



# 2016 Virginia Horse Industry Board: Horse Population Surveys

## Report of Results

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**Prepared for:**

**Virginia Horse Industry Board**

102 Governor Street  
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Richmond, VA 23219

**October 2017**



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*University of Virginia*

CSR Project  
# 14.12



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## Acknowledgments

A complex and ambitious project like this one necessarily draws on the contributions of many different people both outside of the Center for Survey Research (CSR) and within it. The members of the Virginia Horse Industry Board (VHIB) provided good counsel, sustained interest and patience throughout the process. In particular, then-chairman Dr. Harold McKenzie advised us on how to categorize breeds of horses and provided useful input on the content of the horse owner and veterinarian surveys. He also served as the key point of contact for substantive issues on the project during his term as chairman

Similarly, then-chairman of VHIB, David Lands, also provided useful review and input on the veterinarian survey and served as the key point of contact for substantive issues on the project during his term as chairman.

We are also thankful for the Virginia Horse Council's willingness to allow us to use its logo on the horse owner survey questionnaire and mailing materials, as well as the veterinarian survey mailing materials, to communicate the legitimacy of the survey request and encourage response from horse owners.

VHIB receives its administrative services and funding through the Virginia Department of Agriculture and Consumer Services (VDACS). At VDACS, Andrea Heid helped define the working relationship among VHIB, CSR and VDACS and helped create the written agreement for the project. She provided project monitoring from the VDACS side until her retirement. Melissa Ball stepped in at VDACS to continue with project monitoring, and she was followed in that role by Heather Wheeler. We are grateful for the time and attention provided by all of them.

Dr. Joseph Garvin in the Office of the State Veterinarian was consistently generous with his time and his knowledge on numerous occasions. Dr. Garvin paved the way for Phase I of the project, which focused on obtaining administrative records for Coggins tests. Dr. Garvin also helped us in several conversations during Phase II of the project regarding data analysis and our understanding of how the

testing records tend to be handled. He was an invaluable asset to the study.

Phase I of the project included visits by CSR staff to five state-run regional animal health laboratories run by VDACS, as well as the central office in Richmond. At each of these six locations, VDACS staff took time out from their busy schedules to provide work space and access to their files for CSR teams. Their collegiality was vital to the success of that part of the project, and much appreciated by CSR. We would like to thank the following people and we apologize for leaving out others who may also have helped make us feel welcome at their locations:

- Office of the State Veterinarian: Dr. Joseph Garvin and Cecilia Freeland
- Harrisonburg Laboratory: Fay Airey and David Brown
- Ivor Laboratory: Lynn Young, Betty Garner and Jackie Teter
- Lynchburg Laboratory: Tammy Adams and Kelly Dietz
- Warrenton Laboratory: Wanda Peters and Christine Wassenaar
- Wytheville Laboratory: Lauren Meek and Melinda Stuart

Dr. Rory Carolan in the National Equine Programs (Surveillance, Preparedness & Response Veterinary Services) at the United States Department of Agriculture (USDA) contacted CSR about the study and provided valuable insights and corroboration regarding the difficulties encountered in counting horses. He also was kind enough to reach out to colleagues who helped address gaps in our knowledge of how Coggins test results are processed and stored electronically.

We are grateful to Jill Wagner, Contact Manager at GlobalVetLink (GVL), who took time to converse about the system and the broader landscape of electronic storage of animal testing data, including thoughts about VSPS.

We are also grateful to Monica Reyna and Liza McNamee of the Social Science Research Unit (SSRU), University of Idaho. The SSRU

conducts a survey in Idaho every few years that is designed to estimate the number of horses living there. Their insights on the strengths and weaknesses of their approach and CSR's approach were very useful. We also appreciate the assistance we received on a later follow-up call to SSRU to clarify our understanding of the horse ownership rates they observed in their most recent study.

At CSR, numerous staff members had a hand in the project. Kathy Coker helped organize contact and background information for the field visits. Kara Fitzgibbon contacted state laboratories to arrange the visits. Deborah Rexrode coordinated the field visits and personally led the visits to Ivor and Wytheville. Thomas Woodson provided on-site supervision of the CSR field crews and records management on the site visits. Jesica Baker, Gael Buckley, Eric Flanagan, Brian Hamshar, Michelle Paul, Chad Van Pelt and David Warner staffed one or more of the field visits, entering selected information from the administrative records into databases on CSR laptop computers. Elliot Toms provide the technical support to prepare the laptop computers for field work.

Dora Brooks, Dorothea Lewis and their CSR staff executed all of the mailings and data entry for the horse owner survey, and the mailing for the veterinarian survey. CSR calling lab supervisors Dora Brooks, Gare Galbraith, Cati Payne and Beverly Kerr provided supervision and management of the reminder calls to non-respondents to the horse owner survey.

Kara Fitzgibbon, Sarah Labriny, Rachel Kopelove, Meghan Smith, Ryan Saunders, Victoria Turner, Yulin Huang and Hexuan Zhang provided data cleaning, data file preparation, analysis, and data tables preparation for Phase I and/or final reporting. Hexuan Zhang assisted with weighting the dataset and drafted much of the final report.

Dr. Jim Ellis served as principal investigator with overall responsibility for the project plan and its execution. He also developed the horse owner survey and veterinarian survey with helpful input from VHIB representatives, programmed the web versions of the surveys, provided oversight of data collection and data

processing activities, and wrote much of the Phase I combined report and selected portions of the final report.

Dr. Thomas Guterbock, CSR Director, solved the thorny issues involved in weighting the data and provided hands-on oversight, analysis and writing that brought the final report over the finish line.

Finally, we are indebted to the 2,084 horse owners who responded to the horse owner survey and the 162 veterinarians who showed their willingness to share their opinions and information by responding to those surveys.

All of these contributions have helped support this study, but any errors or omissions are the responsibility of CSR alone.

# I. Introduction

## About the Study

The Virginia Horse Industry Board (VHIB) and the Virginia Department of Agriculture and Consumer Services (VDACS) contracted with the Center for Survey Research (CSR) at the University of Virginia to estimate the number of horses living in Virginia by breed, age and locality.

It is difficult to estimate horse populations. Widely varying estimates have been produced in recent years by different researchers using different methods. For example, the American Horse Council Foundation estimated that there were 9.2 million horses in the U.S. in 2003, the National Agricultural Statistics Service estimated 3.75 million in 2002, and the American Veterinary Medical Association (AVMA) estimated 5.1 million in 2001. These estimates vary because of different methods used in the studies, different definitions of eligible reporting units in the studies, and different purposes of the studies.<sup>1</sup>

Horses are not licensed or taxed in Virginia, so there is no comprehensive registry of horses, nor is there an authoritative list of horse owners. Ownership of horses is somewhat rare in the general population – in the AVMA study in 2001, 1.7 percent of responding households from a nationally representative panel reported owning horses.<sup>2</sup> In a 2015 random-digit dial telephone survey in Idaho, about 11 percent (unweighted) of responding households reported owning horses.<sup>3</sup> Because of the relatively rare occurrence of horse ownership, traditional random sampling methods are cost-prohibitive, as are door to door and areal survey methods. Government surveys of farms are tilted to large

operations and by their nature focus only on horses located on those types of operations.

In response to these issues, this study rested heavily on administrative records kept in Virginia for horses that received Coggins tests for equine infectious anemia (EIA) in calendar 2014. These records constitute the closest thing to a registry or list of horses, but of course they cover only horses that were tested for EIA.

Equine infectious anemia is an equine viral disease that is usually asymptomatic but in some cases can cause serious symptoms and even death. The disease is spread by biting insects. Equines who are asymptomatic carriers help to spread the disease. There is no cure for EIA. Testing is used to break the chain of transmission. Diseased horses are segregated from healthy horses, slaughtered or euthanized. In the U.S., EIA is most prevalent in the southeast and upper Mississippi Valley. In 1972, about four percent of all Coggins tests were positive for EIA; in 2005 only about one-tenth of one percent were positive.<sup>4</sup>

The Administrative Code of Virginia states that “All horses assembled at a show, fair, race meet, or other such function, or participating in any activity on properties where horses belonging to different owners may come into contact with each other in Virginia, must be accompanied by a report of an official negative test for equine infectious anemia.”<sup>5</sup>

The tests require veterinarians to obtain a blood sample from the horse. The sample is given to a certified testing laboratory. In Virginia there are four state-run testing laboratories that conduct and file Coggins tests (during this study, a fifth state-run laboratory at Ivor was in the process of closing). Veterinarians or horse owners are also free to use other laboratories in Virginia or out of state. The testing laboratory returns the result to the state, which records it, and to the

<sup>1</sup> Kilby, Emily R. (2007), “The Demographics of the U.S. Equine Population.” Ch. 10 in Salem, Deborah J. and Rowan, Andrew N. (eds.), *The State of the Animals IV: 2007*, pp. 175-176. Washington, D.C., Humane Society Press.

<sup>2</sup> Kilby (2007), p. 177.

<sup>3</sup> Personal communication with Monica Reyna and Liza McNamee of the Social Science Research Unit, University of Idaho, April 21, 2016.

<sup>4</sup> U.S. Department of Agriculture, Animal and Plant Health Inspection Service (2006), “APHIS Info Sheet,” September 2006.

<sup>5</sup> 2VAC5-70-20.

veterinarian, who communicates it to the horse owner.

The state collects a small fee for each test result reported to it, which goes toward the operations of VHIB. The test result may be recorded on paper with the owner receiving a copy of the test result, or it may be recorded in an online system at a small additional cost.

When the Coggins test is performed at one of the four state-run laboratories and recorded on a paper record, the paper record is usually stored at that laboratory. When the Coggins test is performed at some other non-state laboratory and recorded on paper, that paper record is usually stored at the VDACS office in Richmond.

For this study, VHIB obtained agreement from the Virginia Department of Agriculture and Consumer Services (VDACS) to provide access to the Coggins test records maintained by VDACS.

In Phase I of this project, which was devoted to assembling the available Coggins test records for 2014, CSR obtained all EIA testing records stored electronically in the online Global Vet Link system. CSR also sent staff to the five state testing laboratories operating at that time plus the central office in Richmond. Working on location, CSR staff randomly selected and entered into a database a sample of all EIA testing records for calendar 2014 stored on paper. (For details see the Phase I report from October 2016 which is included as Appendix D to this report).

The testing records were used to generate a sample of horse owners for a mail and web survey. This survey would gather more detail about tested horses, and about untested horses owned by those owners who tested at least one of their horses in 2014. We refer to these owners as “testing owners” in this report.

In addition, a web-based survey of veterinarians was designed and executed to expand information about untested horses in Virginia and about horse owners who had none of their horses tested for EIA in 2014 (we refer to these owners as “non-testing owners” in this report). It was anticipated that data gathered through the

survey reports from horse owners and veterinarians would allow the data about tested horses to be extended to untested horses. That strategy was used to produce the estimates in this study. See Figure I-1 for a visual representation of this approach.

## **Key Results**

Based on the horse owner survey (the survey of testing owners), we estimate that they owned a total of 60,032 horses – tested and untested – who lived in Virginia for six months or more in 2014.<sup>6</sup> Based on a projection from this number that used data from the horse owner survey, the survey of veterinarians and information from other sources, we estimate that there were 151,484 horses living in Virginia for six months or more in 2014.<sup>7</sup> This excludes wild horses. This projection represents all horses owned by testing and non-testing owners in Virginia.

Among the localities of Virginia, Loudoun County has the highest estimated number of horses using this method (9,165) accounting for 6.1 percent of the horse population in Virginia. Fauquier County has the second largest number of horses (8,116) and accounts for 5.4 percent of the horse population. Clarke County is third with 6,211 horses (4.1%).

We estimate that 44.3 percent of all horses living in Virginia for six months or more in 2014 received a Coggins test.

## **NASS Regions**

Based on their geographic location, owners and horses in the horse owner survey were assigned to one of seven Virginia regions based on the geography used by the Richmond Field Office of the National Agricultural Statistics Service (NASS) in its 2007 survey of equids. The location of each respondent was assigned from the geocoded data from Phase I. In the survey of

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<sup>6</sup> The confidence interval ranges from 57,892 to 62,171 at the 95% level of confidence. For more details of the table, please refer to Appendix B, item VirginiaYN.

<sup>7</sup> The confidence interval ranges from 141,457 to 161,510 at the 95% level of confidence. For more details of the table, please refer to Appendix C, item VirginiaYN.

veterinarians, the NASS region in which each veterinarian's practice was located was determined from an open-ended description of their practice location provided by responding veterinarians. See Figure I-2 for a breakdown of which counties are assigned to each region.

### ***Weighting the Data***

This section summarizes how the horse owner survey data were weighted. More detail is available in Appendix E. The veterinarian survey data were not weighted.

The horse owner survey was sent to a sample of 5,600 horse owners selected from the Coggins test records obtained in Phase I of the study. We counted the number of horses each owner had had tested in the Coggins administrative records and grouped them into four categories (1 horse, 2-3 horses, 4-10 horses and 11 or more horses). Owners who had larger numbers of tested horses were oversampled. The responding owners (n=2,084) were asked questions about their lands and operations. They were also asked to list their horses individually and answer several questions about each horse. The 2,084 responding owners collectively listed 7,870 horses.

The data about the owners, their lands and operations constitute an owner-level dataset with 2,084 records in it. The data about the individual horses constitute a horse-level dataset with 7,870 records in it. These two datasets require slightly different weighting schemes.

Both datasets were first weighted to offset the initial oversampling of owners who tested more horses as well as any subsequent differences in the rates of response among the four categories of number of tested horses. This produces a full probability sample of testing owners in Virginia – perhaps the most comprehensive one ever done.

For the horse dataset only, additional weights were introduced to adjust for underrepresentation of young horses in Coggins test records and to expand the set of horses reported by testing owners to include the estimated number of horses owned by non-testing owners.

### ***Sampling Error and Key Assumptions***

As with any survey based on a probability sample, all estimates are subject to sampling error. Survey sampling errors are often reported as a “plus-or-minus” percentage for the survey as a whole. This is a convenient way to communicate the general precision of the survey, but in fact every individual statistic from a sample survey has its own unique sampling error. In this report, the survey results from the horse owners and the horses they reported found in Appendix B have the appropriate upper and lower bounds defined by the sampling error for each survey item. Similarly, the survey results projected to the full universe of horses – found in Appendix C – also have their own sampling errors and accompanying upper and lower bounds shown in the appendix tables. The sampling errors in Appendix C are larger than those in Appendix B because the weights used to produce the data in Appendix C are larger and more variable than those used to produce the data in Appendix B.

The appropriate confidence intervals for weighted data were produced using the Complex Samples analysis module in SPSS (IBM Statistics) software. The calculations take into account the fact that weights in the data increase sampling errors. We use the term “design effect” to describe the ratio of the properly calculated sampling error to the sampling error calculated without taking weighting, clustering, or stratification into account. Each item or statistic in the survey has its own design effect. The design effects in the horse owners survey range from 0.160 to 6.685. The design effects in the total horse population projections range from 0.101 to 49.815.

To produce the total horse population projections, we needed to make some strong but reasonably plausible assumptions. These assumptions included:

1. Based on data from national studies we estimated that 44.3% of all horses in Virginia were tested for EIA in 2014.
2. Based partly on data from national studies but more heavily on data from

our own horse owner and veterinarian surveys, we also assumed some variations in testing rates across different regions of Virginia.

3. We assumed that a trivial number of Coggins test records were stored somewhere other than the GVL system. We operationalized this assumption to say that the GVL electronic records completely covered all Virginia Coggins test records from 2014 stored electronically.<sup>8</sup>
4. We also assumed that our sample from state testing laboratories was drawn from a set of records that covered all Virginia Coggins test records from 2014 stored on paper.
5. In addition, the data from the horse owner survey data estimating all horses in Virginia owned by testing owners assume that non-respondents to the survey are like those who did respond.
6. Finally, the projections of the horse owner survey data to the full universe of horses in Virginia assumes that the key characteristics of untested horses owned by testing owners are similar to those for horses owned by non-testing owners.

There are other sources of error in surveys beyond sampling error. For example, survey questions may not be understood in the same way by all respondents. There can be errors in reporting or processing data. Some of the key assumptions listed above could be incorrect. These kinds of errors – unlike sampling error – can be difficult or impossible to quantify, but their possible presence should be kept in mind by users of the data reported here.

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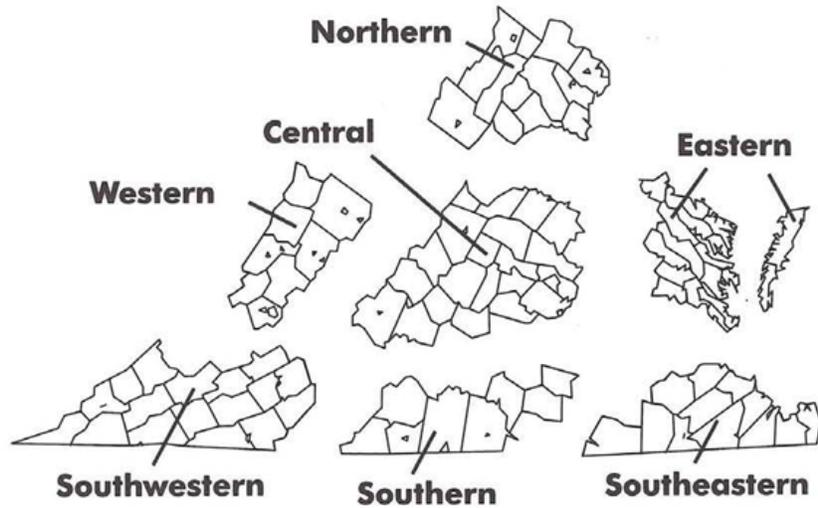
<sup>8</sup> Later in the analysis stages of our study, we had conversations about this assumption that involved staff at GVL, VSPS (the other major electronic Coggins test repository) and VDACS. It seems likely that VSPS stores a non-trivial number of Virginia Coggins test results, but changing that assumption would not affect our estimates very much.

**Figure I-1: Visual Representation of the Logic of the Study**

| Test status of horse | Ownership of horse                               | Coggins filing location  | Horse lives... | Source of data for horse  |  |
|----------------------|--|--------------------------|----------------|---|--|
| Tested in 2014       | Owned, by definition                             | Filed in VA              | In VA          | GVL (100% count), paper (sample est.) Also collect in owners survey.  | Phase I<br>Phase II: Owners Survey<br>Vet survey |
|                      |  |                          | Outside VA     | Of interest only to subtract from any global estimates or counts of tests. Est. from owners survey. Est. from GVL data. |  |
|                      |  | Filed outside VA         | In VA          | Est. from owners survey.  |  |
|                      |  |                          | Outside VA     | Of interest only to subtract from any global estimates or counts of tests. Est. from owners survey.                     |  |
| Not tested in 2014   | Owned by owner who had at least one horse tested | No filing, by definition | In VA          | Est. from owners survey (Appendix B tables).  |  |
|                      |  |                          | Outside VA     | May be of interest in creating overall estimates. Est. from owners survey.  |  |
|                      | Owned by owner who had no horses tested          | No filing, by definition | In VA          | Veterinarian estimate (Appendix C tables)   |  |
|                      |  |                          | Outside VA     | Not of interest   |  |
|                      | Not owned (wild)                                 | No filing, by definition | In VA          | Wild horses excluded from projections   |  |
|                      |  |                          | Outside VA     | Not of interest   |  |

Figure I-2: Map of NASS Regions

**Virginia District Map, 2006**



| <b>Northern</b> | <b>Western</b> | <b>Central</b> | <b>Eastern</b> | <b>Southwestern</b> | <b>Southern</b> | <b>Southeastern</b> |
|-----------------|----------------|----------------|----------------|---------------------|-----------------|---------------------|
| Clarke          | Alleghany      | Albemarle      | Accomack       | Bland               | Charlotte       | Brunswick           |
| Culpeper        | Augusta        | Amelia         | Charles City   | Buchanan            | Franklin        | Dinwiddie           |
| Fairfax         | Bath           | Amherst        | Essex          | Carroll             | Halifax         | Greensville         |
| Fauquier        | Botetourt      | Appomattox     | Gloucester     | Dickenson           | Henry           | Isle of Wight       |
| Frederick       | Craig          | Bedford        | James City     | Floyd               | Lunenburg       | Mecklenburg         |
| Loudoun         | Highland       | Buckingham     | King & Queen   | Giles               | Nottoway        | Prince George       |
| Madison         | Roanoke        | Campbell       | King George    | Grayson             | Patrick         | Southampton         |
| Page            | Rockbridge     | Caroline       | King William   | Lee                 | Pittsylvania    | Suffolk             |
| Prince William  |                | Chesterfield   | Lancaster      | Montgomery          |                 | Surry               |
| Rappahannock    |                | Cumberland     | Mathews        | Pulaski             |                 | Sussex              |
| Rockingham      |                | Fluvanna       | Middlesex      | Russell             |                 | Chesapeake          |
| Shenandoah      |                | Goochland      | New Kent       | Scott               |                 | Virginia Beach      |
| Stafford        |                | Greene         | Northampton    | Smyth               |                 |                     |
| Warren          |                | Hanover        | Northumberland | Tazewell            |                 |                     |
|                 |                | Henrico        | Richmond       | Washington          |                 |                     |
|                 |                | Louisa         | Westmoreland   | Wise                |                 |                     |
|                 |                | Nelson         | York           | Wythe               |                 |                     |
|                 |                | Orange         |                |                     |                 |                     |
|                 |                | Powhatan       |                |                     |                 |                     |
|                 |                | Prince Edward  |                |                     |                 |                     |
|                 |                | Spotsylvania   |                |                     |                 |                     |

## About the Report

### Overview

This report describes the survey methods and results from the 2016 Virginia Horse Population Surveys. After the Acknowledgments and Executive Summary, the report sections are as follows:

- Section I is this Introduction.
- Section II briefly reviews the survey methods used for this study.
- Section III reports the findings from the Horse Owner Survey from both datasets relating to owners and individual horses. These results represent owners who tested one or more of their horses for EIA in 2014. The results for horses represent Virginia horses that are owned by these “testing owners.”
- Section IV reports the findings from the Veterinarian Survey, results of which were used as an aid in estimating Coggins test rates in different regions of Virginia.
- Section V presents horse data projections meant to represent all horses in Virginia, including those whose owners did not test any horses for EIA in 2014 (“non-testing owners”).
- Section VI briefly summarizes the conclusions from the survey.
- Appendix A provides unweighted frequency and crosstabulations of the survey results.
- Appendix B provides results weighted to reflect the survey population (testing owners).
- Appendix C provides results projected to include estimates for all Virginia horses (including those owned by non-testing owners).
- Appendix D is a report on the development of the sampling frame for the Horse Owners Survey.
- Appendix E is a description of the survey methods and methods of weighting for the Horse Owners Survey.
- Appendix F is a copy of the Horse Owners Survey questionnaire.
- Appendix G is a copy of mailing materials for the Horse Owners Survey.
- Appendix H provides the demographics of the Veterinarians Survey.
- Appendix I provides the frequency results from the Veterinarians Survey.
- Appendix J provides the cross-tabulations by region from the Veterinarians Survey.
- Appendix K is a description of the methods used in the Veterinarian’s Survey.
- Appendix L is a copy of the Veterinarians Survey questionnaire.
- Appendix M is a copy of mailing materials for the Veterinarians Survey.
- Appendix N provides open-ended responses from the Horse Owners Survey.
- Appendix O provides open-ended responses from the Veterinarians Survey.

## II. Methods Overview

This section describes the methods used for the two surveys that comprised Phase II of the study – the mail- and web-based survey of horse owners, and the web-based survey of veterinarians.

### *Respondent Selection*

#### **Horse owners**

The sampling frame of horse owners for Phase II of the study was derived from the Coggins test data collected in Phase I of the study – 22,938 electronic records from the Global VetLink system (GVL) and 4,256 paper records sampled from an estimated 30,492 such records stored at six locations around the state of Virginia. An unduplicated list of 13,466 horse owners was created from these test records by geocoding the records to standardize owner addresses to U.S. Postal Service standards, then unduplicating the list by owner address.

There were 5,600 horse owners selected from the unduplicated list of owners (the Phase II sampling frame). To ensure representation of all types of owners, the owners were categorized by the number of times they appeared in the list prior to de-duplication. Greater proportions of owners were selected from those appearing more times in the list because those owners were rarer. The sample was drawn as follows:

Group 1: owners appearing 1 time in the list. Sampled 2,924 out of 7,889 (37%)

Group 2: owners appearing 2-3 times in the list. Sampled 1,620 out of 4,047 (40%)

Group 3: owners appearing 4-10 times in the list. Sampled 900 out of 1,374 (65%)

Group 4: owners appearing 11 or more times in the list. Sampled 156 out of 156 (100%)

#### **Veterinarians**

The 2016 Virginia Veterinarians Survey was a web-based survey conducted from January 26, 2016 to April 4, 2016. The sampling frame of veterinarians was derived from a licensure list kept by the state of Virginia. There were 798 veterinarians selected from the Virginia

licensure list because they had any specialty or subspecialty code related to equines. This included veterinarians with mailing addresses outside of Virginia. We collected usable (full or partial) electronic questionnaires from 146 respondents.

### *Questionnaire Design*

#### **Horse owners**

The horse owner survey was conceived to be a mail survey with the option to do the survey by web. The questionnaire was developed by CSR with feedback from VHIB. The outline of the questionnaire was based partly on the 2006 NASS Field Office survey in Virginia, partly on the NASS Agricultural Census of 2011, and partly on original ideas designed to support the research and data plan captured in Figure I-1. The questionnaire outline was vetted with VHIB and with CSR colleagues.

The final questionnaire included questions about the number of horses owned by the responding owner, whether the owner knows other owners who had none of their horse tested in 2014, rough guesses as to the percentages of horses receiving Coggins tests in the owner's area and statewide, land use for equine activities and expenditures and valuation of the owner's horses. The questionnaire also included a listing of the individual horses and some of their characteristics including name, age, breed, primary use, whether the horse lived in Virginia in 2014 for six months or more, the county or independent city in Virginia where the horse lived, whether the horse was tested for EIA in 2014, and whether the horse was ever tested for EIA before 2014. The paper and web questionnaires can be seen in Appendix F.

#### **Veterinarians**

The veterinarian survey was conceived to be a web-only survey. The questionnaire was developed by CSR with feedback from VHIB. The veterinarian survey asked for expert estimates of the size of the Virginia horse population, rates of testing in various areas of the state and among horses used in different ways, and some characteristics of their veterinary practices. The purpose of the

veterinarian survey was to obtain information used to project the horse owner survey data to the full universe of horses in Virginia. The questionnaire can be seen in Appendix L.

## **Survey Process**

### **Horse owners**

The horse owners survey was formatted for a four-page survey booklet and printed on 11 x 17 paper, center-folded. The web version of the survey was programmed in Qualtrics. Data collection was conducted in several steps from October 20, 2015 to January 11, 2016.

First, a survey packet was mailed to all horse owners in the sample. The packet contained a personalized cover letter describing the purpose and procedures of the survey, the survey booklet and a postage-paid business reply return envelope. The cover letter also included a URL and individual code number for those who wished to do the survey online rather than on paper. Second, we followed up with a combination thank-you/reminder postcard to all horse owners in the sample. The card thanked those who had already responded and encouraged those who had not responded to do so by mail or web. The card included the URL for the web survey and the individual code number.

Then we carried out telephone reminders to 3,068 non-respondents for whom we had telephone numbers from the Coggins test files. The calls encouraged horse owners to take the time to respond to the survey and allowed CSR interviewers to immediately send an email to respondents who wished to receive their individualized Qualtrics survey link by email. Finally, we sent a second survey packet by mail to all remaining non-responders. We collected usable (full or partial) electronic questionnaires from 2,804 respondents reporting in detail on 7,870 of their horses.

### **Veterinarians**

The survey was programmed in Qualtrics and conducted in several steps. First, we sent postcards to veterinarians in the sample describing the purpose and procedures of the

survey (a copy of the postcard is included in the third part of this report). Second, we followed up with an email invitation to veterinarians with a personalized link to the web survey. We sent two waves of reminder emails to non-responders following the first invitation email. Finally, there was a closeout reminder email sent to the veterinarians who had not yet taken the survey.

For more detail about the survey methods, see Appendix E and Appendix K in this report.

### III. Horse Owners Survey Results (for horses owned by testing owners)

#### Weighted Data and Confidence Intervals

This section of the report presents horse and owner data weighted with base weights and non-response weights so as to represent all testing owners and the Virginia horses that they own. Note that the survey is not a census (complete count). Because it uses a sample, it provides estimates, which we present at the 95% level of confidence.

Appendix E provides a detailed description of the base weights (which adjust for features of the study design that gave some owners and some horses greater chances of being included) and the non-response weights (which adjust for differences in rates of survey response across sampling frames and regions). Appendix B provides detailed tables showing survey estimates as well as upper and lower bounds at the 95% level of confidence for each estimate.

#### Horse Dataset

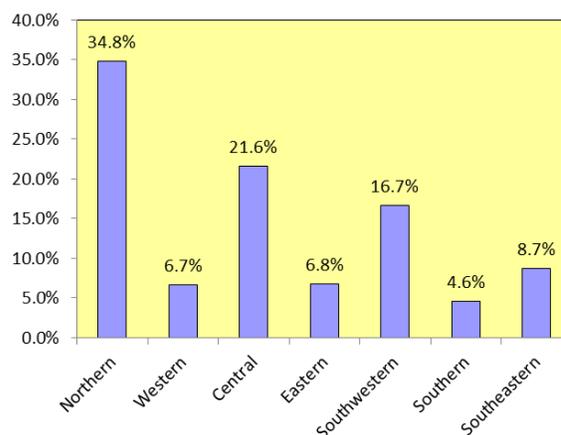
##### *Virginian Horse Estimation*

Based on the sample size of horse file, we estimate that 61,881 horses lived in Virginia for 6 months or more in 2014, while 1,886 did not. When we filter out the non-Virginian horses as well as horses whose first reported breed are donkey/mule, we have 60,032 horses in total that lived in Virginia for 6 months or more in 2014.<sup>9</sup> This number represents all horses owned by testing owners. (Horses owned by non-testing owners are excluded. See Chapter V and Appendix C of this report for projections that include the estimated numbers of such horses.)

When breaking the results down into seven NASS regions, the Northern region has the highest percent of horses (34.8%), Central has

21.6 percent, and Southwestern has 16.7 percent. Southern has the lowest percent (4.6%) of horses among the seven regions. See Figure III-1.

**Figure III-1: Distribution of horses by NASS regions**



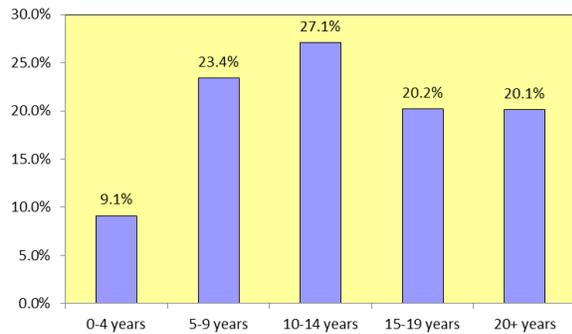
#### Age Group

Most horses are between 10 to 14 years old (27.1%) and 5 to 9 years old (23.4%). Horses aged 15-19 years old (20.2%) and more than 20 years old (20.1%) both take about one fifth of the total horse number. The young horses aged 0 to 4 years old have the lowest percent (9.1%) out of the total number of horses. See Figure III-2.

It is apparent that the youngest horses were under-represented in the data reported by testing owners and presented here. See Appendix E for more detail on the age distribution and a discussion of the age weights that were applied to the data to correct this problem. These age-correction weights were applied in the projected results reported in Section V below and in Appendix C.

<sup>9</sup> The confidence interval ranges from 57,892 to 62,171 at the 95% level of confidence. For more details of the table, please refer to Appendix B, item VirginiaYN.

**Figure III-2: Age groups of horses**



When the age groups are broken down by NASS regions of Virginia, we find that the Southwestern region has the highest percentage of horses aged 0-4 years old (11.9%) and 5-9 years old (31.0%) compared to other regions. The Northern region has the highest percent of horses aged 10-14 years old (29.6%). See Table III-1 for more details.

**Table III-1 Age groups of horses by NASS region of Virginia**

| Horse age group |                 | NASS Region of Virginia |           |           |           |                |            |                | Total  |
|-----------------|-----------------|-------------------------|-----------|-----------|-----------|----------------|------------|----------------|--------|
|                 |                 | 1 Northern              | 2 Western | 3 Central | 4 Eastern | 5 Southwestern | 6 Southern | 7 Southeastern |        |
| 0-4 years       | N               | 1,673                   | 362       | 1,175     | 302       | 1,165          | 168        | 461            | 5,306  |
|                 | % within region | 8.4%                    | 9.0%      | 9.5%      | 7.7%      | 11.9%          | 6.1%       | 8.9%           | 9.1%   |
| 5-9 years       | N               | 4,438                   | 813       | 2,723     | 818       | 3,043          | 608        | 1,063          | 13,505 |
|                 | % within region | 22.3%                   | 20.2%     | 22.0%     | 20.7%     | 31.0%          | 22.1%      | 20.5%          | 23.3%  |
| 10-14 years     | N               | 5,906                   | 1,134     | 3,276     | 1,072     | 2,349          | 661        | 1,388          | 15,785 |
|                 | % within region | 29.6%                   | 28.2%     | 26.4%     | 27.2%     | 23.9%          | 24.0%      | 26.8%          | 27.2%  |
| 15-19 years     | N               | 3,908                   | 816       | 2,526     | 794       | 1,857          | 697        | 1,179          | 11,778 |
|                 | % within region | 19.6%                   | 20.3%     | 20.4%     | 20.1%     | 18.9%          | 25.3%      | 22.8%          | 20.3%  |
| 20+ years       | N               | 4,016                   | 899       | 2,702     | 957       | 1,412          | 620        | 1,081          | 11,687 |
|                 | % within region | 20.1%                   | 22.3%     | 21.8%     | 24.3%     | 14.4%          | 22.5%      | 20.9%          | 20.1%  |
| Total           | N               | 19,941                  | 4,023     | 12,402    | 3,942     | 9,827          | 2,755      | 5,172          | 58,062 |
|                 | % within region | 100.0%                  | 100.0%    | 100.0%    | 100.0%    | 100.0%         | 100.0%     | 100.0%         | 100.0% |

### ***Top10 Horse Breeds***

Owners were allowed to list up to three categories of breed for each horse they entered on the horse roster in the questionnaire. Based on the first reported horse breed for each horse, we list the top 10 horse breeds in Virginia. Thoroughbred (13.9%) and Quarter Horse (13.8%) are the top two horse breeds, with Warmbloods in third place with 10.1 percent.

**Table III-2 Top10 Horse breeds**

|                          | <b>Population Size</b> | <b>% of Total</b> |
|--------------------------|------------------------|-------------------|
| <b>Thoroughbred</b>      | 8,335                  | 13.9%             |
| <b>Quarter Horse</b>     | 8,270                  | 13.8%             |
| <b>Warmblood</b>         | 6,076                  | 10.1%             |
| <b>Tennessee Walking</b> | 5,079                  | 8.5%              |
| <b>Paint</b>             | 3,326                  | 5.5%              |
| <b>Pony</b>              | 2,885                  | 4.8%              |
| <b>Arabian</b>           | 2,694                  | 4.5%              |
| <b>Other Gaited</b>      | 2,067                  | 3.4%              |
| <b>ThoroughbredX</b>     | 1,674                  | 2.8%              |
| <b>Appaloosa</b>         | 1,452                  | 2.4%              |
| <b>Other Breeds</b>      | 18,173                 | 30.3%             |
| <b>Total</b>             | 60,032                 | 100.0%            |

The top three breeds comprise more than one-third of all Virginia horses owned by testing owners. See Table III-2.

When we break down the top 10 horse breeds into seven NASS regions in Virginia, the Northern (20.8%) and Central (17.3%) regions have higher percentages of Thoroughbred horses, while the Southwestern region has a higher percentage of Quarter Horses (21.2%). Both the Southwestern (15.9%) and South (17.1%) regions have relatively higher percentages of Tennessee Walking horses compared to other regions. See Table III-3.

Table III-3 Top10 Horse breeds by NASS regions

| First breed reported |                 | NASS Region of Virginia |                   |              |                   |                        |                     |                        | Total  |
|----------------------|-----------------|-------------------------|-------------------|--------------|-------------------|------------------------|---------------------|------------------------|--------|
|                      |                 | 1<br>North-<br>ern      | 2<br>West-<br>ern | 3<br>Central | 4<br>East-<br>ern | 5<br>South-<br>western | 6<br>South-<br>-ern | 7<br>South-<br>eastern |        |
| Thoroughbred         | N               | 4,329                   | 437               | 2,236        | 429               | 223                    | 178                 | 503                    | 8,335  |
|                      | % within region | 20.8%                   | 10.8%             | 17.3%        | 10.5%             | 2.2%                   | 6.4%                | 9.6%                   | 13.9%  |
| Quarter Horse        | N               | 2,211                   | 459               | 1,526        | 659               | 2,124                  | 450                 | 841                    | 8,270  |
|                      | % within region | 10.6%                   | 11.4%             | 11.8%        | 16.1%             | 21.2%                  | 16.2%               | 16.1%                  | 13.8%  |
| Warmblood            | N               | 3,091                   | 433               | 1,370        | 354               | 167                    | 128                 | 439                    | 5,983  |
|                      | % within region | 14.8%                   | 10.8%             | 10.6%        | 8.7%              | 1.7%                   | 4.6%                | 8.4%                   | 10.0%  |
| Tennessee Walking    | N               | 800                     | 262               | 898          | 356               | 1,595                  | 473                 | 696                    | 5,079  |
|                      | % within region | 3.8%                    | 6.5%              | 6.9%         | 8.7%              | 15.9%                  | 17.1%               | 13.3%                  | 8.5%   |
| Paint                | N               | 792                     | 290               | 621          | 268               | 726                    | 280                 | 349                    | 3,326  |
|                      | % within region | 3.8%                    | 7.2%              | 4.8%         | 6.6%              | 7.3%                   | 10.1%               | 6.7%                   | 5.6%   |
| Pony                 | N               | 1,239                   | 165               | 641          | 201               | 403                    | 112                 | 124                    | 2,885  |
|                      | % within region | 5.9%                    | 4.1%              | 5.0%         | 4.9%              | 4.0%                   | 4.0%                | 2.4%                   | 4.8%   |
| Arabian              | N               | 551                     | 291               | 691          | 173               | 515                    | 86                  | 371                    | 2,678  |
|                      | % within region | 2.6%                    | 7.2%              | 5.3%         | 4.2%              | 5.2%                   | 3.1%                | 7.1%                   | 4.5%   |
| Other Gaited         | N               | 534                     | 169               | 338          | 234               | 381                    | 171                 | 242                    | 2,067  |
|                      | % within region | 2.6%                    | 4.2%              | 2.6%         | 5.7%              | 3.8%                   | 6.2%                | 4.6%                   | 3.5%   |
| Thoroughbred cross   | N               | 760                     | 122               | 421          | 64                | 191                    | 60                  | 55                     | 1,674  |
|                      | % within region | 3.6%                    | 3.0%              | 3.3%         | 1.6%              | 1.9%                   | 2.2%                | 1.1%                   | 2.8%   |
| Appaloosa            | N               | 397                     | 139               | 424          | 39                | 118                    | 135                 | 186                    | 1,438  |
|                      | % within region | 1.9%                    | 3.5%              | 3.3%         | 0.9%              | 1.2%                   | 4.9%                | 3.6%                   | 2.4%   |
| All Others           | N               | 6,145                   | 1,261             | 3,773        | 1,306             | 3,556                  | 700                 | 1,418                  | 18,158 |
|                      | % within region | 29.5%                   | 31.3%             | 29.2%        | 32.0%             | 35.6%                  | 25.2%               | 27.1%                  | 30.3%  |
| Total                | N               | 20,848                  | 4,029             | 12,940       | 4,081             | 10,000                 | 2,772               | 5,224                  | 59,893 |
|                      | % within region | 100%                    | 100%              | 100%         | 100%              | 100%                   | 100%                | 100%                   | 100%   |

### Top 10 Localities

Based on the reported horses living in cities or counties of Virginia, we list the top 10 localities in terms of the count of horses owned by testing owners and living in Virginia. Loudoun County has the highest numbers of horses (4,512) and takes about 7.5 percent of the population of horses owned by testing owners. Fauquier County has the second largest numbers of horses (3,975) and takes about 6.6 percent of the population. See Table III-4.

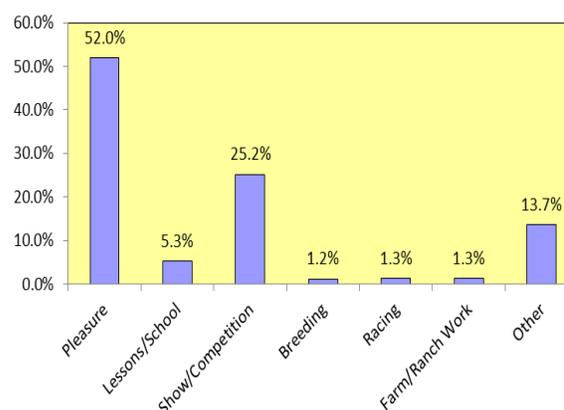
**Table III-4 Top 10 Localities**

|                       | Population Size | % of Total    |
|-----------------------|-----------------|---------------|
| Loudoun County        | 4,512           | 7.5%          |
| Fauquier County       | 3,975           | 6.6%          |
| Clarke County         | 2,455           | 4.1%          |
| Albemarle County      | 2,062           | 3.4%          |
| Culpeper County       | 1,557           | 2.6%          |
| Hanover County        | 1,560           | 2.6%          |
| Prince William County | 1,505           | 2.5%          |
| Washington County     | 1,528           | 2.5%          |
| Wythe County          | 1,475           | 2.5%          |
| Tazewell County       | 1,432           | 2.4%          |
| Other Counties        | 37,972          | 63.3%         |
| <b>Total</b>          | <b>60,032</b>   | <b>100.0%</b> |

### Primary Use of Horses

More than half (52.0%) of horses are used for pleasure, and about a quarter (25.2%) of horses are used for show or competition. See Figure III-3.

**Figure III-3: Primary use of horses**



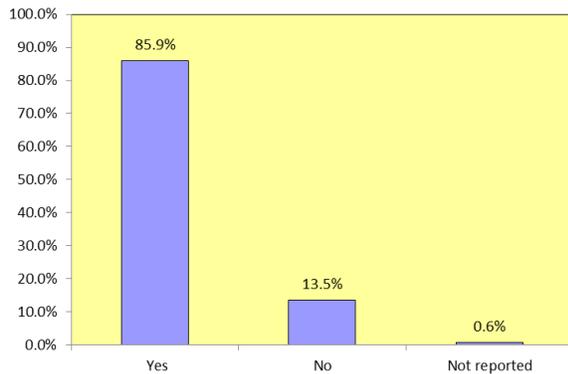
As seen in the crosstabulation by NASS region in Appendix B, 30.6 percent of the horses in the Northern region are show or competition horses, compared to only 11.2 percent in the Southern region. While nearly two thirds (66.1%) percent of Southern region horses are “pleasure” horses, less than half of Northern region horses (44.1%) are. Racing horses comprise 3.1 percent of Northern region horses, but are less than one percent in every other region. Horses described as for “breeding” or for farm or ranch work are most common in the Southwestern region.

### Coggins Test in 2014 and before

The survey estimates that about 85.9 percent of all horses owned by testing owners received a Coggins test in 2014. About 13.5 percent of horses owned by testing owners were untested. See Figure III-4.

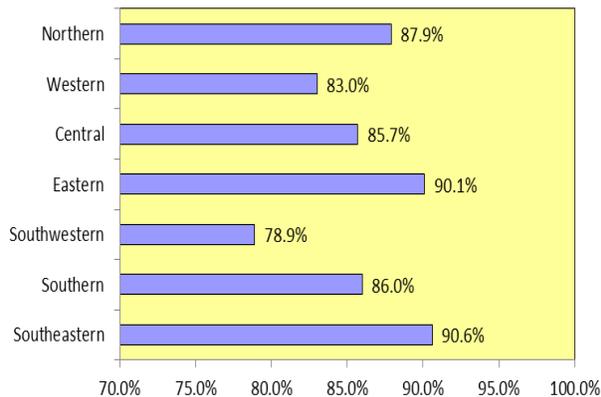
This weighted estimate of untested horses owned by testing owners serves as a bridge group for us to estimate characteristics of horses owned by non-testing owners presented later in this report. As described in Appendix E with results shown in Section V and Appendix C, we will assume in the projections that the horses of non-testing owners are similar in their characteristics to the untested horses owned by testing owners.

**Figure III-4: Did horse get a Coggins test in 2014**



When we examine the percentage of horses that received Coggins tests in 2014 by different NASS regions in Virginia, we find that the Southeastern region has the highest percent (90.6%) of horses who received a Coggins test in 2014, followed by the Northern region (87.9%), while the Southwestern region has the lowest percent (78.9%) of horses who got Coggins tested in 2014. See Figure III-5.

**Figure III-5: Percentage of horses that received a Coggins test in 2014, by NASS regions in Virginia**



In addition, there are about 92.6 percent of horses who received a Coggins test *before* 2014, among horses owned by testing owners. There were 4.7 percent of horses owned by testing owners that did not receive a Coggins test before 2014, and 2.8 percent have no response reported for this question on the horse roster.

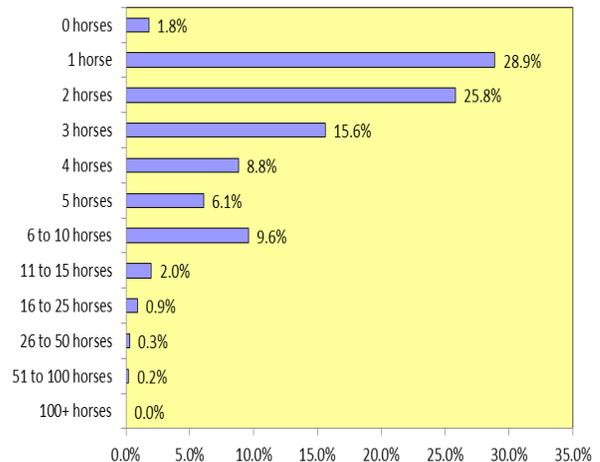
## Owners Dataset

There are 2,084 testing owners who participated in the survey and reported about their horses and their farms or properties. We weighted them using base weights and non-response weights and estimate that they represent about 20,475 testing owners in Virginia in total. (See Appendix E for details on the weights used.)

### Horses Owned

Most horse owners reported owning one horse (28.9%) or two horses (25.8%) in 2014. There are very few testing owners (less than 3.5%) owning more than 10 horses. See Figure III-6.

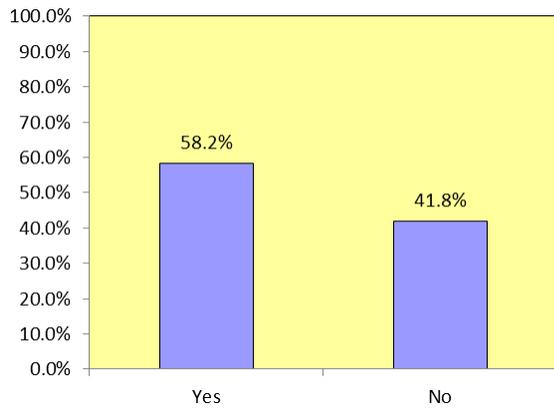
**Figure III-6: Number of Horses Owned in 2014**



### Land Use for Equine Operations

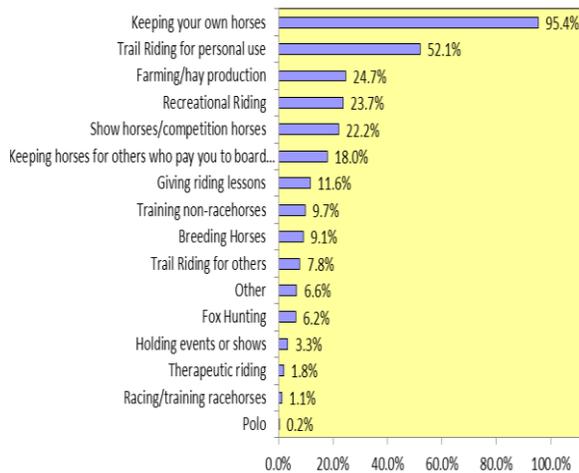
More than half (58.2%) of testing owners reported owning or renting land in Virginia for equine-related activities. See Figure III-7.

**Figure III-7: Own or rent land in Virginia for equine-related activities**



Among these testing owners who own or rent land for equine-related activities, the main use is keeping their own horses (95.1%). More than half (53.3%) of horse owners also use their land for personal trail riding. In addition, around a quarter of horse owners use their land for farming/hay production (25.2%), recreational riding (23.0%) and show/competition horses (22.7%). See Figure III-8.

**Figure III-8: Use of land for equine-related activities**



When examining reported land use across different NASS regions in Virginia, we find that besides keeping their own horses, Northern owners have the highest percentage using the land to keep horses for others who paid them to board (25.3%) and to keep show or competition horses (26.5%). Southwestern owners have the highest percentage (46.6%) using their land for farming/hay production. See Table III-5.

**Table III-5 Land Use for equine-related activities by NASS region in Virginia**

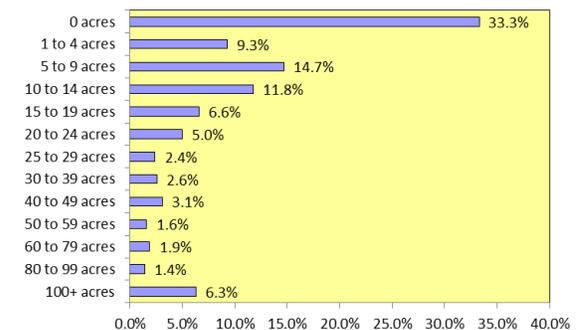
| Percentage of respondents indicating this use (respondents could give more than one answer) | NASS Region of Virginia |           |           |           |                |            |                |       |
|---|-------------------------|-----------|-----------|-----------|----------------|------------|----------------|-------|
|   | 1 Northern              | 2 Western | 3 Central | 4 Eastern | 5 Southwestern | 6 Southern | 7 Southeastern | Total |
| Keeping your own horses   | 96.8%                   | 95.4%     | 94.8%     | 95.2%     | 96.0%          | 97.6%      | 91.9%          | 95.4% |
| Keeping horses for others who pay you to board their horses                                 | 25.3%                   | 8.6%      | 19.7%     | 14.8%     | 9.7%           | 6.9%       | 19.5%          | 18.0% |
| Farming/hay production  | 18.3%                   | 29.3%     | 20.7%     | 13.8%     | 46.6%          | 22.9%      | 27.4%          | 24.7% |
| Giving riding lessons   | 15.5%                   | 7.1%      | 12.3%     | 9.8%      | 7.5%           | 9.9%       | 9.0%           | 11.6% |
| Breeding Horses   | 10.2%                   | 8.4%      | 7.0%      | 6.1%      | 13.2%          | 10.1%      | 4.4%           | 9.1%  |
| Trail Riding for personal use   | 50.3%                   | 35.7%     | 50.1%     | 47.6%     | 61.8%          | 61.6%      | 61.6%          | 52.1% |
| Trail Riding for others   | 6.4%                    | 5.9%      | 12.0%     | 12.1%     | 3.0%           | 5.2%       | 9.4%           | 7.8%  |
| Holding events or shows   | 1.2%                    | 2.0%      | 5.3%      | 3.7%      | 6.0%           | 3.2%       | 2.3%           | 3.3%  |
| Fox Hunting   | 10.2%                   | 10.1%     | 5.5%      | 1.0%      | 2.8%           | 1.6%       | 0.7%           | 6.2%  |
| Therapeutic riding  | 2.1%                    | 0.4%      | 2.8%      | 0.7%      | 1.2%           | 0.0%       | 2.0%           | 1.8%  |
| Recreational Riding   | 23.3%                   | 16.1%     | 26.5%     | 30.8%     | 18.2%          | 32.2%      | 22.0%          | 23.7% |
| Polo  | 0.6%                    | 0.0%      | 0.0%      | 0.0%      | 0.0%           | 0.0%       | 0.4%           | 0.2%  |
| Racing/training racehorses  | 2.0%                    | 0.5%      | 0.5%      | 1.9%      | 0.0%           | 0.0%       | 0.0%           | 1.1%  |
| Training non-racehorses   | 12.4%                   | 11.0%     | 10.6%     | 6.5%      | 6.4%           | 9.8%       | 4.6%           | 9.7%  |
| Show horses/competition horses  | 26.5%                   | 22.4%     | 21.9%     | 15.5%     | 24.4%          | 18.2%      | 11.4%          | 22.2% |
| Other   | 5.6%                    | 5.4%      | 5.8%      | 11.5%     | 4.2%           | 15.2%      | 7.4%           | 6.6%  |
| Total weighted N  | 3,680                   | 896       | 2,410     | 812       | 1,639          | 665        | 983            |       |

a. Percentages and totals are based on respondents

b. More than one answer was accepted. Therefore, percent of cases can add to more than 100.

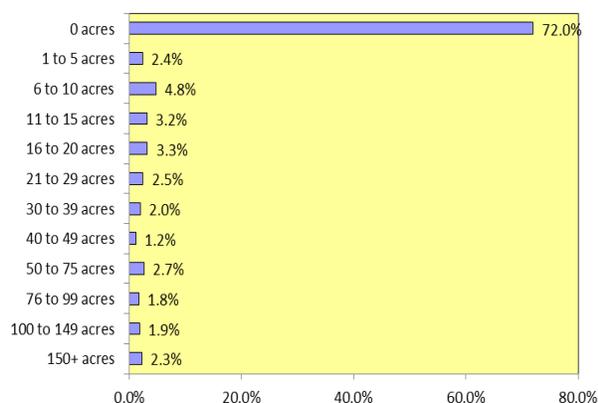
On average, owners have 23.7 acres of land in Virginia for equine use. The median is 5.1 acres. A third (33.3%) of owners do not own any acres of land in Virginia for equine use. About a quarter (26.5%) of respondents own between 5 and 14 acres. 6.3% of horse owners report owning more than 100 acres of land for equine use. See Figure III-9.

**Figure III-9: Acres of Land in Virginia**



On average, owners have 70.6 acres of land in Virginia that are in tax abatement or other tax programs. The median is 0 acre. A majority of owners (72%) do not have land in tax abatement or other tax programs. See Figure III-10.

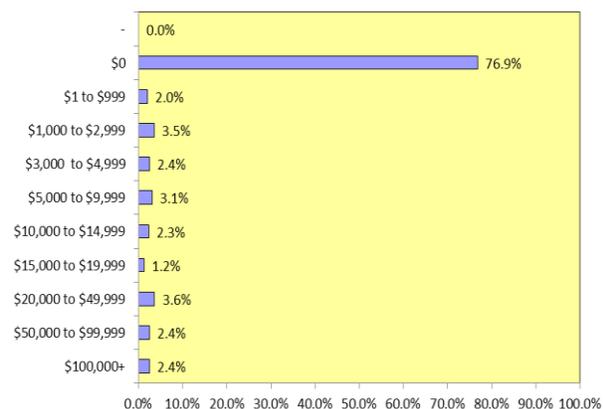
**Figure III-10: Acres of Land in Virginia that are in tax abatement or other tax programs**



### Gross annual revenues

On average, the approximate gross annual revenue of owners based on equine uses in Virginia is \$25,684; the median revenue is \$0. More than three-fourths (76.9%) of horse owners do not report earning any annual revenue from Virginia-based equine uses. See Figure III-11.

**Figure III-11: Gross Annual Revenues**

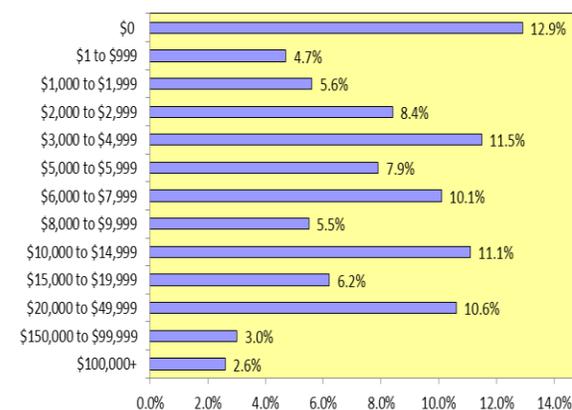


### Gross annual expenditures

On average, the approximate gross annual expenditure of owners for their equine uses in

Virginia is \$18,758, and the median is \$5,000. Of testing owners, 12.9 percent reported spending no money on Virginia-based equine uses annually, 11.5 percent of owners spend between \$3,000 and \$4,999 annually, 11.1 percent of owners spend between \$10,000 and \$14,999 annually, and 10.6 percent of owners spend between \$20,000 and \$49,999 annually. See Figure III-12.

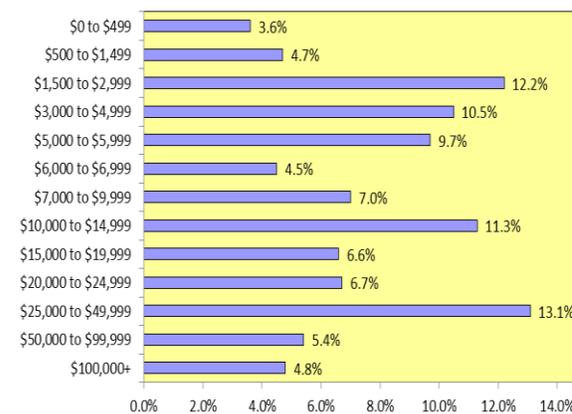
**Figure III-12: Gross Annual Expenditures**



### Value of Horses

On average, owners value their horses at \$27,868; the median is \$8,000. Thirteen percent of owners report the total value of their horses as being between \$25,000 and \$49,999. About a third (32.4 %) of owners report total values of horses between \$1,500 and \$6,999 and 11.3 percent of owners report total value between \$10,000 and \$14,999. See Figure III-13.

**Figure III-13: Total horse values**



Based on the reported number of horses owned by each testing owner and their total value of horses living in Virginia for 6 or more months, we calculate the average value of the individual horses. The unweighted average value per horse is \$10,446, based on 1,823 unweighted testing owners. After weighting by number of horses, base weights and the non-response rate, the weighted average value per horse is \$8,430 and the weighted median horse value is \$3,500 based on 57,577 weighted cases. When broken down by NASS regions, the Central region has the highest mean value of horses (\$12,001), and the Northern region has the second highest mean value (\$8,771) See Table III-6.

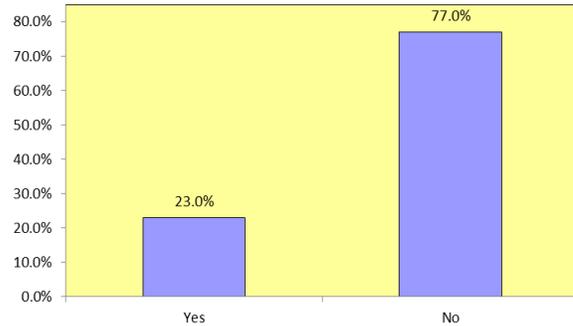
**Table III-6 Average value of horses by NASS region in Virginia**

| Region         | N     | Mean     | Median  |
|----------------|-------|----------|---------|
| 1 Northern     | 19407 | \$8,771  | \$4,500 |
| 2 Western      | 3466  | \$5,203  | \$2,500 |
| 3 Central      | 12981 | \$12,001 | \$4,000 |
| 4 Eastern      | 3620  | \$6,917  | \$3,000 |
| 5 Southwestern | 9586  | \$3,684  | \$2,000 |
| 6 Southern     | 2630  | \$3,368  | \$2,400 |
| 7 Southeastern | 4604  | \$6,518  | \$2,500 |

### Knowing Non-testing Owners

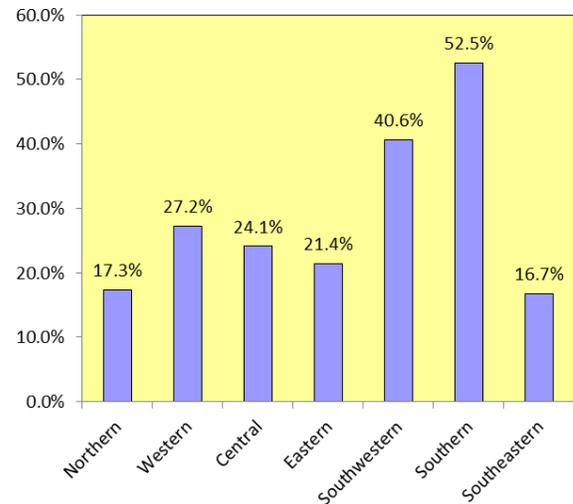
We asked the horse owners several questions that were aimed at helping us to estimate the Coggins testing rate in different parts of Virginia. More than three-fourths (77%) of testing owners report not personally knowing any horse owners in their area who had none of their horses get a Coggins test in 2014, while 23 percent of owners reported knowing some non-testing owners in their areas. See Figure III-14.

**Figure III-14: Do You Know Any Non-Testing Owners?**



When divided into NASS regions, more than half (52.5%) of owners from the Southern region reported knowing non-testing owners in their areas, compared to 40.6 percent of owners from the Southwestern region. Testing owners in the Northern (17.3%) and Southeastern (16.7%) regions were far less likely to know any non-testing owners. See Figure III-15.

**Figure III-15: Know Any Non-Testing Owners by NASS region in Virginia**

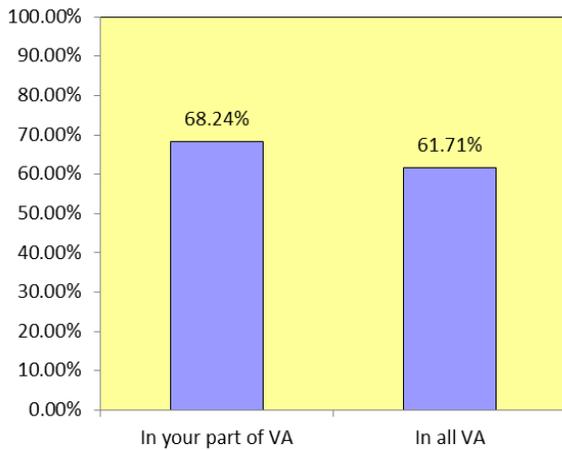


### Owner Estimates of Percentage of Horses Receiving Coggins Tests in 2014

On average, testing owners estimate that the average percentage of horses that have had Coggins tests in 2014 in their part of Virginia is 68.24%, while their estimate of the testing rate in all of Virginia is 61.71%. The testing owners

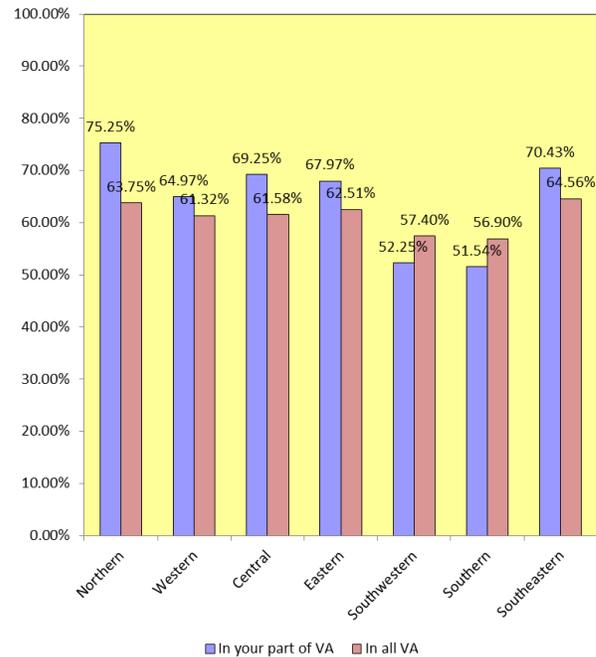
tend to estimate that a higher percentage of horses got Coggins tests in their own areas than in all of Virginia. See Figure III-16.

**Figure III-16: Estimated average percentages of horses receiving Coggins tests in 2014**



Testing owners in most NASS regions estimate that a higher percentage of horses in their part of Virginia received Coggins tests than in Virginia overall, except in the Southwestern and Southern regions. Owners from the Northern region have the highest average estimate (75.3%) of the percent of horses that got Coggins tests in 2014 in their part of Virginia, while their estimate for all Virginia is 63.8%. Owners from the Southern region have the lowest average estimate of the testing percentage (51.5%) in their part of Virginia, while their estimate for all Virginia is 56.9%, which is higher than their own area, but still the lowest compared to average estimates of the testing percentage in all Virginia as given by owners in other regions. See Figure III-17.

**Figure III-17: Estimated average percentages of horses receiving Coggins tests in 2014, by NASS region in Virginia**



## IV. Veterinarian Survey Results

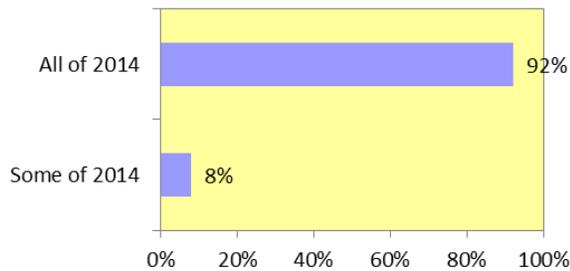
### Profile of Veterinarians

This section of the report presents general information from the 162 veterinarians who provided usable responses to the survey.

#### Practice in 2014

Among the 162 veterinarians, 92 percent reported practicing as a veterinarian in all of 2014, and the rest (8%) reported practicing in some of 2014. See Figure IV-1.

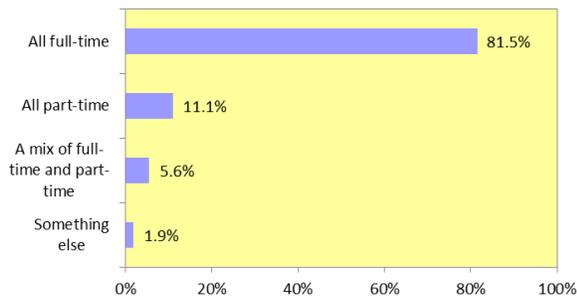
**Figure IV-1: Personal practice as a veterinarian in 2014**



#### Practice full/part time

A majority (81.5%) of veterinarians reported practicing all full-time in 2014, and 11.1 percent reported practicing all part-time in 2014, followed by a mix of full-time and part-time (5.6%) and something else (1.9%). See Figure IV-2.

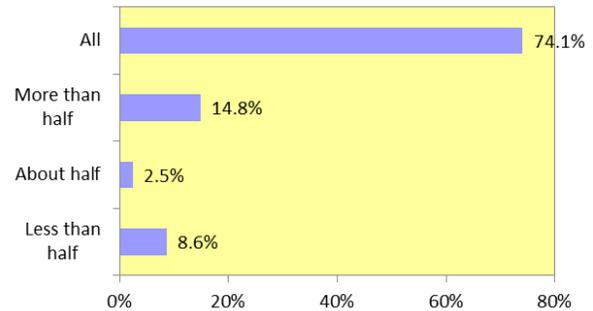
**Figure IV-2: Practice full time of not (for all/some of 2014)**



### Practice in Virginia

Almost three quarters (74.1%) of veterinarians reported practicing all in Virginia in 2014, 14.8 percent reported practicing more than half in Virginia in 2014, and the rest reported practicing about half (2.5%) and less than half (8.6%) in Virginia in 2014. See Figure IV-3.

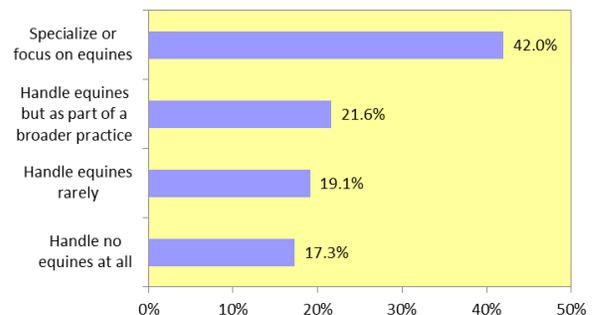
**Figure IV-3: Practice in Virginia in 2014**



### Specialization in equines

In the survey, 42 percent of veterinarians reported specializing or focusing on equines in their practice, 21.6 percent reported handling equines but as part of a broader practice, 19.1 percent reported handling equines rarely, and the rest (17.3%) reported handling no equines at all. See Figure IV-4.

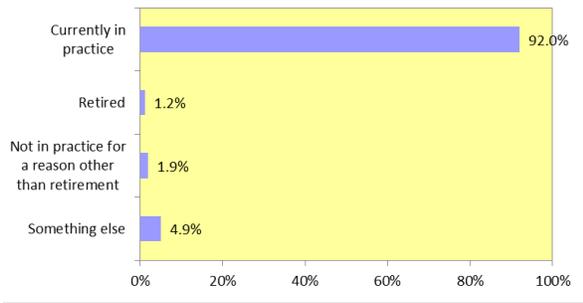
**Figure IV-4: Specialization in equines**



### Currently in practice

A majority (92%) of veterinarians were currently in practice, only a few were retired (1.2%), not in practice for a reason other than retirement (1.9%), or something else (4.9%). See Figure IV-5.

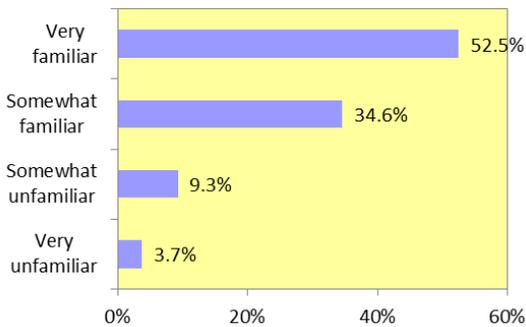
**Figure IV-5: Currently in practice or not**



**Familiarity with equine health issues**

Among the 162 veterinarians, more than half (52.5%) reported very familiar with equine health issues, about a third (34.6%) reported somewhat familiar, 9.3 percent reported somewhat unfamiliar and 3.7 percent reported very unfamiliar with equine health issues. See Figure IV-6.

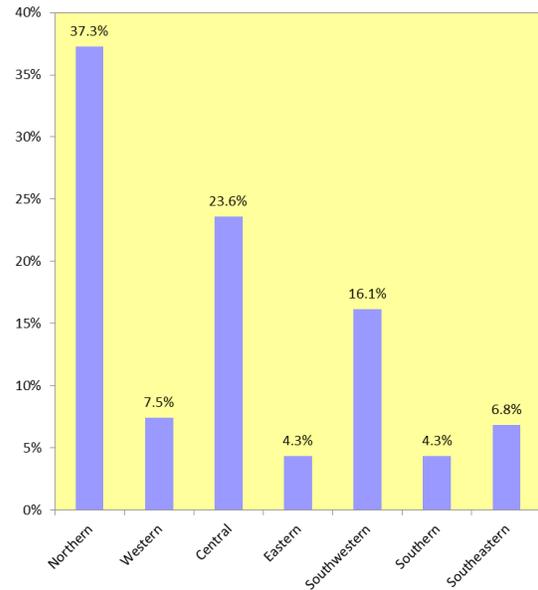
**Figure IV-6: Familiarity with equine health issues**



**Region of practice (NASS region)**

More than a third (37.3%) of veterinarians practice in Northern area of Virginia, 23.6 percent in Central Virginia, 16.1 percent in Southwestern Virginia, followed by Western (7.5%), Southeastern (6.8%), Eastern (4.3%) and Southern (4.3%). See Figure IV-7.

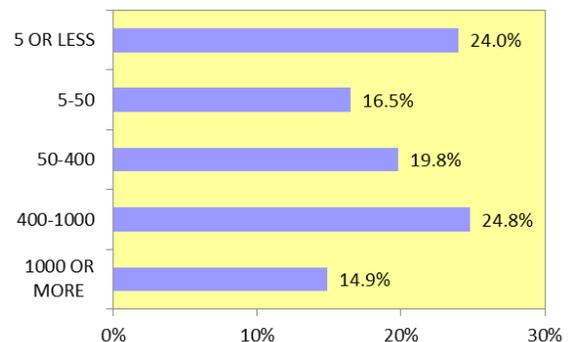
**Figure IV-7: Region of practice (conforms to NASS 2007 report)**



**Number of horses treated in Virginia 2014**

Among 162 veterinarians, 121 reported on the number of horses they treated in personal practice in Virginia in 2014. About a quarter (24%) of veterinarians treated 5 horses or less, 16.5 percent treated 5 to 50 horses, 19.8 percent treated 50 to 400 horses, 24.8 percent treated 400 to 1000 horses, and 14.9 percent treated 1000 horses or more. See Figure IV-8.

**Figure IV-8: Number of horses treated in personal practice in VA 2014**



## Construction of Expertise Indexes for Estimation

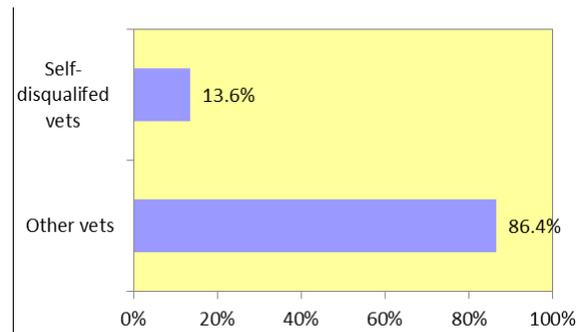
Some questions in the veterinarian survey asked the respondents to estimate the percentage of horses receiving Coggins tests in the respondent’s practice area and in Virginia as a whole, and the percentage of horse owners that had all, some or none of their horses tested. These questions were not easy to answer, but we anticipated that some crude estimates from the veterinarians – and the relationships among those estimates – would be helpful for us to project the horse numbers in Virginia.

However, the veterinarians provided a very wide range of estimates based on their own practice areas and experiences. In order to narrow down the ranges, we created two indexes of expertise to screen out less experienced or less confident veterinarians from these estimates. While we were very thankful to all veterinarians who responded to our survey and attempted these difficult questions, some of our statistical analyses performed better when some of the responses were temporarily set aside.

The two expertise indexes were constructed based on the seven profile variables of veterinarians we provided in the previous section plus the last question on the survey (Q22), which asked veterinarians to add any information or comments that they thought might be helpful for the survey. We used Q22 because some veterinarians said they did not feel they were experienced enough to provide good estimates of these numbers.

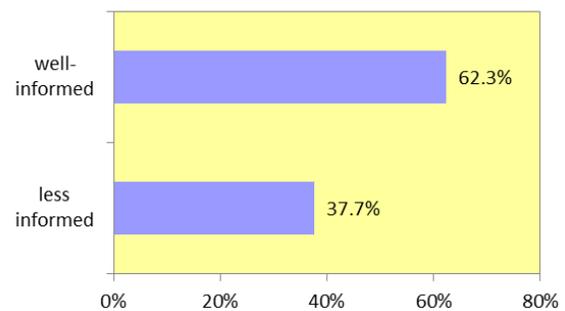
First, we created a binary variable UNEXPERIENCED in which 13.6% of veterinarians disqualified themselves in their responses to Q22. See Figure IV-9.

**Figure IV-9: UNEXPERIENCED (self-qualification in Q22)**



The first expertise index excluded cases who did not practice in 2014 (value 3 of Q1), answered “something else” when asked if they were in full-time practice or not (value 4 of Q2), handled no equines at all (value 4 of Q4), were not currently in practice or “something else” (value 3 and 4 of Q5), were somewhat unfamiliar or very unfamiliar with equine health issues (value 3 and 4 of Q6), treated fewer than five horses in personal practice in Virginia 2014 (Q16<5), or disqualified themselves in Q22 (value 1 of UNEXPERIENCED). The first index was called “nonexpert1” with 101 (62.3%) well-informed veterinarians and 61 (37.7%) less-informed veterinarians. See Figure IV-10.

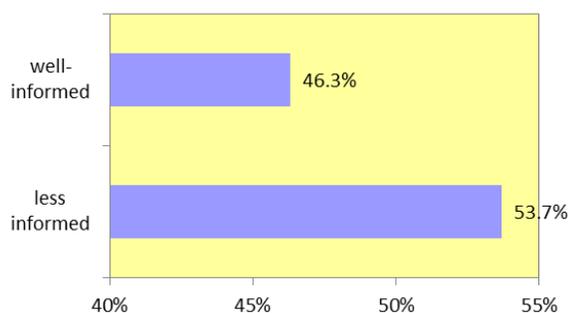
**Figure IV-10: Expertise of veterinarians for estimating numbers of tested horses and testing owners (Nonexpert1)**



The second expertise index was constructed with stricter standards. It excluded cases who did not practice or practiced for only some of 2014 (value 2 and 3 of Q1), “something else” when asked if they were in full-time practice or not (value 4 of Q2), did less than half of their practice in Virginia 2014 (value 4 of Q3), handled equines rarely or handled no equines at

all (value 3 and 4 of Q4), were retired, not currently in practice or something else (value 2, 3 and 4 of Q5), were somewhat unfamiliar or very unfamiliar with equine health issues (value 3 and 4 of Q6), treated less than five horses in personal practice in Virginia 2014 (Q16<5), or disqualified themselves in Q22 (value 1 of UNEXPERIENCED). The second index was called “nonexpert2” with 75 (46.3%) well-informed veterinarians and 87 (53.7%) less-informed veterinarians. See Figure IV-11.

**Figure IV-11: Expertise of veterinarians for estimating numbers of tested horses and testing owners (Nonexpert2)**



After constructing the two indexes, we selected cases based on them respectively and made frequency and crosstab (estimation by NASS region) analyses for later questions that estimated the percent of horses got Coggins tests in their practice area and Virginia as a whole. By comparing the estimated results of selected cases based on the two indexes with results based on all cases, we found that the frequency results of nonexpert1 and nonexpert2 did not differ much from all cases, but the crosstab results demonstrated significant regional differences. For example, Q11 of our survey asked about the estimated percentage of horses in the veterinarian’s Virginia practice area receiving Coggins tests in 2014. The mean estimate was 60.2% for all cases, 60.9% for cases selected on nonexpert1, and 60.6% for cases selected on nonexpert2. See Table IV-1. The results of nonexpert1 and nonexpert2 did not differ much from the results based on all cases, and from each other.

**Table IV-1 Estimated percentage of HORSES in Virginia practice area receiving Coggins tests in 2014**

|            | Mean  | Valid N | Missing |
|------------|-------|---------|---------|
| All cases  | 60.2% | 146     | 15      |
| Nonexpert1 | 60.9% | 97      | 4       |
| Nonexpert2 | 60.6% | 72      | 3       |

However, the crosstab results of Q11 by NASS region demonstrated more differences between all cases, and cases selected on nonexpert1 or nonexpert2. The Western region showed a lower mean for cases selected on nonexpert2 (37.0%) than for nonexpert1 (43.6%) and all cases (41.5%). The Eastern region had the same mean (52.5%) for nonexpert1 and nonexpert2, but this was higher than the mean based on all cases (46.7%). The Southwestern region also had a higher mean in nonexpert1 (49.1%) and nonexpert2 (49.6%) than the mean based on all cases (45.0%). The Southern region had a higher mean with cases selected on nonexpert2 (72.5%) than on nonexpert1 (67.5%) and all cases (67.1%). The Southern region had a lower mean on nonexpert1 (62.5%) and a higher mean on nonexpert2 (65%) compared to all cases (63.2%). See Table IV-2.

**Table IV-2 Estimated percentage of HORSES in Virginia practice area receiving Coggins tests in 2014 by NASS Region**

| Region         |      | All cases | Non-expert1 | Non-expert2 |
|----------------|------|-----------|-------------|-------------|
| 1 Northern     | Mean | 73.2%     | 72.4%       | 72.6%       |
|                | N    | 51        | 34          | 27          |
| 2 Western      | Mean | 41.5%     | 43.6%       | 37.0%       |
|                | N    | 10        | 7           | 5           |
| 3 Central      | Mean | 56.3%     | 56.6%       | 55.4%       |
|                | N    | 36        | 25          | 17          |
| 4 Eastern      | Mean | 46.7%     | 52.5%       | 52.5%       |
|                | N    | 6         | 4           | 4           |
| 5 Southwestern | Mean | 45.0%     | 49.1%       | 49.6%       |
|                | N    | 24        | 16          | 12          |
| 6 Southern     | Mean | 67.1%     | 67.5%       | 72.5%       |
|                | N    | 7         | 4           | 2           |
| 7 Southeastern | Mean | 63.2%     | 62.5%       | 65.0%       |
|                | N    | 11        | 6           | 5           |
| Total          | Mean | 60.0%     | 60.6%       | 60.6%       |
|                | N    | 145       | 96          | 72          |

We judged nonexpert2 to provide better estimates for each region. Therefore, the results reported from here on are based on the subset of cases classified as knowledgeable using the nonexpert2 variable.

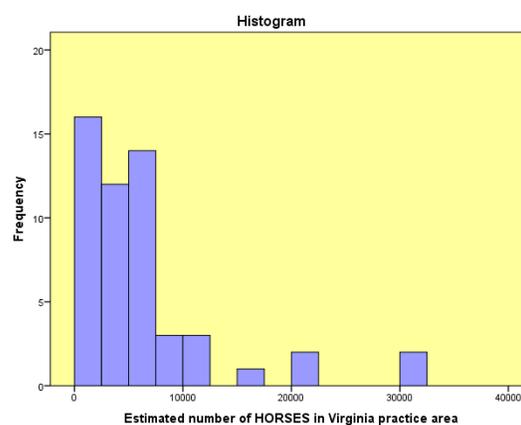
## Estimation based on Well-informed Veterinarians

### *Estimated number of horses in Virginia practice area*

The estimated number of horses in Virginia practice area of the veterinarians ranged from 200 to 30,000, and the mean was 5,628, median was 4,000. See Table IV-3 and Figure IV-12 for general distribution.

**Table IV-3 Estimated number of HORSES in Virginia practice area (well-informed vets)**

| N              | Valid   | 53     |
|----------------|---------|--------|
|                | Missing | 22     |
| Mean           |         | 5,628  |
| Median         |         | 4,000  |
| Std. Deviation |         | 6,461  |
| Minimum        |         | 200    |
| Maximum        |         | 30,000 |

**Figure IV-12: Estimated number of HORSES in Virginia practice area**

Differentiated by NASS regions, veterinarians from the Northern region had the highest estimated mean (10,406) number of horses, while the Southern region had the lowest (1,550). See Table IV-4.

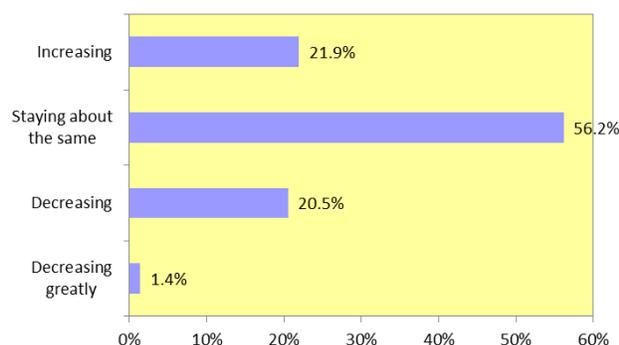
**Table IV-4 Estimated number of HORSES in Virginia practice area by NASS region**

| Region         | Mean   | N of vets estimating |
|----------------|--------|----------------------|
| 1 Northern     | 10,406 | 16                   |
| 2 Western      | 4,125  | 4                    |
| 3 Central      | 4,831  | 13                   |
| 4 Eastern      | 2,125  | 4                    |
| 5 Southwestern | 2,582  | 11                   |
| 6 Southern     | 1,550  | 2                    |
| 7 Southeastern | 4,167  | 3                    |
| Total          | 5,628  | 53                   |

### Estimated trend in the number of horses in Virginia practice area

More than half of veterinarians reported that the number of horses in their practice area in Virginia stayed about the same (56.2%), 21.9 percent of veterinarians reported increasing horse numbers, 20.5 percent reported decreasing, and only 1.4 percent reported decreasing greatly. See Figure IV-13.

**Figure IV-13: Estimated trend of the number of HORSES in Virginia practice area**



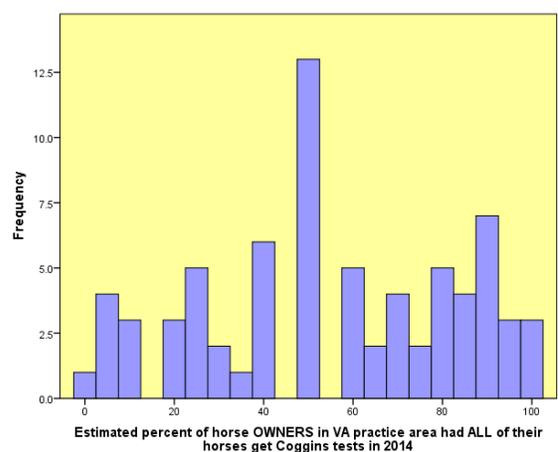
### Estimated percentage of horse OWNERS in Virginia practice area who had ALL/SOME/NONE of their horses get Coggins tests in 2014

On average, veterinarians estimated that about 55.3 percent of horse owners in their practice area in Virginia had ALL of their horses get Coggins tests in 2014, 25.6 percent of horse owners had SOME of their horses get Coggins tests, and 19.1 percent of horse owners had NONE of their horses get Coggins tests in 2014. See Table IV-5 for estimated mean and median, and see Figure IV-14, Figure IV-15, and Figure IV-16 for their general distributions.

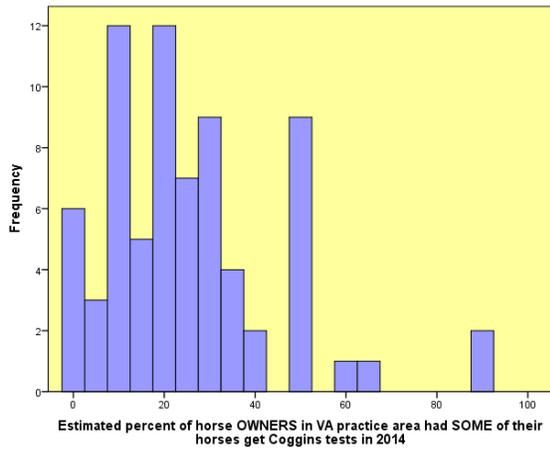
**Table IV-5 Estimated percent of horse OWNERS in vet’s practice area who had ALL/SOME/NONE of their horses get Coggins tests in 2014**

|           | OWNERS in practice area who had ALL of their horses tested | OWNERS in practice area who had SOME of their horses tested | OWNERS in practice area who had NONE of their horses tested |
|-----------|--|---|---|
| N Valid   | 73   | 73  | 73  |
| Missing   | 2  | 2   | 2   |
| Mean      | 55.3%  | 25.6%   | 19.1%   |
| Median    | 50.0%  | 20.0%   | 10.0%   |
| Std. Dev. | 28.58  | 19.19   | 19.51   |
| Minimum   | 0.0%   | 0.0%  | 0.0%  |
| Maximum   | 100.0%   | 90.0%   | 85.0%   |

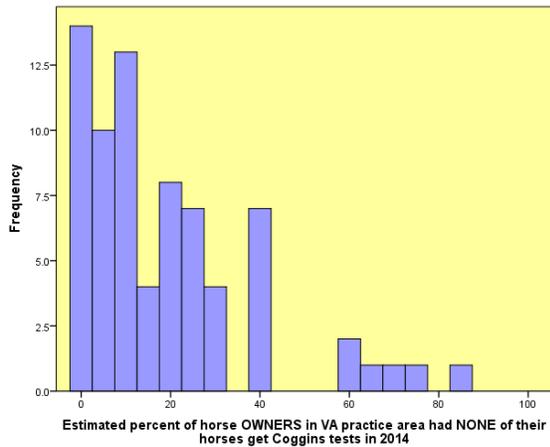
**Figure IV-14: Estimated percent of horse OWNERS in vet’s practice area who had ALL of their horses get Coggins tests in 2014**



**Figure IV-15: Estimated percent of horse OWNERS in vet’s practice area who had SOME of their horses get Coggins tests in 2014**



**Figure IV-16: Estimated percent of horse OWNERS in vet’s practice area who had NONE of their horses get Coggins tests in 2014**



When we differentiated the estimation by NASS regions, we saw large regional variations. Veterinarians from the Northern, Southern and Southeastern regions estimated that more than 60 percent of horse owners in their practice areas had all of their horses get Coggins tests in 2014 (N-64.6%, S-70%, SE-67%), and less than 13 percent of horse owners in their practice areas had none of their horses tested (N-12%, S-12.5%, SE-9%). At the same time, veterinarians from Western, Central, Eastern, Southwestern regions estimated that half or less than half of horse owners in their practice areas had all of

their horses tested in 2014 (W-38%, C-50%, E-47.5%, SW-45%), and more than 22 percent of horse owners in their practice areas had none of their horses tested (W-29%, C-22.8%, E 26.3%, SW-27.7%). See Table IV-6.

**Table IV-6 Estimated percent of horse OWNERS in vet’s practice area who had ALL/SOME/NONE of their horses get Coggins tests in 2014 by NASS regions**

| Region         |      | OWNERS in practice area who had ALL of their horses tested | OWNERS in practice area who had SOME of their horses tested | OWNERS in practice area who had NONE of their horses tested |
|----------------|------|--|---|---|
| <b>1 North</b> | Mean | 64.6%  | 23.0%   | 12.0%   |
|                | N    | 27   | 27  | 27  |
| <b>2 West</b>  | Mean | 38.0%  | 33.0%   | 29.0%   |
|                | N    | 5  | 5   | 5   |
| <b>3 Cent.</b> | Mean | 50.0%  | 27.2%   | 22.8%   |
|                | N    | 17   | 17  | 17  |
| <b>4 East</b>  | Mean | 47.5%  | 26.3%   | 26.3%   |
|                | N    | 4  | 4   | 4   |
| <b>5 SW</b>    | Mean | 45.0%  | 26.9%   | 27.7%   |
|                | N    | 13   | 13  | 13  |
| <b>6 South</b> | Mean | 70.0%  | 17.5%   | 12.5%   |
|                | N    | 2  | 2   | 2   |
| <b>7 SE</b>    | Mean | 67.0%  | 26.0%   | 9.0%  |
|                | N    | 5  | 5   | 5   |
| <b>Total</b>   | Mean | 55.3%  | 25.6%   | 19.1%   |
|                | N    | 73   | 73  | 73  |

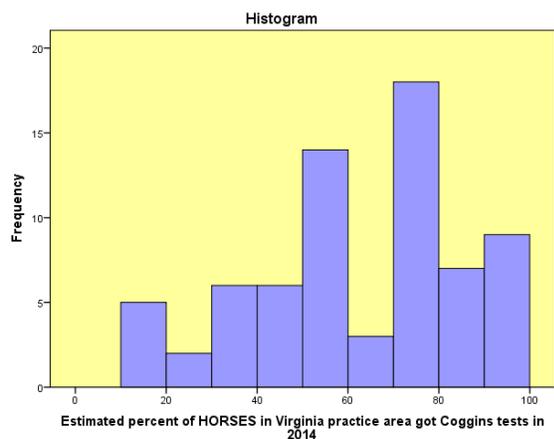
### *Estimated percentage of horses in Virginia practice area receiving Coggins tests in 2014*

On average, veterinarians estimated that 60.6 percent of horses in their practice areas in Virginia got Coggins tests in 2014. The median was 67.5 percent. See Table IV-7 for detailed information and Figure IV-17 for general distribution.

**Table IV-7 Estimated percent of HORSES in Virginia practice area got Coggins tests in 2014**

| N              | Valid   | 72     |
|----------------|---------|--------|
|                | Missing | 3      |
| Mean           |         | 60.6%  |
| Median         |         | 67.5%  |
| Std. Deviation |         | 23.84  |
| Minimum        |         | 10.0%  |
| Maximum        |         | 100.0% |

**Figure IV-17: Estimated percentage of HORSES in Virginia practice area got Coggins tests in 2014**



When we differentiated the estimation by NASS regions, there were also big regional differences. In Northern (72.6%) and Southern (72.5%) regions, veterinarians had the highest estimated percent of horses in Virginia practice area who got Coggins tests in 2014. In Central (55.4%), Eastern (52.5%), and Southeastern (65%) regions, veterinarians estimated that more than

half of horses got Coggins tests in their practice areas. In Western (37%) and Southwestern (49.6%) regions, veterinarians estimated that less than half of horses got Coggins tests in 2014 in their practice areas in Virginia. See Table IV-8.

**Table IV-8 Estimated percentage of HORSES in Virginia practice area got Coggins tests in 2014 by NASS regions**

| Region         | Mean  | N  |
|----------------|-------|----|
| 1 Northern     | 72.6% | 27 |
| 2 Western      | 37.0% | 5  |
| 3 Central      | 55.4% | 17 |
| 4 Eastern      | 52.5% | 4  |
| 5 Southwestern | 49.6% | 12 |
| 6 Southern     | 72.5% | 2  |
| 7 Southeastern | 65.0% | 5  |
| Total          | 60.6% | 72 |

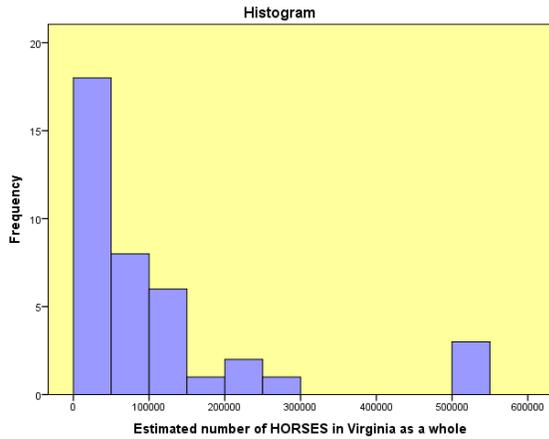
### *Estimated number of horses in Virginia as a whole*

Veterinarians' estimation of horse numbers in Virginia as a whole ranged from 7,000 to 500,000; the mean was 95,513 and the median was 50,000. See Table IV-9 and Figure IV-18 for general distribution.

**Table IV-9 Estimated number of HORSES in Virginia as a whole**

| N              | Valid   | 39      |
|----------------|---------|---------|
|                | Missing | 36      |
| Mean           |         | 95,513  |
| Median         |         | 50,000  |
| Std. Deviation |         | 131,647 |
| Minimum        |         | 7,000   |
| Maximum        |         | 500,000 |

**Figure IV-18: Estimated number of HORSES in Virginia as a whole**



Differentiated by NASS regions, veterinarians from Western (116,667), Central (161,500), and Southwestern (116,667) regions had higher estimated mean of horse numbers in Virginia as a whole compared to veterinarians from Northern (52,909), Eastern (14,333) and Southeastern (28,333) regions. No expert veterinarians in the Southern region answered this question. See Table IV-10.

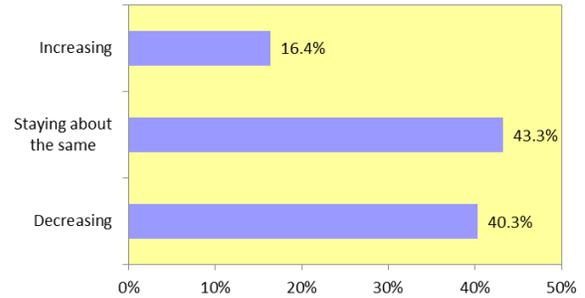
**Table IV-10 Estimated number of HORSES in Virginia as a whole by NASS regions**

| Region         | Mean          | N         |
|----------------|---------------|-----------|
| 1 Northern     | 52,909        | 11        |
| 2 Western      | 116,667       | 3         |
| 3 Central      | 161,500       | 10        |
| 4 Eastern      | 14,333        | 3         |
| 5 Southwestern | 116,667       | 9         |
| 7 Southeastern | 28,333        | 3         |
| <b>Total</b>   | <b>95,513</b> | <b>39</b> |

*Estimated trend of the number of horses in Virginia as a whole*

About 16 percent of veterinarians estimated that the number of horses in Virginia as a whole is increasing, 43.3 percent estimated it is staying about the same, and 40.3 percent estimated it is decreasing. See Figure IV-19.

**Figure IV-19: Estimated trend of the number of HORSES in Virginia as a whole**



*Estimated percentage of horse OWNERS in Virginia as a whole who had ALL/SOME/NONE of their horses get Coggins tests in 2014*

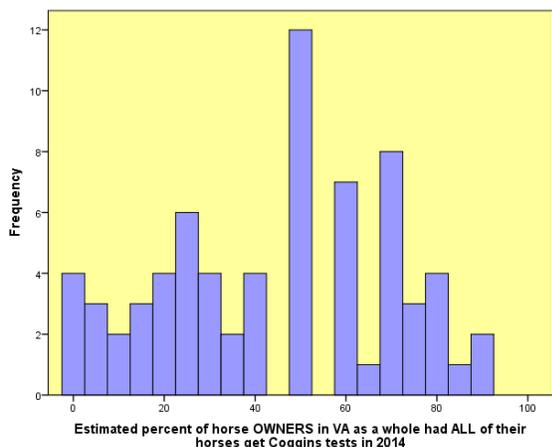
On average, veterinarians estimated that about 44.5 percent of horse owners in Virginia as a whole had ALL of their horses get Coggins tests in 2014, 28.7 percent of horse owners had SOME of their horses get Coggins tests, and 23.8 percent of horse owners had NONE of their horses get Coggins tests in 2014. See Table IV-11 for estimated means and medians, and see Figure IV-20, Figure IV-21, and Figure IV-22 for their general distributions.

**Table IV-11 Estimated percent of horse OWNERS in VA as a whole had ALL/SOME/NONE of their horses get Coggins tests in 2014**

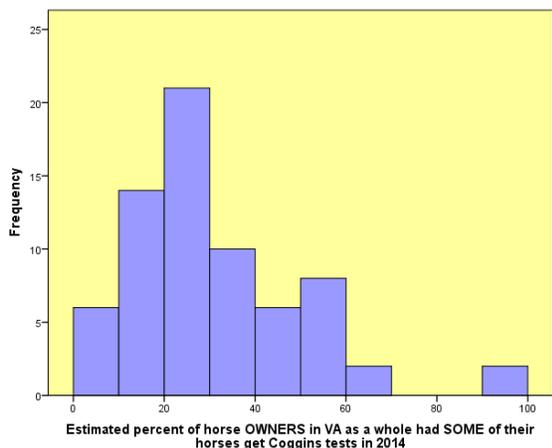
| Region  | OWNERS statewide who had ALL of their horses tested | OWNERS statewide who had SOME of their horses tested | OWNERS statewide who had NONE of their horses tested |
|---------|---|--|--|
| N Valid | 70  | 70   | 70   |
| Missing | 5   | 5  | 5  |
| Mean    | 44.5%   | 28.7%  | 23.8%  |
| Median  | 50.0%   | 25.0%  | 22.5%  |

|           |       |        |       |
|-----------|-------|--------|-------|
| Std. Dev. | 25.44 | 20.23  | 18.12 |
| Minimum   | 0.0%  | 0.0%   | 0.0%  |
| Maximum   | 90.0% | 100.0% | 80.0% |

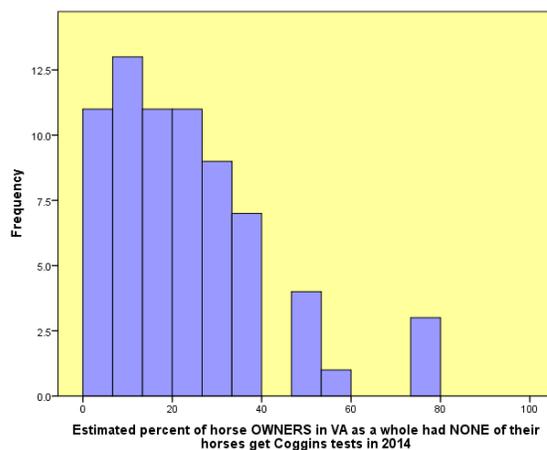
**Figure IV-20: Estimated percent of horse OWNERS in VA as a whole had ALL of their horses get Coggins tests in 2014**



**Figure IV-21: Estimated percentage of horse OWNERS in VA as a whole had SOME of their horses get Coggins tests in 2014**



**Figure IV-22: Estimated percentage of horse OWNERS in VA as a whole had NONE of their horses get Coggins tests in 2014**



When we differentiated the estimations by NASS regions, we saw some regional variations, but not as large as the estimations in veterinarians’ practice areas. Veterinarians from Southeastern region estimated that more than half (55%) of horse owners in Virginia as a whole had all of their horses get Coggins tests in 2014, and 19 percent of horse owners in Virginia as a whole had none of their horses tested. Veterinarians from the Northern, Central, Southwestern, and Southern regions estimated more than 40 percent of horse owners in Virginia as a whole had all of their horses get Coggins tests in 2014 (N-49.8, C-40.9%, SW-42.3%). Veterinarians from the rest of the regions estimated that less than 40 percent of horse owners in Virginia as a whole had all of their horses tested (W-38.8%, E-33.8%, S-30%). Veterinarians from the Western, Eastern, and Southwestern regions estimated that more than 30 percent of horse owners in Virginia as a whole had none of their horses tested (W-30%, E-33.8%, SW-31.5%). See Table IV-12.

**Table IV-12 Estimated percentage of horse OWNERS in VA as a whole had ALL/SOME/NONE of their horses get Coggins tests in 2014 by NASS regions**

| Region     |      | OWNERS  | OWNERS   | OWNERS   |
|------------|------|---|--|--|
|            |      | statewide<br>who had<br>ALL of<br>their<br>horses<br>tested | statewide<br>who had<br>SOME of<br>their<br>horses<br>tested | statewide<br>who had<br>NONE of<br>their<br>horses<br>tested |
| 1<br>North | Mean | 49.8%   | 31.1%  | 18.7%  |
|            | N    | 25  | 25   | 25   |
| 2<br>West  | Mean | 38.8%   | 31.3%  | 30.0%  |
|            | N    | 4   | 4  | 4  |
| 3<br>Cent. | Mean | 40.9%   | 28.8%  | 24.4%  |
|            | N    | 17  | 17   | 17   |
| 4<br>East  | Mean | 33.8%   | 32.5%  | 33.8%  |
|            | N    | 4   | 4  | 4  |
| 5<br>SW    | Mean | 42.3%   | 26.2%  | 31.5%  |
|            | N    | 13  | 13   | 13   |
| 6<br>South | Mean | 30.0%   | 10.0%  | 10.0%  |
|            | N    | 2   | 2  | 2  |
| 7<br>SE    | Mean | 55.0%   | 26.0%  | 19.0%  |
|            | N    | 5   | 5  | 5  |
| Total      | Mean | 44.5%   | 28.7%  | 23.8%  |
|            | N    | 70  | 70   | 70   |

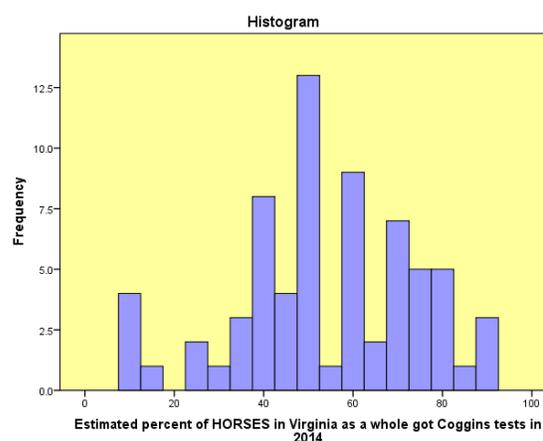
**Estimated percentage of horses in Virginia as a whole receiving Coggins tests in 2014**

On average, veterinarians estimated that more than half (54.1%) of horses in Virginia as a whole got Coggins tests in 2014, and the median is 50 percent. See Table IV-13 and Figure IV-23 for general distribution.

**Table IV-13 Estimated percent of HORSES in Virginia as a whole got Coggins tests in 2014**

|                |         |       |
|----------------|---------|-------|
| N              | Valid   | 69    |
|                | Missing | 6     |
| Mean           |         | 54.1% |
| Median         |         | 50.0% |
| Std. Deviation |         | 20.06 |
| Minimum        |         | 10.0% |
| Maximum        |         | 90.0% |

**Figure IV-23: Estimated percent of HORSES in Virginia as a whole got Coggins tests in 2014**



When we differentiated the estimation by NASS regions, there were some regional differences. In the Northern (62.8%) and Southern (60%) regions, veterinarians estimated that more than 60 percent of horses in Virginia as a whole got Coggins tests in 2014. In the Central (49.6%), Eastern (47.5%), Southwestern (49.8%), and Southeastern (54%) regions, veterinarians estimated that about half of horses in Virginia as a whole got tested. In Western region, veterinarians estimated 36.3 percent of horses in Virginia as a whole got tested. See Table IV-14.

**Table IV-14 Estimated percent of HORSES in Virginia as a whole got Coggins tests in 2014 by NASS regions**

| <b>Region</b>         | <b>Mean</b> | <b>N</b> |
|-----------------------|-------------|----------|
| <b>1 Northern</b>     | 62.8%       | 25       |
| <b>2 Western</b>      | 36.3%       | 4        |
| <b>3 Central</b>      | 49.6%       | 17       |
| <b>4 Eastern</b>      | 47.5%       | 4        |
| <b>5 Southwestern</b> | 49.8%       | 12       |
| <b>6 Southern</b>     | 60.0%       | 2        |
| <b>7 Southeastern</b> | 54.0%       | 5        |
| <b>Total</b>          | 54.1%       | 69       |

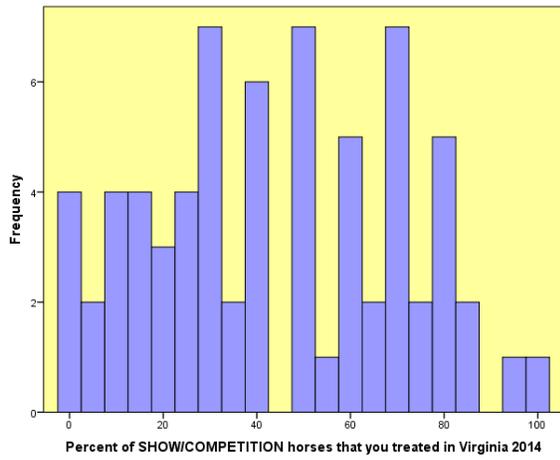
**Percentage of types of horses that a veterinarian treated in Virginia 2014**

On average, among all horses a veterinarian treated in 2014, there were about 44 percent show/competition horses, 12.6 percent farm/breeding/agritourism (petting zoos, pony rides, etc.) horses, 33.1 percent retired, rescue, or non-commercial used (but available for recreational riding) horses, and 10.4 percent other types of horses. See Table IV-15 for means and medians, Figure IV-24, Figure IV-25, Figure IV-26, and Figure IV-27 for their general distributions.

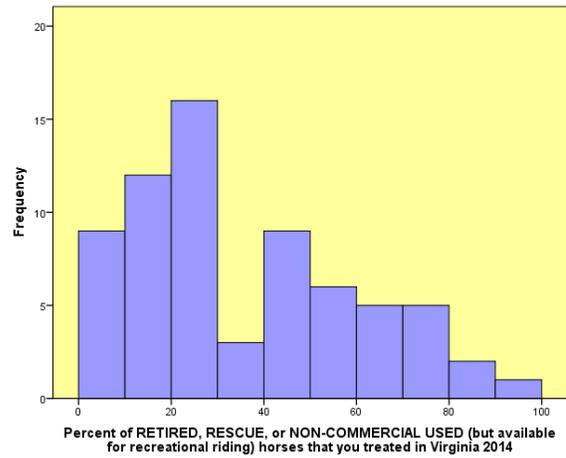
**Table IV-15 Percent of types of horses that a veterinarian treated in Virginia 2014**

|                | <b>SHOW/<br/>COMPETITION<br/>horses</b> | <b>FARM/ BREEDING/<br/>AGRITOURISM (petting<br/>zoos, pony rides, etc.)<br/>horses</b> | <b>RETIRED, RESCUE,<br/>NON-COMMERCIAL<br/>USE (but available for<br/>recreational riding)<br/>horses</b> | <b>OTHER TYPES<br/>of horses</b> |
|----------------|---|--|---|----------------------------------|
| N              | Valid 69                                | 69   | 69  | 68                               |
|                | Missing 6                               | 6  | 6   | 7                                |
| Mean           | 44.0%                                   | 12.6%  | 33.1%   | 10.4%                            |
| Median         | 40.0%                                   | 10.0%  | 25.0%   | 6.5%                             |
| Std. Deviation | 26.57                                   | 15.83  | 25.25   | 14.30                            |
| Minimum        | 0.0%                                    | 0.0%   | 0.0%  | 0.0%                             |
| Maximum        | 100.0%                                  | 80.0%  | 100.0%  | 90.0%                            |

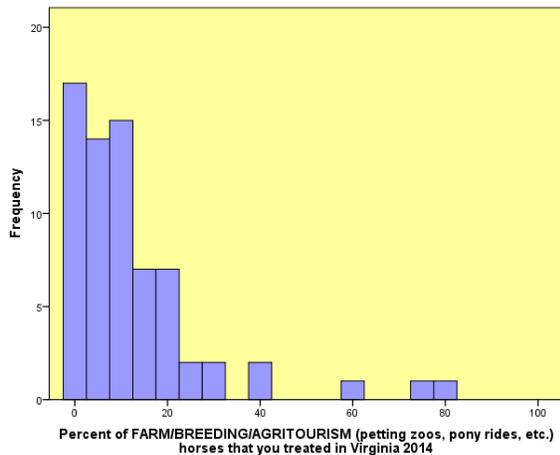
**Figure IV-24: Percentage of SHOW/COMPETITION horses that a veterinarian treated in Virginia 2014**



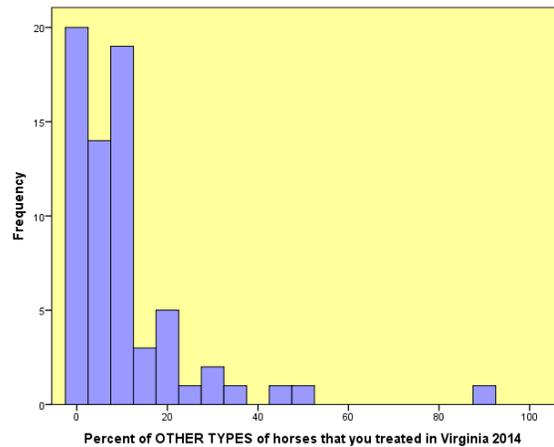
**Figure IV-26: Percentage of RETIRED, RESCUE, or NON-COMMERCIAL USED (but available for recreational riding) horses that a veterinarian treated in Virginia 2014**



**Figure IV-25: Percentage of FARM/BREEDING/AGRITOURISM (petting zoos, pony rides, etc.) horses that a veterinarian treated in Virginia 2014**



**Figure IV-27: Percentage of OTHER TYPES of horses that a veterinarian treated in Virginia 2014**



Differentiated by NASS regions, we saw large regional differences in the types of horses veterinarians mostly treated in 2014. For example, in the Northern region, veterinarians reported that more than half (54.2%) of horses they treated were show/competition horses, 12.7 percent were farming/breeding/agritourism horses and 25.4 percent were retired, rescue or non-commercial use horses. In the Western region, however, veterinarians treated 29.3 percent show/competition horses, 23.8 percent farming/breeding/agritourism horses and 41.3

percent retired, rescue or non-commercial use horses. In the Central and Southeastern regions, veterinarians treated about 45 percent of show/completion horses, and more than 30 percent retired, rescue or non-commercial used horses. See Table IV-16 for more information.

**Table IV-16 Percentage of types of horses that a veterinarian treated in Virginia 2014 by NASS regions**

| Region                |      | SHOW/<br>COMPETITION<br>horses | FARM/ BREEDING/<br>AGRITOURISM<br>(petting zoos, pony<br>rides, etc.) horses | RETIRE, RESCUE,<br>NON-  | OTHER<br>TYPES<br>of horses |
|-----------------------|------|--------------------------------|--|--|-----------------------------|
|                       |      |                                |  | COMMERCIAL USE<br>(but available for<br>recreational riding)<br>horses |                             |
| <b>1 Northern</b>     | Mean | 54.2%                          | 12.7%  | 25.4%  | 7.7%                        |
|                       | N    | 24                             | 24   | 24   | 24                          |
| <b>2 Western</b>      | Mean | 29.3%                          | 23.8%  | 41.3%  | 5.8%                        |
|                       | N    | 4                              | 4  | 4  | 4                           |
| <b>3 Central</b>      | Mean | 45.3%                          | 10.9%  | 31.4%  | 12.4%                       |
|                       | N    | 17                             | 17   | 17   | 17                          |
| <b>4 Eastern</b>      | Mean | 26.5%                          | 7.8%   | 24.5%  | 41.3%                       |
|                       | N    | 4                              | 4  | 4  | 4                           |
| <b>5 Southwestern</b> | Mean | 35.1%                          | 12.4%  | 46.5%  | 6.5%                        |
|                       | N    | 13                             | 13   | 13   | 12                          |
| <b>6 Southern</b>     | Mean | 30.0%                          | 10.0%  | 50.0%  | 10.0%                       |
|                       | N    | 2                              | 2  | 2  | 2                           |
| <b>7 Southeastern</b> | Mean | 45.0%                          | 15.0%  | 35.0%  | 5.0%                        |
|                       | N    | 5                              | 5  | 5  | 5                           |
| <b>Total</b>          | Mean | 44.0%                          | 12.6%  | 33.1%  | 10.4%                       |
|                       | N    | 69                             | 69   | 69   | 68                          |

***Percentage of different types of horses that a veterinarian treated in Virginia 2014 got a Coggins test in 2014***

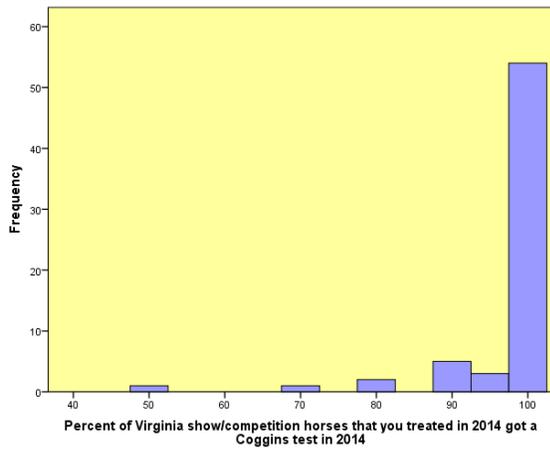
The percentage of horses receiving a Coggins test was closely related to the function of the horses. On average, among the horses treated by a veterinarian in 2014, 97.2 percent of show/competition horses got a Coggins test;

66.4 percent of farm/breeding/agritourism horses got a Coggins test; 45.7 percent of retired, rescue or non-commercial used horses got a Coggins test; and 41.4 percent of other types of horses got a Coggins test. See Table IV-17 for estimated means and medians, and see Figure IV-28, Figure IV-29, Figure IV-30, and Figure IV-31 for general distributions.

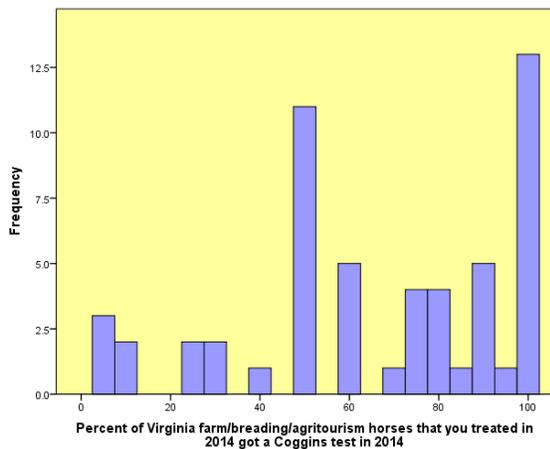
**Table IV-17 Percentage of different types of horses that a veterinarian treated in Virginia 2014 got a Coggins test in 2014**

|                |         | Percent of<br>Virginia<br>show/competition<br>horses that you<br>treated in 2014<br>that got a Coggins<br>test in 2014 | Percent of Virginia<br>farm/breeding/agritourism<br>horses that you treated in<br>2014 that got a Coggins<br>test in 2014 | Percent of<br>Virginia retired,<br>rescue, or non-<br>commercial used<br>(but available for<br>recreational<br>riding) horses that<br>you treated in<br>2014 that got a<br>Coggins test in<br>2014 | Percent of<br>Virginia Other<br>types of horses<br>that you treated<br>in Virginia 2014<br>that got a Coggins<br>test in 2014 |
|----------------|---------|--|---|--|---|
| N              | Valid   | 66   | 55  | 65   | 49  |
|                | Missing | 9  | 20  | 10   | 26  |
| Mean           |         | 97.2%  | 66.4%   | 45.7%  | 41.4%   |
| Median         |         | 100.0%   | 75.0%   | 50.0%  | 30.0%   |
| Std. Deviation |         | 8.08   | 29.57   | 26.61  | 33.67   |
| Minimum        |         | 50.0%  | 5.0%  | 0.0%   | 0.0%  |
| Maximum        |         | 100.0%   | 100.0%  | 100.0%   | 100.0%  |

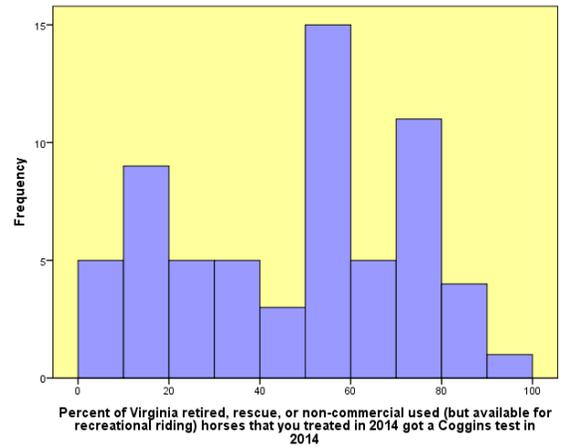
**Figure IV-28: Percentage of Virginia show/competition horses that you treated in 2014 that got a Coggins test in 2014**



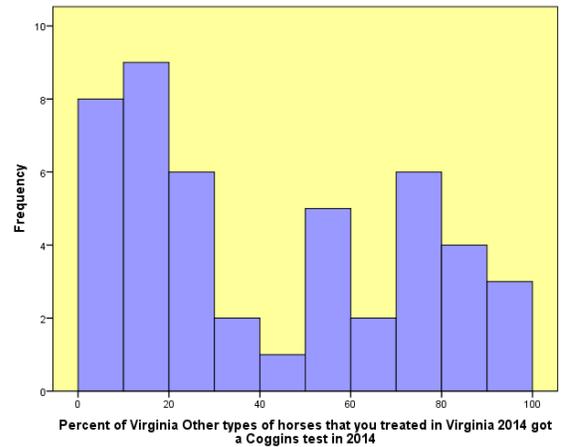
**Figure IV-29: Percentage of Virginia farm/breeding/agritourism horses that you treated in 2014 that got a Coggins test in 2014**



**Figure IV-30: Percentage of Virginia retired, rescue, or non-commercial used (but available for recreational riding) horses that you treated in 2014 that got a Coggins test in 2014**



**Figure IV-31: Percentage of Virginia Other types of horses that you treated in Virginia 2014 that got a Coggins test in 2014**



Differentiated by NASS regions, we could see some regional differences. In all of the regions, more than 90 percent of show/competition horses treated by veterinarians got a Coggins test in 2014. There were more regional differences for farm/breeding/agritourism horses. In the Northern (70.6%) and Southeastern regions (82.5%), more than 70 percent of farm/breeding/agritourism horses treated by veterinarians got a Coggins test, while in the Western region, only 35 percent got a Coggins test. The rest of the regions ranged from 55

percent (Southern) to 68.5 percent (Central). For the retired, rescue, or non-commercial used horses, the percentage of treated horses got a Coggins tests ranged from 39.1 percent (Central) to 52.5 percent (Southeastern). See Table IV-18 for more information.

## Assessing the Veterinarian Survey

The survey of Virginia veterinarians provides some insights and data that are useful to our task of estimating the numbers and types of horses that are owned by non-testing owners. The survey confirms that some regions of Virginia have higher rates of Coggins testing than others, and also suggests how testing rates differ according to the main purpose for which the horse is kept.

However, the range of veterinarian estimates of testing rates and of owners who are non-testing owners vary quite widely. The estimates (based

on means across vets from each region) may thus not be as accurate as we hoped. When we screened vets according to their level of expertise, the estimates still varied quite widely. In addition, the screening reduced the number of vets reporting to low counts in some regions. When the number of respondents is low, the possibility of sampling error is increased. In addition, it is possible that veterinarians are not aware of horses in their practice regions who are not regularly seen by a veterinarian.

Taking these factors into account, we used the veterinarian survey results as just one source of data for estimating the Coggins testing rate and the counts of horses owned by non-testing owners. Our method for generating those estimates is described in more detail in Appendix E.

**Table IV-18 Percentage of different types of horses that a veterinarian treated in Virginia 2014 got a Coggins test in 2014 by NASS regions**

| Region                |      | Percent of Virginia show/competition horses that you treated in that got a Coggins test | Percent of Virginia farm/breeding/agritourism horses that you treated in 2014 that got a Coggins test | Percent of Virginia retired, rescue, or non-commercial use (but available for recreational riding) horses that you treated in 2014 that got a Coggins test | Percent of Virginia Other types of horses that you treated in Virginia 2014 that got a Coggins test |
|-----------------------|------|---|---|--|---|
| <b>1 Northern</b>     | Mean | 98.0%   | 70.6%   | 47.5%  | 57.5%   |
|                       | N    | 23  | 18  | 22   | 16  |
| <b>2 Western</b>      | Mean | 95.0%   | 35.0%   | 50.0%  | 17.0%   |
|                       | N    | 4   | 3   | 4  | 3   |
| <b>3 Central</b>      | Mean | 98.8%   | 68.5%   | 39.1%  | 30.4%   |
|                       | N    | 16  | 13  | 16   | 13  |
| <b>4 Eastern</b>      | Mean | 92.5%   | 57.5%   | 40.0%  | 45.0%   |
|                       | N    | 4   | 4   | 4  | 4   |
| <b>5 Southwestern</b> | Mean | 94.4%   | 65.4%   | 49.8%  | 29.3%   |
|                       | N    | 12  | 11  | 13   | 7   |
| <b>6 Southern</b>     | Mean | 100.0%  | 55.0%   | 42.5%  | 50.0%   |
|                       | N    | 2   | 2   | 2  | 2   |
| <b>7 Southeastern</b> | Mean | 99.0%   | 82.5%   | 52.5%  | 45.0%   |
|                       | N    | 5   | 4   | 4  | 4   |
| <b>Total</b>          | Mean | 97.2%   | 66.4%   | 45.7%  | 41.4%   |
|                       | N    | 66  | 55  | 65   | 49  |

## V. Projections

### Projected Data and Confidence Intervals

This section of the report presents horse data weighted to represent all horses in Virginia, including young horses and horses owned by non-testing owners. Note that since the survey uses a sample, it provides estimates and confidence intervals at 95% confidence level – it is not a census (complete count). These results represent a projection based on the results of the survey of testing owners, accomplished by applying weights to the data to compensate for the under-representation of very young horses in the data, and to expand the counts of untested horses to account for the fact that owners who did not test any of their horses for EIA in 2014 were excluded from the sampling frame for the survey. These weights were applied to the results based on the horse-roster data. (No adjustment of the owner data to represent non-testing owners was attempted.) For details on the methods used to weight the horse data and the assumptions upon which the weights were based, see Appendix E.

### Horse Dataset

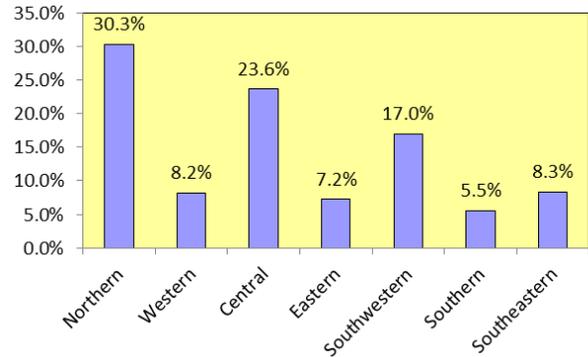
#### Virginia Horse Estimation

Based on the horse file, we estimate that 159,390 horses lived in Virginia for 6 months or more in 2014, while 4,569 did not. When we filter out the non-Virginian horses as well as horses whose first reported breed are donkey/mule, we estimate that 151,484 horses in total lived in Virginia for 6 months or more in 2014.<sup>10</sup> This excludes wild horses. This projection represents all horses owned by testing and non-testing owners in Virginia.

When breaking it down to seven NASS regions, Northern region has the highest percent of horses (30.3%), Central has 23.6 percent, and Southwestern has 17 percent. Southern has the

lowest percent (5.5%) of horses among the seven regions. See Figure V-1.

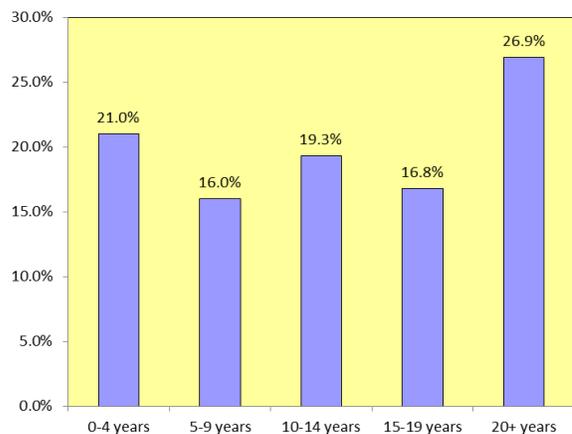
**Figure V-1: Horse estimation by NASS regions**



### Age Group

After weighted for young horses and horses owned by non-testing owners, most horses are more than 20 years old (26.9%) and 0 to 4 years old (21%). Horses aged between 10 to 14 years old take 19.3 percent of the total horse number. 5 to 9 years old horses are about 16 percent, and 15-19 years old horses are about 16.8 percent of total horse number. See Figure V-2.

**Figure V-2: Age groups of horses**



When the age groups break down into NASS regions of Virginia, we find that Central (23.7%) and Southwestern (22.6%) regions have higher percent of young horses aged 0-4 years old compared to other regions. Southwestern region

<sup>10</sup> The confidence interval ranges from 141,457 to 161,510 at the 95% level of confidence. For more details of the table, please refer to Appendix C, item VirginiaYN.

has the highest percent (20.9%) of horses aged 5-9 years old compared to other regions. The Eastern region has the highest percent (22.6%) of horses aged 10-14 years old, and Southern region has the highest percent (22.9%) of horses aged 15-19 years old. The Eastern (35.2%), Southern (33.8%) and Western (30.8%) regions

have relatively higher percent of horses aged more than 20 years old compared to the other regions. See Table V-1 for more details.

**Table V-1 Age groups of horses by NASS region of Virginia**

| Horse age group |                 | NASS Region of Virginia |           |              |           |         |            |         | Total   |
|-----------------|-----------------|-------------------------|-----------|--------------|-----------|---------|------------|---------|---------|
|                 |                 | 1<br>North              | 2<br>West | 3<br>Central | 4<br>East | 5<br>SW | 6<br>South | 7<br>SE |         |
| 0-4<br>years    | N               | 8,841                   | 2,704     | 8,250        | 1,880     | 5,766   | 1,116      | 2,306   | 30,862  |
|                 | % within region | 20.6%                   | 21.9%     | 23.7%        | 17.6%     | 22.6%   | 13.5%      | 18.9%   | 21.0%   |
| 5-9<br>years    | N               | 7,112                   | 1,819     | 4,717        | 1,291     | 5,311   | 1,090      | 2,012   | 23,351  |
|                 | % within region | 16.5%                   | 14.7%     | 13.5%        | 12.1%     | 20.9%   | 13.2%      | 16.4%   | 15.9%   |
| 10-14<br>years  | N               | 8,938                   | 2,179     | 5,791        | 2,406     | 5,378   | 1,372      | 2,220   | 28,284  |
|                 | % within region | 20.8%                   | 17.7%     | 16.6%        | 22.6%     | 21.1%   | 16.6%      | 18.2%   | 19.3%   |
| 15-19<br>years  | N               | 6,564                   | 1,831     | 6,761        | 1,340     | 4,050   | 1,893      | 2,295   | 24,734  |
|                 | % within region | 15.3%                   | 14.8%     | 19.4%        | 12.6%     | 15.9%   | 22.9%      | 18.8%   | 16.9%   |
| 20+<br>years    | N               | 11,522                  | 3,802     | 9,326        | 3,752     | 4,960   | 2,799      | 3,398   | 39,558  |
|                 | % within region | 26.8%                   | 30.8%     | 26.8%        | 35.2%     | 19.5%   | 33.8%      | 27.8%   | 26.9%   |
| Total           | N               | 42,977                  | 12,334    | 34,845       | 10,668    | 25,464  | 8,269      | 12,232  | 146,789 |
|                 | % within region | 100.0%                  | 100.0%    | 100.0%       | 100.0%    | 100.0%  | 100.0%     | 100.0%  | 100.0%  |

### ***Top10 Horse Breeds***

Based on the first reported horse breed of horses, we list the top 10 horse breeds in Virginia. Thoroughbred (14.2%) and Quarter Horse (13.3%) are the top two horse breeds. See Table V-2.

**Table V-2 Top10 Horse breeds**

|                                | <b>N</b> | <b>% of Total</b> |
|--------------------------------|----------|-------------------|
| <b>Thoroughbred</b>            | 21,542   | 14.2%             |
| <b>Quarter Horse</b>           | 20,211   | 13.3%             |
| <b>Tennessee Walking Horse</b> | 13,377   | 8.8%              |
| <b>Warmblood</b>               | 12,764   | 8.4%              |
| <b>Arabian</b>                 | 7,394    | 4.9%              |
| <b>Paint</b>                   | 7,438    | 4.9%              |
| <b>Pony</b>                    | 7,278    | 4.8%              |
| <b>Miniature</b>               | 6,883    | 4.5%              |
| <b>Other Gaited</b>            | 4,763    | 3.1%              |
| <b>Appaloosa</b>               | 4,133    | 2.7%              |
| <b>Other</b>                   | 45,699   | 30.2%             |
| <b>Total</b>                   | 151,484  | 100.0%            |

When we break down the top 10 horse breeds into seven NASS regions in Virginia, it shows that the Northern region has highest percent of Thoroughbred (23.6%) and Warmblood (12.2%) horses compared to other regions. The Southwestern region has more Quarter Horses (23.8%) and the Southeastern region has relatively more (20.3%) Tennessee Walking horses compared to other regions. See Table V-3.

**Table V-3 Top10 Horse breeds by NASS regions**

| First breed reported    |                 | 1<br>North | 2<br>West | 3<br>Cent. | 4<br>East | 5<br>SW | 6<br>South | 7<br>SE | Total   |
|-------------------------|-----------------|------------|-----------|------------|-----------|---------|------------|---------|---------|
| Thoroughbred            | N               | 10,818     | 1,354     | 5,917      | 1,469     | 398     | 576        | 1,010   | 21,542  |
|                         | % within region | 23.6%      | 11.0%     | 16.6%      | 13.6%     | 1.5%    | 7.0%       | 8.0%    | 14.2%   |
| Quarter Horse           | N               | 4,058      | 1,312     | 3,953      | 1,162     | 6,126   | 1,567      | 2,033   | 20,211  |
|                         | % within region | 8.8%       | 10.6%     | 11.1%      | 10.7%     | 23.8%   | 18.9%      | 16.2%   | 13.4%   |
| Tennessee Walking Horse | N               | 2,073      | 995       | 2,322      | 601       | 3,730   | 1,095      | 2,561   | 13,377  |
|                         | % within region | 4.5%       | 8.1%      | 6.5%       | 5.5%      | 14.5%   | 13.2%      | 20.3%   | 8.8%    |
| Warmblood               | N               | 5,609      | 1,087     | 3,430      | 772       | 477     | 273        | 1,002   | 12,650  |
|                         | % within region | 12.2%      | 8.8%      | 9.6%       | 7.1%      | 1.9%    | 3.3%       | 8.0%    | 8.4%    |
| Arabian                 | N               | 1,193      | 1,343     | 2,191      | 398       | 1,199   | 287        | 763     | 7,375   |
|                         | % within region | 2.6%       | 10.9%     | 6.1%       | 3.7%      | 4.7%    | 3.5%       | 6.1%    | 4.9%    |
| Paint                   | N               | 1,409      | 919       | 1,132      | 741       | 2,028   | 538        | 672     | 7,438   |
|                         | % within region | 3.1%       | 7.4%      | 3.2%       | 6.8%      | 7.9%    | 6.5%       | 5.3%    | 4.9%    |
| Pony                    | N               | 2,766      | 400       | 2,208      | 450       | 912     | 287        | 256     | 7,278   |
|                         | % within region | 6.0%       | 3.2%      | 6.2%       | 4.2%      | 3.5%    | 3.5%       | 2.0%    | 4.8%    |
| Miniature               | N               | 1,068      | 907       | 1,688      | 1,719     | 568     | 644        | 289     | 6,883   |
|                         | % within region | 2.3%       | 7.3%      | 4.7%       | 15.9%     | 2.2%    | 7.8%       | 2.3%    | 4.5%    |
| Other Gaited            | N               | 1,062      | 398       | 590        | 605       | 711     | 925        | 472     | 4,763   |
|                         | % within region | 2.3%       | 3.2%      | 1.7%       | 5.6%      | 2.8%    | 11.2%      | 3.7%    | 3.1%    |
| Appaloosa               | N               | 680        | 375       | 1,249      | 46        | 675     | 523        | 568     | 4,116   |
|                         | % within region | 1.5%       | 3.0%      | 3.5%       | 0.4%      | 2.6%    | 6.3%       | 4.5%    | 2.7%    |
| Other                   | N               | 15,122     | 3,253     | 10,966     | 2,871     | 8,933   | 1,574      | 2,962   | 45,681  |
|                         | % within region | 33.0%      | 26.4%     | 30.8%      | 26.5%     | 34.7%   | 19.0%      | 23.5%   | 30.2%   |
| Total                   | N               | 45,859     | 12,342    | 35,645     | 10,834    | 25,757  | 8,290      | 12,588  | 151,315 |
|                         | % within region | 100%       | 100%      | 100%       | 100%      | 100%    | 100%       | 100%    | 100%    |

### Top 10 Localities

Based on the weighted horses lived in cities or counties of Virginia, we list the top 10 localities of horses lived in Virginia. Loudoun County has highest numbers of horses lived (9,165) and takes about 6.1 percent of the population of horses in Virginia. Fauquier County has the second largest numbers of horses (8,116) and takes about 5.4 percent of the population. See Table V-4.

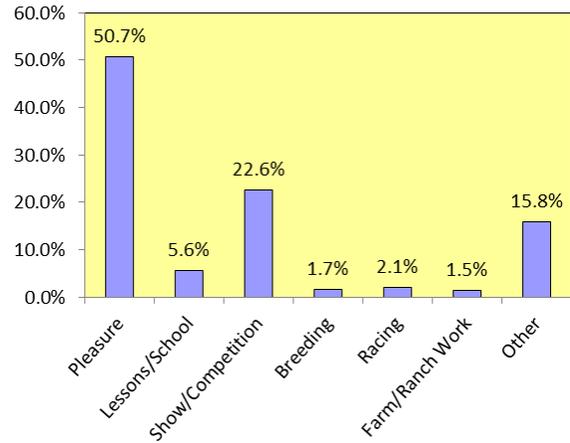
**Table V-4 Top10 Localities**

|                  | N              | % of Total    |
|------------------|----------------|---------------|
| Loudoun County   | 9,165          | 6.1%          |
| Fauquier County  | 8,116          | 5.4%          |
| Clarke County    | 6,211          | 4.1%          |
| Albemarle County | 5,479          | 3.6%          |
| Wythe County     | 4,983          | 3.3%          |
| Hanover County   | 4,948          | 3.3%          |
| Tazewell County  | 4,352          | 2.9%          |
| Bedford County   | 4,239          | 2.8%          |
| Augusta County   | 3,220          | 2.1%          |
| Pulaski County   | 3,133          | 2.1%          |
| Other Counties   | 97,638         | 64.5%         |
| <b>Total</b>     | <b>151,484</b> | <b>100.0%</b> |

### Primary Use of Horses

About half (50.7%) of horses are used for pleasure, and 22.6 percent of horses are used for show or competition. See Figure V-3.

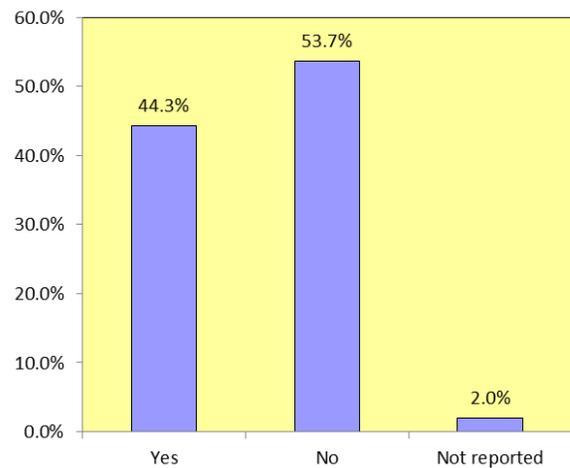
**Figure V-3: Primary use of horses**



### Coggins Test in 2014 and before

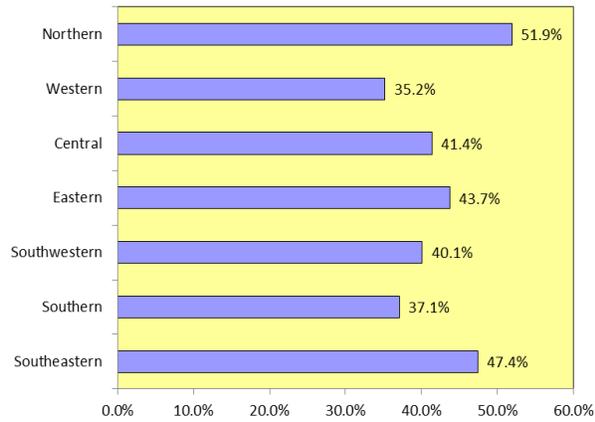
The estimation of horses that got Coggins tested in 2014 is about 44.3 percent of all horses in Virginia. There are about 53.7 percent of untested horses in Virginia. See Figure V-4.

**Figure V-4: Did horse get a Coggins test in 2014**



When we examine the percent of horses that got Coggins tests in 2014 by different NASS regions in Virginia, we find that the Northern region has the highest percent (51.9%) of horses that got a Coggins test in 2014, followed by the Southeastern region (47.4%), while the Western region has the lowest percent (35.2%) of horses that got a Coggins test in 2014. See Figure V-5.

**Figure V-5: Percent of horse got a Coggins test in 2014 by NASS regions in Virginia**



In addition, there are about 78.5 percent of horses that got a Coggins test before 2014 in Virginia, 17.5 percent of horses that did not get a Coggins test before 2014 in Virginia, and 4.1 percent whose status was not reported.

## VI. Value and Limitations of the Study

Unlike other agricultural outputs, the value of the horse industry cannot be measured by acres in cultivation, crop yields or sales of harvested food and fiber. Regardless of the techniques used to measure its impact, the horse industry is an important economic and social enterprise. Any attempt to understand its impact rests on a sound estimate of the number of horses in a given area. As noted in the introduction to this report, it is difficult to make such estimates, and different approaches serving different research needs can produce very different numbers.

The purpose of this study was to create a sound estimate of the number of horses living in Virginia by age, breed and locality. The proposed research plan was informed by the understanding that the available resources would not allow for areal techniques to be used. We knew that the strategy of using the Coggins test records would give us an efficient way to produce a very sound estimate of tested horses (the data found in Appendix B), but the projection of those data to include untested horses would be more speculative (the data found in Appendix C).

The probability sample used to estimate Coggins-tested horses does rely on some key assumptions. Primarily, we assumed that the GVL electronic records completely covered all Coggins tests stored electronically and that the paper records completely covered all Coggins test results stored on paper. We also assumed that non-respondents to the survey are like those who did respond.

Given these assumptions, the survey of testing owners provides a very sound estimate at the state level. When the numbers for tested horses are broken down for small localities there are larger sampling errors, as reflected in the confidence intervals for those estimates. In general, we are more confident in the percentages than we are in the counts.

The total statewide projections including untested horses estimate that 151,484 horses live in Virginia, with a range of 141,457 to 161,510 at the 95% level of confidence. This estimate is

lower than the 2006 estimate of 201,600<sup>11</sup> horses from the NASS Virginia Field Office, and the large difference may not seem plausible. Yet despite its limitations, the survey data succeed in capturing important differences in the uses, breeds and testing rates of horses across different regions of Virginia.

We offer this study one more contribution to the question of how many horse live in Virginia.

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<sup>11</sup> This number was derived by subtracting 13,400 donkeys and mules estimated in the study from the 215,000 total estimated equine in Virginia in 2006. Source: *2006 Virginia Equine Report*, compiled by the Virginia Field Office of the National Agricultural Statistics Service, Richmond, VA, 2008.