

STATISTICAL ANALYSIS OF THE CERTIFYING EXAMINATION OF THE AMERICAN COLLEGE OF THERIOGENOLOGISTS

Margaret V. Root Kustritz, DVM, PhD, DACT
John P. Kastelic, DVM, PhD, DACT

INTRODUCTION

The American College of Theriogenologists (ACT) is the specialty college encompassing the disciplines of andrology, gynecology, obstetrics, reproductive endocrinology, and neonatology in all non-human animal species. The Certifying Examination requires demonstration of basic science and clinical knowledge in these disciplines and species. Candidates may be credentialed through a residency route or via an alternate (practitioner) route, wherein they complete a course of study with a mentor while in clinical practice. Complete information regarding credentialing to take the certifying examination in the ACT is available on the College's website (www.theriogenology.org). The certifying examination is offered annually and may be taken multiple times.

The portion of the certifying exam taken by all candidates includes 50 multiple choice and 10 essay questions, as well as a practical examination, consisting of projected images and accompanying questions. In addition, there are 50 multiple choice and 10 essay questions, in the species emphasis of the candidate's choice, including multi-species (general), bovine, equine, small animal (dog and cat), and swine. Each candidate must choose only one species of emphasis in a specific year, with identical questions given to all candidates for each species emphasis. However, a candidate may change their species emphasis if they take the certifying examination more than once.

Questions arise every year regarding the historical passing rate and whether it varies among species emphasis chosen or route of preparation (residency versus alternate). To provide a reliable answer, data from 2000 to 2008 were subjected to statistical analysis.

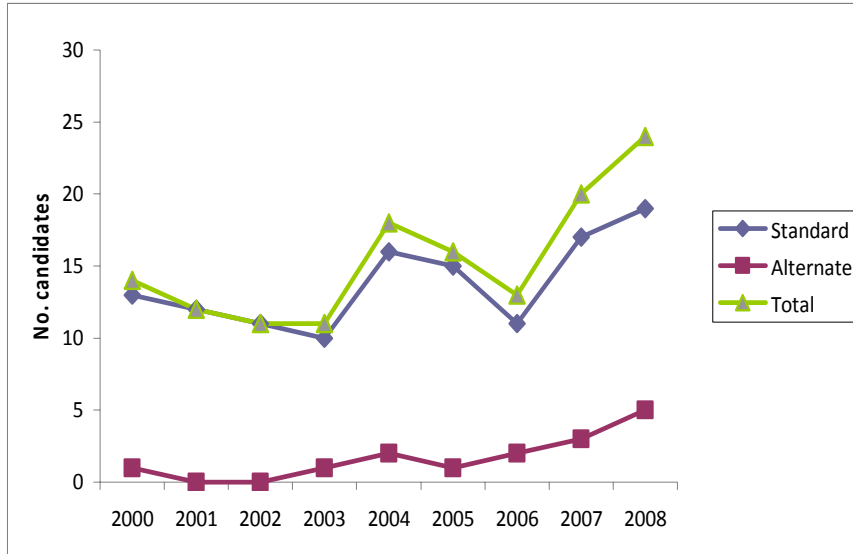
MATERIALS AND METHODS

Data were collected from records of the ACT. Descriptive statistics were used where appropriate. Correlations were performed using Pearson's correlation coefficient. Groups were compared using analysis of variance (ANOVA), Chi square test, or Students' t-test.

RESULTS

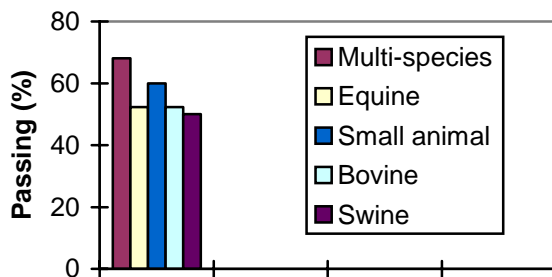
The number of people credentialed to take the examination has generally increased over time, for both the standard and alternate route (Figure 1).

Figure 1: Number of candidates credentialed to take the certifying examination of the ACT by year



Overall, the pass rate averaged 56.8%, with a range of 29.2 to 68.8% (2004 and 2003, respectively). There was no difference in pass rate between candidates who prepared by the residency route and those who prepared by the alternate route (89 of 166 versus 12 of 21; $P > 0.10$). The pass rate did not differ among species emphasis ($P = 0.09$; Figure 2). Note that swine were excluded from this analysis, as it was only rarely chosen.

Figure 2: Percentage passing by species emphasis



For each portion of the examination, successful candidates performed better than unsuccessful candidates ($P < 0.001$). Furthermore, unsuccessful candidates did better on the species essay questions than on the general essay questions ($P < 0.001$).

It was noteworthy that 71 of 88 (80.7%) of candidates passed on their first attempt (mean number of attempts per successful candidate, 1.24). For those writing a second or third time, the success rate was 12 of 13 (92.3%) and 3 of 4 (75.0%), respectively. Despite speculation that the pass rate is affected by the number of candidates who had previously taken the examination, there was no correlation between annual overall pass rate and the number of times the candidates had taken the examination ($r = 0.41$).

DISCUSSION

There is no way to “play the system” to pass the certifying examination of the ACT. Candidates are strongly encouraged to undertake broad-based preparation. Adequacy of preparation is dependent on the dedication of candidates to their preparation, the mentors available to them, and to the candidate’s desire and ability to seek out education experiences outside their species of interest. The ACT provides a study guide, reading list, and links to sites for study; these are available on the ACT website. In recent years, a list-serve has been created for individuals interested in taking the certifying examination. Past members of the examining committee post questions and grade the responses as would be done during the actual examination. This permits candidates to practice studying and answering questions at the level of detail required by the ACT and to learn from each other as they share information.

The certifying examination is carefully balanced to ensure consistency between species emphasis examination sections; a description of examination procedures is regularly evaluated and approved by the American Board of Veterinary Specialties.

The comparative nature of theriogenology is one of its strengths. While it may not be immediately apparent to a candidate strongly interested in one species to see where knowledge of other species will assist them in the future, there is no question but that ability to extrapolate information from all species, assisted by clear and detailed understanding of those species’ physiology and pathology, makes one a better practitioner and teacher. The Diplomates of the ACT strongly believe that ability to demonstrate knowledge of basic and applied reproduction in multiple domestic species, as measured by the certifying examination, provides individuals that can best serve the discipline of veterinary medicine and society.

ACKNOWLEDGEMENTS

The authors thank Dr. Charles Franz and the staff of Franz Management, Dr. Craig Smith, and Dr. Phil Prater, for providing raw data for analysis.

THE CERTIFYING EXAMINATION OF THE AMERICAN COLLEGE OF THERIOGENOLOGISTS: UPDATE ON EXAMINATION PROCEDURES AND A STATISTICAL ANALYSIS

Margaret V. Root Kustritz, DVM, PhD, DACT
Vice-president, American College of Theriogenologists

The Certifying Examination of the American College of Theriogenologists (ACT) is offered annually, just prior to the scientific meeting sponsored by the Society for Theriogenology in late summer or early fall. The Certifying Examination has undergone changes over the last six years. Rumors abound among those in residency training regarding which species emphasis to choose to enhance their chance of passing the examination on the first attempt. The members of the Executive Board and Examining Committee collected data from the last six to ten years and evaluated it to either refute or substantiate these rumors and to guide the Board and Examining Committee with any future changes.

APPROVAL TO TAKE THE EXAMINATION

Candidates may acquire the background needed for approval to take the examination either through a residency or through study with a mentor while in practice. All candidates are expected to have completed an internship or an equivalent year of clinical work before embarking on specialty training.

Residencies can be either two or three years in length and need not encompass study for an advanced degree. Residency training need not include a clinical component but it is generally thought that those individuals that do some clinical work during their residency perform better on the examination. The earliest an individual coming through the residency route can apply for approval to take the examination is three years after graduation from veterinary school. Residency training or advanced degree work that is to be used for credentialing must take place after graduation from veterinary school.

Training and study through the practitioner route require that the practitioner do predominantly reproductive work in clinics and complete a two-year course of study with a mentor that is a Diplomate of the ACT. Interested applicants are required to submit a plan of study, their curriculum vitae and signed letter from their proposed mentor to be approved to study as an eventual applicant for approval to take the examination. The earliest a practitioner can apply to take the examination is six years after graduation from veterinary school; the two years of study with a mentor can be included in these six years.

Currently, those applying for approval to take the examination must submit the appropriate materials by November 1 of the year prior to the calendar year when they intend to take the examination. Details of the application process are available on the ACT website (www.theriogenology.org) by clicking on “Becoming a Diplomate.”

TAKING THE EXAMINATION

The Certifying Examination consists of six parts. There are two general multiple choice and essay sections, containing 25 multiple choice and 5 essay questions each. This section of the examination is identical for all students in a given year. Questions may be clinical or refer to basic science and may ask about any species. There is one section of 25 general multiple choice questions and 25 multiple choice questions from a candidate's species emphasis of choice. There are two sections containing 5 essay questions each; these are from the candidate's stated species emphasis. Finally, there is a practical examination, involving the candidates answering questions based on projected images; this section again is identical for all candidates in a given year.

At this time, half of the essay questions and one-fourth of the multiple choice questions in a given year are from a species emphasis chosen by the candidate. Options include multi-species, bovine, equine, porcine and small animal. Questions for the multi-species section are drawn from the other species emphasis examinations and all are contained within the examination database. Questions within each variant of the examination are weighted for difficulty by the Examining Committee to ensure that all variants of the examination are equally difficult and to ensure that the published passing point of 70% is accurate.

Candidates may change their choice of species emphasis in subsequent years should they not pass the examination on the first try. The Board and Examining Committee are interested in any suggestions for other possible areas of emphasis, such as biotechnology or genetics; creation of an examination for these areas of emphasis requires training programs be in place to support interested candidates.

EXAMINATION STATISTICS

This information uses the definition of “class” set forth by the American Board of Veterinary Specialties. The individuals who applied to take the examination and had their credentials approved comprise a class. Not all individuals in a class took the examination the first year they were eligible and some individuals from prior classes took the examination each year, making the information in the latter years more complete and presumably more valuable than that from the earlier years in this review. Very complete information about scores achieved on various sections of the test only was available for the years 2000-2004. Thanks to Charles Franz and his staff and to Craig Smith, ACT secretary, for providing the raw data.

I) Number approved per year

YEAR	NUMBER APPROVED
1996	19
1997	19
1998	17
1999	6
2000	14
2001	12
2002	11
2003	11
2004	18

II) Number approved per year – Alternate (practitioner) versus standard (residency) route

YEAR	ALTERNATE	STANDARD	UNKNOWN
1998	2	13	2
1999	2	4	-
2000	1	13	-
2001	0	12	-
2002	0	11	-
2003	1	10	-
2004	2	16	-

III) Number of times taking the examination each year (for those approved since 1996)

YEAR	TOTAL	1 ST TIME	2 ND TIME	3 RD TIME	4 TH TIME	MEAN
1996*	19	19	-	-	-	---
1997*	23	19	4	-	-	---
1998*	19	15	3	1	-	---
1999*	12	8	1	2	1	---
2000	20	13	7	0	0	1.35
2001	18	12	6	0	0	1.33
2002	18	11	5	2	0	1.50
2003	16	9	5	2	0	1.56
2004	24	19	3	2	0	1.29

* Data may be incomplete

IV) Number of times taken before passing

NUMBER OF ATTEMPTS BEFORE PASSING	NUMBER OF INDIVIDUALS
First try	65
Second try	18
Third try	5
Fourth try	1

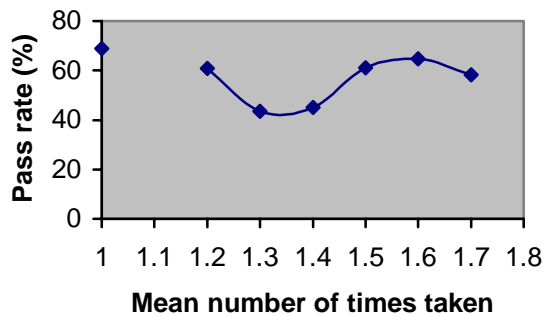
The mean number of attempts before passing is 1.4. Seventy-five percent of candidates passed on their first try.

V) Overall pass rate per year

YEAR	PERCENTAGE PASSING EXAMINATION
1996	68.8
1997	60.9
1998	63.2
1999	58.3
2000	45.0
2001	38.9
2002	61.0
2003	68.8
2004	29.2

Mean percentage passing the examination 2000-2004 = 48.6%

Mean number of times taken versus pass rate



There is neither a positive nor a negative correlation between candidate experience in taking the examination (mean number of times taken as calculated by combining information for all candidates in a given year) with pass rate (percentage passing that year); $r = 0.48$. It is not true, as has been supposed, that in those years with a low pass rate more people are taking the examination for the first time and that in those years with a high pass rate more people are taking the examination for a second or third time.

VI) Percentage passing and failing each year by species emphasis

YEAR	SPECIES EMPHASIS									
	MULTI		BOVINE		EQUINE		SM ANIM		PORCINE	
	PASS	FAIL	PASS	FAIL	PASS	FAIL	PASS	FAIL	PASS	FAIL
2000	3	1	1	6	5	3	0	1	0	0
2001	3	1	1	4	2	5	1	1	0	0

2002	5	1	3	3	1	2	2	0	0	1
2003	2	1	3	1	5	3	0	0	1	0
2004	5	6	1	2	1	8	0	1	0	0
PERCENTAGE	63.0 ^a		41.2 ^b		33.3 ^b		60.0		50.0	

It does appear to be true, as has been supposed, that candidates that take the examination by the Multi-species route do better, perhaps because they prepare more broadly. Students t-test analysis on total scores for successful and unsuccessful candidates for each year in each species emphasis, with significance of $\alpha < 0.5$ rejecting the null hypothesis (n=96), verifies that those individuals taking the Multi-species emphasis are more likely to achieve a passing grade than are those individuals taking the Bovine species emphasis or the Equine species emphasis. There was no difference between the Equine and Bovine groups or between any other groupings, for example, Multi-species versus Small Animal; however, sample size for the Porcine and Small Animal groups is very small.

VII) For those taking the examination more than once (1999 – 2004)

Number that did not change species emphasis

Mean number of times test taken before passing by species emphasis

Multi = 2 (n=1)

Bovine = 2.3 (n=4)

Equine = 2.0 (n=3)

Small animal = 0

Porcine = 3 (n=1)

Mean number of times test taken without yet passing by species emphasis

Multi = 0

Bovine = 2.0 (n=3)

Equine = 2.3 (n=4)

Small animal = 3.0 (n=1)

Porcine = 0

Number that did change species emphasis and still did not pass = 2

1 Equine to Multi

1 Bovine to Equine

Number that did change species emphasis and did pass = 3

1 Equine to Multi

1 Bovine to Multi

1 Equine to Multi to Small Animal

It does not appear to be true, as had been supposed, that changing one's species emphasis after having failed the examination is correlated with better performance on subsequent examinations.

VIII) Comparisons of successful and unsuccessful candidates by section of the examination

Students t-test analysis was performed to determine if the mean score of successful candidates varied significantly from the mean score of unsuccessful candidates on any portion of the examination, with significance of $\alpha < 0.5$ rejecting the null hypothesis. Information for Multiple Choice questions is not broken out as General versus Species emphasis because that information is not routinely solicited from the testing service for successful candidates and so is not recorded in our files.

SUCCESSFUL CANDIDATES SCORES (mean +/- SD)	UNSUCCESSFUL CANDIDATES SCORES (mean +/- SD)	SIGNIFICANTLY DIFFERENT?
PRACTICAL EXAMINATION*		
75.5 +/- 5.4	62.3 +/- 8.4	Yes
MULTIPLE CHOICE (GENERAL AND SPECIES EMPHASIS COMBINED)**		
74.6 +/- 7.6	62.3 +/- 8.4	Yes
ESSAY – GENERAL**		
71.16 +/- 7.7	52.2 +/- 11.6	Yes
ESSAY – SPECIES EMPHASIS**		

75.5 +/- 7.8	62.3 +/- 9.9	Yes
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* For 1999-2004, n = 112

** For 2002-2004, n = 58

It appears that those candidates that are successful are better prepared for all portions of the examination than are those candidates that are not successful.

IX) Comparison of successful and unsuccessful candidates by species emphasis for general essay and species-specific essay questions**

	EQUINE (mean +/- SD)		BOVINE (mean +/- SD)		MULTI-SPECIES (mean +/- SD)	
	S (n=7)	U (n=12)	S (n=7)	U (n=7)	S (n=12)	U (n=8)
GENERAL ESSAY	69.6 +/- 11.1	51.8 +/- 10.5	69.5 +/- 6.9	49.7 +/- 17.0	74.1 +/- 6.4	52.3 +/- 8.5
SPECIES ESSAY	75.8 +/- 5.6	62.3 +/- 8.4	75.4 +/- 5.9	57.0 +/- 8.1	75.6 +/- 8.4	60.1 +/- 7.4

** For 2002-2004

Using Students t-test analysis as described previously, for successful candidates, comparing performance on the general versus the species essay questions by species emphasis, there was no difference in performance on the general versus the species questions for any group. For unsuccessful candidates, comparing performance on the general versus the species essay questions by species emphasis, there was no difference for the bovine group. The unsuccessful equine and multi-species candidates did significantly better on the species emphasis portion than on the general essay portion of the exam. For candidates within a given species emphasis, comparing performance of unsuccessful to successful candidates for the general and species portion of each exam, there was a statistically significant difference in each group.

Successful candidates in each species emphasis group performed better, and presumably were better prepared, for both the general and species-specific portions of the examination and unsuccessful candidates often did better in their species emphasis than on the general essay questions, again suggesting lack of broad-based preparation for the examination.

CONCLUSIONS AND PLANS FOR THE FUTURE

There is no way to “play the system” to pass the Certifying Examination of the ACT. Successful candidates are better prepared in all regards compared to unsuccessful candidates. Adequacy of preparation in a residency program is dependent on the mentors available to that candidate, their dedication to and experience with the mentoring process and to the candidate’s desire to study and actively seek out information not available at their institution of study. Practitioners, too, must be dedicated in their time allotted to study and may be required to take time away from work to seek out educational experiences in species outside their routine.

In recent years, the ACT website has been expanded to include a study guide, improved reading list, and links to sites for study on the Internet. A list-serve has been created for individuals interested in taking the Certifying Examination, to allow them to study together and to provide a conduit for dissemination of information to the candidates. The abstract competition at the annual meeting of the SFT has been expanded to include undergraduate veterinary students, to foster interest in the rigorous study of theriogenology from before the time of residency application. Those individuals studying through the practitioner route have been contacted regularly, to ensure they stay on track with their course of study and to encourage them to complete their training in a timely manner so as to stay current with what they are studying and to minimize the time commitment required by their mentors.

New examination questions currently are supplied by the Examining Committee members. Candidates provide questions with their application packet; these questions rarely are of a quality or subject matter useful for inclusion in the database. Each year, each Examining Committee member is asked to submit two

to four new multiple choice questions and two to three essay questions in their fields of interest. This means that we routinely add 14 to 28 multiple choice and 14 to 21 essay questions to the database yearly. Examining committee members also supply many images from their photo collections to the examination database and spend a fair amount of time directly soliciting images from colleagues. Images submitted by applicants often come from their mentors and already are in the database. Compared to the volume of new research data that is generated on a yearly basis, these additions to the database are miniscule. The Examining Committee spends a great deal of time reworking questions. Infusion of new questions into the database would decrease this needless and frustrating work and improve the quality of the examination overall.

You, the Diplomates, have a collective body of knowledge far surpassing that of the Examining Committee and have much to share. Whenever you are preparing a lecture or continuing education course, gathering images for a PowerPoint presentation or writing a proceedings paper, write a test question or consider submitting an image. The ACT website (www.theriogenologyr.org) has templates for both multiple choice and essay questions for use by candidates and Diplomates. All questions and images can be submitted to Charles Franz (charles@franzmgt.com) and will be passed on to the appropriate member of the Examining Committee. The members of the Examining Committee are happy to help you with submission of test questions and images and implore you for submissions.

Plans for the future may include expanding the species emphasis options available to candidates. Again, this cannot happen in the absence of suitable training programs. There is no intention of moving away from the comparative aspect of theriogenology, or pushing for designation as either a small animal or a large animal theriogenologist. The comparative nature of our discipline is one of its strengths. We owe it to the discipline and to those undergoing training now and in the future to ensure we have an examination process that is fair in assessing candidates' knowledge and skills and that provides candidates with the training they need to succeed in their career. The Executive Board and Examining Committee are open to all suggestions.