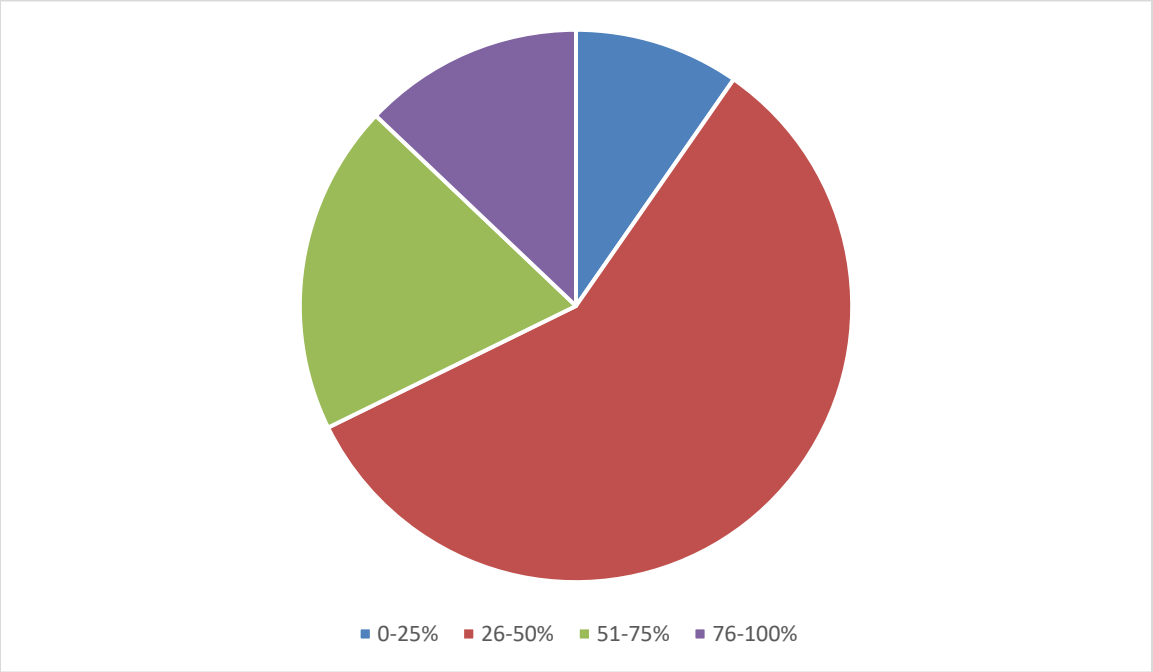


Figure 3. *Demographic Question *1B. Do you currently practice as a full time or part time* cardiologist*?*

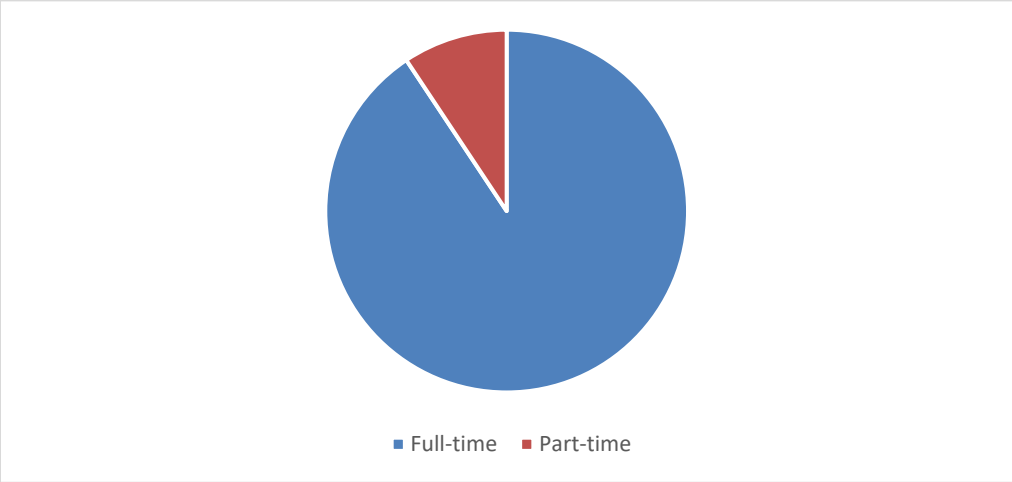


Figure 4. *Demographic Question *2. Which of the following have you worked in as an ACVIM board certified cardiologist?*

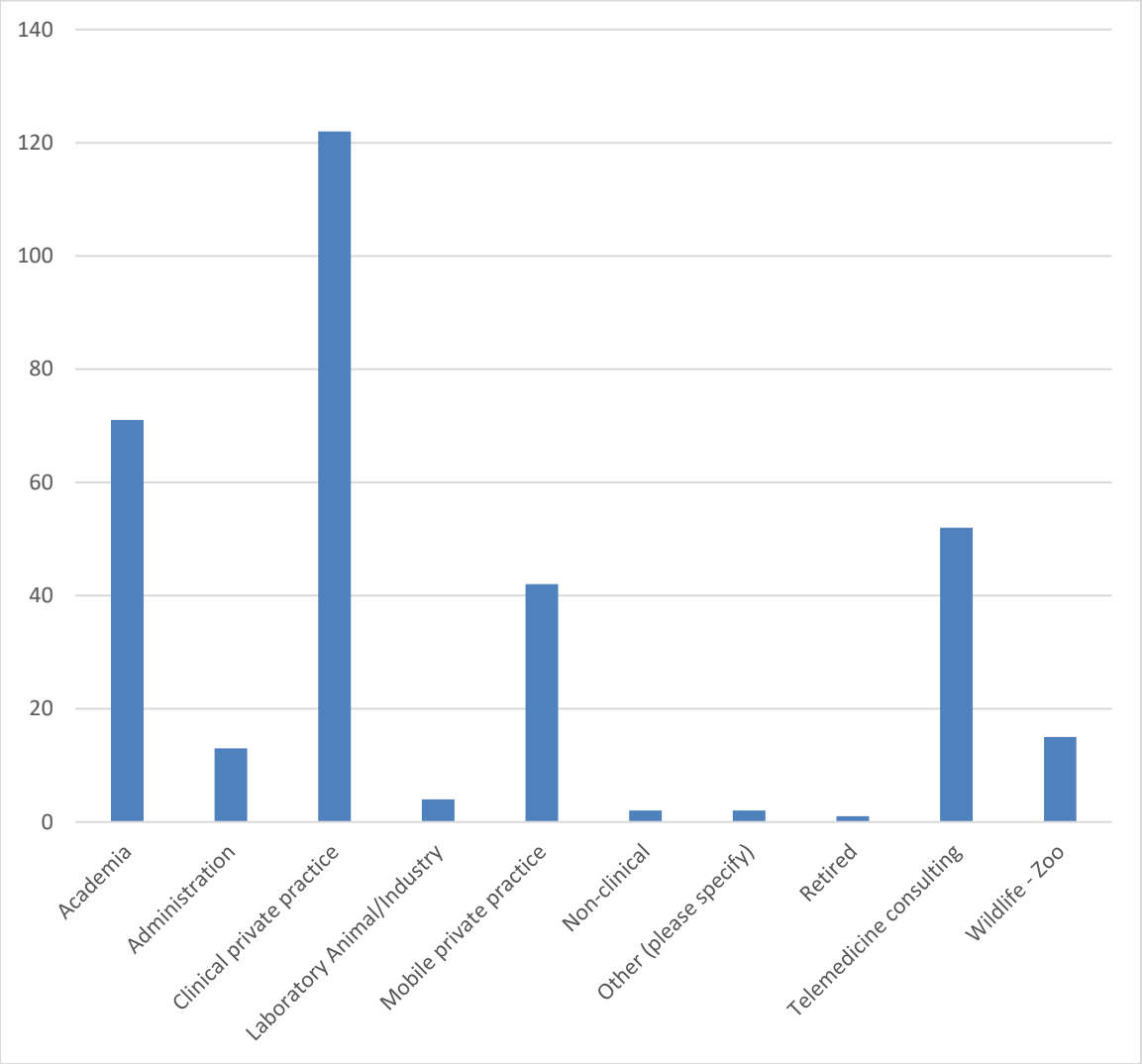


Figure 5. *Demographic Question *3. How long have you been an ACVIM board certified cardiologist?*

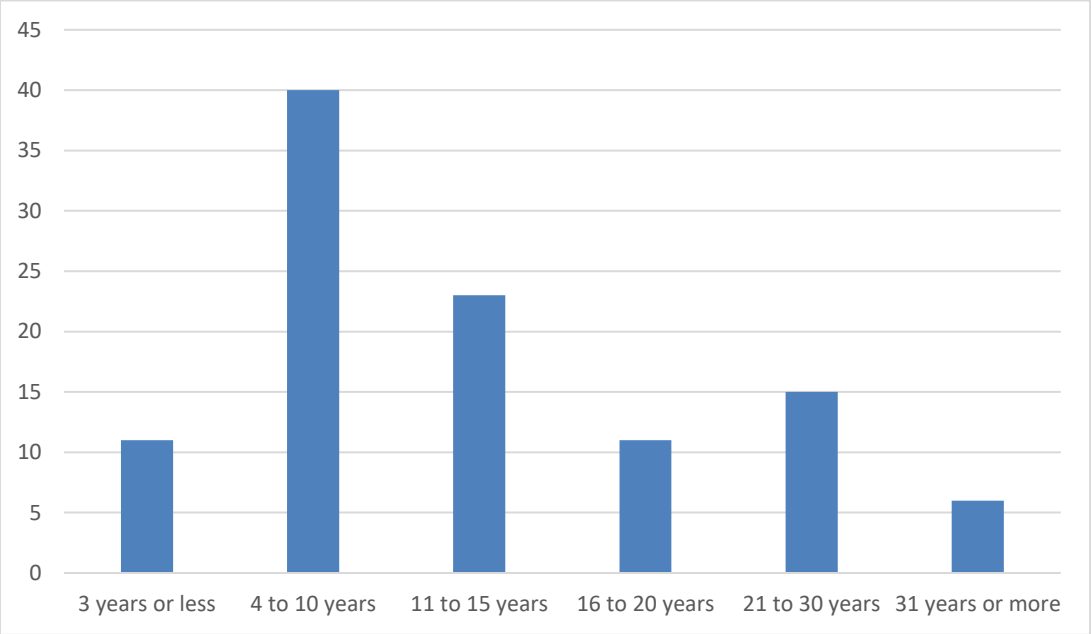


Figure 6. *Demographic Question *4. Including yourself, how many ACVIM board certified cardiologist(s) do you work with daily (on-site or virtual)?*

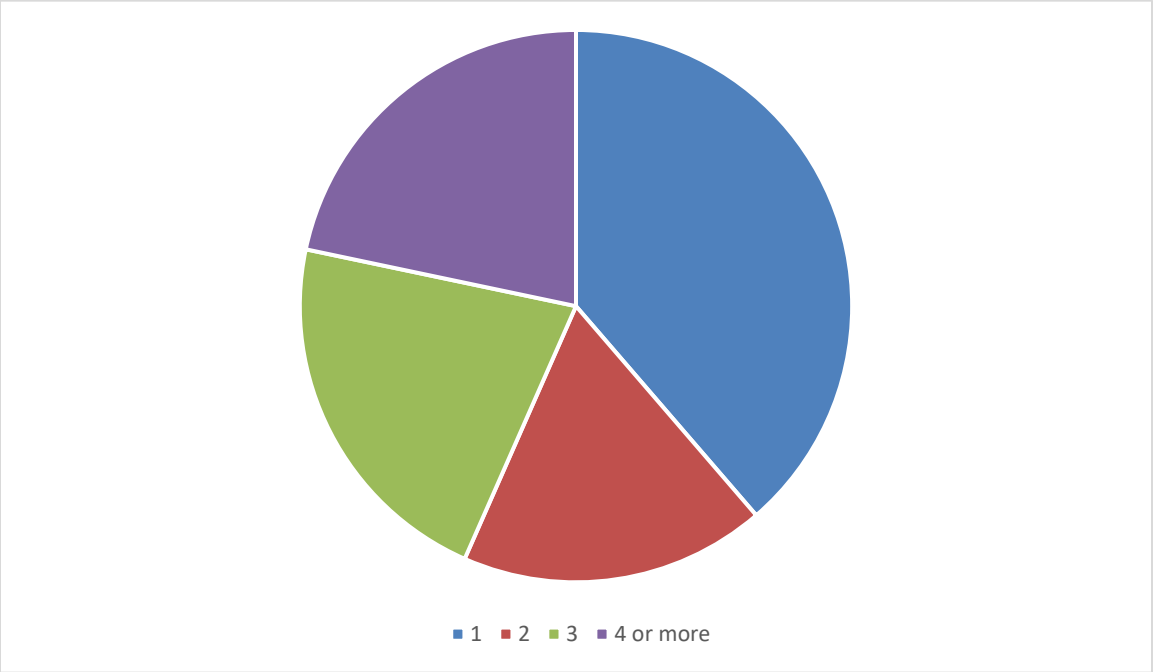


Figure 7. *Demographic Question *5. Was your residency program primarily academia or private practice?*

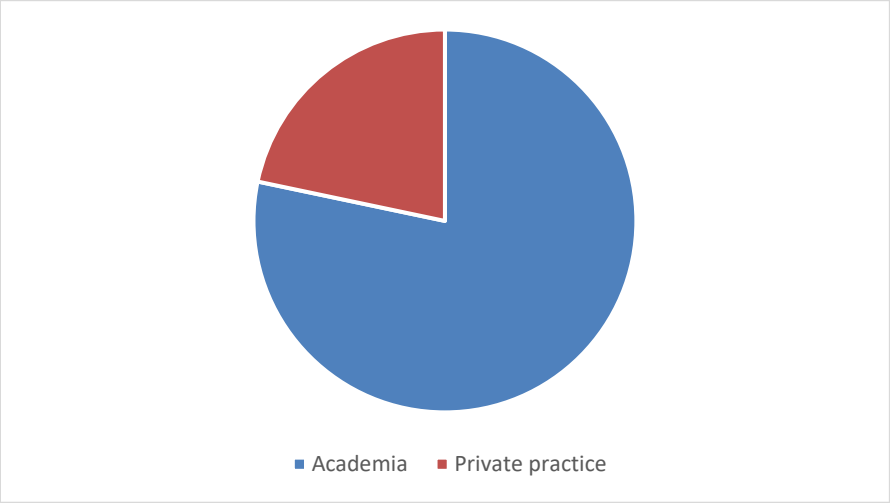


Figure 8. *Demographic Question *6. Does your institution/employer currently have an ACVIM-approved residency training program in Cardiology?*

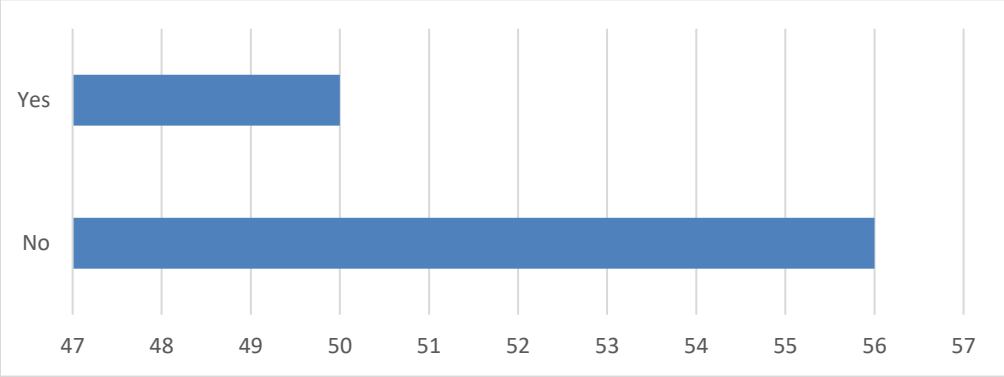


Figure 9. *Demographic Question *6A. Have you (within the last 10 years) trained a resident in Cardiology (e.g., listed on their training program)?*

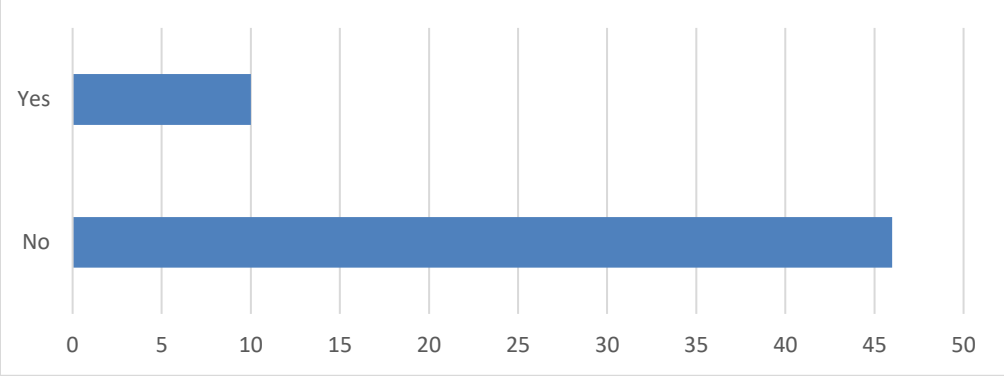


Figure 10. *Demographic Question * 7. Have you served on the ACVIM Cardiology Exam Committee (e.g., the committee involved in writing test questions and creating the exam)?*

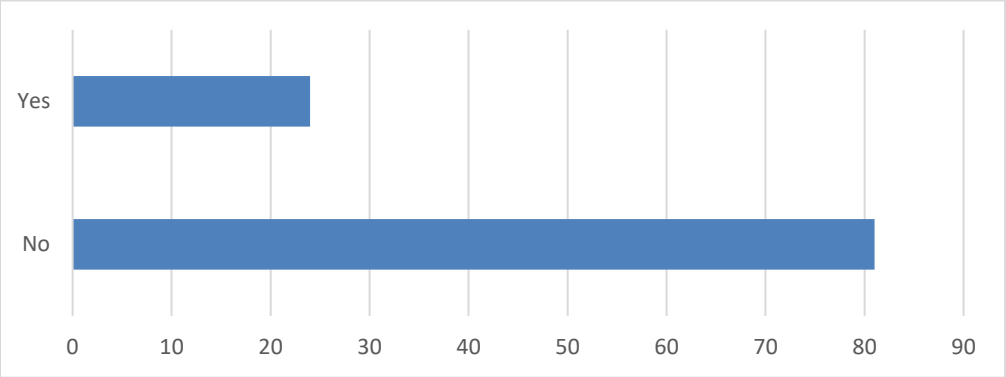


Figure 11. *Demographic Question *8. Have you served on the ACVIM Cardiology Exam Review Committee? (e.g., the committee that reviews the exam once the questions have been created)?*

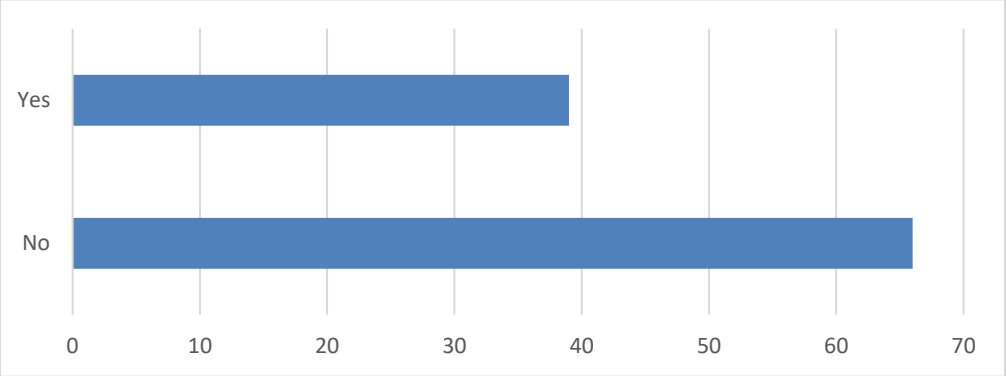


Figure 12. *Demographic Question *9. Have you served on the ACVIM Cardiology Residency Training Committee?*

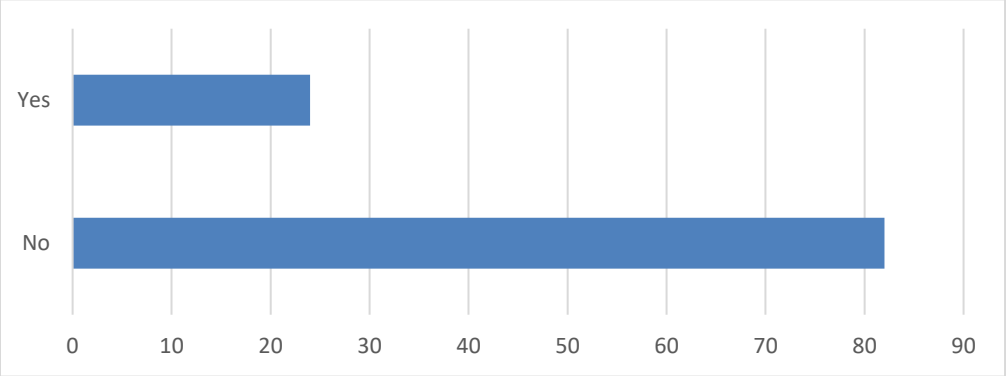


Figure 13. *Demographic Question *10. Have you served on the ACVIM Cardiology Credentials Committee?*

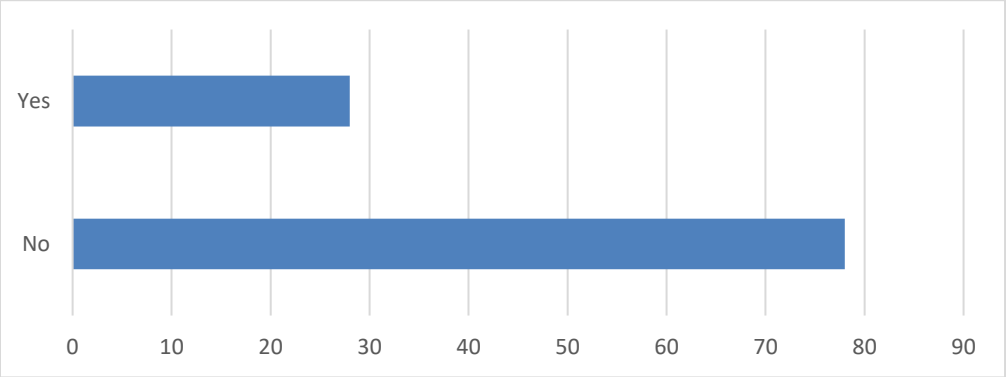


Figure 14. *Demographic Question *11. Which species do you currently work with?*

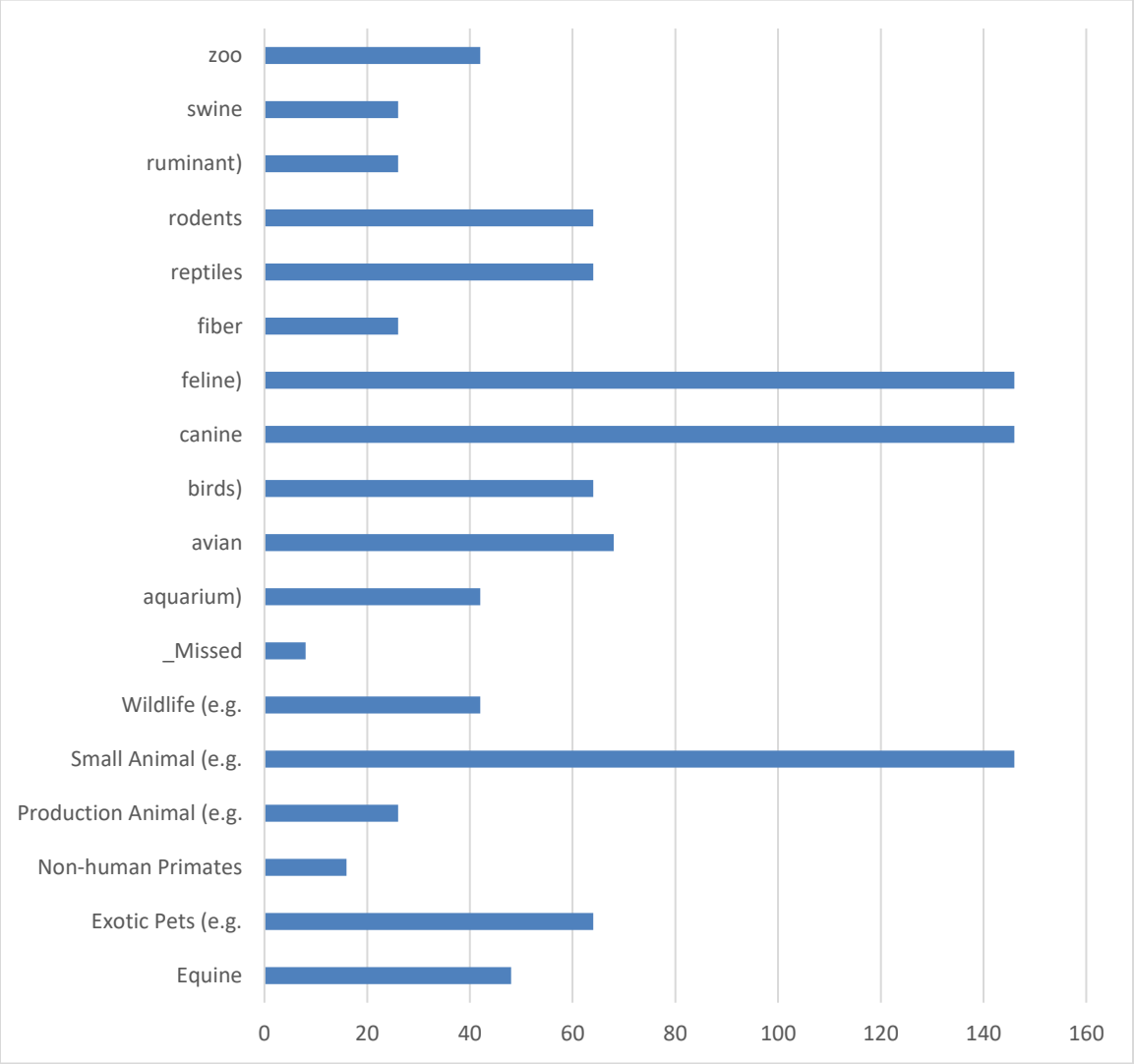


Figure 15. *Demographic Question *12. Currently, what percentage of your time did you spend with the following species? - Small Animal (e.g., canine, feline)*

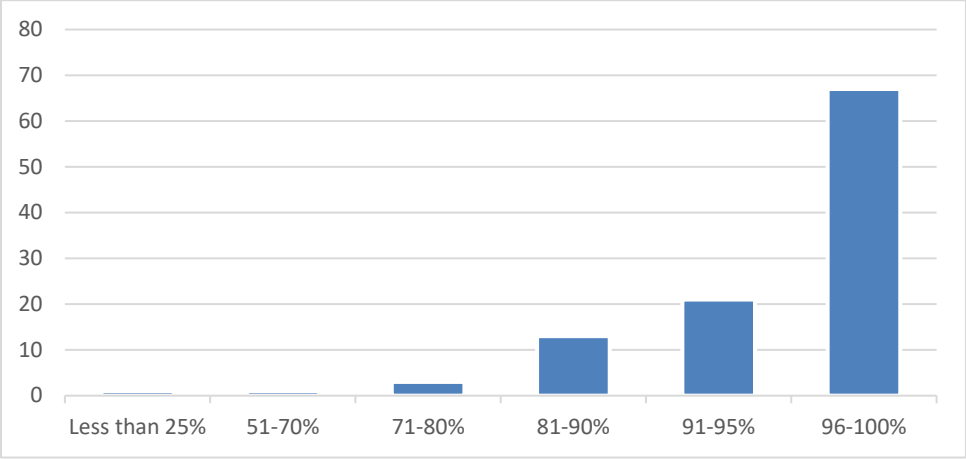


Figure 16. *Demographic Question *12A. Currently, what percentage of your time did you spend with the following species? Non-human Primates*

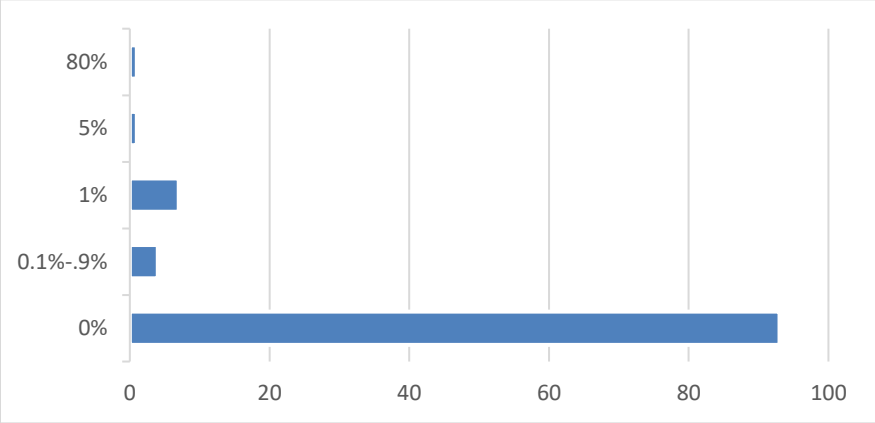


*Figure 17. Demographic Question * 12B. Currently, what percentage of your time did you spend with the following species? Equine*

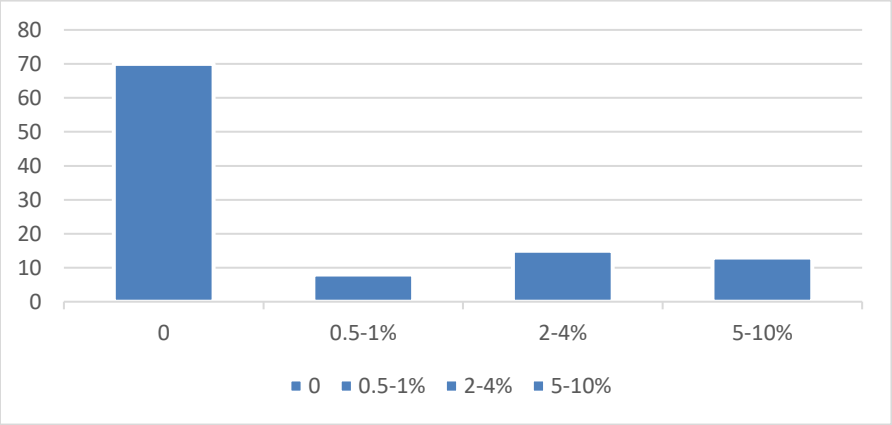


*Figure 18. Demographic Question * 12C. Currently, what percentage of your time did you spend with the following species? -Production Animal (e.g., swine, avian, fiber, ruminant)*

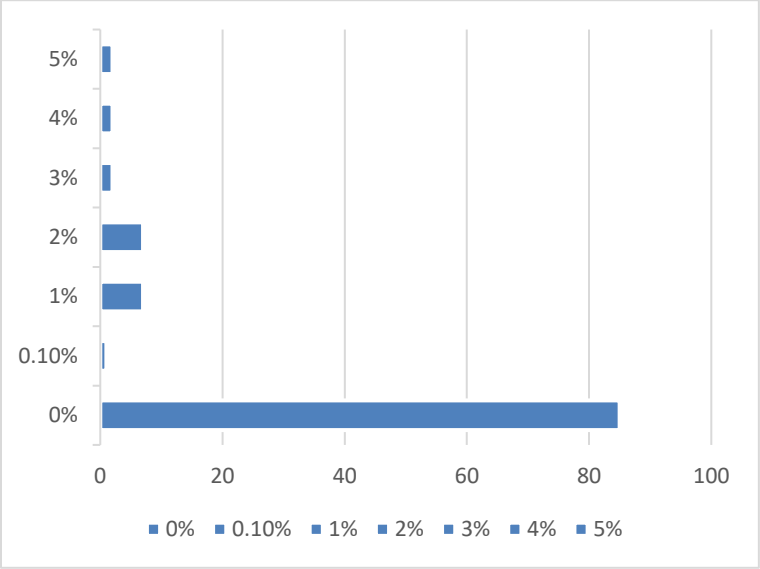


*Figure 19. Demographic Question *12D. Currently, what percentage of your time did you spend with the following species? - Exotic Pets ((e.g., rodents, reptiles, birds)*

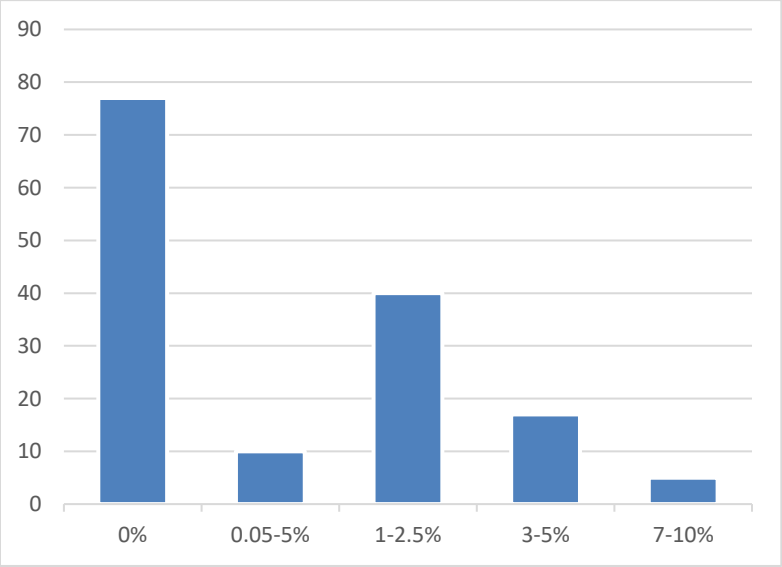


*Figure 20. Demographic Question *12E. Currently, what percentage of your time did you spend with the following species? Wildlife (e.g., avian, zoo, aquarium)*

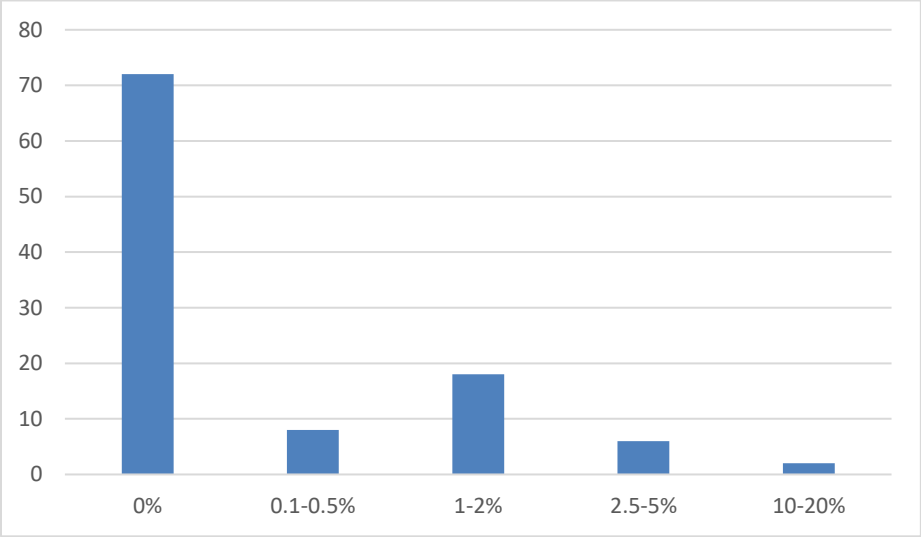


*Figure 21. Demographic Question *13. How many clinical cardiology cases do you personally see or supervise per year, on average? (including consultations)*

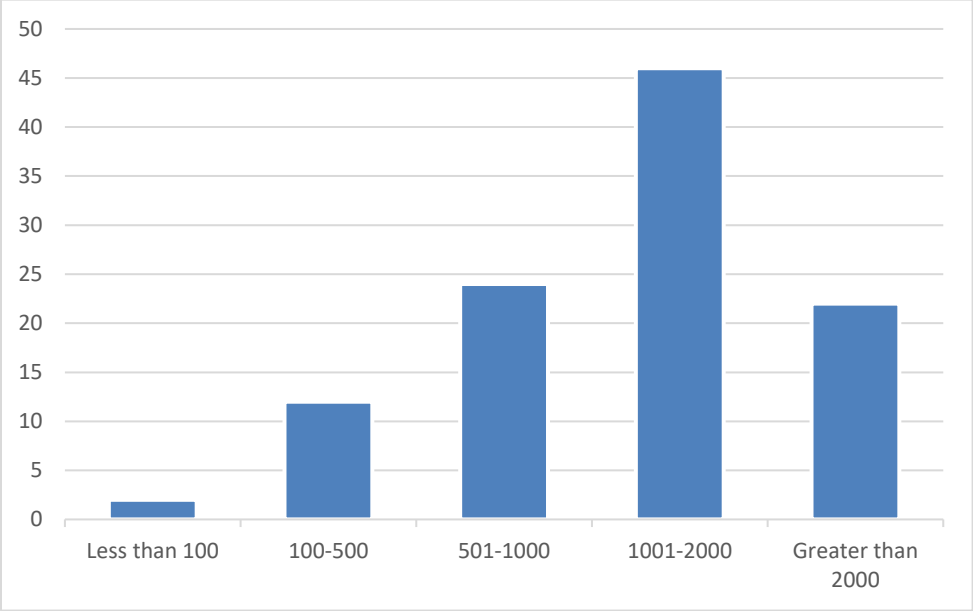
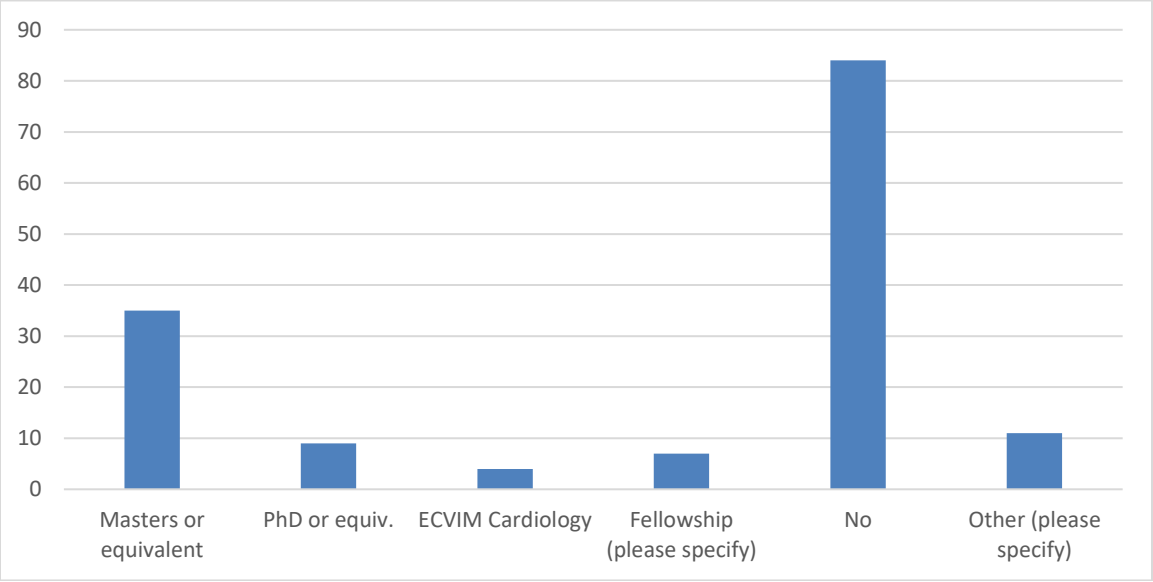


*Figure 22. Demographic Question *14. Do you have any other certifications/certificates/degrees in addition to ACVIM cardiology board certification?*



Task and Knowledge Overall Ratings

The following provides a summary of survey respondents' ratings of the task and knowledge. The survey respondents passed 88 (88 %) of the 100 task and knowledge statements.

Tasks

Means and standard deviations for the tasks included on the survey are in Appendix D. A total of 38 (86.36%) of the 44 tasks achieved high importance means. Table 1 shows the delineation of tasks in Pass, Borderline, and Fail categories by domain.

Table 1. *Tasks by Pass, Borderline, and Fail categories*

Task Domains	No. of Task Statements	Pass (Mean 2.50 or Above)	Borderline (Mean 2.40 to 2.49)	Fail (Mean Less than 2.40)
1. History and Physical Examination	2	2	0	0
2. Laboratory Tests	7	6	1	0
3. Diagnostic Procedures	8	7	0	1
4. Procedures	10	9	0	1
5. Therapeutic Intervention	9	6	0	3
6. Management	8	8	0	0
Total	44	38	1	5
Percentage		86.36%	2.27%	11.36%

The 1 task statement rated borderline is:

Domain II: Laboratory Tests

- Task 4. Pathology (e.g., gross pathology, histopathology, ultrastructure, cytology)

The 5 task statements rated failing are:

Domain III: Diagnostic Procedures

- Task 8. Advanced cardiac imaging (e.g., computed tomography, magnetic resonance imaging)

Domain IV: Procedures

- Task 8. Ancillary interventional procedures (e.g., placement of loop recorders, heartworm retrieval)

Domain V: Therapeutic Intervention

- Task 4. Hybrid surgical repair and palliation (e.g., gene therapy, ASD or VSD occlusion, mitral valve repair)
- Task 5. Open surgical on or off bypass (e.g., pulmonary artery banding, patch graft for ASD or VSD repair, mitral valve repair)
- Task 7. EP mapping and ablation

Knowledge

Analysis of the knowledge statements included on the survey are in Appendix E. A total of 50 (89.29%) of the 56 knowledge statements achieved high importance means. Table 3 shows the knowledge statements placed in Pass, Borderline, and Fail categories.

Table 2. *Knowledge Importance by Pass, Borderline, and Fail categories*

Knowledge Domains	No. of Knowledge	Pass (Mean 2.50 or Above)	Borderline (Mean 2.40 to 2.49)	Fail (Mean Less than 2.40)
1. Normal Cardiovascular Anatomy	4	2	1	1
2. Normal Cardiovascular Physiology	9	9	0	0
3. Diagnostic Studies	11	8	0	3
4. Pharmacologic and Non-pharmacologic Management of Cardiovascular Disease (includes mechanism of action, classification, side effects, indication, drug interactions)	9	9	0	0
5. Cardiovascular Pathophysiology	13	12	0	1
6. Cardiovascular Disease	8	8	0	0
7. Statistics and Research	2	2	0	0
Total	**56**	**50**	**1**	**5**
Percentage		**89.29%**	**1.79%**	**8.93%**

The knowledge statement rated borderline is:

Domain I: Normal Cardiovascular Anatomy

- Knowledge 2. Histology

The 5 task statements rated failing are:

Domain I: Normal Cardiovascular Anatomy

- Knowledge 3. Ultrastructure

Domain III: Diagnostic Studies

- Knowledge 5. Intracardiac (e.g., His-bundle recordings)
- Knowledge 6. Heart rate variability and signal average
- Knowledge 9. Advanced imaging (e.g., CT, MRI)

Domain V: Cardiovascular Pathophysiology

- Knowledge 9. Ultrastructure

Subgroup Analysis of Task and Knowledge Ratings

The index of agreement (IOA) is a measure of the extent to which subgroups of respondents agree on which tasks and knowledge are important. Using the mean importance ratings for tasks and knowledge, indices of agreement were computed:

- If the subgroup means are above the critical importance value (mean ratings at or above 2.50), then they agree that the content is important.
- If the subgroup means are below the critical importance value (mean ratings less than 2.50), then the subgroups agree that the content is considered less important.
- By contrast, if one subgroup's (for example, female) mean ratings are above the critical importance value and another subgroup's (for example, male) means are below the critical importance value then the subgroups are in disagreement as to whether the content is important.

The index of agreement provides a method of computing the similarity in judgments between groups and is tailored to the purpose of a job analysis study more than the correlation coefficient. Although the correlation coefficient measures the tendency toward agreement along the full range of possible ratings, the agreement index focuses on whether two groups agree that the content should (or should not) be included in an examination.

As one of the major purposes of this job analysis study is to identify appropriate test content, the agreement index provides a statistical method to address this question at the subgroup level. Furthermore, the agreement index requires only 30 respondents per subgroup for computation, whereas the correlation coefficient requires at least 100 respondents per subgroup to provide a reliable measure of agreement.

An illustrative example for two groups on a survey with 100 knowledge areas shows how to compute the index. If two groups passed the same 96 knowledge areas and failed the same 2 knowledge areas (out of the 100 total knowledge areas in the survey), the consistency index would be computed as *Agreement* = (96 + 2)/100 = 0.98. Values of 0.80 or less show less than optimal agreement and therefore additional mean analyses are required.

The index of agreement coefficients for task and knowledge are in Appendix F. Agreement coefficients were produced on the following background questions:

- Which type of practice do you primarily currently work in?
- How long have you been an ACVIM board certified cardiologist?
- Does your institution/employer currently have an ACVIM-approved residency training program in Cardiology?

The agreement coefficients ranged from .95 to 1.00 for tasks and .93 to 1.00 for the knowledge statements. All of the subgroups statements achieved strong agreement (coefficients of 0.80 or higher) and additional mean analysis was not necessary.

Content Coverage Ratings

The survey participants indicated how well the statements within each of the task and knowledge domains covered important aspects of that area. These responses provide an indication of the comprehensiveness of the survey content.

The five-point rating scale included 1= Poorly, 2=Adequately, 3=Well, and 4=Very Well. The means and standard deviations for the task and knowledge ratings are provided in Tables 5 and 6. For the task domains, the means ranged from 3.14 to 3.36 and for the knowledge statements ranged from 3.18 to 3.44. These means provide evidence that the task and knowledge were well to very well covered on the survey.

Table 3. *Mean, Standard Deviation, and Frequency Distribution Percentage of Task Content Coverage*

Task: Domain/Subdomain	Content Coverage					
			Frequency Percentage			
	Mean	SD	1= Poorly	2=Adequately	3=Well	4=Very well
1. History and Physical Examination	3.36	0.74	0.97%	12.62%	35.92%	50.49%
2. Laboratory Tests	3.21	0.75	0.00%	19.23%	40.38%	40.38%
3. Diagnostic Procedures	3.23	0.79	0.96%	19.23%	35.58%	44.23%
4. Procedures	3.29	0.72	0.96%	12.50%	43.27%	43.27%
5. Therapeutic Intervention	3.14	0.79	0.00%	25.24%	35.92%	38.83%
6. Management	3.29	0.72	0.00%	15.15%	40.40%	44.44%

Table 4. *Mean, Standard Deviation, and Frequency Distribution Percentage of Knowledge Content Coverage*

Knowledge/Skills Domain	Content Coverage					
			Frequency Percentage			
	Mean	SD	1= Poorly	2=Adequately	3=Well	4=Very well
1. Normal Cardiovascular Anatomy	3.31	0.69	0.00%	13.00%	43.00%	44.00%
2. Normal Cardiovascular Physiology	3.32	0.73	0.00%	15.69%	36.27%	48.04%
3. Diagnostic Studies	3.18	0.84	3.06%	18.37%	35.71%	42.86%
4. Pharmacologic and Non-pharmacologic Management of Cardiovascular Disease (includes mechanism of action, classification, side effects, indication, drug interactions)	3.44	0.73	0.00%	14.00%	28.00%	58.00%
5. Cardiovascular Pathophysiology	3.33	0.75	1.04%	13.54%	36.46%	48.96%
6. Cardiovascular Disease	3.44	0.69	0.00%	11.00%	34.00%	55.00%
7. Statistics and Research	3.14	0.79	1.04%	21.88%	39.58%	37.50%

Survey respondents could write in tasks or knowledge that they believe should be included in the listing of important task and knowledge. See Appendices G1 and G2 for the content coverage write-in

comments. The Test Specifications Committee reviewed the comments to determine whether there were important statements not covered on the survey that should be included in the test specifications.

Test Content Recommendations

In survey Section 4: Recommendations for Test Content, participants were asked to assign a percentage weight to each knowledge domain. The sum of percentage weights was required to equal 100. This information guided the Test Specifications Committee in making decisions about how much emphasis the domains should receive on the test content outline. The mean weights across all survey respondents are in Table 5.

Table 5. *Survey Respondents' Test Content Recommendations by Mean Percentages and Standard Deviations*

Domain	Mean (%)	SD (%)
1. Normal Cardiovascular Anatomy	9.62	4.05
2. Normal Cardiovascular Physiology	11.24	4.39
3. Diagnostic Studies	19.35	6.81
4. Pharmacologic and Non-pharmacologic Management of Cardiovascular Disease (includes mechanism of action, classification, side effects, indication, drug interactions)	14.70	4.74
5. Cardiovascular Pathology and pathophysiology	16.36	5.05
6. Cardiovascular Disease	24.30	8.42

Write-In Comments

Many survey respondents provided responses to the open-ended questions in Section 5: Comments about expected changes in their veterinary cardiology over the next few years and professional development/continuing education needs. See Appendix H for write-in comments.

DEVELOPMENT OF TEST SPECIFICATIONS FOR THE ACVIM CARDIOLOGY EXAMINATION

The test specification meeting for the ACVIM Cardiology Exam occurred December 2022, via web conference. The steps involved in the development of test specifications included the following:

- presentation of the job analysis project and results to the Test Specifications Committee;
- identification of the task and knowledge statements to be included on the ACVIM Cardiology test specifications;
- development of the test content weights for the exam; and,
- linkage of task and knowledge statements.

Presentation of the Job Analysis Project and Results to the Test Specifications Committee

The first activity involved in the test specification development was to provide the Test Specifications Committee an overview of the job analysis activities that were conducted and to present the results of the study.

Identification of the Task, Knowledge, and Skill Statements to be Included on the ACVIM Cardiology Exam

The Test Specifications Committee reviewed the task and knowledge results to make final recommendations about the areas that should be included on the exam.

The survey results served as the primary source of information used by the Test Specification Committee members to make test content decisions. Recommendations were based on the following criteria:

- the mean task and knowledge ratings for all respondents;
- the frequency distribution of ratings for all respondents; and,
- the appropriateness of the content for the examination.

Appendix I outlines the task and knowledge approval decisions.

Tasks Recommended for Inclusion

- A total of 38 of the 44 tasks achieved mean ratings at or above 2.50 (Pass category).
- 1 task statement achieved mean ratings between 2.40 and 2.49 (Borderline category). 1 was included on the test specifications based on committee recommendations.
- 5 task statements achieved mean ratings less than 2.40 (Fail category).
- 1 new task was added to Domain V based on respondent comments.

Knowledge Recommended for Inclusion

- A total of 50 of the 56 knowledge statements achieved mean ratings at or above 2.50 (Pass category) and were included on the test specifications.
- 1 knowledge statement achieved a mean rating between 2.40 and 2.49 (Borderline category). This statement was not included on the test specifications.
- 5 task statements achieved mean ratings less than 2.40 (Fail category). 5 were included on the test specifications based on committee recommendations.

Development of Test Content Weights

The Test Specifications Committee participated in an exercise that required each member to assign a percentage weight to each of the knowledge domains. Weights were then entered into a spreadsheet and shown to the committee. The committee members were able to compare the test content weights derived from the survey responses to their own estimates. This resulted in a productive discussion among the committee members regarding the optimal percentages for the exam.

Table 9 shows the test specifications recommendations including the percentage content. The complete test specifications are in Appendix J.

Table 6. *ACVIM Cardiology Test Content Weights Recommended by the Test Specifications Committee*

Knowledge Domains	No. of Statements	% Weight
1. Normal Cardiovascular Anatomy	3	5%
2. Normal Cardiovascular Physiology	9	5%
3. Diagnostic Studies	11	25%
4. Pharmacologic and Non-pharmacologic Management of Cardiovascular Disease (includes mechanism of action, classification, side effects, indication, drug interactions)	9	12%
5. Cardiovascular Pathology and pathophysiology	13	20%
6. Cardiovascular Disease	8	29%
7. Statistics and Research	2	4%

Linkage of Task and Knowledge Statements

Task and knowledge linking verifies that each knowledge area included on an examination relates to the competent performance of important tasks. As such, linking supports the content validity of the task included in the test specifications. Linking does not require the production of an exhaustive listing; rather, task-knowledge links are developed to ensure that each knowledge is identified as being related to the performance of at least one, or in most cases several, important tasks.

Linking also provides guidance for item-writing activities. When item writers develop questions for specific knowledge areas, they have a listing of tasks that relate to the knowledge. This provides context for developing examination questions and assists the item writers in question design. The linkage of tasks to knowledge is in Appendix K.

SUMMARY AND CONCLUSIONS

The job analysis study for veterinary cardiology identified task and knowledge statements that are important to the work performed by veterinary cardiology. Further, the data collected will guide the development of the test specifications that will be used to develop the examination.

The task and knowledge statements were developed through an iterative process involving the combined efforts of ACVIM, subject matter experts, and Prometric staff. These statements were entered into a survey format and subjected to verification/refutation through the dissemination of a survey to veterinary cardiology professionals. The survey participants were asked to rate the importance of task and knowledge statements.

The results of the study support the following:

- All of the task and knowledge statements that were verified as important through the survey provide the foundation of empirically derived information from which to develop test specifications for the ACVIM Cardiology Examination.

- Evidence was provided in this study that the comprehensiveness of the content within the task and knowledge domains was well to very well covered.

- The process utilized and all of the information that resulted from the analysis supported the development of the test specifications.

In summary, the study used a multi-method approach to identify the tasks and knowledge that are important to the work performed by veterinary cardiology. The results of the study were used to develop the test specifications for the ACVIM Cardiology Examination.