2017 AVMA Report on

VETERINARY MARKETS

AVMA Veterinary Economics

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Veterinary Economics Division
American Veterinary Medical Association
March 2017

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CONTENTS

LIST OF FIGURES AND TABLES

SUMMARY

Once again, the AVMA Economics Division ushers in the year by issuing the first in a series of four annual reports examining economic conditions as they relate to business trends, and, in turn, management challenges and potential opportunities for the veterinary profession. Looking through a lens that not only examines professional sectors within the veterinary industry, the four reports in their totality analyze the various veterinary markets identified by the Economics Division's team of economists:

- The Market for Veterinary Education;
- The Market for Veterinarians; and
- The Market for Veterinary Services.

This first report, as with previous editions, sets the stage for the year's coverage by the AMVA of key economic indicators relative to these three markets, summarizing the economics and finance research presented at the association's annual Economic Summit held that prior autumn; discussing U.S. general economic conditions; and offering perspectives relative to the performance of veterinary practices in the country.

This initial 2017 report, *The AVMA Report on Veterinary Markets*, leads off with background on AVMA Economics initiatives, including projects associated with the recent launch of the Economic Advisory Research Council (EARC), and the advancement of the Practice Management Core Continuing Education pilot by the AVMA Veterinary Economics Strategy Committee. The report moves on to present an assessment of directions in the general economy.

Professing that the performance of the veterinary profession is inextricably linked to the economy's ability to generate disposable income for U.S. residents, the report looks at the measure of Gross Domestic Product (GDP) and notes a year-on-year growth rate of 3.2 percent as of the third quarter of 2016 over the same period in 2015, or, after adjusting for inflation, what represents a more modest 1.5 percent increase. And, though still registering below their pre-recession high, real median household incomes have climbed from a post-recession low of $52,666 to a high of $56,516 in 2015. More expected increases suggest a continued growth in GDP into 2017 and further increases in the demand for veterinary services. On the other hand, January 2017 marked 91 months of the current business cycle's expansion period – longer than the 61-month average period of expansion since the 1950s. While an expansion's duration does not necessarily portend recession, those factors leading to a downturn tend to crop up within a 10-year timeframe. This suggests that the likelihood of continued expansion will decline with each passing month.

To show the difference between early expansion and current expectations, we compared the last four 10-year U.S. Congressional Budget Office (CBO) forecasts, detecting that some economic relationships over the last four years have fundamentally changed. Additionally, while the CBO 10-year outlook forecasted strong early economic growth diminishing to a longer term growth rate of 2.2 percent, the 2016 forecast points to a lessening in GDP growth rates below 2 percent in the near term and lower in the longer term. The upshot: Slower growth in the demand for veterinary services means more modest growth in veterinary incomes. This slowing growth will likely diminish the growth rate for veterinarian salaries in the next few years.

GETTING EDUCATED – AND PAYING TO DO SO

Well before new veterinarians enter the field, they are applicants who apply for the seats available at colleges of veterinary medicine that supply the industry with talent. Data gathered from the Association of American Veterinary Medical Colleges (AAVMC) on applicants pertain to U.S. applicants and draw information from U.S. veterinary colleges and foreign, AVMA-accredited colleges. At the 30 AVMA-accredited U.S. schools in the 2015-16 academic year, applicants applied for 3,219 seats, comprised of 1,798 resident, 1,226 non-resident and 195 contract seats. In 2016 the 28 U.S. veterinary medical colleges with graduates had a combined class size of 2,930.

Whereas the AAVMC provides an estimate of the number of total graduates from all AVMA-accredited U.S. veterinary colleges, the North American Veterinary Licensing Exam (NAVLE) provides an estimate of the number of graduates from all AVMA-accredited colleges of veterinary medicine – both domestic and foreign. The total number of new veterinarians entering the field in 2016 is denoted by the number passing the NAVLE: 4,477 – about the same number as the previous year, and includes graduates seeking licensure in Canada and Australia in addition to the United States.

What does it take financially to get to exam time? Estimates of living expenses for a four-year education include housing, food and transportation, and interest payments on associated loans give an answer. Tuition, fees and living expenses combined made up the cost of a seat taken by the 2016 graduates from the 28 U.S. colleges. The four-year total cost ranged from $127,138 for "discounted" seats, or those for which students do not pay full price, to a high of $363,972 for a non-discounted one.

Fortunately, some students receive tuition assistance, manage to live on the cheap, or can save on interest expenses. Among 2016 graduates, the mean debt acquired while in veterinary college was reported as $141,000. While some schools apparently have maintained a modest number of graduates with debt exceeding total costs at graduation and yet others have had a larger percent of students in this situation, the year-to-year variation in their percentages suggests that the problem might be attributed more to student choices than associated with the specific institution.

How much applicants are willing to pay for a seat at a school reflects the demand for veterinary education. For the 2016 fall enrollment, 6,667 applicants applied to veterinary college through the Veterinary Medical College Application System (VMCAS). The number of applications denotes a cyclical pattern over the past three decades: almost 7,000 in 1980, 1999 and 2014, but in 1990 and 2002 drops to about 4,000. A continuation of this cycle would yield a near-term fall in the number of applicants, though specific factors causing the cycle have not been identified. More significant than the total number of applicants, however, is the number of applicants per available seat – a number also observed to be cyclical. The current ratio of total applicants to the number of seats at the 30 U.S. colleges of veterinary medicine is approximately 2.25:1. If the seats available to U.S. students at both domestic and foreign U.S.-accredited schools are considered, however, the ratio plunges to 1.52:1 for 2016. The number of available seats will exceed the number of applicants should the latter again dip to 4,000. Based on the willingness to borrow expressed, and the cost per seat provided by the colleges, the total number of seats applicants are willing to buy in 2016 was estimated at 2,331 at an average price of $163,292. This estimate assumes a willingness to pay only for tuition and fees. Add in living expenses and interest, and the estimated number of seats drops to 1,606, with an average total cost of $189,912.

WORKING, AND WORKING HAPPILY

The report includes surveys of veterinary incomes, including a breakdown by sector, reporting that veterinarians employed in industry and academia have the highest mean incomes, while those in predominately food animal practice and non-veterinary employment have the lowest. For the years 2013-2015, unemployment in the profession has remained low – with the mean unemployment rate near 4 percent – while the amount of negative underemployment has increased. Underemployment occurred for men in 2013 and 2014 but became negative in 2015. Also of note, is a significant decline in the percent of veterinarians who want to work a longer hourly work week in 2015 compared to 2013 and 2014 – a change indicative of the growth in demand for veterinary services. A desire by veterinarians to increase their hours is a sign that some practices are operating at less-than-optimal capacity. Conversely, practices with veterinarians wishing to work fewer hours suggest that practices might be working beyond optimum capacity. Unemployment levels could also be symptomatic of the concentration of veterinarians in a particular geographic location. Merely looking at the concentration of veterinarians may not give the whole picture of variations in unemployment, underemployment and incomes, however, since the demand for veterinary services is affected by a host of demographic factors.

The report concludes that the year ahead could present a continuation of challenges in finding candidates to fill vacancies for veterinarians, and with it mounting pressure to increase compensation to hire new employees.

Another section of the report looks at wellness among veterinarians, discussing in particular compassion fatigue, and its two sources: burnout and secondary traumatic stress. Also, links between career concerns and compassion satisfaction – gratification drawn from work – were subjects of investigation, which found that satisfaction with current employment and veterinarians' perspectives as to how prepared they were for their vocation – both factors positively associated with compassion satisfaction – to be statistically significant in both 2015 and 2016. Also statistically significant in 2016 were negative associations with lower income and hourly compensation. Factors positively associated with compassion satisfaction were: being older, living in a smaller community, and working in academia.

What is the state of the return on investment – or the economic return on cost to attain the educational credentials to pursue a career as a veterinarian? One way to evaluate this is by looking at what is termed the net present value (NPV) of the DVM degree to see how the investment stacks up against other investment opportunities. NPV is the difference between the income earned over a veterinary career and the sum of both the direct cost to earn the degree and the indirect cost of the salary that might have been earned without it. For men, mean NPV is estimated to be -$43,038, while for women it is estimated to be $308,892. This gender difference is interesting because women incur higher educational debt and have lower mean starting salaries compared to men, but these are more than offset by the lower indirect cost.

VETERINARY PRODUCTS AND SERVICES

The market for veterinary services is complex, with both public and private sectors featuring a range of offerings. The market for private veterinary services, for example, delivers wellness, emergency, and specialty services associated with equine, food, and companion animals. The public sector includes government, education and research, and industry applications as well.

The relationships among factors that determine the level and type of services "demanded" in the market are yet to be comprehensively understood. Although the AVMA Pet Demographic Survey (PDS) conducted every five years seeks to help stakeholders in the companion animal veterinary industry make informed decisions by developing a better understanding of pet-owning households, information necessary to gauge demand has been lacking. At the end of 2015, however, through a process with potential for incorporation into the PDS, an independent consulting group specializing in demand analysis, under the direction from the AVMA, studied demand in one metropolitan market. This pilot study looked deeper into alternatives from which canine care services, specifically in the form of routine check-ups, were obtained. Some 13 percent of respondents reported taking their dog for a routine check-up to a facility other than a veterinary hospital or clinic. The study also elicited information as to price paid for the routine check-up and number of annual care visits made.

Pharmaceutical products constitute a substantial business in the veterinary industry. A quarter of all product purchases tracked by Animalytix, a data firm that collects information on sales by manufacturers of animal health products, perhaps not surprisingly, were made by fewer than 6 percent of practices, while 60 percent of practices accounted for another 25 percent of the product market.

Research relative to demand is also discussed in the *2017 AMVA Report on Veterinary Markets* in the context of calculating the optimum quantity of veterinary services – in terms of number of veterinarians – advisable for governments to cost-effectively combat zoonotic diseases.

INTRODUCTION

This report provides an overview of the research findings presented at the 2016 AVMA Economic Summit. Each year, in October, AVMA economists and collaborators from academia, industry, and the veterinary profession provide a summary of the economics and finance research conducted over the previous 12 months to identify problems or evaluate strategies to improve the efficiency of the veterinary markets or the financial performance of veterinary practices. This year, five economists from the AVMA Veterinary Economics Division along with 17 other professionals provided research findings and observations about the veterinary markets and practices.

As we pass 90 months of economic expansion, the U.S. economy remains on a slow growth path that shows continued signs of weakening but no clear indication that a recession is pending in the next six to eight months. The steady economic growth and tight job market suggests continued increase in consumer expenditures, which comprise two thirds of the U.S. economy. But, continued weakness in both exports and government spending are putting a drag on GDP growth and neither is likely to change anytime soon. The tightening job market, lethargic exports and government spending will continue to dampen investment in new production capacity, leaving an economy that will continue to struggle to reach growth rates above 2 percent. For some communities, with GDP growth rates under 2 percent, a recession may already be occurring. The slow GDP growth will also mean lower state government revenues, less public support of education and thus higher education costs for students in response to higher costs of operations.

The demand for veterinary education increased in 2016, with more than 7,000 applicants seeking fewer than 4,400 seats at U.S. and foreign colleges of veterinary medicine. The general characteristics of this group of applicants seeking a 2017 seat remain similar to years past. Academic performance, the number of service hours, and willingness to pay, are consistent with the recent years of applicants, while the percentage of female and minority applicants continues to increase. But the gap between what applicants indicate they are willing to pay and the cost of the veterinary education continues to widen. If students were held to what they indicated they are willing to pay for their veterinary education, less than half the total available seats would be occupied.

The debt-to-income ratio (DIR) for graduating veterinary students continues to be a major problem for the profession. Although starting salaries rose by an average of more than $3,200 (roughly 4.7 percent for 2016 over 2015), debt rose slightly faster and thus the DIR continues at roughly 2:1. More importantly, approximately 12 percent of the graduates report having veterinary college debt that exceeds the total costs (tuition and fees, living and interest on borrowed funds) of their education – a portion of the debt that comprises 3 percent ($10 million) of the total debt of the 2016 graduating class. While the mean DIR remains at 2:1, 56 percent of the graduates start their careers with a DIR greater than 2:1.

In response to the DIR problem in the profession, the Association of American Veterinary Medical Colleges, AVMA and Michigan State's College of Veterinary Medicine, held the first "Fix the Debt" summit in April of 2016. We noted that in 2015, U.S. veterinary graduates started their careers with roughly $428 million dollars of debt and an average DIR of 2:1. While the current robust market for veterinarians will likely continue to provide strong increases in starting salaries, no reduction in the debt-to-income ratio is likely. At the "Fix the Debt" summit AVMA introduced the target DIR of 1.4:1. This target represents the amount of debt that can be serviced with 10 percent of the mean disposable income of a veterinarian five years post-graduation. For the class of 2016, nearly 70 percent have a DIR in excess of 1.4:1, and even if the profession is able to reduce the mean DIR to 1.4:1, a large number will still have debt that exceeds twice their income. And, these statistical descriptions do not include the higher debt students from the U.S.-accredited foreign colleges of veterinary medicine. Thus, it is imperative that strategies to reduce costs of education, assist students in accumulating funds to offset education and living expenses, and raise incomes of graduates be identified and implemented quickly.

While our research has identified only an indirect relationship between the DIR and veterinary wellness, this topic warrants further, deeper investigation. We have identified a relationship between higher incomes and employment satisfaction and between employment satisfaction and compassion fatigue. While the veterinary profession generally appears to be no different than other professions with respect to the health of its professionals, there are signs that compassion fatigue in the profession may be more widespread than in other professions. More research is needed to understand what factors are leading to the numbers of veterinarians with high levels of compassion fatigue and understanding the relationship between financial stress, compassion fatigue, mental illness and suicide.

The accuracy of our forecasts depends on the near future representing the recent past. Thus, forecasts that seem pessimistic can be altered by changing current behaviors. Excess capacity, increasing competition, levels of unemployment and underemployment, type of labor markets and higher DIRs are all factors that will produce behavioral change in the profession that, in turn, could generate changes throughout the supply chain, closing the gap between need and demand for veterinary services. Our forecasts don't include "what might happen," but merely point to where we are headed based on current behavior. In her presentation on the market for veterinary education, Dr. Eleanor Green, dean at the Texas A&M College of Veterinary Medicine, noted that, "Veterinary medicine is on the precipice of significant disruption;" and the question for the profession is whether the profession will lead this disruption for positive change or react to it and hope for the best.

Better Understanding the Diversity

The market for veterinarians was exceedingly robust in 2016, with the number of applicants less than the number of available jobs for the first time since before the last recession. A greater number of jobs found no applicants over the previous year. While maldistribution and sharply increasing demand for veterinary services during the last year may be the two factors that have led to the location-specific shortage of veterinarians, no evidence suggests a national shortage of veterinarians.

In 2016 we began to examine specific veterinary markets such as the bovine veterinary profession, lab animal veterinary profession, equine veterinary profession, and the state veterinary professions of Arizona, Colorado, Indiana and Texas. This new effort was to better understand the diversity within the veterinary profession across states and practice types and to understand the relationship of the markets for specific practice types and locations to national veterinary labor markets. The research certainly indicates that considerable variation in the labor markets exists between geographical locations and practice types.

The AVMAs Veterinary Economic Strategy Committee (VESC) brought forward the Practice Profitability Management Core Continuing Education pilot program at the AVMA Convention 2016. After more than a year in planning with the assistance of Banfield Veterinary Hospitals, Henry Schein Animal Health, Katz, Sapper and Miller (KSM), Veterinary Management Groups, and VetPartners, the AVMA Veterinary Economics Division implemented a 16-hour, four-day experiential learning platform that focused on 16 key action items to assist veterinary practices improve financial performance. Practice owners and managers from 57 practices attended what could only be described as an extremely successful event. But, as Dr. Karen Felsted of PantheraT Veterinary Management Consulting, Dallas, noted, we have always had plenty of resources to assist veterinarians to improve their financial performance but we still see the majority of practices underperforming. Thus, the importance of the new AVMA program will be the impact it has on the 57 practices, and this will be measured and reported on next year.

The practice finance focus in 2016 was a new direction for AVMA's VED. The AVMA Board of Directors created the VED with the vision of ensuring, through the work of the VED, that every veterinarian would find the veterinary profession to be personally and financially rewarding. We conceived the Economic Advisory Research Council to provide critical oversight of the data analytics of the veterinary profession. Data analytics is the process of identifying what measures are important to track the performance of the profession; determining what data must be collected to compute those measures; and the management of the data and methods to ensure the availability of both to the general profession. While past efforts to improve financial performance in veterinary practices were somewhat successful, without these data analytics methods in place, noted Tracy Dowdy, past president of Villanova, Pa.-based VetPartners, we are unlikely to have a more far reaching impact on financial performance in the profession.

Another new initiative this year was the EARC, which met for the first time at the AVMA Convention 2016 in August. The EARC currently is comprised of several research groups: the Pet Demographics Research Group (PDRG), the Pet Insurance Research Group (PIRG), the Practice Finance Research Group (PFRG), and within the PFRG, the Veterinary Procedural Terminology Council (VPTC). The collection of 73 individuals representing 62 entities from across the profession provided at the organizing meeting of the EARC an excellent start to profession-wide participation in developing the data analytics for the profession – an important first for the profession.

Two other initiatives of the PFRG will be the development of a standard curriculum for financial literacy and practice financial performance. And, one of the key components of this new thrust into practice financial performance will be the focus on key performance indicators (KPI) from the Dupont method

of financial analysis. Currently the profession is focused only on practice profitability rather than the more comprehensive, financial performance. Financial performance includes both profitability – an indicator of the effectiveness of pricing and cost control strategies; and asset turnover – an indicator of how efficiently assets are used to generate sales. And, these two indicators of performance are important not only for every practice but for every profit center within practices to determine relative financial performance.

The Pet Demographics Research Group is developing the data collection and management processes for more targeted collection of information about pet owners, methodology that may be available profession-wide, specifically in the areas of price and income effects on the demand for veterinary products and services. This group will be evaluating all avenues that have the potential for improving the demand for veterinary services and veterinarians, such as the economics of zoonotic diseases, One Health, and the human-animal bond. But most importantly, the new survey is specifically designed to help us better understand how pricing strategies can be used to maximize earns or turns depending on the demographics of the local market.

The Pet Insurance Research Group is sharing research with the goal of providing guidance to veterinary practitioners on the role of risk management strategies for pet owners to avoid making economic decisions that are not in the best interest of the health and welfare of the pet, as a means to control the personal one-time outlays of medical services and to boost the level of care provided to pets. Most importantly, this group seeks to be able to provide the profession with statistically valid evidence as to whether risk management strategies can improve the demand for veterinary services.

In 2017, the AVMA's Economics program will focus on data analytics, personal and practice finance and developing an outreach program. It is imperative that the profession develop best methods for collecting and managing the information of the profession and providing a means for its widespread use. These best methods comprise a data analytics process, a process that includes the collection, management and sharing of data pertaining to the veterinary profession. This process will reduce duplication of efforts and enhance the exchange of research findings and research cooperation. The process will also include ongoing audits of survey design and methods to ensure the validity of the information provided to the veterinary profession.

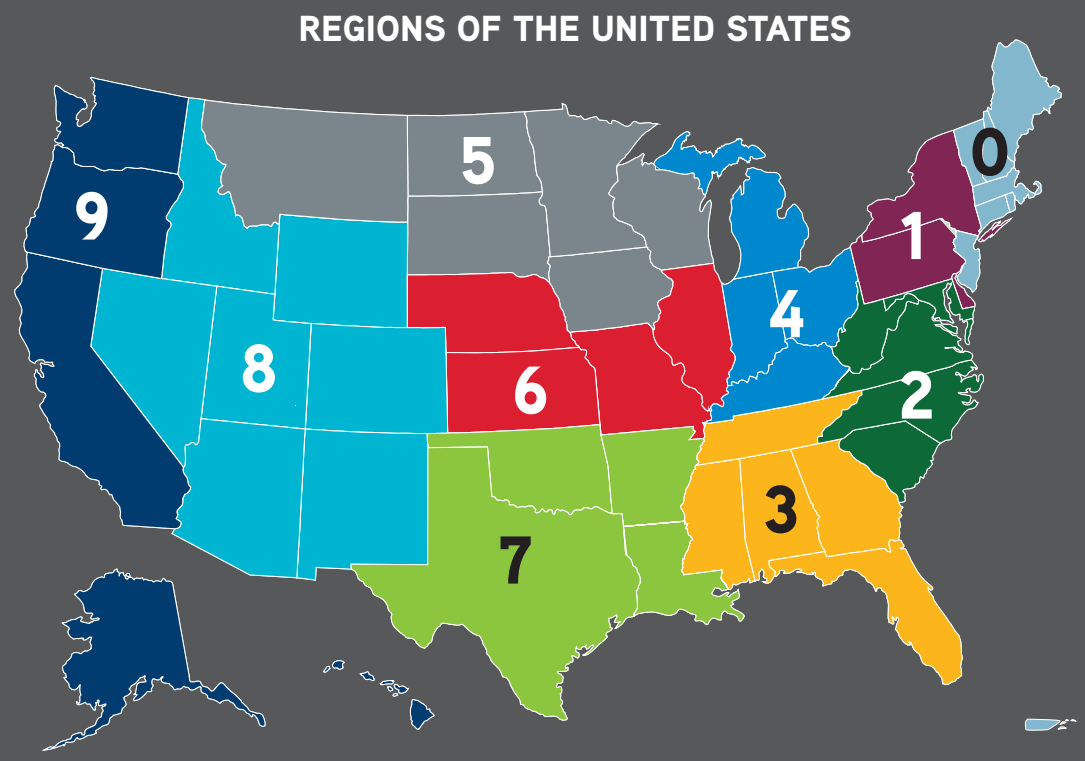


Figure 1

FINANCIAL LITERACY PROGRAM

Practice Financial Performance

This component will provide information that veterinarians can access based on their needed application, when they want the information, and delivery in the format that want – and with help in how to use it.

Outreach

The AVMA Economic Report Series provides a comprehensive source of pertinent knowledge obtained through collecting and analyzing millions of pieces of data from veterinarians, veterinary employers and consumers of veterinary services. The 2017 report series will present four reports:

- *Report on Veterinary Markets*
- *Report on the Market for Veterinary Education*
- *Report on the Market for Veterinarians*
- *Report on the Market for Veterinary Services*

The purpose of this first report is to provide a concise overview of the economy, veterinary markets and veterinary firms, drawing from key information in the presentations delivered at the 2016 AVMA Economic Summit. This information was supplied by analysts from entities outside of the AVMA in addition to that provided by AVMA. Much of the work from the entities outside of the AVMA was acquired in response to research priorities established by the volunteer members of the VESC. After each year's Summit the VESC meets to review the research priorities established by the Workforce Advisory Group's 2013 Workforce Study, and the requests for economic analysis received from numerous other veterinary entities. The VED attempts to collect proposals for research areas that the VESC considers of highest priority and present these proposals to the VESC at its spring meeting where research projects are selected. Thus, the research presented in this report, in essence, provides an overview of the research priorities established by the VESC. More detailed data, methods and results will be provided in the three reports to follow.

This report is divided into four sections:

- The first section looks at the general economy and provides information about the general climate, the current business cycle, and how veterinary markets are affected by the business cycle.
- The second section provides research results on the market for veterinary education, the market for veterinarians, and the market for veterinary services.
- The third section provides the most recent research on veterinary firms or practices.
- Finally, the last section will provide a summary of general trends in the profession and how the AVMA research effort will be developed to better evaluate these trends.

Throughout the report we will refer to regions within the United States, which are identified in the figure opposite depicting these regions on a map.

THE U.S. GENERAL ECONOMY

The performance of the U.S. economy, specifically the U.S. economy's ability to create disposable income for residents of the United States, has a major impact on the performance of the veterinary profession.

Animal owners are the driving force for demand in the veterinary services markets. And like all consumers, their willingness to pay for goods and services is influenced by their level of income. Assuming that animal owners' demographic characteristics cannot be distinguished from those of non-animal owners, national information on disposable income and personal consumption expenditures provides us with an accurate picture of their economic condition. Because there is generally a very close relationship between the growth in the general economy and growth in household disposable income and personal consumption expenditures, changes to the general U.S. economy over a long period of time serve as an important indicator of changes to the demand for veterinary services.

The performance of the U.S. economy, specifically the U.S. economy's ability to create disposable income for residents of the United States, has a major impact on the performance of the veterinary profession. As of the third quarter of 2016, the Gross Domestic Product (GDP) for the U.S. economy stood at $18.651 trillion, a growth of 3.2 percent over the same period in 2015, but only a 1.5 percent increase after adjusting for inflation. The real growth in the GDP is the KPI for the U.S. economy, and over the last six years (since the recovery began) the average annual rate of growth has been 2.2 percent, which can be seen to be low in comparison to previous economic expansions.

Expenditures on goods and services accounted for $12.693 trillion, with services alone accounting for $8.607 trillion. Government spending and investments account for closely equal shares of the remaining roughly $6 trillion ($3.262 and $2.987, respectively).

U.S. REAL GDP GROWTH RATE, 1930-2015

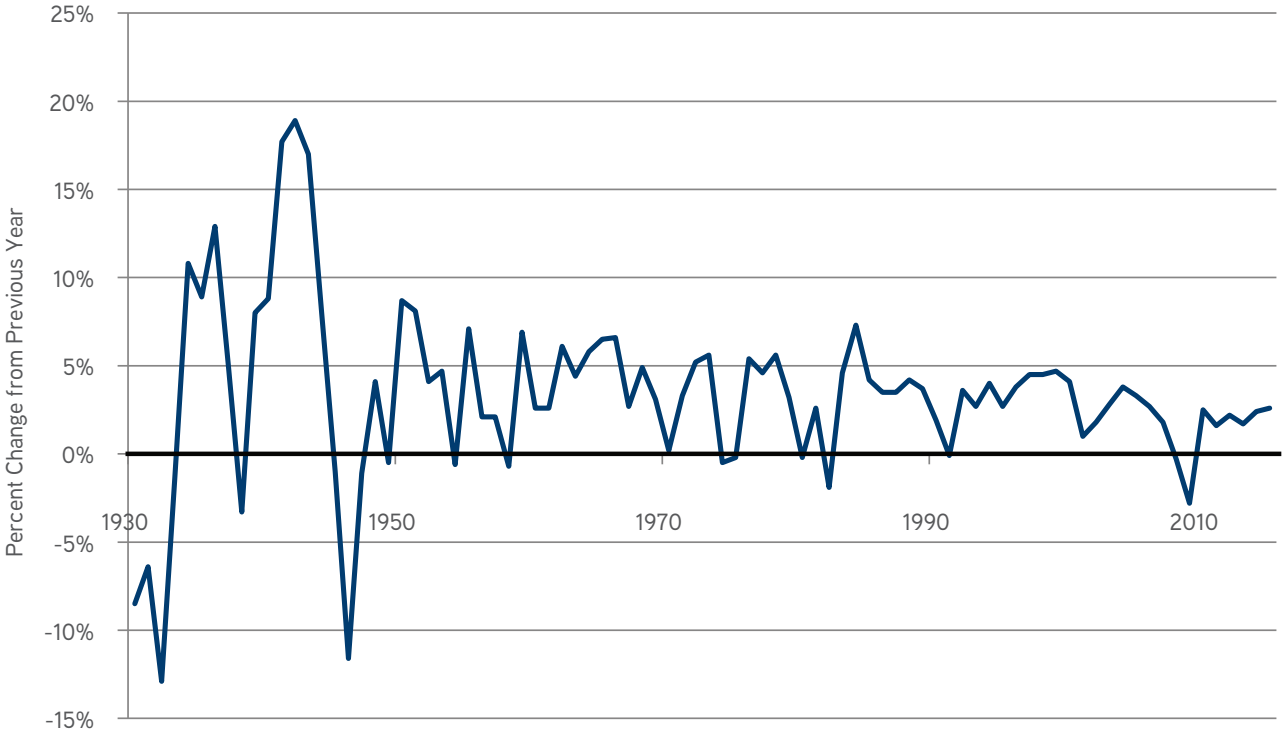


Figure 2

BUSINESS CYCLE

The U.S. economy and all sectors within it experience periods of contraction (recessions) and expansion (growth). A contraction technically occurs when the economy experiences two consecutive quarters of negative GDP growth and remains until the economy experiences a quarter of positive GDP growth.

Historically, the average period of contraction has been 11 months and the average period of expansion has been 61 months for an average length of cycle (peak to peak) of 72 months. The last recession began in December of 2007 and ended in June of 2009 (18 months), making this the longest recessionary period in the last 10 business cycles. The current expansion period has reached 91 months (as of January 2017), well above the 61-month average period of expansion but still below the expansion period of recent economic expansions. While the length of the expansion should not be seen to be a predictor of a recession, the factors that lead to a recession do appear to occur generally within a decade. At this point in the current economic expansion, the probability of continued expansion will decline with each month.

LENGTH OF U.S. BUSINESS CYCLES, 1953-2009

Recession Periods	Peak to trough	Previous trough to this peak
July 1953 - May 1954	10	45
August 1957 - April 1958	8	39
April 1960 - February 1961	10	24
December 1969 - November 1970	11	106
November 1973 - March 1975	16	36
January 1980 - July 1980	6	58
July 1981 - November 1982	16	12
July 1990 - March 1991	8	92
March 2001 - November 2001	8	120
December 2007 - June 2009	18	78
Average, 1953-2009 (10 cycles)	**11**	**61**

Table 1

Personal consumption expenditures comprise two-thirds of the U.S. economy, representing roughly $12 trillion of the $18 trillion economy. As noted earlier, services make up two-thirds of personal consumption expenditures at roughly $8 trillion while goods comprise the remaining third at roughly $4 trillion. Goods can be further disaggregated into non-durable goods (e.g., food and clothing) and durable goods (e.g., automobiles and appliances). Non-durable goods represented $2.3 trillion of personal consumption expenditures in the third quarter of 2015 and durable goods represented just more than $1.3 trillion. The durable goods component of the economy, while relatively small, is an important component influencing the business cycle. Services and non-durable goods are items that consumers need continuously and thus are unable to eliminate entirely during a recession. However, durable goods purchases can be minimized by extending the life of current durable items through repairs.

The business cycle can be described simply as the build-up and draw-down of inventories. At the bottom of a recession businesses have more excess capacity than optimum. They may have laid-off employees or reduced employee hours in an attempt to reduce production until accumulated inventories are drawn down. As inventories are reduced such that production plus inventories can no longer meet demand the business must begin to increase production. The increased production will require increased work hours or number of employees and reducing the amount of excess production capacity of the firm. The increasing number of employees and hours worked stimulates the demand for more products and the business must increase production again. During this economic expansion, firms work to fill orders, increasing economic activity. Eventually, consumers have all the new durable goods they need and inventories start to accumulate sending a signal to businesses to begin to cut back production, and a new economic contraction occurs. This business cycle is highly dependent on the demand for durable goods and the amount of inventories of these goods relative to that demand. And, as noted earlier this demand depends on consumer or household incomes.

Real median household incomes have risen sharply from the post-recession low of $52,666 to a high of $56,516 in 2015. While this is still below the pre-recession high of $57,909, the increasingly tight labor market with an unemployment rate reaching 4.9 percent in October of 2016 suggests further advances in median household incomes. Increasing household incomes contribute to GDP growth, and recessions only occur as household incomes fall. This would suggest that GDP will continue to grow into 2017 until household incomes reach a peak and begin to decline.

REAL MEDIAN HOUSEHOLD INCOME IN THE UNITED STATES, 1984-2015

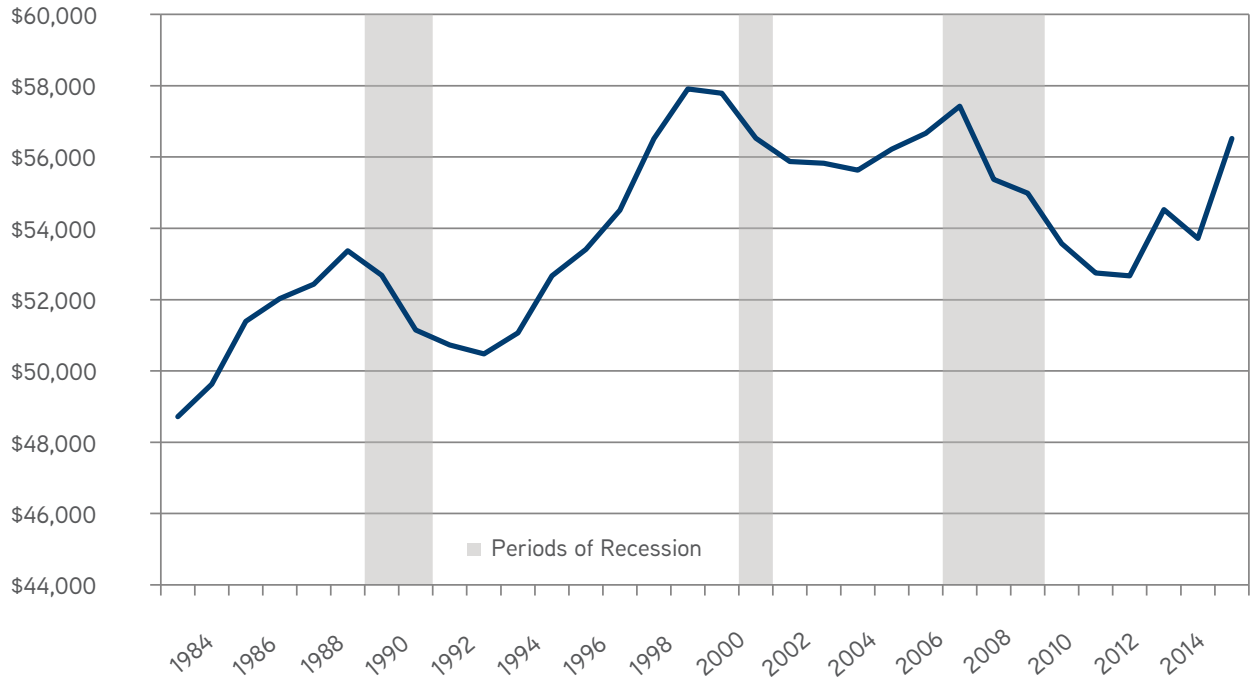


Figure 3

INDEX OF LEADING ECONOMIC INDICATORS

While the rate of growth in real GDP provides the best indicator of the health of the general economy currently, the Conference Board's Leading Economic Index (LEI) may provide the best indicator of the near future performance of the general economy.

Shortly after the Great Depression of the 1930s, economists were eager to identify an early warning system that would enable businesses and governments to prepare for an impending recession. In the mid-1940s several economists identified repeating periods of business expansion and contraction and called them "business cycles." The National Bureau of Economic Research began to research the development of a Business Cycle Indicator (BCI) to predict the turning points in business cycles.

Three BCIs are currently provided by the Conference Board, a global, independent business membership and research association working in the public interest. The three indicators – leading, coincident and lagging – provide a forward, current, and past look at the performance of the economy, respectively.

The Index of LEIs incorporates the data from 10 different economic data time series that have been demonstrated to have peaked or bottomed in advance of economic expansions or contractions.

Each of the 10 economic series is weighted based on its relative predictive strength to produce the index of indicators. The Conference Board produces a monthly value for the LEI and reports this normally on the third Thursday of every month.

The chart below shows the LEI for the most recent 17-year period, with the gray vertical bars indicating periods of recession. The most recent recession began in December of 2007 and ended June of 2009. The LEI peaked in March of 2006 and thus the decline in the LEI began 21 months prior to the last recession. The LEI continued to advance through November, 2005 exceeding the peak before the last recession. The rate of increase in the LEI, however has declined over the last two years and may foretell the reaching of the apex in the business cycle. But, the continued rise in the LEI through November of 2017 would indicate that the economy is likely to continue to expand into 2017 but also that without some major change in the economy (e.g., government stimulus or increased exports) the probability of a recession is beginning to increase with each passing month beyond the summer of 2017.

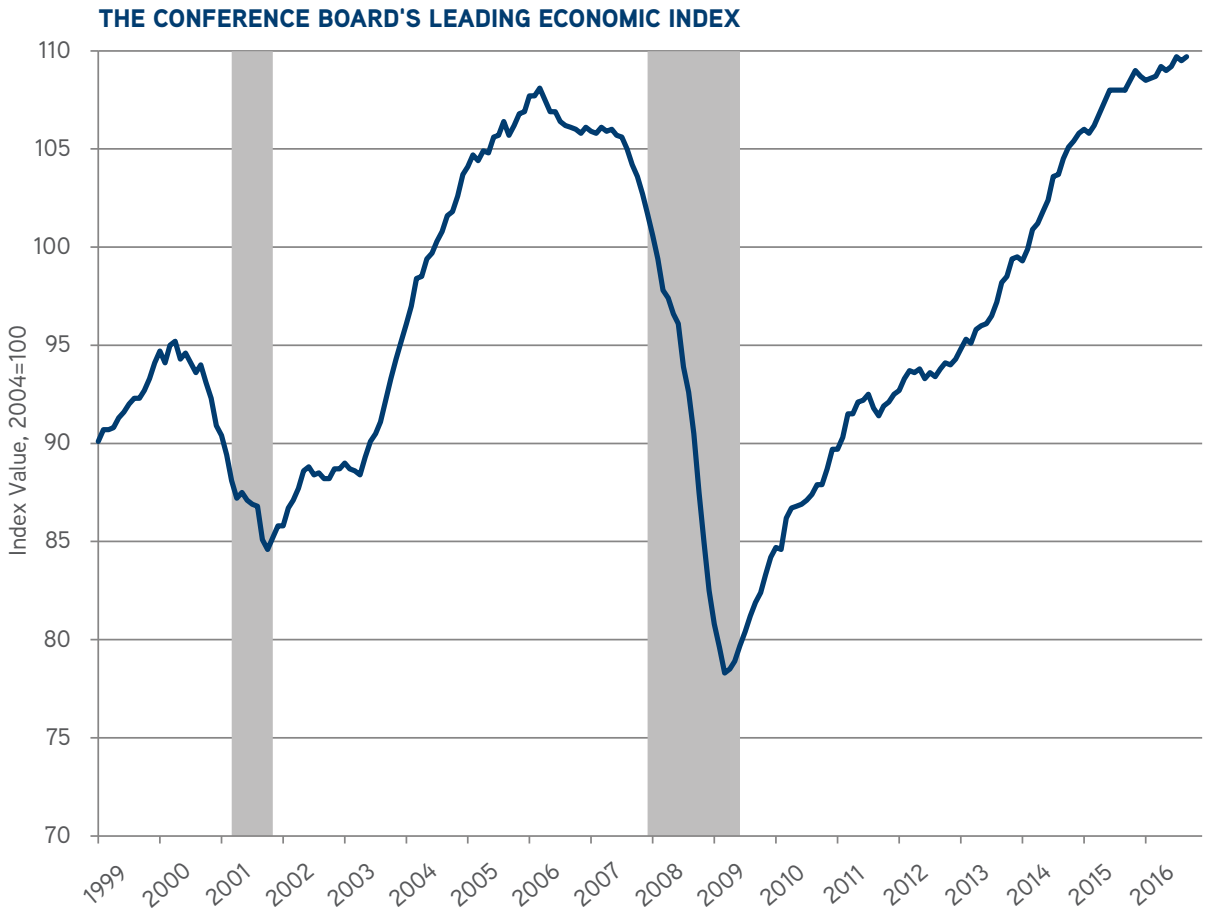


Figure 4

The Federal Reserve Bank of Philadelphia has a leading economic indicator that is also used to predict turning points in the business cycle. The post-recession movement of this indicator appears to be relatively flat following the post-recession rise. Following previous post-recession periods the Federal Reserve indicator maintained a value between 1 and 2 for the duration of the economic expansion.

LEADING INDEX FOR THE UNITED STATES, PERCENT, MONTHLY, SEASONALLY ADJUSTED, 1982-2016

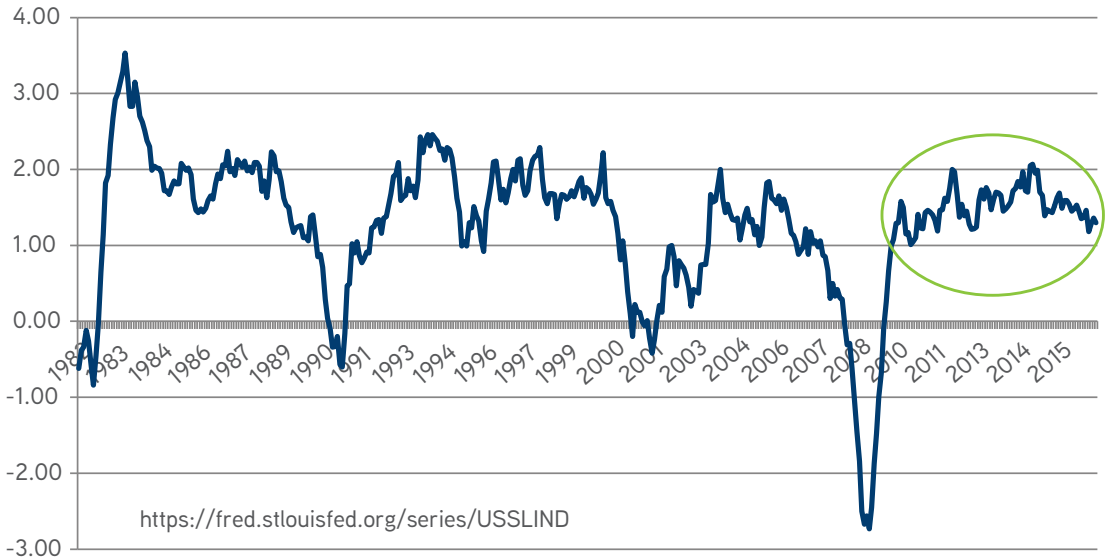


Figure 5

On closer examination of the Federal Reserve indicator over the post-recession period, however, a change in direction of the indicator can be seen to have occurred after reaching a peak in August of 2014. Since reaching the apex, the indicator has been on a definitive downward path suggesting that the economic expansion may have reached or is reaching its peak and the growth in GDP has been continuing to decline.

LEADING INDEX FOR THE UNITED STATES, PERCENT, MONTHLY, SEASONALLY ADJUSTED, 2009-2016

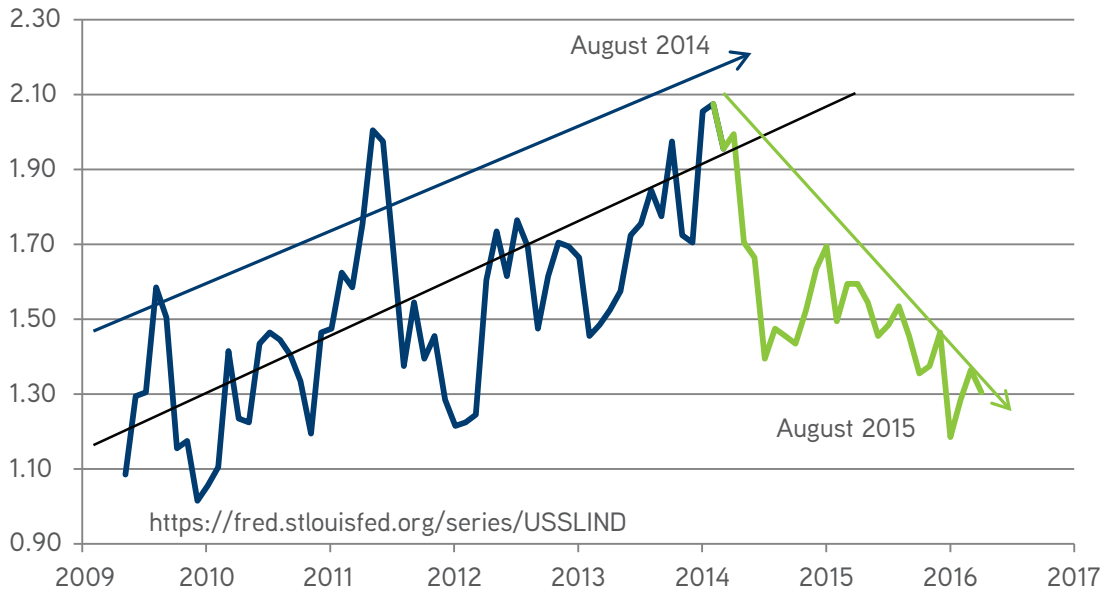


Figure 6

To forecast the change in economic factors in the veterinary markets (e.g., veterinary incomes) we use the forecast of GDP, interest rates and other economic factors from the Congressional Budget Office. The CBO is a non-partisan congressional support agency tasked with producing the 10-year forecasts of economic variables specifically for the use of determining the effect of changes in federal government policies on the federal budget. The CBO extends current policies 10 years into the future to produce its 10-year trends, "snapshots" used to develop the forecasts.

The CBO provides a 10-year forecast each January and a mid-term forecast in August of each year, and these forecasts are publically available. We have compared the last four 10-year CBO forecasts to illustrate the difference between early expansion and current expectations. The 2013 forecast expected that, under current policies, the economic growth rate would accelerate to 4.4 percent annual growth by 2016. Yet, each year the forecast for 2016 was reduced until the January 2016 forecast expects the 2016 annual GDP growth rate of just 2.4 percent, well off the early prediction of 4.4 percent. This suggests that based on historic responses to economic conditions and with the economy not performing as expected under current policy, that some historic economic relationships have not held over the last four years. Further, while the CBO 10-year forecast predicted strong economic growth early and then moderating to a longer term growth rate of 2.2 percent, the 2016 forecast indicates a decline in GDP growth rates below 2 percent in the near term and lower longer term growth rates. These lower estimates of future GDP growth rates suggest slower growth in the demand for veterinary services and lower veterinary incomes.

CONGRESSIONAL BUDGET OFFICE 10-YEAR BASELINE FORECAST OF U.S. GDP

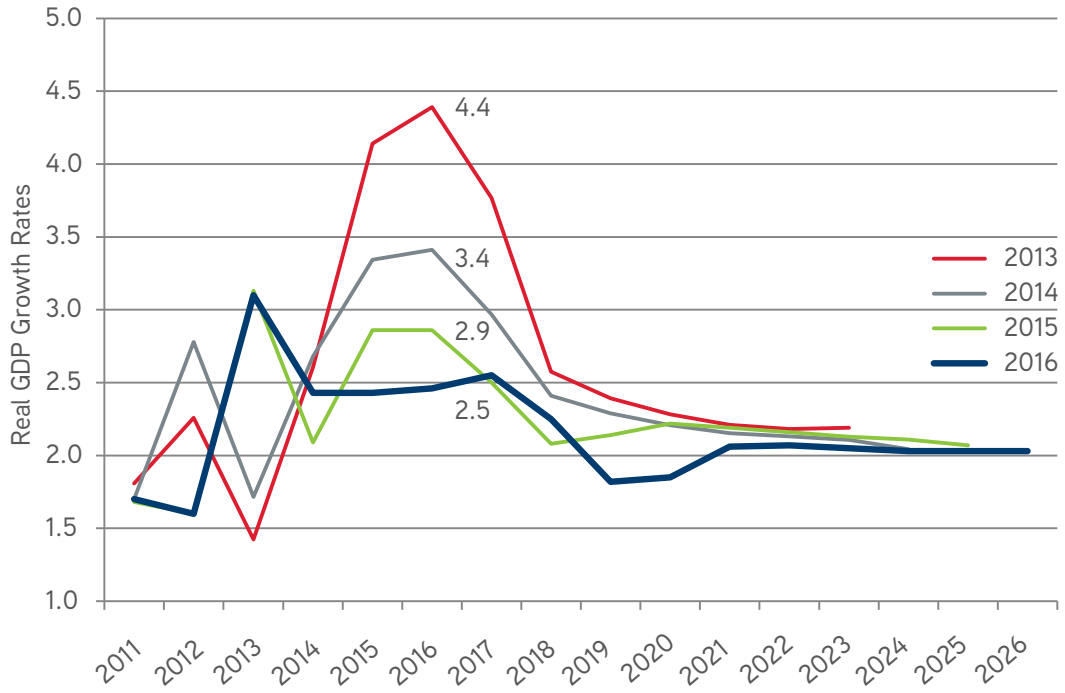


Figure 7

AT CURRENT GDP, WHEN THE MARKET IS IN EQUILIBRIUM, THE MEAN 2016 STARTING SALARY IS ESTIMATED TO BE $72,229.

GROSS DOMESTIC PRODUCT AND STARTING SALARIES

The model of starting salaries requires two steps and comprises two main components. These two components are GDP and demographic data of the new entrants into the market for veterinarians, including the number of new veterinarians each year.

In the first step, we use regression analysis on a repeated cross-sectional data set comprised of 17 years' worth of information on DVM graduates. This regression explains the variation in income (starting salaries) as determined by the variation in the explanatory variables of year, practice type, hours worked per week, gender, region and DVM debt. The resulting coefficients from this estimation are then used to estimate a time series of real weighted income, one for each of the 16 years of observations.

In the second step, we determine how the relationship between the number of graduates per year and real weighted income changes as GDP changes. Using this relationship we can estimate how incomes might change as the number of veterinarians and GDP change. Using the CBO forecast of GDP and our forecast of the number of new veterinarians we can forecast new veterinarians' incomes (i.e., starting salaries) and the impact of GDP on these incomes.

At current GDP, when the market is in equilibrium, the mean 2016 starting salary is estimated to be $72,229. If the market were to return to potential GDP, we estimate that the mean 2016 starting salary would be $73,774. Consequently, GDP not only affects demand for veterinary services as stated above, but this in turn increases the number of new veterinarians able to find employment and thus increases mean starting salaries. According to our model, a 3.3 percent increase in GDP, from current to potential, would result in a 2.1 percent increase in the mean starting salary, based on the projected number of graduates.

THE MARKET FOR VETERINARY EDUCATION

The ability to provide veterinary services begins in the market for veterinary education, the source of labor in the veterinary markets supply chain.

The ability to provide veterinary services begins in the market for veterinary education, the source of labor in the veterinary markets supply chain. The supply of veterinary services begins with the applicants who apply for the available veterinary medical college seats. Data on applicants are obtained from the Association of American Veterinary Medical Colleges Veterinary Medical College Application System and information provided to AAVMC by member colleges. As a result, our data are limited to U.S. resident applicants and the information available from the 30 U.S. colleges of veterinary medicine and the 19 foreign, U.S.-accredited colleges.

Additional sources of information for the market for veterinary education are two AVMA surveys: the senior survey and the census of veterinarians. The senior survey is completed by senior veterinary college students just prior to graduation and provides information on debt and future employment. The census of veterinarians provides both information on compensation and subjective information on student outcomes.

SUPPLY OF VETERINARY EDUCATION

Veterinary education is provided by U.S.-accredited domestic and foreign schools, as well as non-U.S.-accredited foreign schools. These schools are both non-profit and for-profit institutions. For the 28 U.S. veterinary colleges (excludes the new schools, Lincoln Memorial and Midwestern, which to date have no graduates), the average tuition and fees have nearly tripled, from $10,549 in 1999 to $28,845 in 2016. As the graph below indicates, this increase has not been equal across all colleges. The growth in tuition over the 18-year period has ranged from $8,668 to $32,321, with an average increase of $18,296 (10.2 percent per year).

U.S. VETERINARY COLLEGES: RESIDENT TUITION & FEES

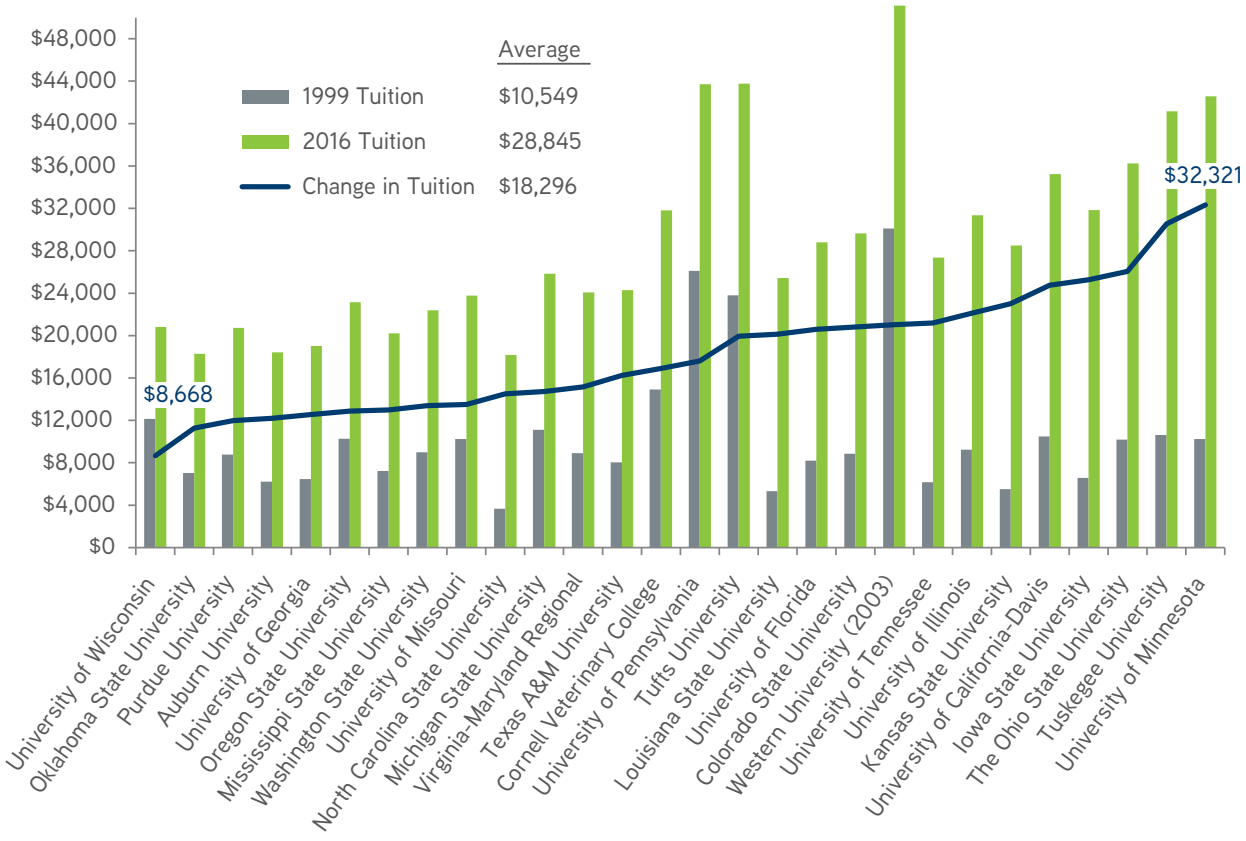


Figure 8

FOR THE 28 U.S. VETERINARY COLLEGES (EXCLUDES THE NEW SCHOOLS, LINCOLN MEMORIAL AND MIDWESTERN, WHICH TO DATE HAVE NO GRADUATES), THE AVERAGE TUITION AND FEES HAVE NEARLY TRIPLED, FROM $10,549 IN 1999 TO $28,845 IN 2016.

SUPPLY OF U.S. ACCREDITED DOMESTIC SCHOOLS

The supply schedule (or curve) for veterinary education is the cost of each seat provided. In the 2015-16 school year there were 3,219 seats at the U.S. veterinary medical colleges, with 1,798 resident, 1,226 non-resident and 195 contract seats. However, not all resident seats are "discounted" (tuition and fees reduced for residents). There were 1,881 discounted seats and 1,338 non-discounted seats. The mean four-year tuition and fees of the 28 U.S. schools for 1999 and 2016 are provided in the previous table.

In 2016 there were 2,930 graduates from the 30 U.S. veterinary medical colleges. A survey of these graduates in the spring of 2016 by the AVMA garnered 2,640 responses (a 90.1 percent response rate). The basis for a supply curve is the production function. How many units of veterinary education (seats) can be provided given the resources available (structures, equipment, faculty)? The number of seats is the quantity of output the veterinary colleges are willing to provide, while the tuition and fees represent the price at which they are willing to offer those seats.

The four-year cost of each seat (tuition and fees) is reported for U.S. colleges of veterinary medicine for 2016 graduates. The four-year cost is an estimate, and likely over-estimates the actual price that students pay for all of the seats. While the colleges report the number of resident and non-resident students each year, they don't report the actual price paid for each seat. Various state and regional contracts and scholarships reduce the price actually paid by students.

TOTAL AGGREGATED FOUR-YEAR COST PER AVAILABLE SEAT, 2016 GRADUATES OF U.S. COLLEGES

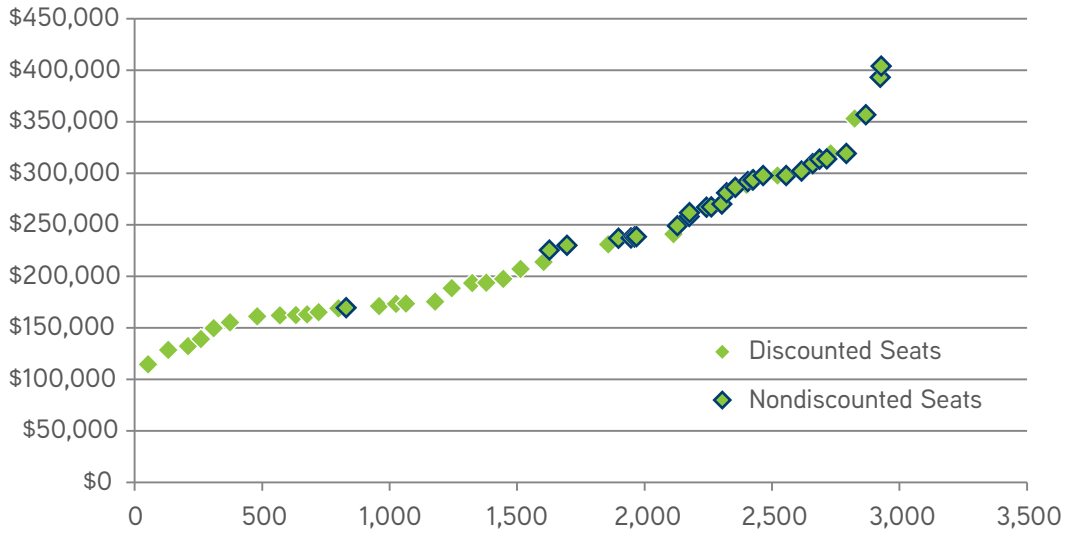
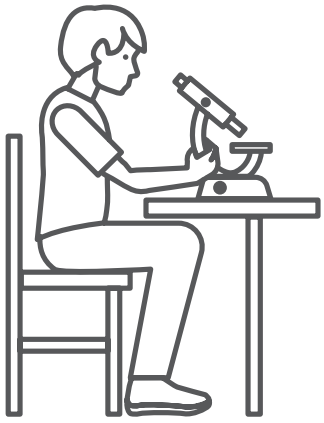


Figure 9



WHILE THE COLLEGES REPORT THE NUMBER OF RESIDENT AND NON-RESIDENT STUDENTS EACH YEAR, THEY DON'T REPORT THE ACTUAL PRICE PAID FOR EACH SEAT.

While data for the number of seats available for U.S. residents at veterinary colleges outside the United States have not been collected in the past, AAVMC provides an estimate of the number of total graduates from all U.S.-accredited veterinary colleges, and the North American Veterinary Licensing Exam (NAVLE) provides the number of graduates from all AVMA-accredited colleges of veterinary medicine both in the U.S. and abroad. The number of students passing the NAVLE provides some indication of the number of seats available for U.S. students both domestically and internationally. In the chart below, the total number of students passing the NAVLE is compared to the number that has passed the NAVLE from AVMA-accredited U.S. colleges of veterinary medicine on their first attempt (the "criterion group"), the number that has passed the NAVLE from AVMA-accredited colleges of veterinary medicine after more than one attempt (the "non-criterion group"), and the number of graduates from non-accredited veterinary colleges. In the 2015-16 school year, 5,521 NAVLE exams were given. The criterion group-NAVLE candidates from U.S.-accredited colleges of veterinary medicine who passed the exam on their first attempt-counted 4,091 examinees. The non-criterion group, those from U.S.-accredited schools taking the exam for a second time, had 825 examinees. The non-accredited group had 605 examinees. Of the 5,521 examinees, 4,477 passed the exam and thus represent the total number of new veterinarians entering the profession in 2016, nearly identical to 2015.

NUMBER OF TEST-TAKERS PASSING NAVLE

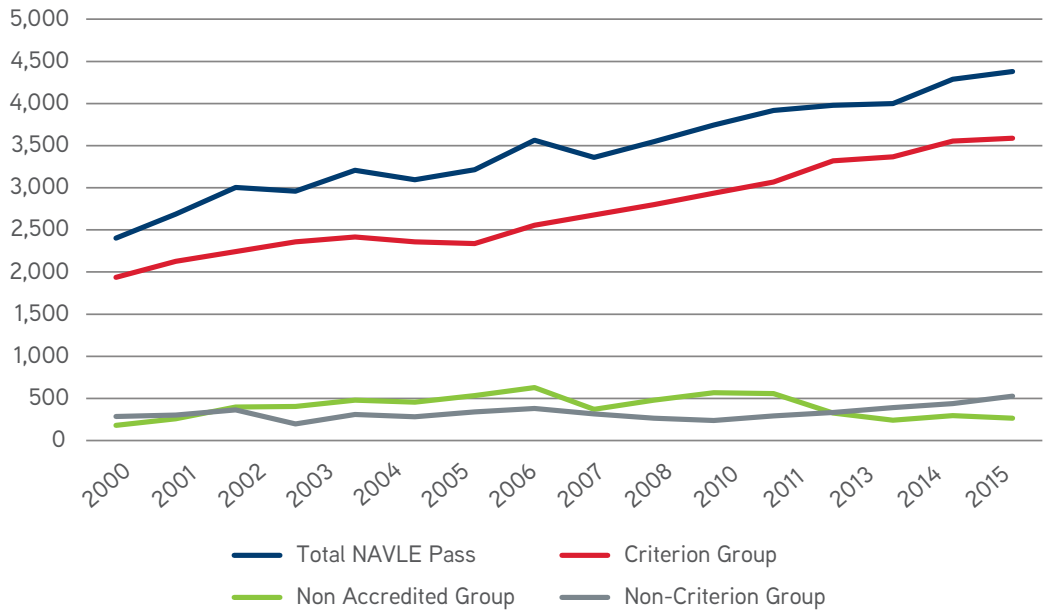


Figure 10

OF THE 5,521 EXAMINEES, 4,477 PASSED THE EXAM AND THUS REPRESENT THE TOTAL NUMBER OF NEW VETERINARIANS ENTERING THE PROFESSION IN 2016, NEARLY IDENTICAL TO 2015.

The cost of each seat that was occupied by the 2016 class of graduates from the 28 U.S. colleges is the tuition and fees plus the living expenses. Using the estimates of living expenses from the colleges for the four-year education, including housing, food and transportation, and an estimate of the interest payment on loans to cover all costs, provides an estimate of the expenditures that veterinary students were required to pay to occupy a seat at a U.S. veterinary college.

TOTAL COST OF ATTENDANCE AT U.S. COLLEGES, 2016

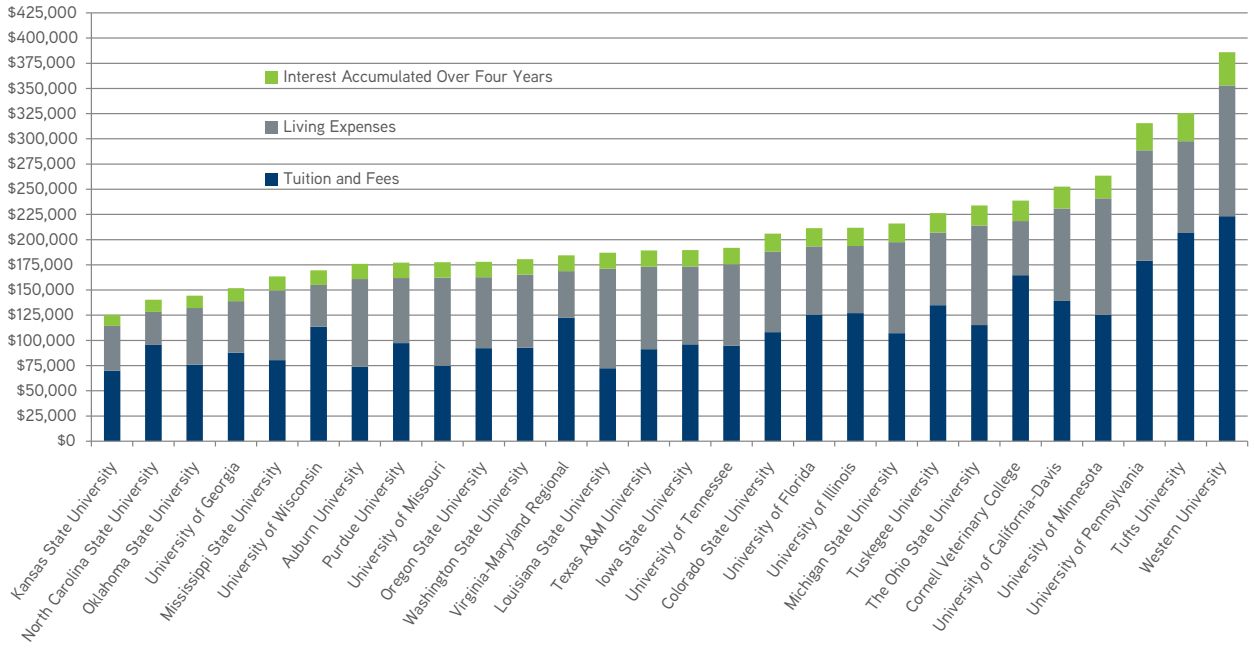


Figure 11

The four-year total cost ranged from a low of $127,138 for discounted seats at Kansas State University to a high of $363,972 for a non-discounted seat at Western University. Because not all colleges reduce the tuition and fees for residents, we have used "discounted seats" to indicate those seats where the students are not required to pay the full cost and "non-discounted seats" to indicate those seats where the students must pay the full, total costs of the seat. These costs represent a maximum and not all students pay the indicated costs either because they have tuition assistance through state contracts, receive scholarships, are able to live cheaper than estimated by the school, and/or because with some form of financial assistance the students are able save on interest expenses. The difference in the average cost of discounted versus non-discounted seats is illustrated in the following figure.

THESE COSTS REPRESENT A MAXIMUM AND NOT ALL STUDENTS PAY THE INDICATED COSTS EITHER BECAUSE THEY HAVE TUITION ASSISTANCE THROUGH STATE CONTRACTS, RECEIVE SCHOLARSHIPS, ARE ABLE TO LIVE CHEAPER THAN ESTIMATED BY THE SCHOOL, AND/OR BECAUSE WITH SOME FORM OF FINANCIAL ASSISTANCE THE STUDENTS ARE ABLE SAVE ON INTEREST EXPENSES.

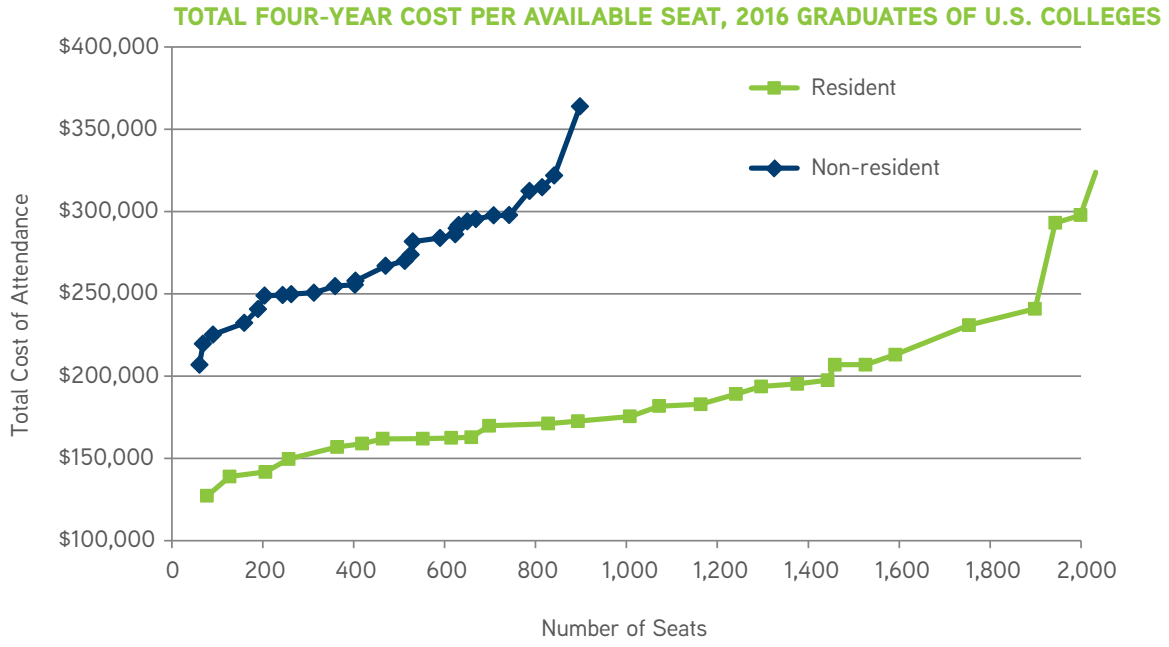


Figure 12

The combination of the discounted and non-discounted seats provides the total supply curve for veterinary education in the United States. The supply of veterinary education has changed over time, expanding the number of seats and increasing the cost per seat. Comparing only the tuition and fees for each seat at the U.S. veterinary schools for 2006, 2011 and 2016 illustrates both the expansion in the number of seats and the annual costs of each of these seats.

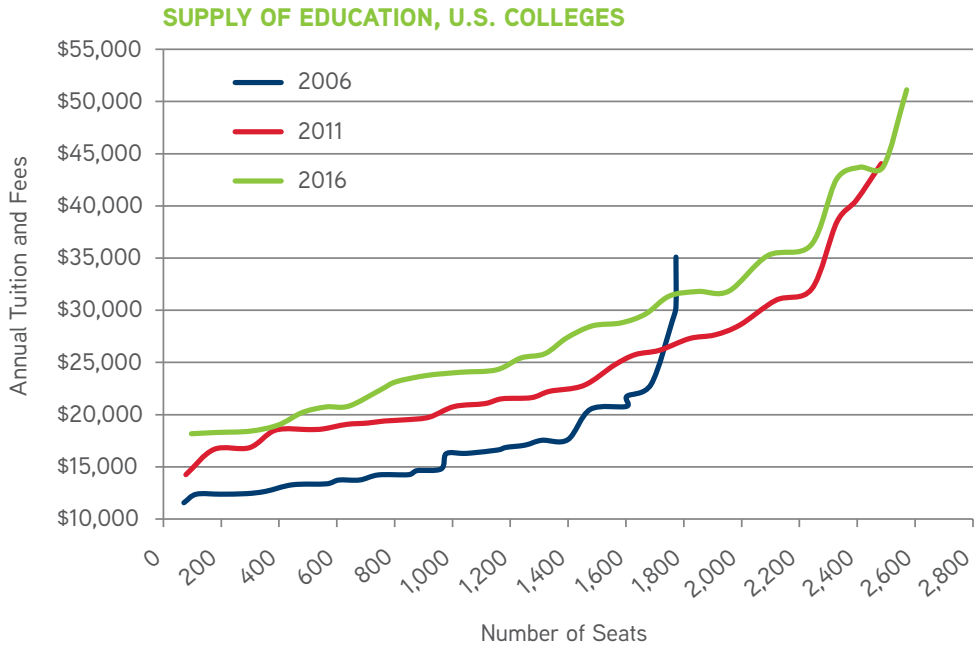


Figure 13

As a result of scholarships, various state and regional contracts, and other sources of assistance with education costs, the amount of debt that veterinary students acquire while attending veterinary college is, for roughly 88 percent of the students, less than the cost for each seat as estimated by the U.S. colleges. The figure below indicates the debt per student, the tuition and fees per seat, and the total costs (tuition and fees, living expenses and interest costs) of each seat. However, the debt per student is not matched to the cost per seat. For instance, in 2016 there were 416 graduates with no debt at graduation as indicated in the figure below. These graduates with no debt were distributed across all of the U.S. colleges.

Tuition and fees have been increasing over the last two decades. One of the largest sources of this increase has been the decline in state and federal government support for public education. Additionally colleges and universities have experienced rising costs of as a result of increasing government accountability requirements, increased labor costs (salary and benefits), declining support for extension and research, and increasing costs of equipment and facilities. These increasing costs and declining public funding have forced colleges to reduce costs, increase enrollment and raise the price of their seats.

MEDIAN ANNUAL TUITION, U.S. COLLEGES

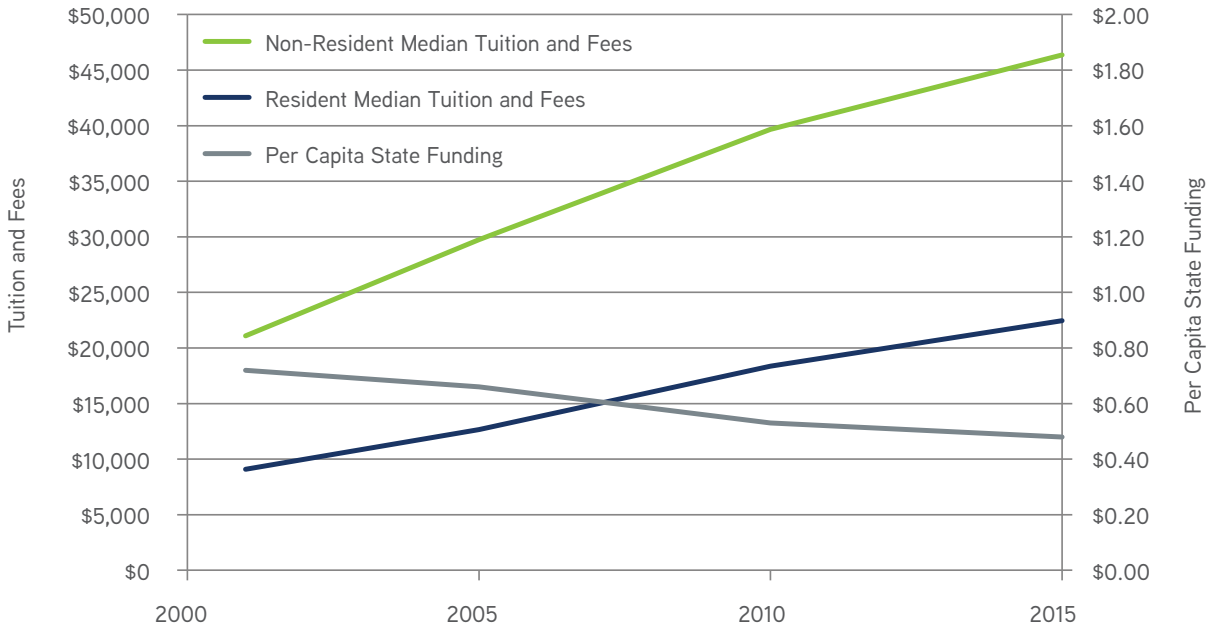


Figure 14

Mean debt acquired while in veterinary college reported by the 2016 graduates was $141,000, with a range of $0 (11.2 percent) to greater than $300,000 (5.0 percent). Overlaying the debt reported by the 2015 graduates with the four-year cost of tuition and fees, and then total costs with living expenses added, would indicate that the students are generally managing their finances within reason and providing some level of contribution to offset costs. However, some students have debt in excess of the total costs. Again, these "excess" expenditures could be the result of interest expenses, health issues, pet or animal expenses, or family emergencies. They may also just be due to meeting living standards above what the colleges have considered in estimating costs.

ADDITIONALLY COLLEGES AND UNIVERSITIES HAVE EXPERIENCED RISING COSTS OF AS A RESULT OF INCREASING GOVERNMENT ACCOUNTABILITY REQUIREMENTS, INCREASED LABOR COSTS (SALARY AND BENEFITS), DECLINING SUPPORT FOR EXTENSION AND RESEARCH, AND INCREASING COSTS OF EQUIPMENT AND FACILITIES.

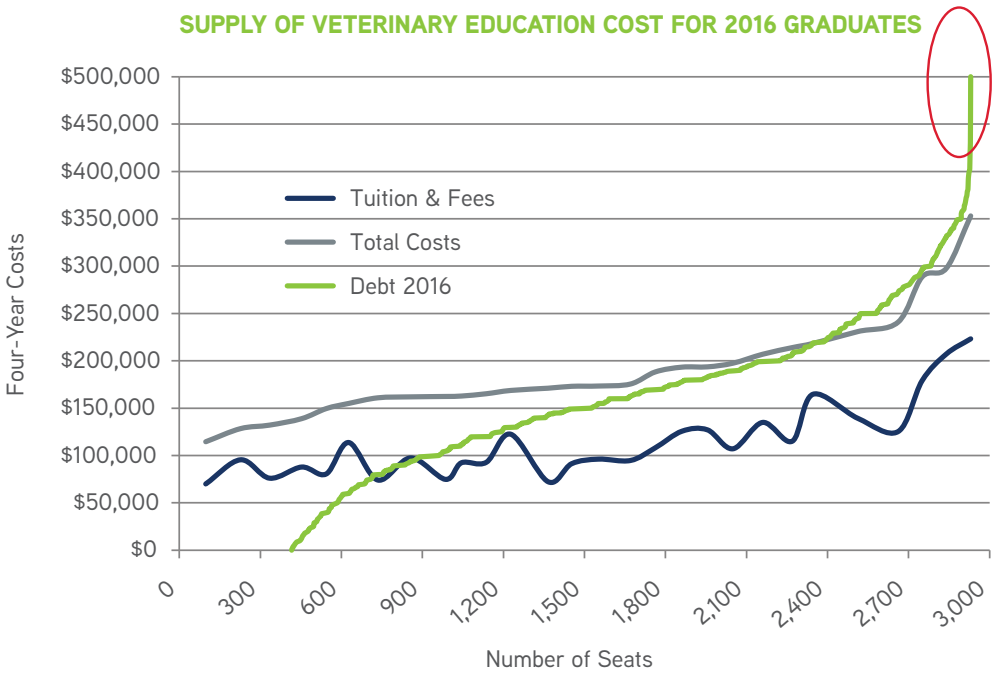


Figure 15

To examine the amount debt that each student had in comparison to the total cost of their veterinary college seat, we estimated for each senior survey respondent the total cost of their specific seat (tuition and fees, living expenses and interest costs) to determine how many students graduated with more debt than the actual costs (as estimated by the colleges) of their college of veterinary medicine seat.

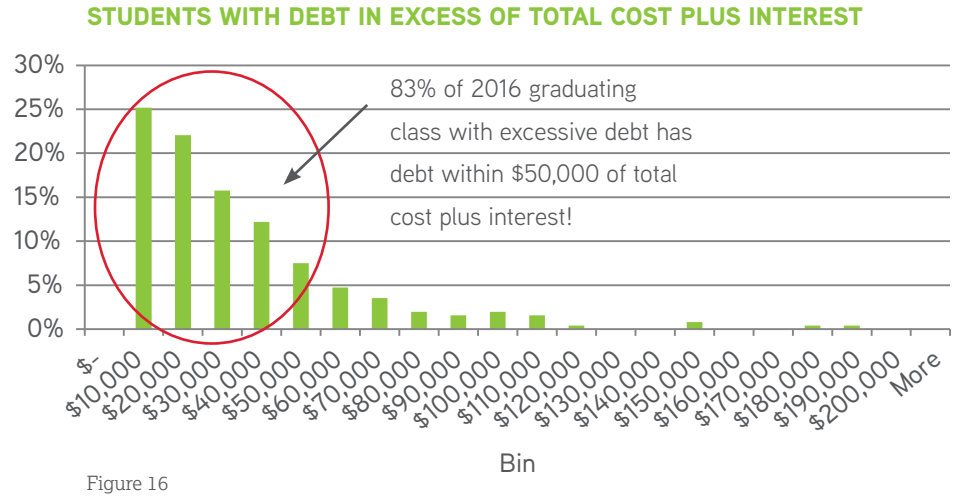


Figure 16

There were 254 graduates with debt that exceeded the total estimated costs of their seat and this excess of debt over total costs ranged from just a few dollars to nearly $200,000, and totalled $10.3 million compared to $8.1 million in 2015. Of those with debt in excess of the total costs, 83 percent had debt levels of less than $50,000 more than the total costs. The total costs do not include the costs of externships, professional or student meeting attendance or other expenditures that may be deemed necessary for the degree. The costs of these additional activities should be estimated in the future by each of the colleges and reported as a separate category but included in the total estimated costs of their seats.

The distribution of students with debt that exceeds total costs at graduation for 2015 and 2016 indicates that while some schools have maintained a low number of graduates with debt exceeding total costs and others have had a larger percent of students with excess debt, the variation year to year in the percent of students with excess debt at each school would suggest that this problem may not be tied to the specific college but rather is more dependent on student choices. Many factors, however, influence the determination of the excess debt including the actual and true cost of the seat, additional professional and educational costs, and the costs of special living needs that need to be determined to provide a more exact estimate of the amount of excess debt graduates have upon starting their careers. This will be an important determination in understanding the role of financial literacy in reducing the debt-to-income ratio of new graduates.

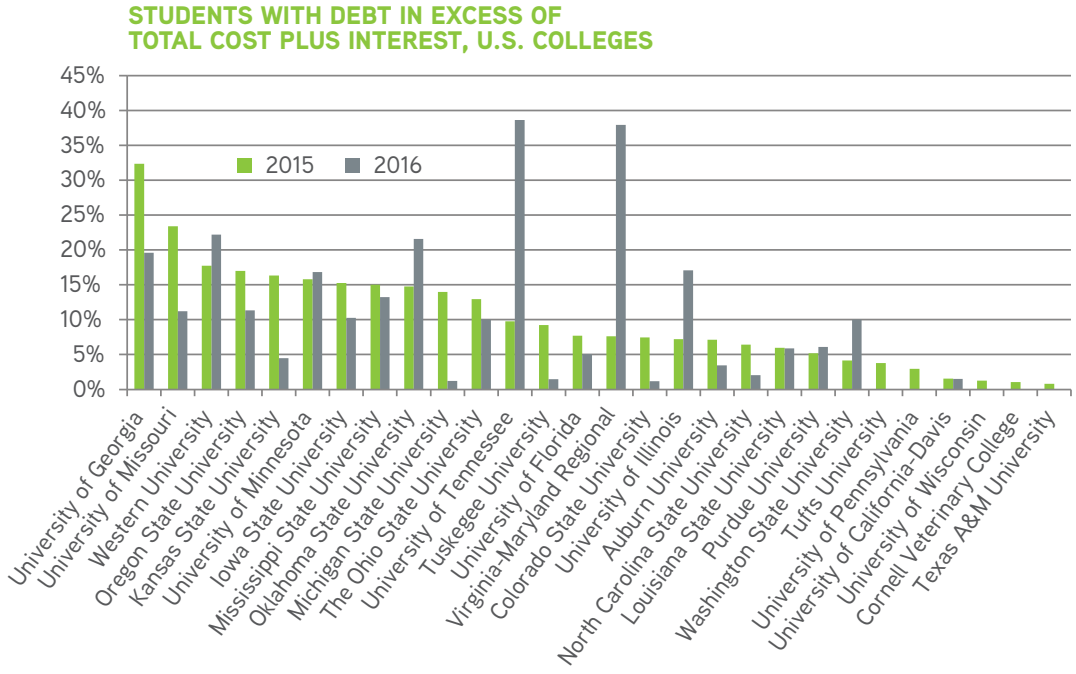


Figure 17

The mean value of living expenses for four years across all U.S. veterinary colleges was estimated at $75,988 for 2016 graduates, or $18,997 per year. Some students may have higher living costs, due to health issues, family emergencies, interest expenses on borrowed funds, expenses for pets or other animals and other personal needs. The mean discounted tuition paid by 2016 graduates (based on rates provided by each school) was $114,064, and $184,099 for non-discounted seats. Thus, the mean value of total costs was $190,052 , and $260,087 for non-discounted seats.

DEMAND FOR VETERINARY EDUCATION

The demand for veterinary education is the price applicants are willing to pay for each seat. For the 2016 fall enrollment there were 6,667 total applicants to veterinary college who applied though the Veterinary Medical College Application System (VMCAS). An annual survey of the VMCAS applicants was initiated in 2014 with one set of questions to determine what applicants would be willing to pay to attend veterinary college. The relationship between the number of applicants and their willingness to pay defines the demand for veterinary medical college. Understanding and measuring this relationship and how the income of veterinarians and the cost of becoming a veterinarian affect the relationship are important in estimating the future demand for veterinary education.

The number of applications for veterinary colleges that have been recorded through the VMCAS has been cyclical over the last three decades, with peaks near 7,000 applicants in 1980, 1999 and 2014 and troughs around 4,000 in 1990 and 2002. This is illustrated in the accompanying chart. If this cycle continues into the future, the number of applicants should begin to fall in the near term. However, no statistical relationship has yet been identified that would suggest that specific factors cause this cycle and they may be unrelated events. Determining what factors affect the number of applicants will be important to predicting future market demand for veterinary college seats.

AAVMC VETERINARY SCHOOL APPLICANT FIGURES, 1980-2015

Figure 18

Veterinary School Applicant Figures

AAVMC Internal Data Reports 1977-2014

More important than the total number of applicants is the number of applicants per available seat. Here again, even with the expansion of the number of schools and the number of seats at each school, the number of applicants per seat is cyclical. The peaks in this cycle have been declining over time while the bottom of the cycle has been roughly constant. The current ratio of total applicants to the number of seats at the 30 U.S. colleges is roughly 2.25:1. But if the seats available to U.S. students at both domestic and foreign U.S.-accredited schools are considered, that ratio drops to 1.52:1 for 2016. If the cycle in applicants follows past trends and the number of applicants drops into the range of 4,000, the number of available seats will exceed the applicants. Further exacerbating this potential situation is the fact that not all applicants meet the current eligibility requirements for veterinary school. Those requirements are necessary to ensure a sufficient NAVLE pass rate which ultimately allows the veterinary college to continue to receive accreditation. Thus, the total number of applicants to the number of available seats will be an important indicator of the demand for an increased number of seats. Increasing the supply of seats at a rate that exceeds the rate of growth in demand for those seats will increase the competition for quality students amongst schools. This increased competition may increase the difficulty of filling the higher cost seats with high-quality students.

VMCAS APPLICANTS AND FIRST-YEAR SEATS, U.S. AND INTERNATIONAL INSTITUTIONS, 2012-2017

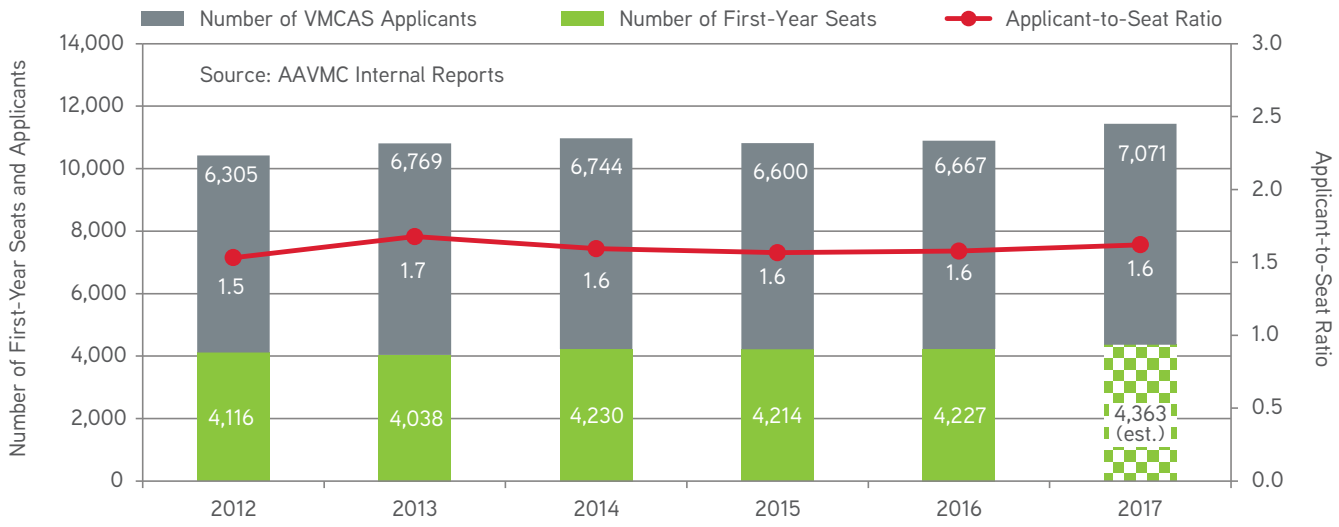


Figure 19

Our forecast is for a constant number of seats and a relatively constant number of applicants in the near term, maintaining the applicant to seat ratio in the range of 1.5-1.6:1 However, as the cost of education continues to climb, and as college students become increasingly knowledgeable of the financial hardships associated with the profession's high debt-to-income ratio, this applicant-to-seat ratio may be expected to decline over the longer term even with a constant number of available seats through 2025.

If the rate of increase in the number of seats at existing schools continues the long-term trend and two new schools are added, however, then the combination of new seats and declining applicants will bring the applicant-to-seat ratio to an estimated 1.2:1 by 2025. While this is likely to be a worst-case scenario, with the competitive environment among veterinary schools currently increasing from highly competitive to extremely competitive, veterinary schools will in the near term have to compete for students. With the addition of even more seats, the market for veterinary education would become a buyer's market, meaning that each applicant (the buyers in this case) would face less competition for seats at veterinary colleges (the sellers).

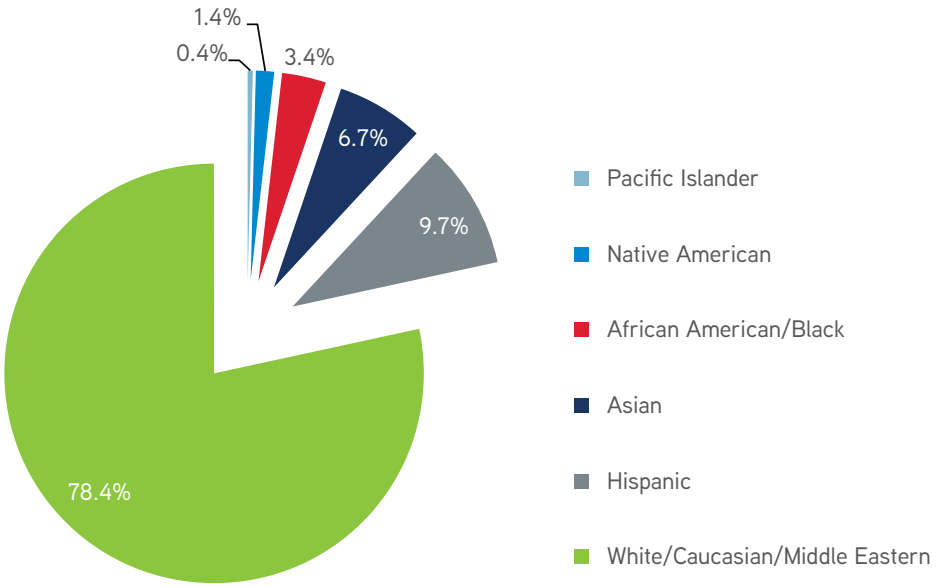
There is likely a threshold value for tuition costs that the average student is willing to pay (discussed below). Above this threshold, the number of applicants decreases, and recent analysis has shown that this threshold may be declining. Those schools whose total costs falling in the top 20th percentile are currently above that threshold. Thus, the addition of new seats that cost more than the threshold in this increasingly competitive market is likely to be unsustainable. This analysis assumes that no change from the baseline occurs in the applicant pool. But because the applicant pool will be adversely impacted by an increasing debt-to-income ratio, this assumption likely won't hold. Therefore, the estimate presented is essentially a conservative scenario.

HOWEVER, AS THE COST OF EDUCATION CONTINUES TO CLIMB, AND AS COLLEGE STUDENTS BECOME INCREASINGLY KNOWLEDGEABLE OF THE FINANCIAL HARDSHIPS ASSOCIATED WITH THE PROFESSION'S HIGH DEBT-TO-INCOME RATIO, THIS APPLICANT-TO-SEAT RATIO MAY BE EXPECTED TO DECLINE OVER THE LONGER TERM EVEN WITH A CONSTANT NUMBER OF AVAILABLE SEATS THROUGH 2025.

Veterinary School Applicant Characteristics

The characteristics of the applicant pool have changed little over time. The average grade point average (GPA) of the applicants remains near 3.5 with less than 20 percent having GPAs below 3.0. The percentage of women applicants remains above 80 percent with roughly 78 percent of the applicants white Caucasians.

RACIAL AND ETHNIC DEMOGRAPHICS OF APPLICANTS TO THE CLASS OF 2020



Source: AAVMC Internal Reports

Figure 20

Although companion animal private practice is the most frequently cited number-one goal, the interests of the applicants is diverse. Large animal, equine and shelter medicine all share the second spot for the most common career interest at the time of application.

As in previous years, roughly 75 percent of the applicants attended a public university; 21 percent are first-generation college students; and 27 percent are Pell grant eligible (financial need and no bachelor or professional degree). The largest proportion of applicants grew up in the suburbs and wish to return there to work. More than 80 percent are working and one-third of the applicants are working full time.

CAREER INTERESTS AT THE TIME OF APPLICATION FOR CLASS OF 2020 VETERINARY SCHOOL APPLICANTS

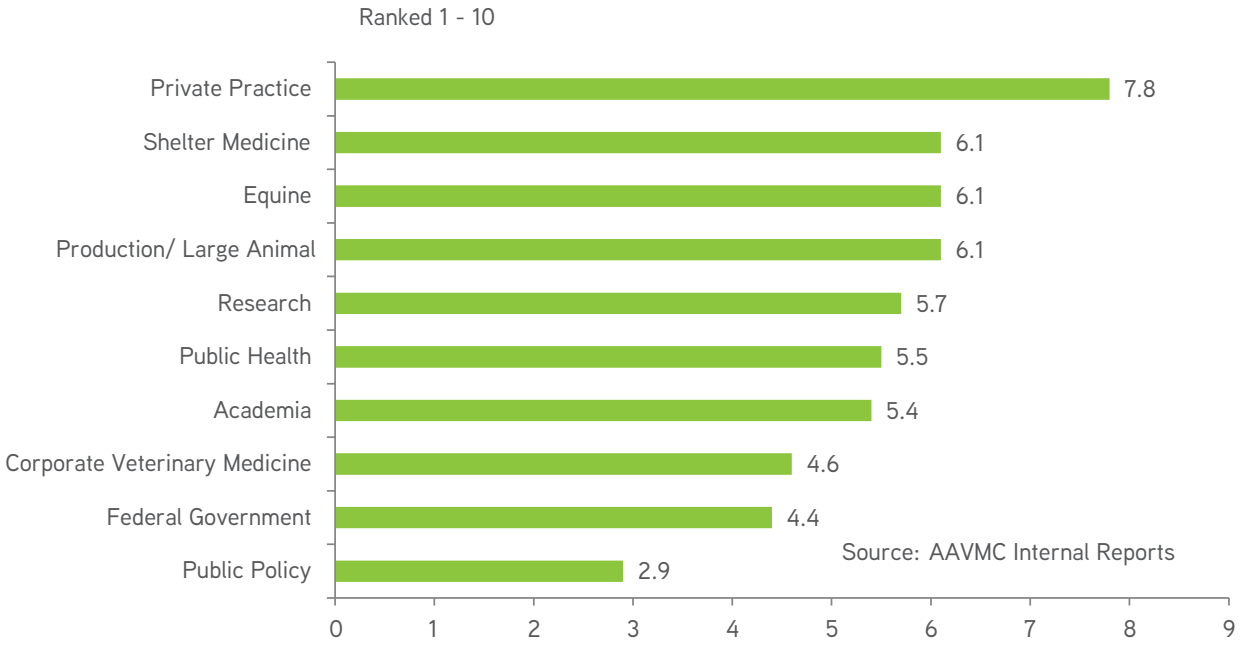


Figure 21

As one might expect, three-quarters of the veterinary school applicants have pets; 44 percent have more than one pet. Of the pet owners, 63 percent estimate that they spend more than $100 per month on their pet(s), and 75 percent of the pet owners plan to bring their pets to veterinary college. However, only one in three have budgeted for pet expenditures.

An area that is currently of great concern in the veterinary profession is financial literacy of the incoming veterinary students. First, only 25 percent of the applicants indicated that they would rely entirely on student loans for the veterinary education. The other 75 percent noted they would receive some support from family, scholarships, personal savings, work or some other source. Roughly 60 percent of the applicants noted that their pre-veterinary advisor provided no information about educational debt, and 55 percent noted they had not spoken to a financial aid professional.

SOURCES OF FINANCIAL SUPPORT FOR CLASS OF 2020 VETERINARY SCHOOL APPLICANTS

Source: AAVMC Internal Reports

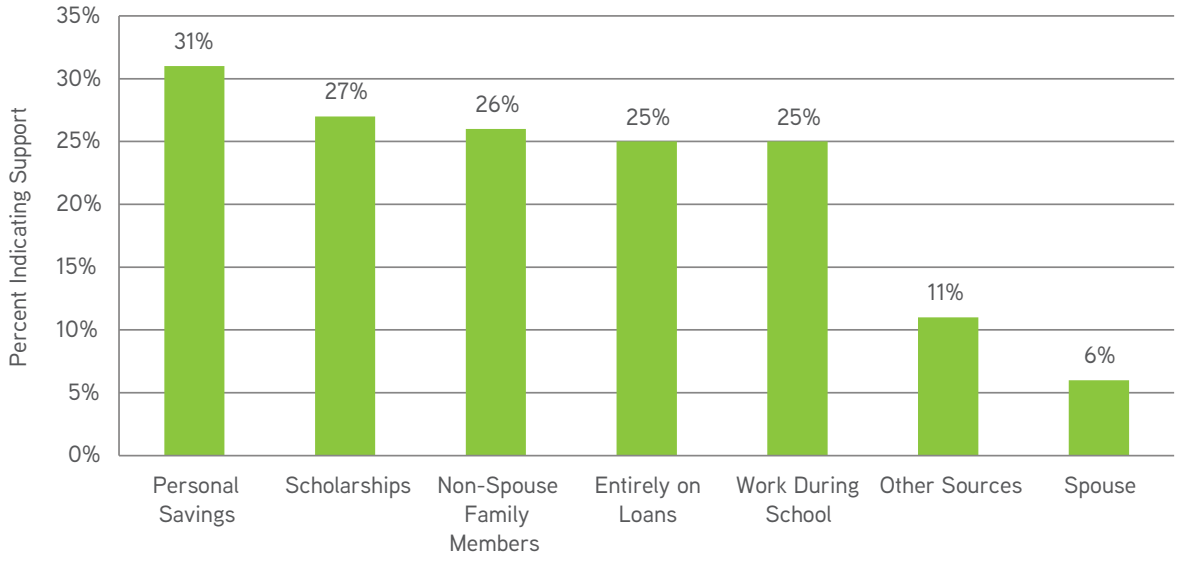


Figure 22

"Check All That Apply." Percentages do not add to 100%.

Willingness to Pay for Veterinary Education

The market for veterinary education is driven by the demand for seats from the pool of applicants. The amount that each applicant is willing to pay for a veterinary college seat will yield the demand schedule (curve) for veterinary education. Applicants were asked three different questions to ascertain their willingness to pay for a seat:

1) How much are you willing to borrow to cover the cost of attendance of veterinary school?

2)If you knew that your starting salary after graduating from vet school would be $70,500 per year, how much *total debt* would you be willing to accept to cover all your expenses (including tuition and cost of living) in order to acquire a DVM?

3)The average starting salary for a new veterinarian is $71,000. With this annual salary, after taxes, assume your monthly take home pay is $3,800. How much would you be willing to pay back on your student loan per month?

Using the information provided in items 2 and 3, the amount that each applicant is willing to pay for a seat was computed and compared to their direct response as to their willingness to borrow. The estimates from each of the three questions are very similar. The close similarity between the demand schedules for items 1 and 2 may suggest that the applicants have a good idea of the mean salary of veterinary graduates and have simply determined an approximately monthly value of the total debt that they are willing to incur. When provided with a take-home salary, however, the level of debt that they are willing to service on this income exceeds by $50,000 the amount of debt they were willing to incur.

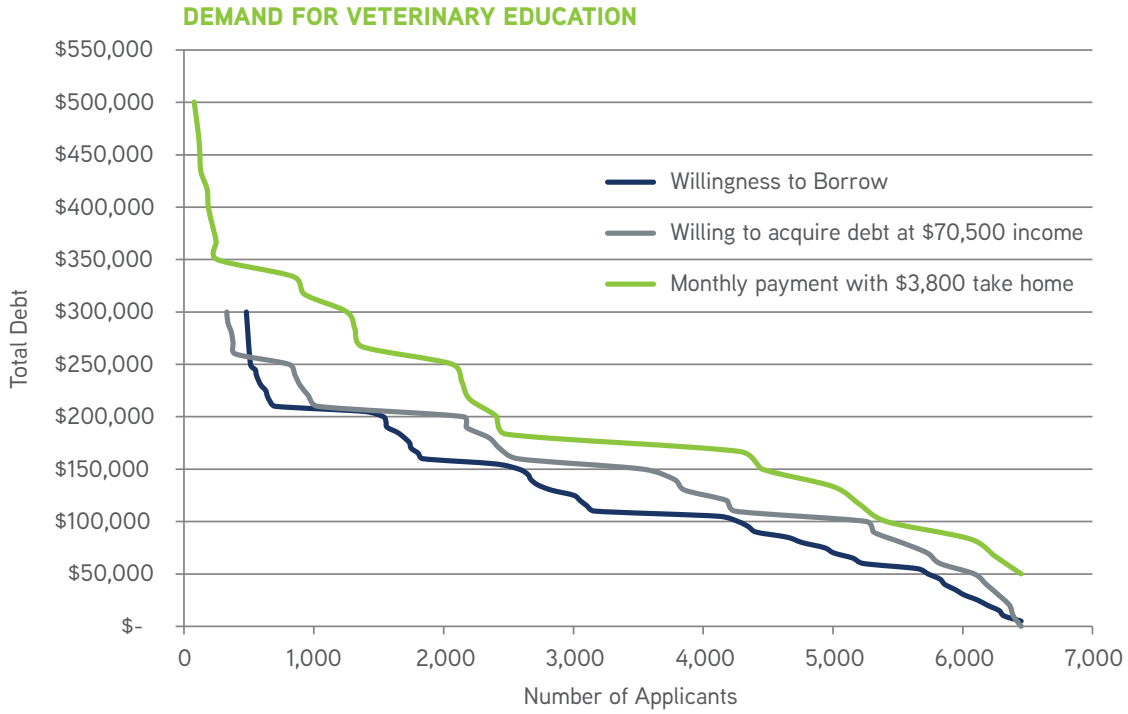


Figure 23

Comparing the willing-to-pay schedule from the last three years there has been very little change. The maximum remains around $250,000 and for every additional seat demanded the willingness to pay declines by roughly $37. Thus to fill 1,000 seats would require that the last seat cost no more than $213,000 ($250,000 less $37,000).

APPLICANT DEMAND FOR VETERINARY EDUCATION

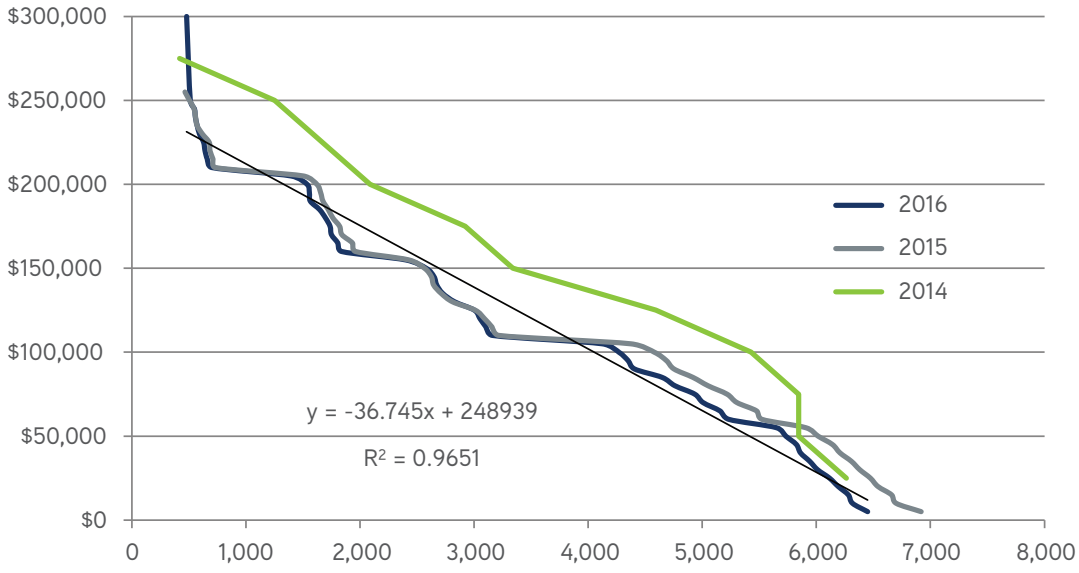


Figure 24

There are, however, several caveats with this analysis. First, the question asked of the applicants sought how much they were willing to *borrow* rather than how much they would be willing to *pay*, inclusive of any outside financial support; And second, whether the willingness to pay represents the amount they are hoping to pay at the college of their choice, or the maximum they are willing to pay to attend whatever veterinary college they can get into, remains unknown. Finally, does the willingness to pay represent what they are willing to pay for tuition and fees only, or does it include living expenses or interest payments? These are important questions that will be used to refine the current questions to better understand the real willingness of applicants to pay to attend veterinary college.

Market for Education Equilibrium

The colleges of veterinary medicine have set the prices per seat and the applicants have indicated their willingness to pay for a seat. In a perfectly competitive market there would be no difference in the quality of education obtainable from each seat and the only feature that would differ is the price of the seat. In this perfectly competitive market, those seeking a seat would purchase a seat only if they would obtain the seat at a price at or below what they are willing to pay for that seat. And, the colleges would provide the seat only if they could receive a price at or above the price for which they are willing to sell the seat.

In this perfectly competitive market analysis, the number of seats that would be purchased by the applicants can be determined by equating the willingness to sell of the colleges with the willingness to buy of the applicants. Using the willingness to borrow obtained from the applicants and the cost per seat provided by the colleges, the total number of seats that the applicants are willing to buy in 2016 was estimated at 2,331 seats with an average price of $163,292. This estimate assumes that the applicants' willingness to pay was for only tuition and fees. If the willingness to pay was for the total costs (tuition and fees, living expenses and interest) of the seat, then the total number of seats that would be purchased was estimated at 1,606 with an average total cost of $189,912.

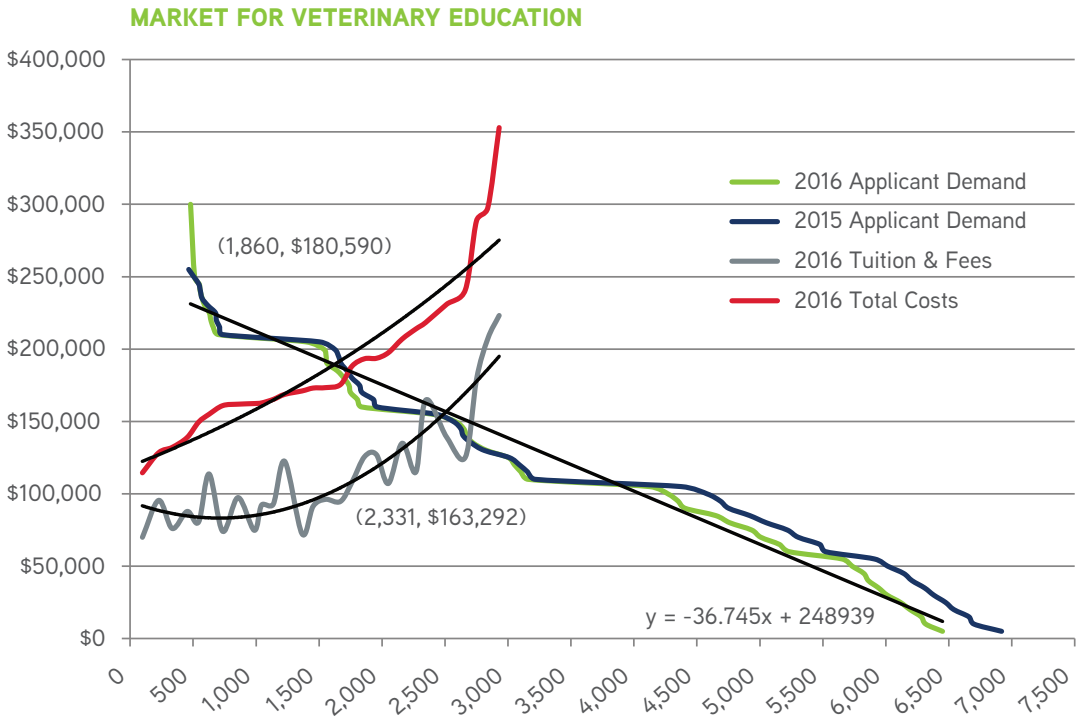


Figure 25

USING THE WILLINGNESS TO BORROW OBTAINED FROM THE APPLICANTS AND THE COST PER SEAT PROVIDED BY THE COLLEGES, THE TOTAL NUMBER OF SEATS THAT THE APPLICANTS ARE WILLING TO BUY IN 2016 WAS ESTIMATED AT 2,331 SEATS WITH AN AVERAGE PRICE OF $163,292.

Of course the market for veterinary education is not perfectly competitive. The quality of education provided at each college is not equal as each college has numerous variations in course selection, areas of concentration, and educational processes to name a few. In addition to tuition costs, in-state students may have a preference for their in-state college, have lower living expenses being closer to home, or may be reluctant to move out of state to a different socioeconomic climate. Regardless of the reasons, applicants generally prefer their home colleges.

Applicants may also have indicated their willingness to pay based only on their first choice of schools and thus they provided a willingness to pay that may only express what they hope to pay and not how much they would be willing to pay to obtain a seat from the school where they might be accepted. Clearly, in the United States alone, more than 3,200 seats were filled and the last seats would have cost in excess of $220,000.

MARKET FOR VETERINARY EDUCATION, ANNUAL CHANGE IN EQUILIBRIUM POINT

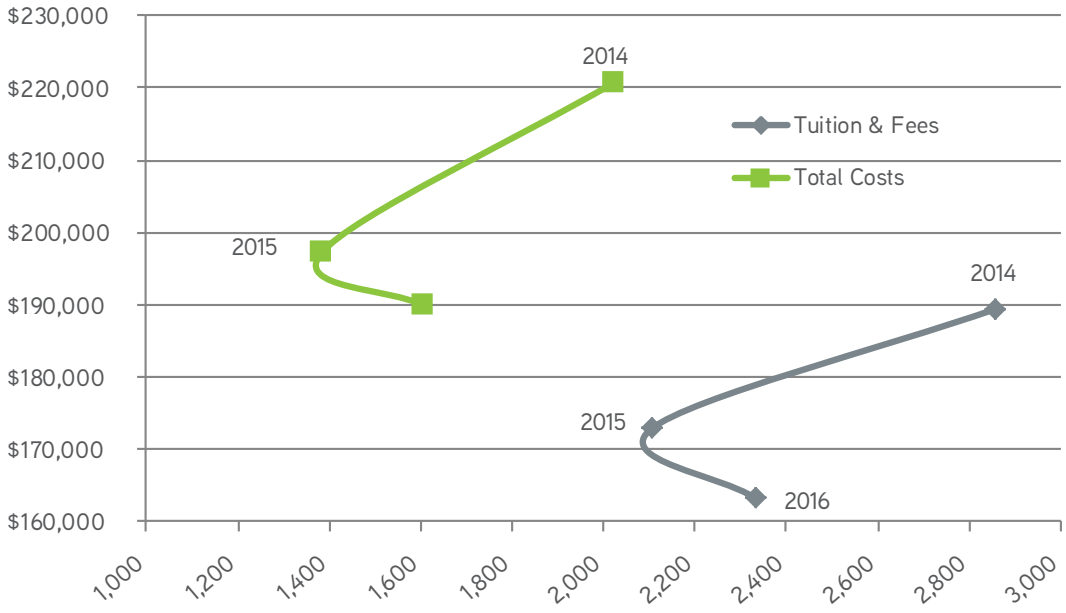


Figure 26

In addition, not all the applicants are selected; less than half are offered a seat in a U.S. college, and the willingness of these new students to pay cannot be separated from the total pool of applicants. With all of these caveats, one might ask, "What is the point of determining this equilibrium in the market for veterinary education?" The key is to observe how the equilibrium is moving year to year.

MARKET KEY PERFORMANCE INDICATOR

The discussion of the applicant's willingness to pay and the veterinary colleges' willingness to sell is summarized by the apparent equilibrium price and quantity of seats. This equilibrium price and quantity compared to the actual price and quantity of seats provides a perspective on the market for veterinary education at a specific point in time. The changes to each of these measures over time provides an overview of how the market is changing and the direction the market is headed. But these measures only provide a view of how well the market is functioning internally, not how well the market is performing within the veterinary markets.

The output of the market for veterinary education is new veterinarians. The performance of this market is the efficiency with which resources are used to produce veterinarians who are valued by society at or above the cost of producing them. More specifically, is the value of output from a veterinary college equal or above the cost of producing the veterinarian? To determine this value would require the actual cost of producing each veterinarian and the value of output that each veterinarian provided over their life of service. But this measure would include more than value provided by the college. Each veterinarian could obtain additional training and experience that would improve their value of output. Thus we need a measure at graduation of the value of the veterinarian against the cost of producing that veterinarian.

The ratio of debt to starting salary (income) provides such a measure. The debt-to-income ratio has several shortcomings as an exact measure of the social value of the veterinarian versus the costs of producing that veterinarian. Consider the following measures for the 2016 graduating class from the 28 U.S. veterinary colleges:

- mean total cost (tuition and fees, living expenses, interest) of a veterinary college seat was $206,952;
- mean debt of a graduating veterinarian was $141,421;
- mean income of graduates obtaining full-time employment prior to graduation was $73,380;
- a DIR of 2.00

The debt does not provide an accurate measure of the cost of producing the veterinarian. Clearly, because the mean debt is less than the mean cost, there are outside funding sources that have been used to pay the educational expenses. Further, the mean cost of a veterinary education just provided does not cover the total costs of providing a veterinary education as the tuition and fees cover only a part of the total actual costs. The majority of the U.S. veterinary college seats are discounted seats. For 25 of the 30 U.S. veterinary colleges, states provide some portion of the costs of the education.

A KPI is an indicator of relative performance, not necessarily an exact measure of performance. The DIR is a KPI that can be used to indicate whether the market is becoming more or less efficient. Over the period 2001 to 2016 the average annual increase in the DIR has been 0.06, but has fallen by 0.027 per year since 2013. An increasing DIR indicates that the cost of producing a veterinarian is growing faster than society's value of the veterinarian.

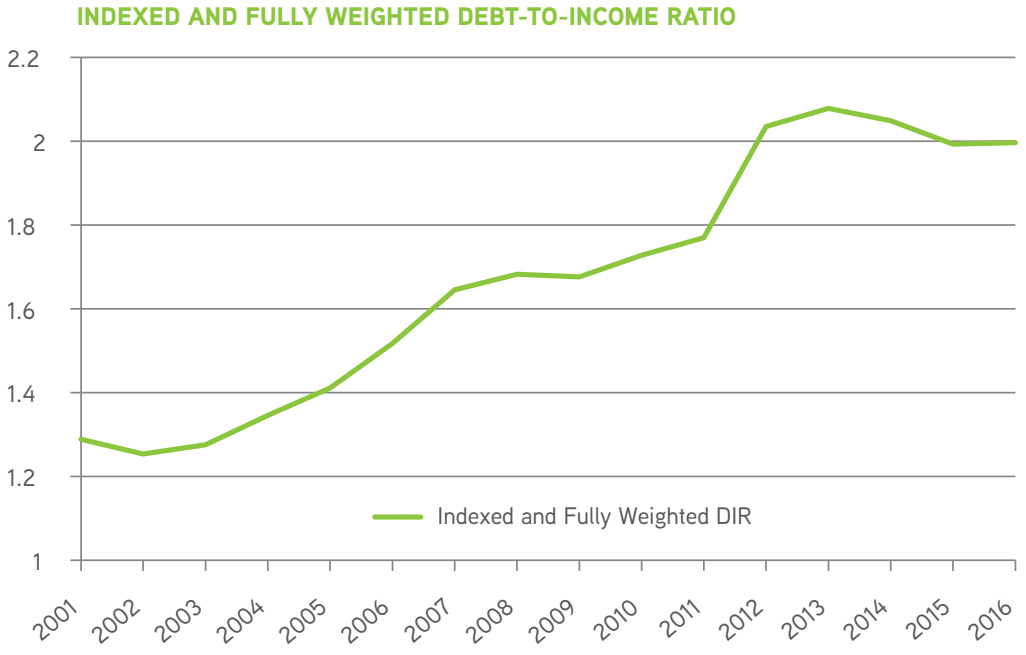


Figure 27

While the weighted indexed DIR provides an indicator for the mean new veterinarian, providing an illustration of the variation of the DIR within the class of nearly 3,000 graduates may be as important. While the mean may change little from year to year, the distribution of DIR for each class may change and indicate a growing problem. The movement to a less kurtotic distribution or to a greater skewness (to the left) would indicate a larger share of graduates with a very high DIR. Currently there are roughly 56 percent of graduates with a DIR at 2:1 or greater, and 65 percent above the veterinary profession's DIR target of 1.4:1.

Any debt must be serviced from available disposable income and as such will reduce future expenditures of the person with debt. The greater the debt, the greater the adverse effect on lifestyle, as the amount of disposable income that must be used to service the debt cannot be used for purchases that may improve lifestyle. The 1.4:1 target DIR for the veterinary profession was determined from the cost of servicing the debt being no more than 10 percent of disposable income at five years after graduation.

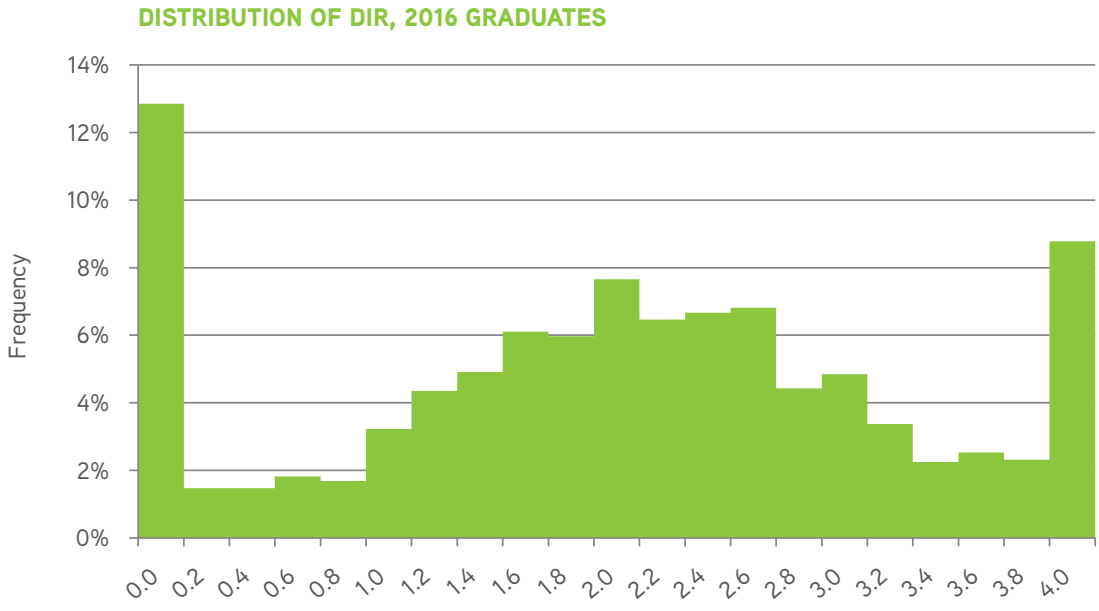


Figure 28

A forecast of the DIR indicates that the efficiency of the market for veterinary education will continue to decline through 2026. The DIR is expected to reach 2.18 by 2026. This forecast assumes no changes in the provision of veterinary education, no new seats added, no change in the number of applicants and no change in society's perceived value of the veterinarian, and growth in the general economic activity as predicted by the CBO.

DEBT AND INCOME OF GRADUATES, U.S. COLLEGES

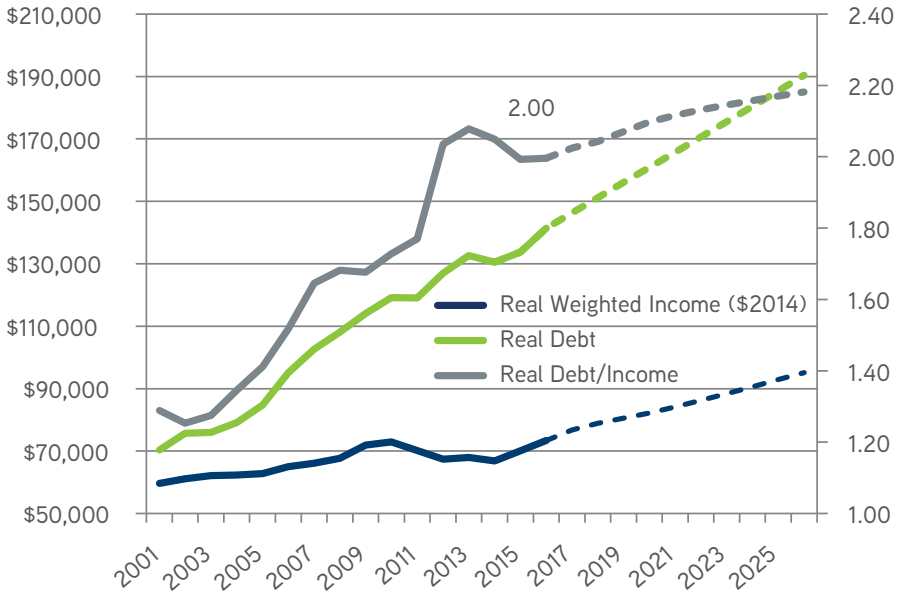


Figure 29

SUMMARY

The number of qualified applicants for veterinary college continues to exceed the number of available seats. And the graduates of the veterinary colleges currently face a rising demand and thus face rising starting salaries in the near term. The costs of a veterinary education continue to rise, however, mostly in relation to the decline in public support. As a result, new graduates will continue to face a higher debt-to-income level.

These near-term projections are based on the continued growth of the U.S. economy. As we approach the apex of the economic cycle, the increasing probability of an economic downturn increases – and, when seen, will both exacerbate the student debt as state funding declines further, and slow the growth in starting salaries. The combined impact will increase the rate of growth in the DIR.

THE MARKET FOR VETERINARIANS

The market for veterinarians is not one single homogenous market.

The market for veterinarians is the market within the vertically related veterinary markets where society's demand for veterinary services interacts with supply of veterinarians to determine the number and value of veterinarians. But the market for veterinarians is not one single homogenous market but rather a number of horizontally related markets based on geographical location, community size, and type of practice.

This report will provide national data and analysis and the more detailed analysis of the location, community and practice type specific markets will be provided in the 2017 Report on *The Market for Veterinarians.*

VETERINARY INCOMES

Incomes of veterinarians increase as they gain experience through the first three decades of their career and then begin to decline as they reduce the hours they devote to the practice of veterinary medicine. The variation in incomes also increases with age through the first three decades and then declines through the remainder of their career.

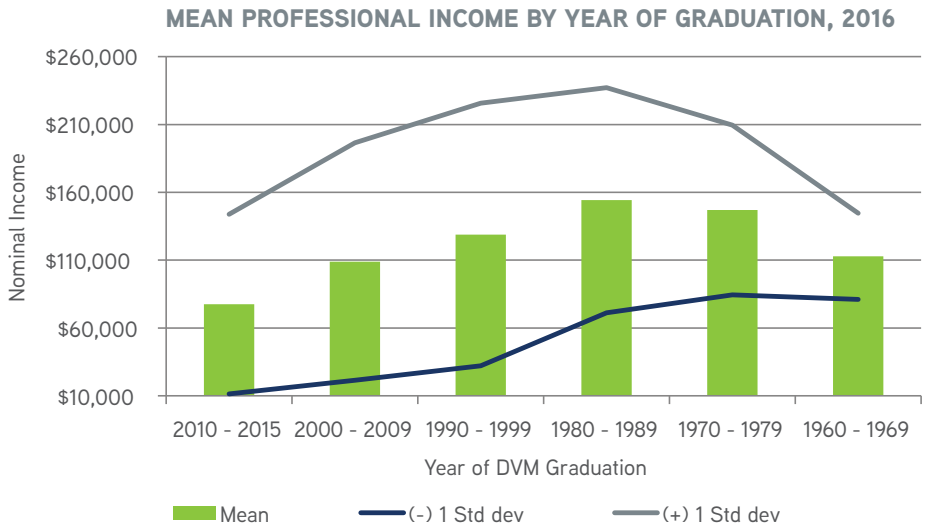


Figure 30

Mean income and the variation in income also differ by practice type. Veterinarians employed in industry and academia have the highest mean incomes while those in predominately food animal practice and non-veterinary employment having the lowest mean incomes. However, the variations in incomes are affected by location and size of community, as are living costs. Thus, mean incomes alone may not be useful as a measure of the standard of living derived from a career in veterinary medicine.

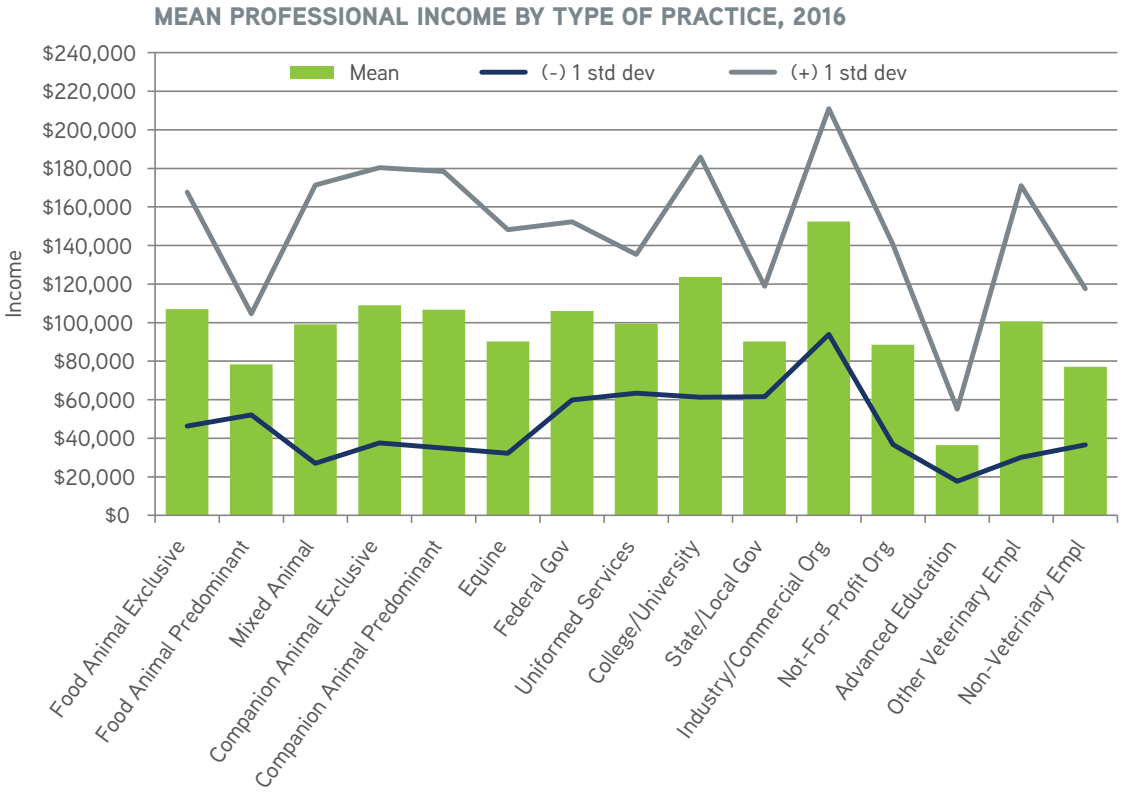


Figure 31

VETERINARIAN UNEMPLOYMENT

Unemployment in veterinary medicine has remained low for the last three years (2013-2015), with the mean unemployment rate near 4 percent. Some unemployment is associated with employment mobility. There is often a period of time where unemployment occurs between jobs. Over the last 12 months nearly 8,000 veterinarians sought employment, roughly 8 percent of the veterinary workforce. Thus, job mobility may account for a large portion of the unemployment and this is known as the natural rate of unemployment nationally, thought to be around 4.5 percent.

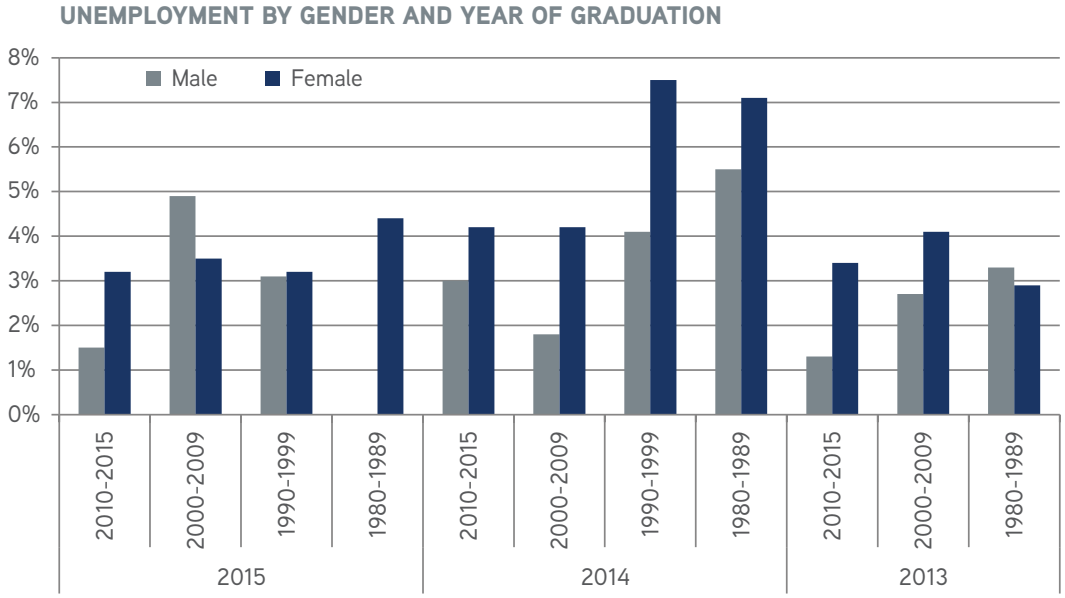


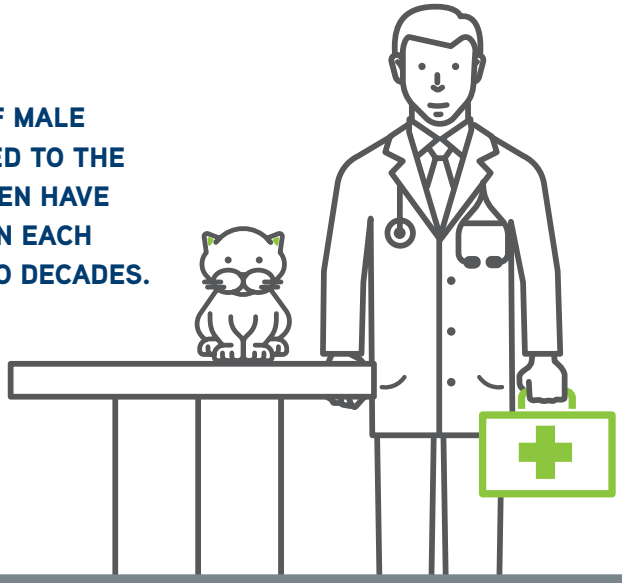
Figure 32

VETERINARIAN UNDEREMPLOYMENT

The veterinary profession continues to experience negative underemployment, the total number of hours that all veterinarians wish to work less for less compensation exceeds the total number of hours that all veterinarians wish to work more for more compensation. And the amount of negative underemployment has increased over the last three years (2013-2015).

For men, underemployment existed in both 2013 and 2014 but became negative in 2015. The age distribution of male veterinarians is skewed to the older ages as fewer men have entered the profession each year over the last two decades. And, generally, among younger veterinarians there are more who wish to work more hours for greater compensation than those who wish to work fewer hours for less compensation, and these preferences shift as veterinarians age.

THE AGE DISTRIBUTION OF MALE VETERINARIANS IS SKEWED TO THE OLDER AGES AS FEWER MEN HAVE ENTERED THE PROFESSION EACH YEAR OVER THE LAST TWO DECADES.



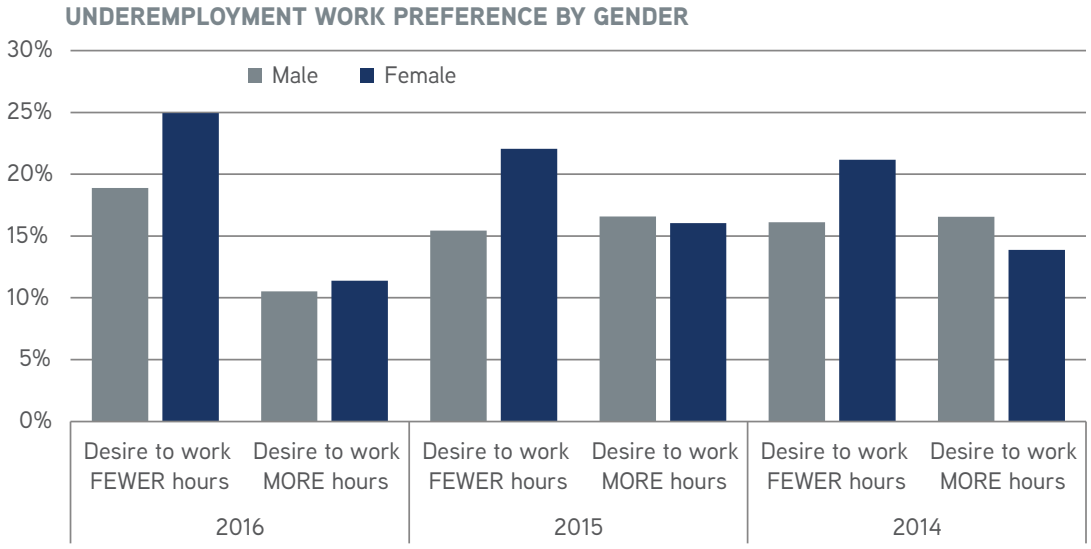


Figure 33

The shifting preferences that occur with age for the hours worked per week can be seen in the percent of veterinarians, by graduation year, who wish to work more hours for greater compensation. In all three years, the percent of those wishing to increase their hourly work week increases as the year of graduation becomes more recent. The significant decline in the percent of veterinarians desiring a longer hourly work week in 2015 compared to the two prior years is an indicator of the growth in demand for veterinary services.

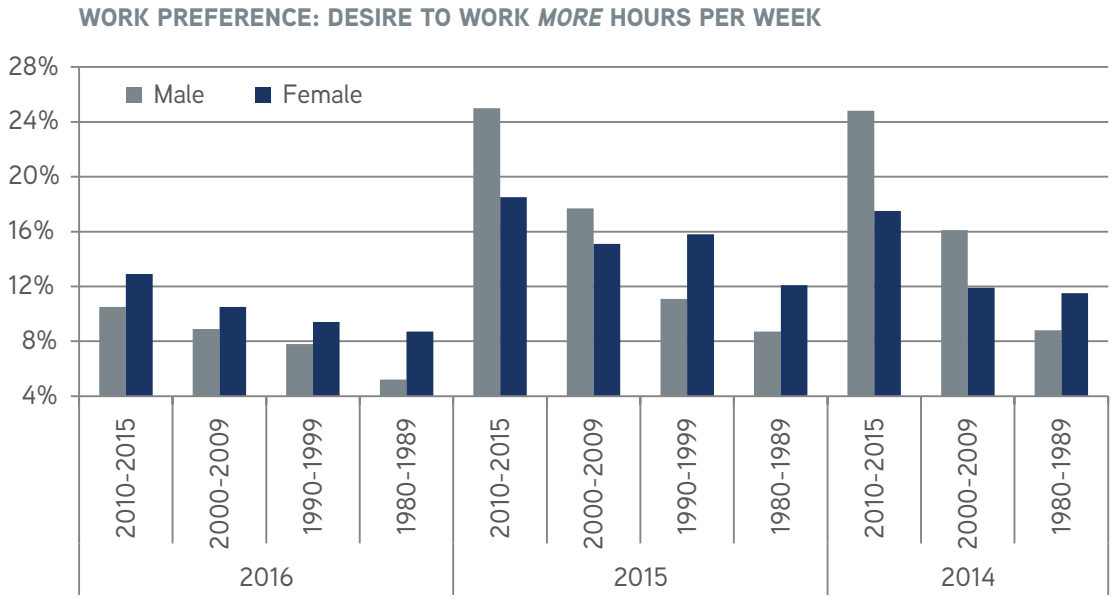


Figure 34

Another indicator of the growing demand for veterinary services is the increase in the percent of veterinarians who wish to work fewer hours. While there is generally a higher percentage of female veterinarians wishing to work fewer hours per week – and the percent has increased over the last three years – the trend is similar for men. The amount of total negative underemployment has increased from 66,200 hours in 2013 to 73,320 in 2014 and 135,640 in 2015. In 2015, 3,391 veterinarians would be required to be added to the workforce to facilitate the desire of all veterinarians to reach their optimal hourly work week.

WORK PREFERENCE: DESIRE TO WORK *FEWER* HOURS PER WEEK

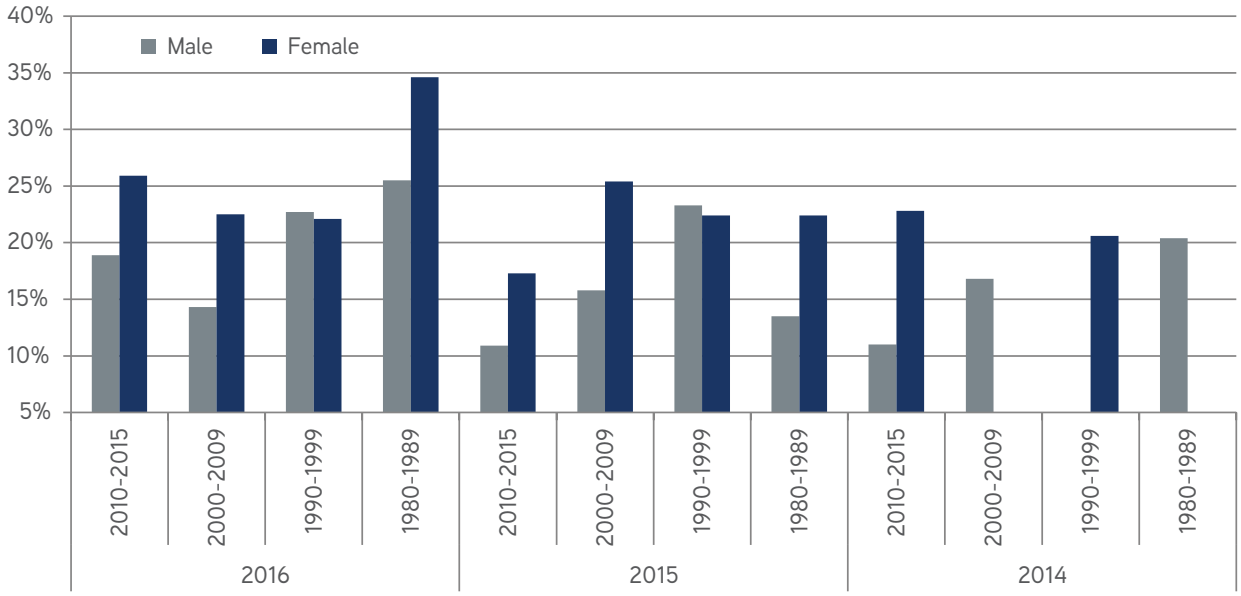
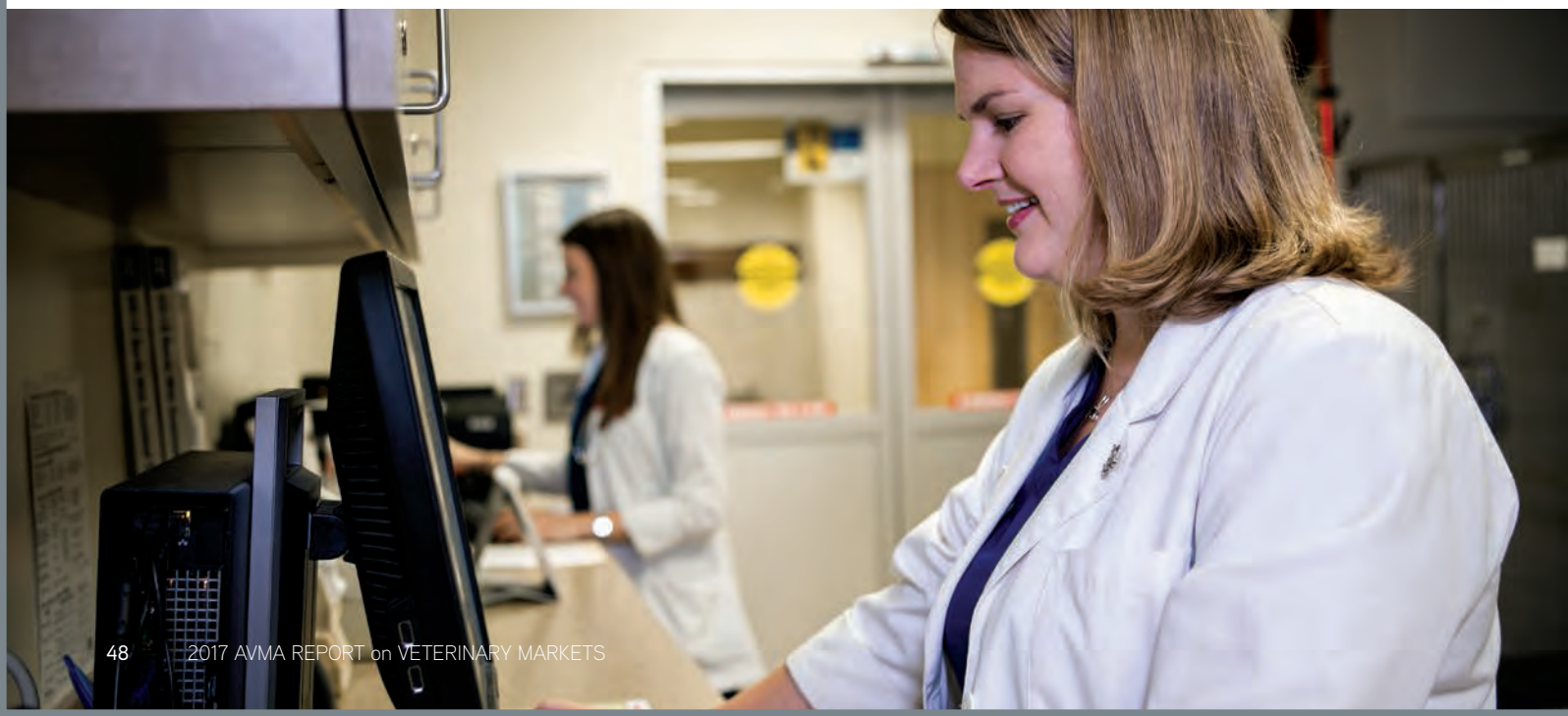


Figure 35

LOCATIONS WHERE THE CONCENTRATION OF VETERINARIANS (NUMBER OF VETERINARIANS PER 100,000 PEOPLE) EXCEEDS THE NATIONAL AVERAGE MAY HAVE HIGHER LEVELS OF UNEMPLOYMENT, UNDEREMPLOYMENT AND LOWER INCOMES THAN IN SIMILAR LOCATIONS WHERE THE CONCENTRATION OF VETERINARIANS IS LESS THAN THE NATIONAL AVERAGE.



RELATIVE CONCENTRATION OF VETERINARIANS

Veterinarians wishing to work more hours is an indication that some practices are not operating at optimal capacity while practices with veterinarians wishing to work fewer hours may be an indication of practices that are working beyond optimum capacity and closer to full capacity. This difference in the amount of hours that veterinarians wish to change may also be a result of the maldistribution of veterinarians.

Locations where the concentration of veterinarians (number of veterinarians per 100,000 people) exceeds the national average may have higher levels of unemployment, underemployment and lower incomes than in similar locations where the concentration of veterinarians is less than the national average. However, because the demand for veterinary services is affected by many demographic factors, simply looking at the concentration of veterinarians will not provide a complete explanation for the differences in unemployment, underemployment and incomes between locations. For instance there is a higher demand for veterinary services among higher-income animal owners and thus high-income locations should be expected to have a concentration of veterinarians that exceeds the national average.

The Bureau of Labor Statistics (BLS) created the location quotient from data collected by the Quarterly Census of Employment and Wages (QCEW) program to allow for a comparison of relative employment levels in the United States, states, counties, and metropolitan statistical areas. A labor quotient of 1 would indicate that the number of veterinarians in the location per 100,000 employees is equal to the number of veterinarians per 100,000 employees for the United States. Thus, an LQ in excess of 1 indicates that veterinarians in that location comprise a higher percent of total employment than for the United States.

LOCATION QUOTIENT OF VETERINARIANS BY STATE, 2015

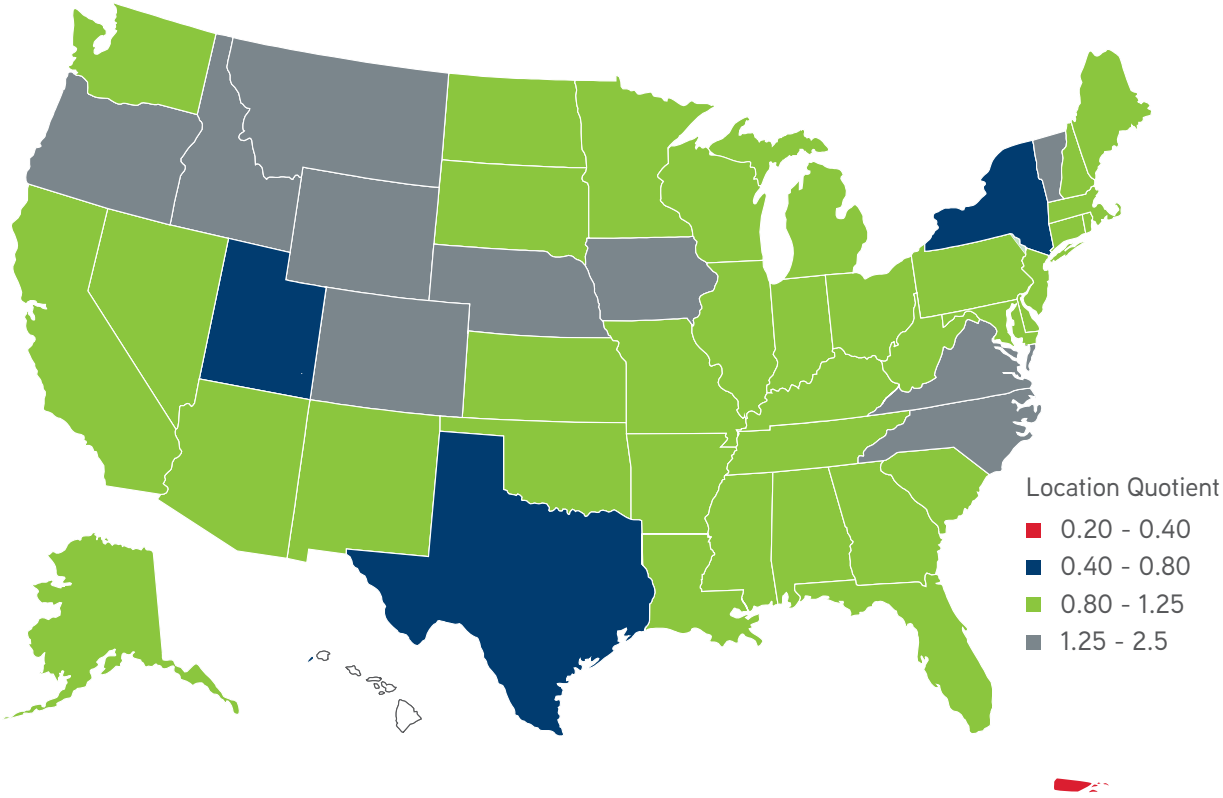


Figure 36

While the BLS uses data from a census of employment and wages, the AVMA has a database of veterinarians, both employers (e.g., practice owners) and employees that can be used to compute a labor quotient. While the state-level labor quotients produced by the BLS and the AVMA data are similar, there are differences. Part of this difference may be due to a locational bias in the AVMA's data of veterinarians, as roughly a quarter of the veterinarians in the database have not reported a current location. Because there is no means for determining the extent to which these veterinarians with an unknown current location are similar in geographic location to the other veterinarians, it is possible that part of the difference between the two maps is due to a locational bias.

However, the AVMA data contain the location of veterinary practice employers (practice owners) that may not all be included in the BLS data on employment. The BLS survey estimates the total number of veterinarians employed at 78,300, far short of the roughly 105,000 veterinarians estimated from the AVMA database. The BLS data does not include employers in the employee data and, with roughly 27,000 veterinary practices in the United States and included in the AVMA data – and many of these practices being single-veterinarian practices – some differences between the AVMA and BLS location quotient may be expected.

LOCATION QUOTIENT OF AVMA VETERINARIANS BY STATE, 2016

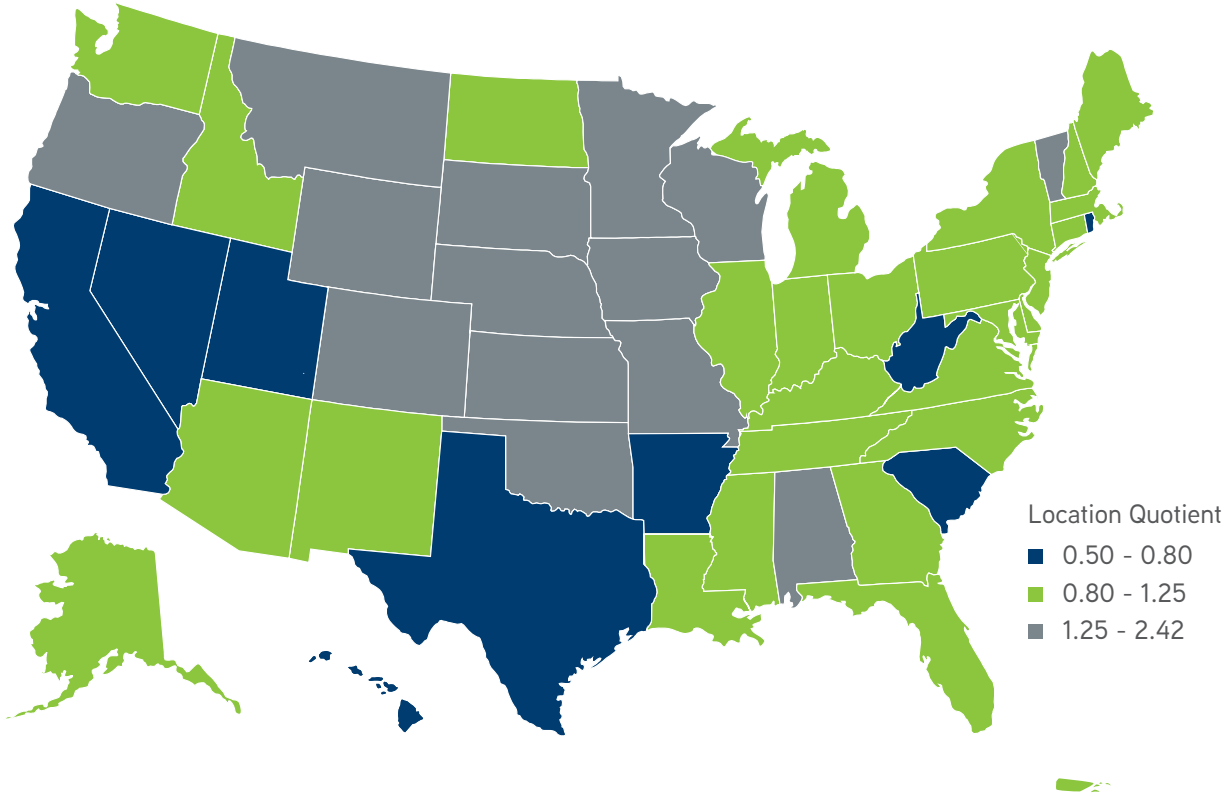


Figure 37

The location quotient for new veterinarians can also be examined by using the responses from the AVMA senior survey. With more than 90 percent of new graduates indicating where their first employment opportunity is located, the relative concentration of new veterinarians is similar to the existing patterns.

LOCATION QUOTIENT OF NEW VETERINARIANS BY STATE, 2016

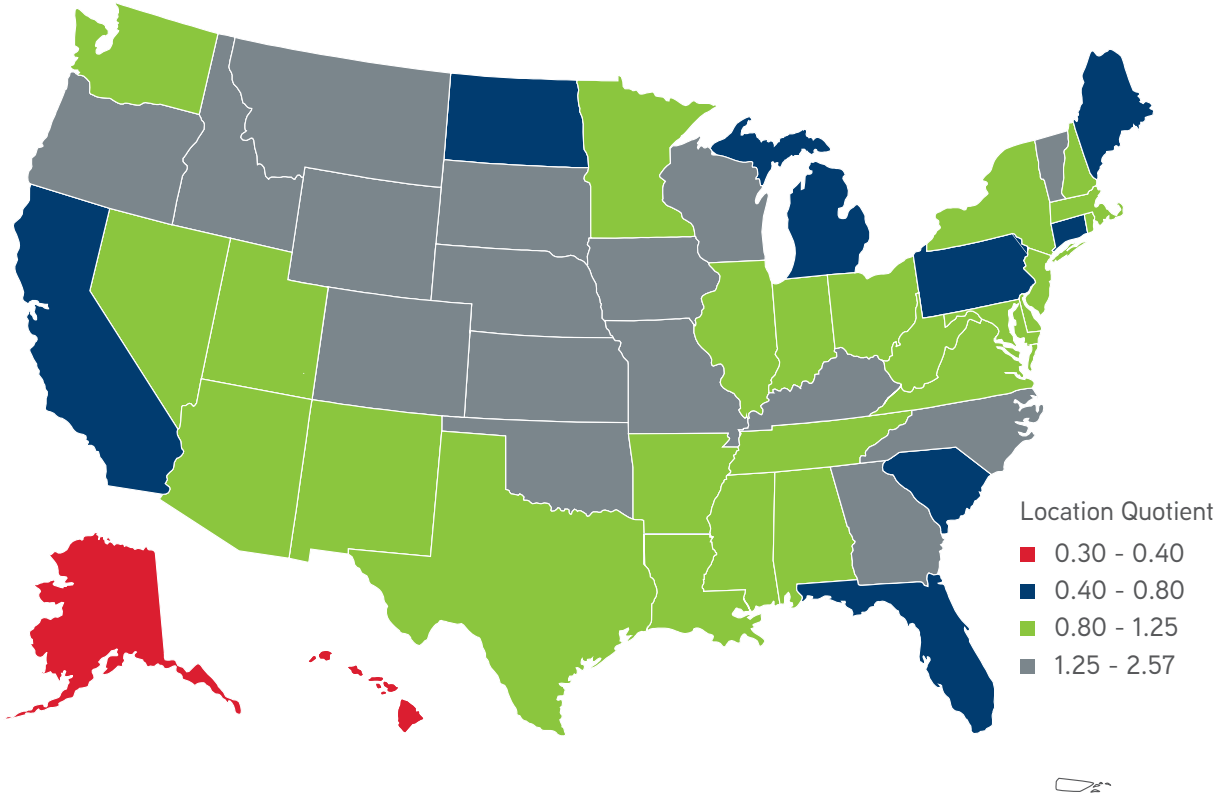


Figure 38

VETERINARIAN EMPLOYMENT OPPORTUNITIES

As the general economy has improved since the recession ended in June 2009, the number of unemployed has declined and the number of jobs available has increased. As of August, 2016 there were just over 7 million people actively seeking employment and just under 5 million jobs available, as estimated by the Conference Board's Help Wanted On-Line (HWOL) Survey. "The HWOL program is targeted to cover the full universe of all online advertised vacancies which are posted directly on Internet job boards. The HWOL program uses data collected from over 16,000 online job-board sources including corporate job boards. Each year new job-board sources are added as they emerge while some existing sources may be dropped if it is determined that they primarily spider their ads from other job boards."[1]

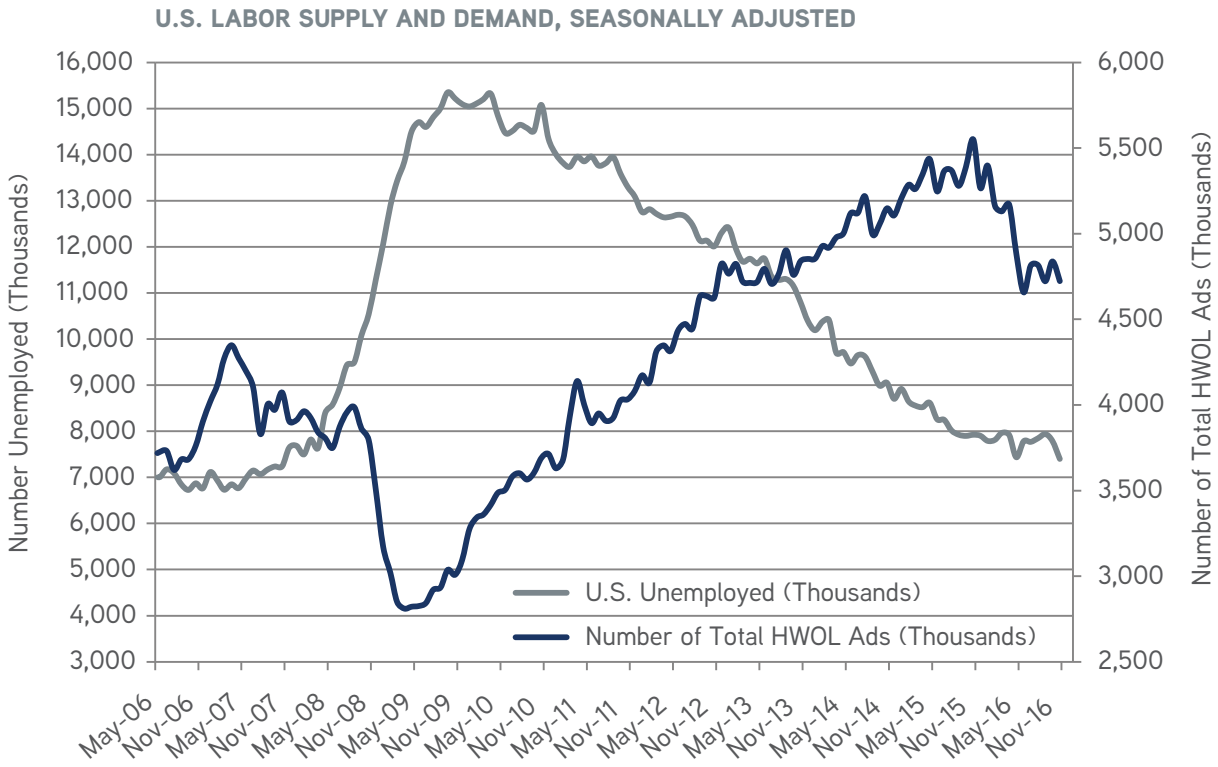
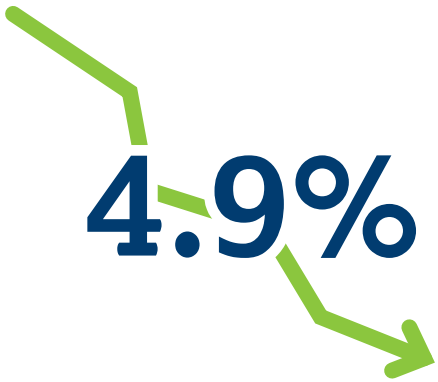


Figure 39



IN LATE 2015 THE NUMBER OF HWOL ADVERTISEMENTS FOR JOBS BEGAN TO FALL AND THE NUMBER OF UNEMPLOYED REACHED A BOTTOM AND BEGAN TO INCREASE. WITH THE U.S. UNEMPLOYMENT RATE NOW AT 4.9 PERCENT THE ECONOMY MAY HAVE REACHED FULL EMPLOYMENT.

[1]https://www.conference-board.org/pdf_free/press/HWOLTechNotesMar3020167.pdf

In late 2015 the number of HWOL advertisements for jobs began to fall and the number of unemployed reached a bottom and began to increase. With the U.S. unemployment rate now at 4.9 percent the economy may have reached full employment.

A similar trend can be seen in the AVMA's Veterinary Career Center (VCC) data. The VCC provides a national database of available jobs and those actively seeking employment specific to veterinary medicine. However, the number of VCC registrants seeking employment may not be unemployed but rather are employed job seekers wishing to change their location or type of employment.

Just prior to the last recession the number of registered job seekers was less than the number of posted employment opportunities. This changed during the recession and the number of registered applicants exceeded the number of available jobs until the end of 2015 when again the number of available jobs exceeded the number of applicants.

VETERINARY CAREER CENTER JOBS AND APPLICANTS

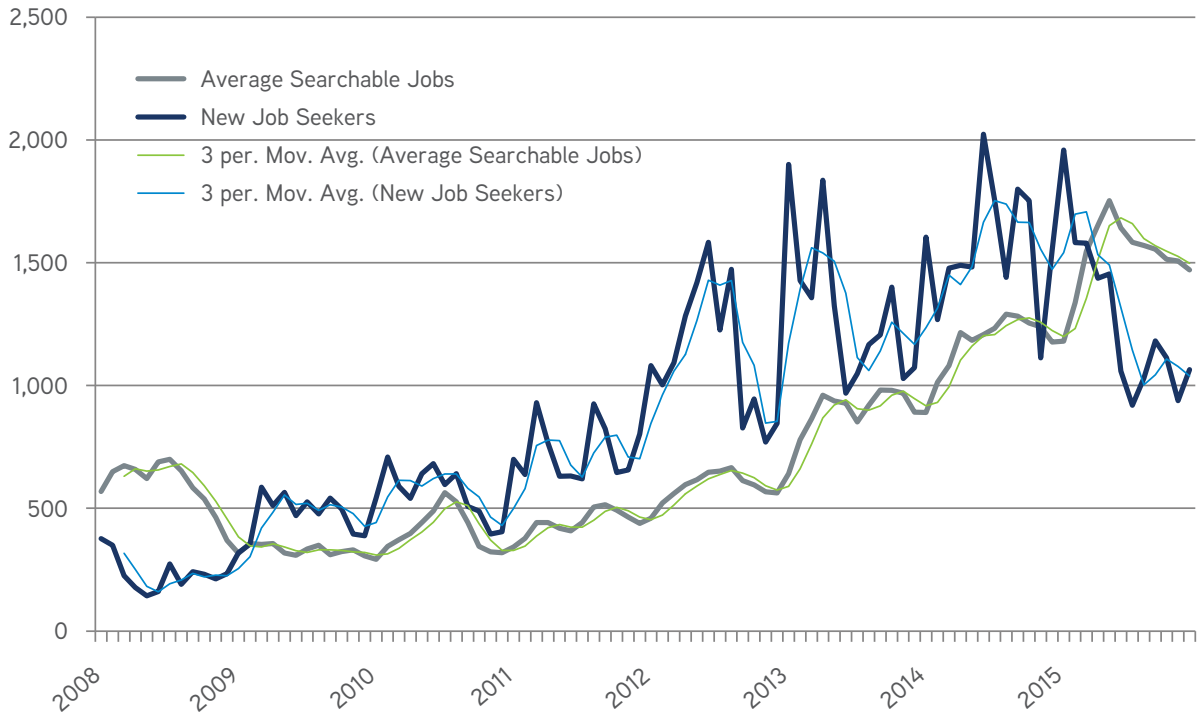


Figure 40

The VCC had 11,990 employment opportunities posted during the first nine months of 2016 with 87 percent of those for DVMs, but during the same period only 7,820 registered applicants with only 44 percent of those identifying as DVMs.

VCC DESCRIPTIVE STATISTICS OF JOBS, 2016

Education Level	Frequency	Percent
2–Year Degree	378	3.2%
4–Year Degree	151	1.3%
DVM or Equivalent	10,420	86.9%
Doctorate	214	1.8%
High School	524	4.4%
Masters	22	0.2%
Some College	281	2.3%
Total	**11,990**	**100%**

Table 2

VCC DESCRIPTIVE STATISTICS OF USERS, 2016

Experience Level of Registered User					
Registered User	< 1	1 to 7	7+	Any Level	Total
Veterinarian	888 (35%)	1,529 (51%)	891 (49%)	114 (26%/3%)	3,422 (44%)
Veterinary Student	677 (26%)	121 (4%)	17 (1%)	73 (17%)	888 (11%)
Veterinary Technician	253 (10%)	620 (21%)	410 (22%)	40 (9%)	1,323 (17%)
Not Listed	729 (29%)	725 (24%)	518 (28%)	215 (48%)	2,187 (28%)
Total	**2,547 (100%)**	**2,995 (100%)**	**1,836 (100%)**	**442 (100%)**	**7,820 (100%)**

Table 3

Computing the ratio of job applicants to available jobs we can compare the trends in the market for veterinary labor with the national labor market. This comparison provides several observations. First, when compared to the national labor market, the market for veterinarians was slower to react to the recession, has a smaller variation in the supply/demand ratio and is considerably more volatile month to month. The U.S. supply/demand ratio peaked at the end of the recession and had declined throughout the economic expansion while the supply/demand ratio for veterinarians did not peak until nearly four years after the end of the recession; and while the national ratio fell below the pre-recession low more than two years ago, the ratio for the veterinary labor market has not yet reached the pre-recession level. This could suggest a continued tightening in the market for veterinarians.

VCC RATIO OF JOB APPLICANTS TO AVAILABLE JOBS

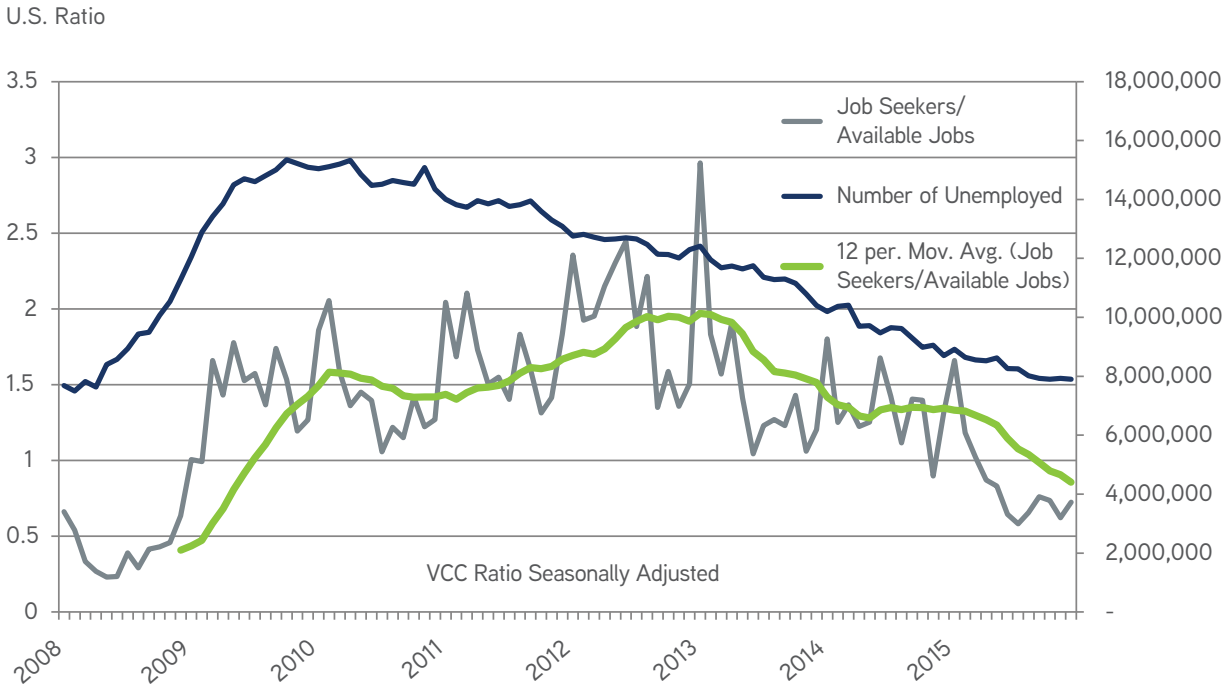


Figure 41

WHEN COMPARED TO THE NATIONAL LABOR MARKET, THE MARKET FOR VETERINARIANS WAS SLOWER TO REACT TO THE RECESSION, HAS A SMALLER VARIATION IN THE SUPPLY/DEMAND RATIO AND IS CONSIDERABLY MORE VOLATILE MONTH TO MONTH.

Geographic Location of Veterinary Jobs and Applicants

The registered job applicants have been mapped by zip code for those (84 percent) who indicated a zip code. And, the available jobs have also been mapped by zip code when available (71 percent). There is some commonality in both the location of the employment opportunities, the location of the applicants and density of the population.

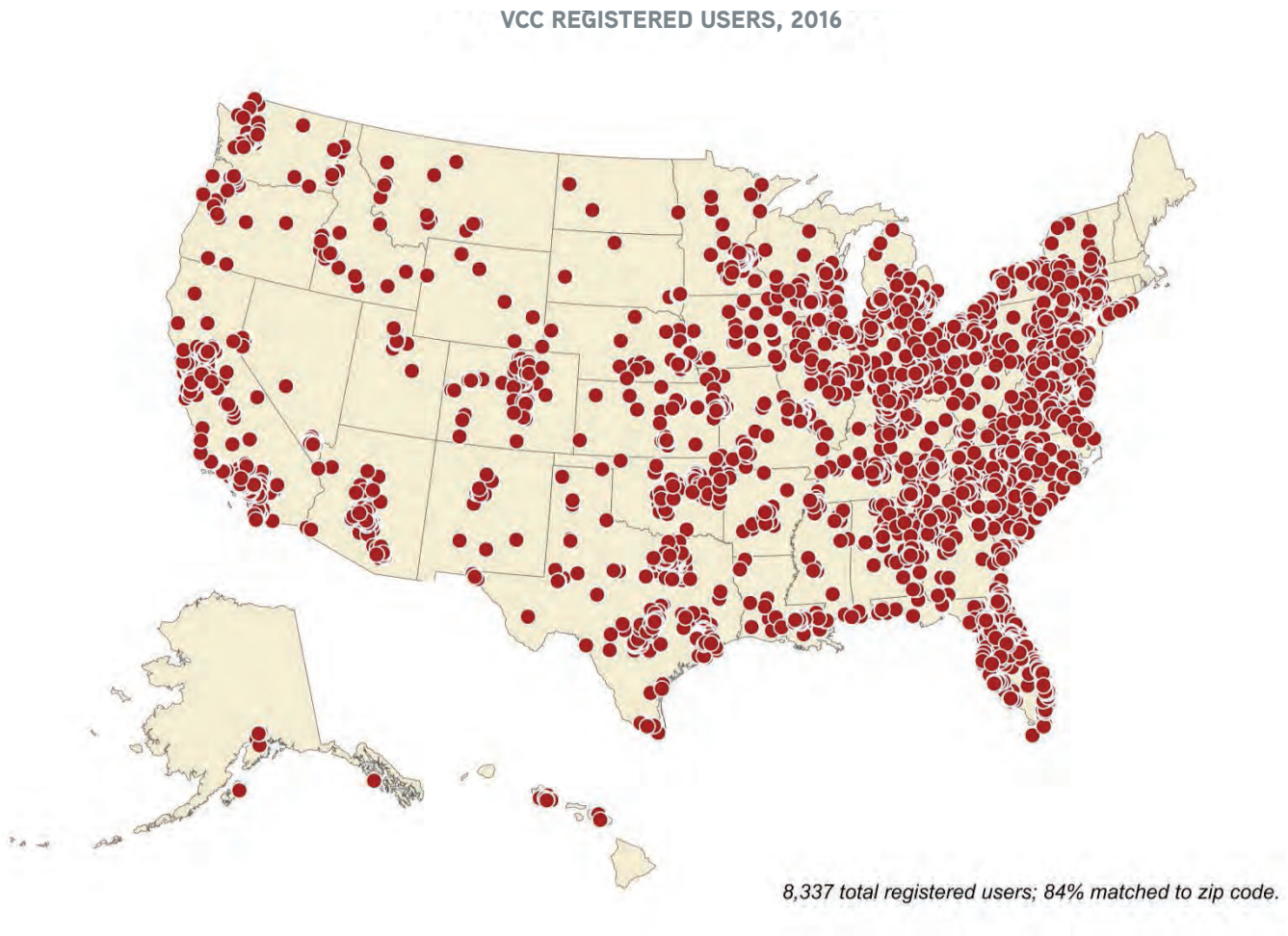


Figure 42

VCC DVM JOB LISTINGS, 2016

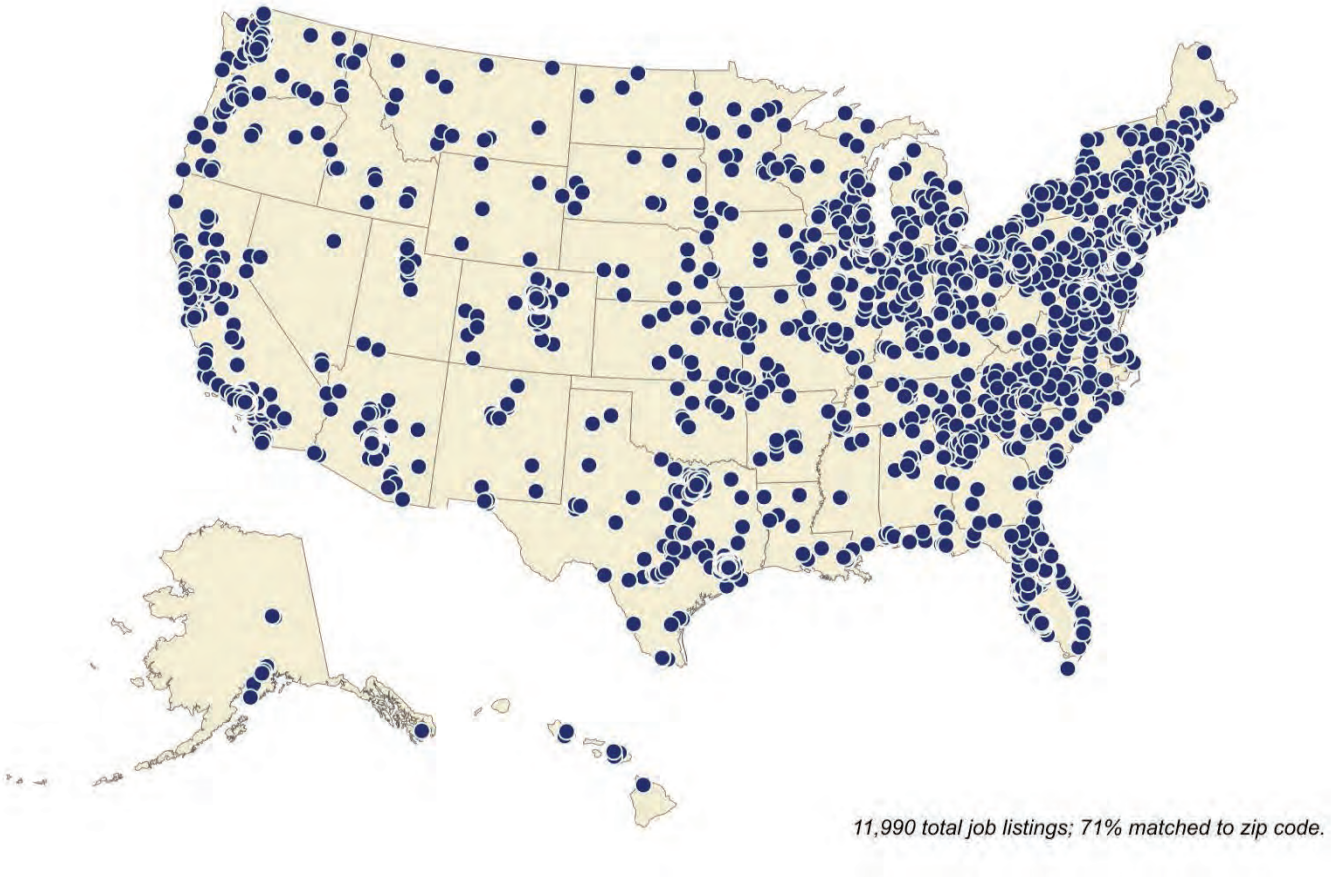


Figure 43

However, the number of job applicants per job varied widely with many employment opportunities finding no applicants through the VCC. While some of these employment opportunities may have been filled through other means, the trend in applicants to jobs over the extended period from 2008 would suggest that some of these employment opportunities simply did not find any applicants. And as noted previously, the sharp rise in starting salaries, low unemployment rate, and negative underemployment would support the conclusion that the tight market has created a short-term shortage of veterinarians for specific locations and employment opportunities.

VCC JOB APPLICANT QUANTITY PER DVM JOB LISTINGS, 2016

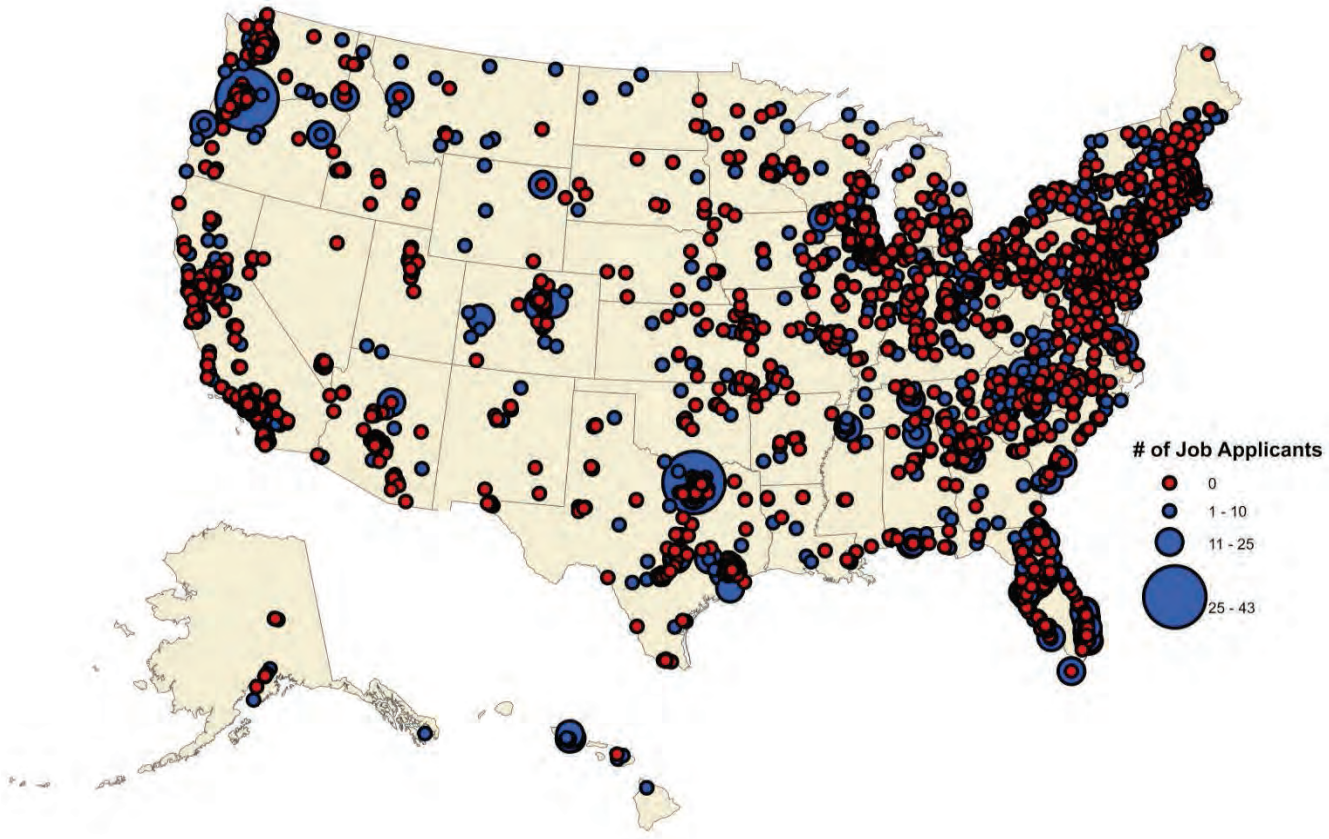


Figure 44

Based on the comparison of the national labor market and the veterinary labor market and the measures of unemployment, underemployment and starting salaries, the year ahead can certainly expect to see continued difficulty in filling veterinary employment opportunities and increasing pressure to raise compensation to attract applicants. However, this tightening of the veterinary job market will vary by location.

The applicant-to-jobs ratio for veterinarians varies from roughly 0.3:1 (roughly three jobs for every applicant) to over 4:1 (four applicants for every job). This extreme geographical disparity in the applicant-to-jobs ratio suggests that maldistribution is playing a major role in the determination of compensation level, unemployment and underemployment.

VCC APPLICANT-TO-AVAILABLE-JOBS RATIO, 2016

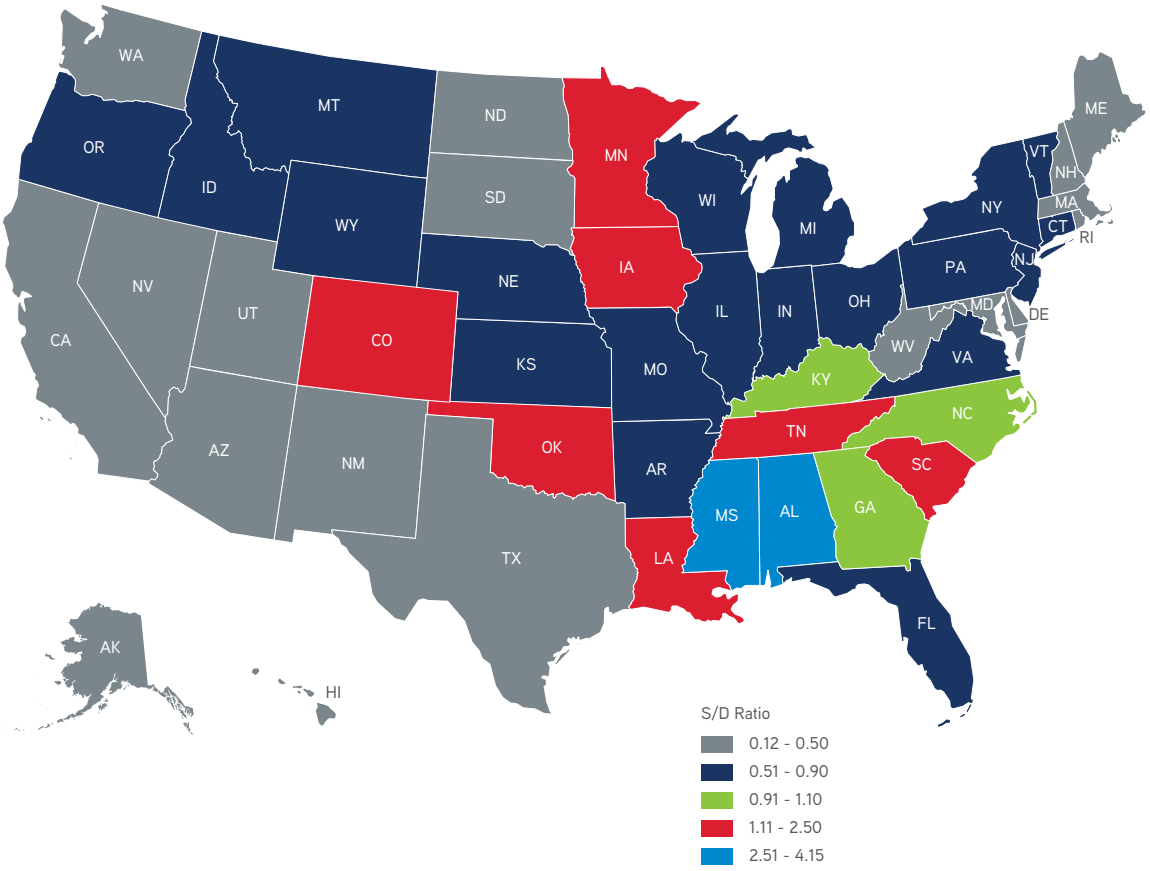


Figure 45

At least a portion of this maldistribution is a function of the desire of veterinarians to return to their home to establish a career. The greatest proportion of new veterinarians are from the suburbs (roughly 60 percent) and a slightly higher percentage of graduates (62 percent) find employment in the suburbs. But only 66 percent of those that grew up in suburban settings returned to the suburbs; another 20 percent of these found employment in rural areas and 14 percent found employment in urban settings.

Of the 3,148 recently graduated veterinarians that grew up in urban settings, however, only 53 percent return to urban areas while 32 percent find employment in the suburbs and another 15 percent begin their careers in rural areas. These trends are interesting, as national trends show a desire among new graduates (millennials) to move to urban settings. Whether the new veterinarians are moving to where the jobs are located or moving to the areas they wish to live and then seeking employment is an important question.

NEW VETERINARIAN COMMUNITY TYPE

	Grew Up	Found Employment			
		Rural	Suburban	Urban	Total
2013-2016	Rural	757	320	140	1,217
	Suburban	1,164	3,804	842	5,810
	Urban	480	994	1,674	3,148
	Total	2,401	5,118	2,656	10,175

	Grew Up	Found Employment			
		Rural	Suburban	Urban	Total
2016	Rural	204	71	38	313
	Suburban	316	982	210	1,508
	Urban	133	258	398	789
	Total	653	1,311	646	2,610

Table 4

VETERINARIAN WELLNESS

Over the last several years, the wellness of veterinarians has become a major concern within the profession. The high rate of suicides among veterinarians compared to other professions has led to a call for action.

Starting in 2015, the Professional Quality of Life (ProQoL) tool was included in the annual survey of veterinarians (employment survey in 2015, census of veterinarians in 2016) to begin to understand the factors that may contribute to compassion satisfaction and fatigue.

The ProQoL[2] tool is a measure of compassion satisfaction and compassion fatigue associated with helping others who have experienced suffering. *Compassion satisfaction* is about the pleasure you derive from your work. For example, you may feel like it is a pleasure to help others through what you do at work. You may feel positively about your colleagues or your ability to contribute to the work setting or even the greater good of society through your work with people who need care. *Compassion fatigue* encompasses negative feelings derived from work through scoring of burnout (exhaustion, frustration, anger, depression) and secondary traumatic stress (work-related trauma).

Responses to the ProQoL questions are scored based on the responses of thousands of individuals across a number of occupations. The scores have been established to describe low, normal and high compassion satisfaction and fatigue as well as burnout and secondary trauma. The results from the AVMA surveys indicated that the mean ProQoL scores for compassion fatigue, burnout and secondary trauma were in the lower normal range, while compassion satisfaction was in the higher normal range. But these mean scores fail to illustrate the number of respondents who were in the high range for burnout and secondary trauma. The results of the ProQoL scores are plotted against the percent of respondents with each specific score. The distribution of compassion satisfaction scores follows a normal distribution that is skewed left. Less than a score of 22 is considered a low score for compassion satisfaction.

[2] B. Hudnall Stamm, 2009. Professional Quality of Life: Compassion Satisfaction and Fatigue Version 5 (ProQOL). /www.isu.edu/~bhstamm or www.proqol.org

COMPASSION SATISFACTION SCORE DISTRIBUTION

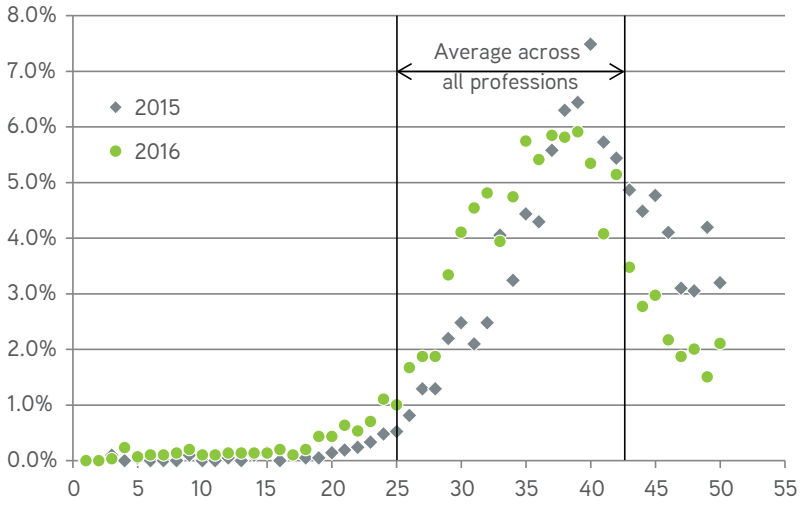


Figure 46

Looking at what factors are associated with low compassion satisfaction, a multiple linear regression was conducted with the variables that were felt might contribute to the variation in compassion satisfaction or compassion fatigue. The result of this analysis indicated that only two factors, satisfaction with current employment and how well the veterinarian felt they were prepared for their career, were statistically significant in both 2015 and 2016. Both of these factors were positively associated with compassion satisfaction.

In 2016, industry employment, lower income and hourly compensation were found to be statistically significant in a negative association with compassion satisfaction, while being employed in academia, living in a smaller community, and increased age were positively associated with compassion satisfaction.

FACTORS CORRELATED WITH COMPASSION SATISFACTION SCORE

	2016		2015	
	Coefficient	P Value	Coefficient	P Value
(Constant)	16.001	0.000	18.851	0.000
Satisfaction with current employment	3.016	0.000	2.753	0.000
How well your education has prepared you to be a veterinarian	1.758	0.000	1.682	0.000
Professor (Assistant, Associate, or Full)	4.488	0.025		
Industry/commercial organizations	-4.441	0.038		
Advanced Education			-1.763	0.018
Size of community in which practice is located: 2,500 to 49,999 residents	0.655	0.035		
Compensation mode: Hourly	-1.162	0.026		
Personal Income	-9.37E-07	0.048		
Gender: Female=1/ Male=0			1.021	0.001
Age	0.054	0.000		
Hours Worked per week			0.035	0.002
Ethnicity – Asian			1.999	0.012
Marital Status: Single			-0.932	0.003
Marital Status: Divorced			1.363	0.038

Table 5

The two sources of compassion fatigue, burnout and secondary traumatic stress, were also measured. A score above 35 on the burnout or secondary trauma stress scale may suggest a need to seek help to deal with the factors that are causing either burnout, secondary trauma stress or both. The burnout scores from both the 2015 and 2016 surveys were normally distributed with the mean at the low end of the normal range. However, 7.2 percent of 2016 respondents had scores in excess of 35.

BURNOUT SCORE DISTRIBUTION

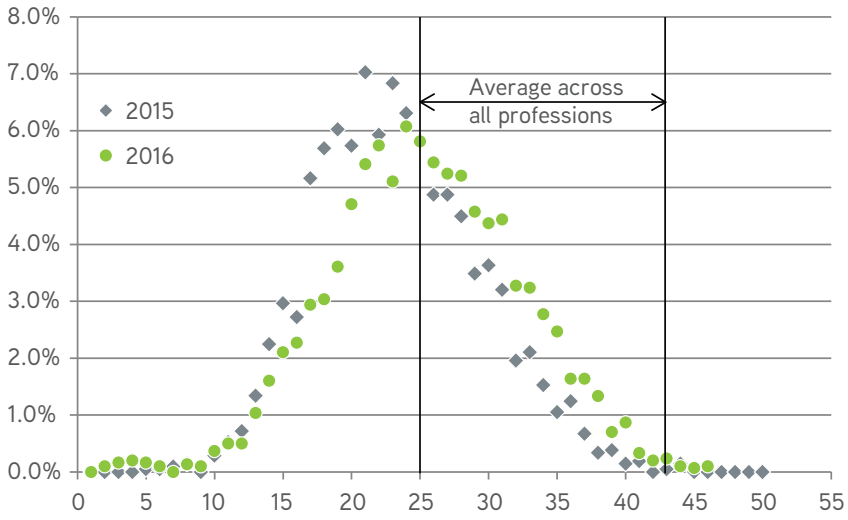


Figure 47

Using the same approach to examine the factors associated with burnout that was used with compassion satisfaction, three factors were found to be statistically significant in both 2015 and 2016. The less satisfied with current employment and the less prepared the respondent felt their education had prepared them for a career in veterinary medicine, the greater the burnout score. The more hours worked per week the greater the burnout score. Again, there were several other factors that were statistically significant in their association with higher levels of burnout.

FACTORS CORRELATED WITH BURNOUT SCORE

	2016		2015	
Dependent Variable: Burnout Scale	**Coefficient**	**P Value**	**Coefficient**	**P Value**
Constant	37.044	0.000	36.151	0.000
Satisfaction with current employment	**-2.707**	**0.000**	**-2.594**	**0.000**
Food animal practice (predominant)			-3.891	0.000
Food animal practice (exclusive)			-3.329	0.000
Equine practice			-1.657	0.008
Not-for-profit organizations	-4.629	0.024		
Hours Worked per week	**0.08**	**0.000**	**0.054**	**0.000**
How well your education has prepared you to be a veterinarian	**-1.055**	**0.000**	**-1.188**	**0.000**
Gender: Female=1/Male=0	1.04	0.002		
Educational Debt	4.28E-06	0.032		
Ethnicity - Black/African American	-3.385	0.038		
Ethnicity - Hispanic/Latino			-2.79	0.001
Ethnicity – Asian			-1.894	0.009
Marital Status: Single			1.02	0.000
Age	-0.051	0.001		
Graduation Year			-0.382	0.038

Table 6

Secondary traumatic stress scores had a similar distribution to that of the burnout scores. However, the mean is to the left (lower) than for burnout and the percent of respondents with a score above 35 (4.1 percent) is lower than for burnout.

SECONDARY TRAUMATIC STRESS SCORE DISTRIBUTION

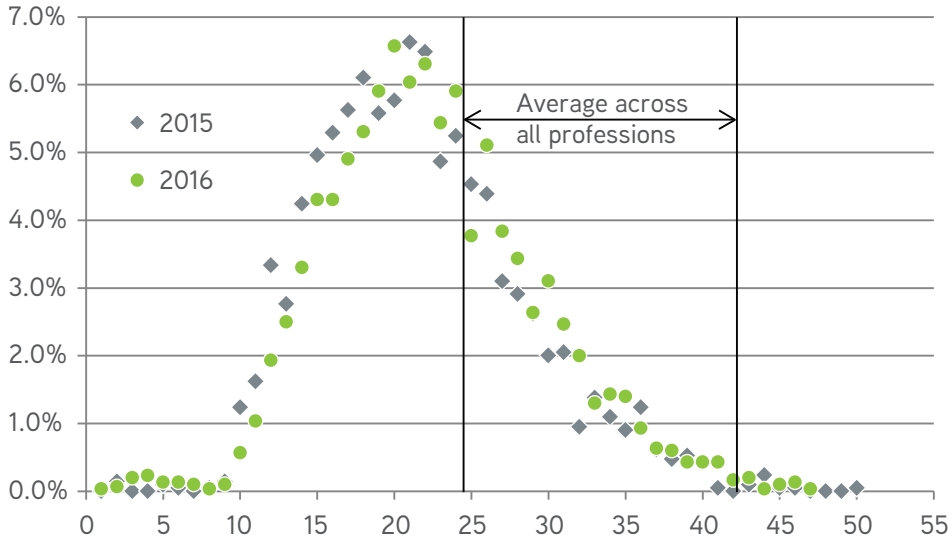


Figure 48

Again, using the same approach to examine the factors associated with secondary traumatic stress that was used with compassion satisfaction and burnout, four factors were found to be statistically significant in both 2015 and 2016. The less satisfied with current employment and the less prepared the respondent felt their education had prepared them for a career in veterinary medicine the greater the secondary traumatic stress score. Females, and the more hours worked per week were associated with greater levels of secondary traumatic stress. As with both compassion satisfaction and burnout, there were several other factors that were statistically significant in their association with higher levels of burnout.

FACTORS CORRELATED WITH SECONDARY TRAUMATIC STRESS SCORE

	2016		2015	
	Coefficient	P Value	Coefficient	P Value
Constant	26.383	0	23.237	0
Graduation Year	-0.749	0		
Satisfaction with current employment	**-1.349**	**0**	**-1.31**	**0**
Hours Worked per week	**0.075**	**0**	**0.072**	**0**
Gender: Female=1/ Male=0	**1.461**	**0**	**1.883**	**0**
How well your education has prepared you to be a veterinarian	**-0.581**	**0.009**	**-0.695**	**0.001**
Food animal practice (predominant)			-3.251	0.014
Food animal practice (exclusive)			-2.732	0.017
Companion animal practice (exclusive)			1.724	0
Companion animal practice (predominant)			1.278	0.015
State/Local government			-3.817	0.015
Uniformed services	12.997	0.032		
Researcher	12.11	0.005		
Ethnicity - Black/African American			-3.427	0.032
Age			-0.037	0.033

Table 7

THE NPV HIT A LOW IN 2014 FOR WOMEN AND 2015 FOR MEN. THE DIFFERENCE IN THE NPV FOR MEN AND WOMEN IS DUE TO THE HIGHER DEBT AND LOWER INCOMES OF WOMEN AT GRADUATION AND THE HIGHER OPPORTUNITY COSTS OF PURSUING A VETERINARY EDUCATION FOR MEN AS COMPARED TO WOMEN.

VETERINARY MARKET KEY PERFORMANCE INDICATOR

The discussion of the veterinary incomes, unemployment, underemployment, applicant-to-jobs ratio and wellness provides an indication of the internal function of the market for veterinarians. The changes to each of these measures over time provides an overview of how the market is changing and the direction the market is headed. But these measures only provide a view of how well the market is functioning internally, not how well the market is performing within the veterinary markets.

The output of the market for veterinarians is the capacity to provide veterinary services. The performance of this market is the efficiency with which veterinary resources are used to produce veterinary services that are valued by society at or above the cost of producing them, and, one of the main costs is veterinary compensation. An efficient market would enable veterinarians to receive a normal economic return on the cost of becoming a veterinarian. A normal economic return is a percent return on the investment for comparable investments. This can be thought of as the return on investment of alternative investments. A simple comparison is a comparison to the long-term return on investment in the U.S. stock market, 7 percent annually. Net Present Value (NPV) of the veterinary degree can be used as an indication of the return on investment to the DVM degree.

The NPV is calculated by estimating the income received from the veterinary career less the compensation that may have been received without the DVM degree and the costs of obtaining the DVM degree. Consider the following measures for the 2016 graduating class from the 28 U.S. veterinary colleges:

- Mean total debt (debt plus the servicing costs) of a 2016 graduating veterinarian is $283,251 using a 25-year repayment plan;
- Mean lifetime income of 2016 graduates was estimated at $52.million;
- NPV for men is estimated at -$43,038
- NPV for women estimated at $308,892

The NPV hit a low in 2014 for women and 2015 for men. The difference in the NPV for men and women is due to the higher debt and lower incomes of women at graduation and the higher opportunity costs of pursuing a veterinary education for men as compared to women.

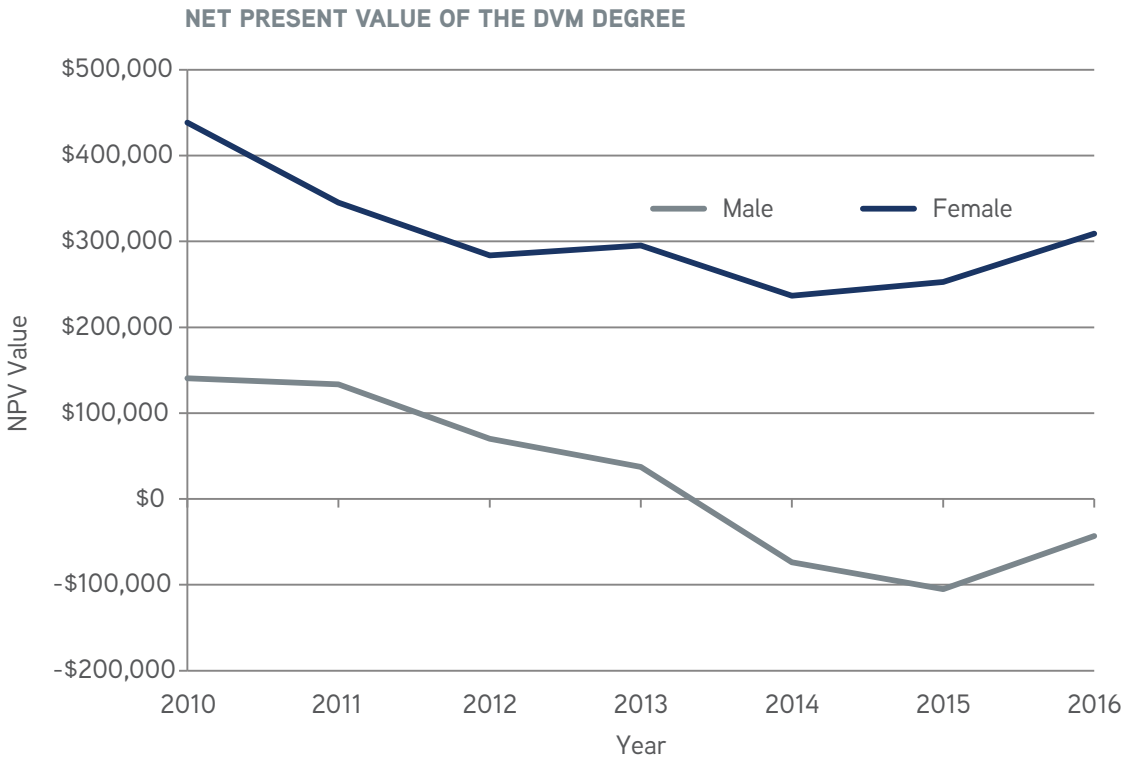


Figure 49

The opportunity costs refer to the lifetime income earning potential had veterinarians pursued an alternative career prior to entering veterinary college. The lifetime mean earnings of a typical bachelor's of science degree recipient are used to estimate this opportunity costs. And this alternative earning profile begins at graduation and thus veterinarian gave up four years of alternative earning potential while in veterinary school and this must be overcome before there is a positive gain in earnings with the DVM versus the bachelor's only.

The difference in the NPV of the DVM for women and men is mostly a result of the higher opportunity costs for men compared to women. With only a B.S., women earn only 72 percent of what men earn over their career, but earn more than 92 percent of what men earn at the beginning of their career as a veterinarian. And the difference between the starting salary of a DVM and B.S. has increased for women but declined for men over the last six years.

The drop in the difference of DVM and B.S. degrees for men from $21,353 to $18,277 indicates that the opportunity cost of men to gain a DVM is increasing, making the economic decision to obtain a DVM more difficult. On the one hand, for women, the opportunity cost of obtaining the DVM is declining as the difference between the DVM and B.S. starting salary has increased from $24,882 to $26,176.[3]

These differences in opportunity costs may contribute to the growing concentration of women in the veterinary profession. For men, the negative NPV yields no return on the DVM, while for women the positive NPV indicates a positive return on investment.

STARTING SALARIES BY GENDER AND DEGREE

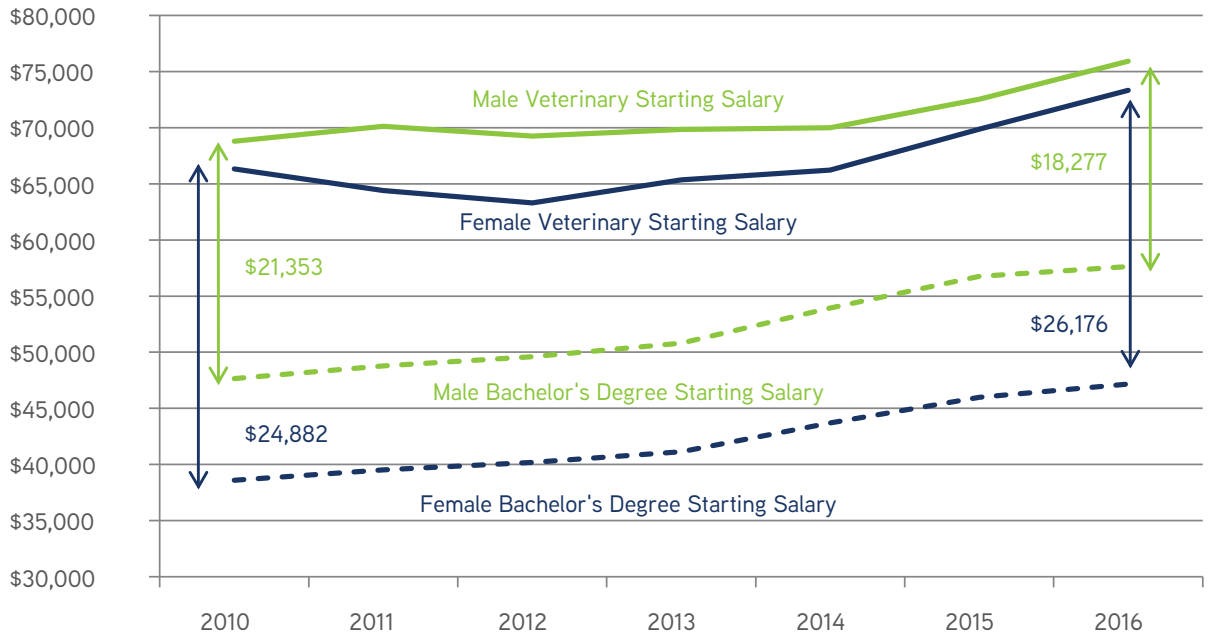


Figure 50

SUMMARY

The market for veterinarians continues to be robust with rising incomes, low unemployment and negative underemployment. The variation in relative concentration of veterinarians, particularly in specific suburban areas creates considerable variation in how veterinarians may perceive the market. Even though the national market currently appears very robust, some local markets may seem much less robust.

The rising median household incomes coupled with the lag between the national economic performance and the markets for veterinarians, the national market for veterinarians should continue to be robust through the next two years. And, improved mobility of veterinarians to correct the current maldistribution would improve the local markets for veterinarians as well as the market for veterinary services.

[3] Salary Trends Through Salary Survey: A Historical Perspective on Starting Salaries for New College Graduates
Salary Trends Through Salary Survey: A Historical Perspective on Starting Salaries for New College Graduates, (2017). Naceweb.org. *Retrieved 5 January 2017, from https://www.naceweb.org/job-market/compensation/salary-trends-through-salary-survey-a-historical-perspective-on-starting-salaries-for-new-college-graduates/#appendix*

THE MARKET FOR VETERINARY SERVICES

While the majority of veterinarians are employed in the provision of services to companion animals, even these markets differ by geography and the types of services offered or of focus.

Like the market for veterinarians, the market for veterinary services is not a single national homogenous market, but rather a number of different markets that are horizontally related. They are related through the common input, veterinarians, but produce many different types of services that can be separated into public and private services.

Within the market for private veterinary services are shelter services, specialty services, general practices in food animals, equine, companion animals (sometimes feline-specific) and various combinations of these. Within public service are state and federal government public health and research services, lab animal services, teaching, research and extension positions are veterinary colleges and non-profit services in veterinary associations, accrediting and licensing bodies.

While the majority of veterinarians are employed in the provision of services to companion animals, even these markets differ by geography and the types of services offered or of focus. As such, describing the market for veterinary services in a general connotation is difficult at best. But some relationships hold across all markets, such as the growth in the demand for veterinary services that occurs as median household incomes increase, the number of animals increase or the disease and medical problems of animals increase.

DEMAND FOR PRIVATE PRACTICE VETERINARY SERVICES

Owners of pets, working animals, livestock, aquatic species, and wildlife all require the services of private veterinary practitioners. For private practitioners, the demand for their veterinary services increases as the number of animals increases, animal owners awareness of the veterinary medical services the animals require increases, and animal owners' willingness to purchase these medical services increases. Each of these factors that affect the demand for veterinary services is, in turn, affected by various factors. And, unfortunately, there has been very little research to determine these relationships.

The number of pets is estimated every five years by the AVMA Pet Demographic Survey (PDS). The first PDS was conducted in 1982, and the most recent PDS was fielded in 2012. The purpose of the PDS is "to serve the veterinary medical profession and all other individuals who need to make decisions about the health care and product marketing demands associated with the companion animal industry and ... to update and expand our knowledge about the companion animal population in the United States regarding demographic characteristics and use of veterinary medical services."

The specific objectives of the PDS are "to determine:

1. Populations of dogs, cats, birds, horses and other pets owned by U.S. households;
2. Household demographic characteristics associated with pet ownership; and
3. Frequency of times that pets were seen by a veterinarian and annual veterinary medical expenditures."[4]

Since the 1992 PDS, the national survey received roughly 50,000 responses (47,000-60,000) and provided a national estimate of the number of pets of all types, frequency of visits to the veterinarian and the expenditure on veterinary services or products and market size. Unfortunately, this information does not provide the data required to measure demand. The annual expenditure provided by a household is a single number of the total amount paid to veterinarians in the surveyed year, while demand is a set of quantities purchased or not purchased at each price by pet owners. And total market size is the number of customers (per year) as well as the pet owners who did not patronize a veterinarian during the year surveyed.

At the end of 2015, in cooperation with the AVMA VED, the National Center for Food and Agricultural Policy, an independent consulting group specializing in demand analysis, conducted a metropolitan market demand study to devise an accurate, low-cost household survey of single multi-county market areas for measuring the demand for veterinary services. This pilot study sought to determine a process for integrating smaller, metropolitan market specific areas with the five-year PDS. These metropolitan market surveys would help to understand the difference in the relationship between the demands for veterinary services that may occur as a result of differing market demographics. A second objective is to provide a method for computing the annual changes to the national estimates of numbers of pets, number of veterinary visits by each pet, and the effect of price and income on the demand for specific veterinary services-and from whom the veterinary services were purchased.

One of the unique findings in the 2015 pilot study was the question on routine check-ups in the past 12 months. The 2012 PDS noted that roughly 20 percent of dog owners had not visited a veterinarian in the last 12 months. However, when provided more choices of where the canine pet may have received a routine check-up in the past 12 months, 80 percent of respondent canine owners noted they had obtained a routine check-up in the last 12 months, in line with the PDS estimate. However, another 13 percent indicated that they had received a routine check-up at a veterinary hospital or clinic alternative. This calls into question the oft-quoted percent of pets not receiving annual care. However, this research occurred in a small local market and thus may not extrapolate to the larger United States.

[4] J. Karl Wise, Center for Information Management, AVMA, 1992

ROUTINE CHECKUP FREQUENCY AND PROVIDER

PDS versus Pilot Survey Q9		2012 PDS	Random Sample	Veterinary Clients
Exam, vaccinations obtained from vet in previous year?		81%		
Routine check-up (somewhere) in past 12 months?			92%	97%
	Not this year	19%	8%	3%
	Not from a veterinarian			
Pilot Q10a-h				
Where did you take Dog for routine check-ups (exam, vaccinations, etc)?				
	veterinary clinic or hospital		80%	82%
	shelter or Humane Society		1%	
	city- or county-sponsored public clinic		1%	
	pet shop		1%	
	pet-focused retail store		4%	
	mobile facilty or van		6%	11%
	OTHER: vet who does house calls			4%

Table 8

The price paid for the routine check-up was also provided by the respondents along with the number of visits per year by type of provider. The visits, along with the price per visit, are shown in the figure below and illustrate the prevalence of one or two visits per dog and the range of prices paid per dog visit.

NUMBER OF CHECKUP VISITS PER YEAR PER DOG (Q) AND TOTAL PAID PER VISIT (P), 2015 PILOT SURVEY

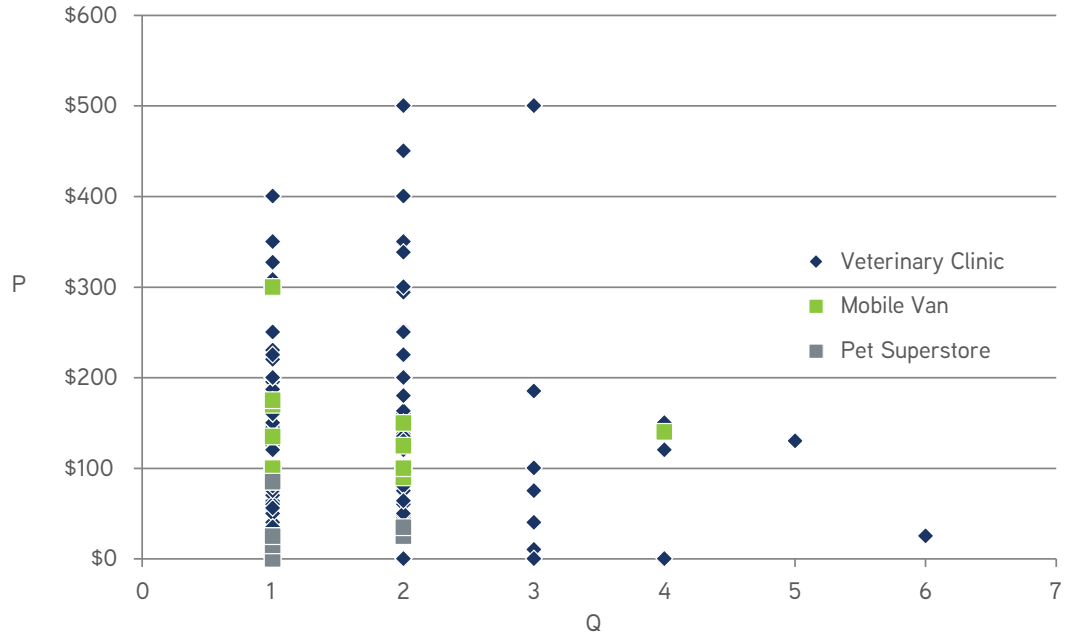


Figure 51

The quantity and price can be organized in an accumulative distribution to produce a demand schedule, indicating how many dog visits for routine check-ups could be provided at different prices. Roughly 100 routine check-up visits would be purchased at a price of $200 per visit and 200 routine check-ups would be purchased at $100 per visit. In this specific market the demand for routine check-ups is inelastic (a large increase in price has little impact on quantity demanded) from $500 to $200 but becomes elastic (a change in price has a larger impact on the quantity demanded) after the price reaches below $200.

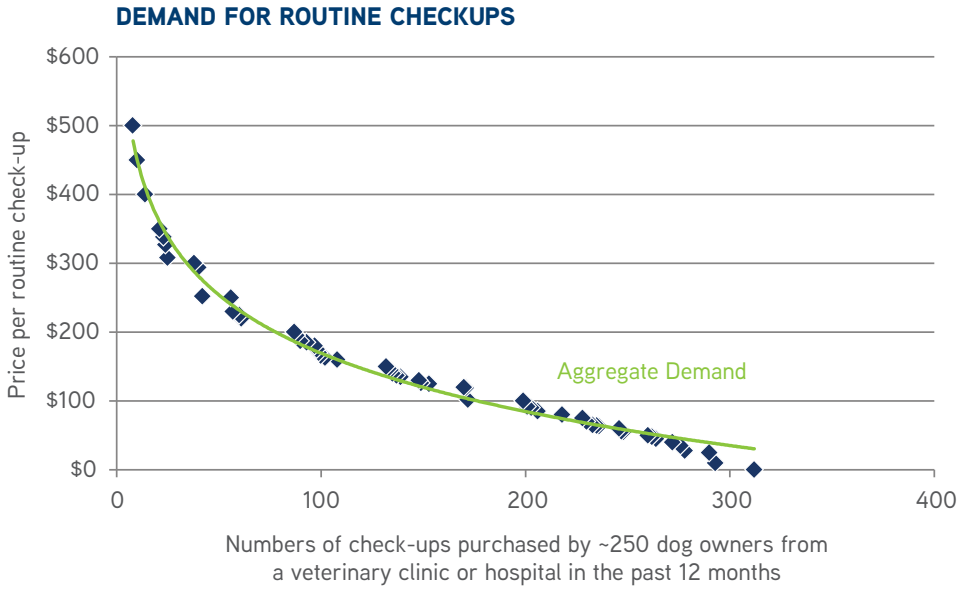


Figure 52

Plotting the amount of revenue (price of each routine check-up times the number of check-ups) that can be earned at each price illustrates the optimum price with which to maximize revenue. At $120 per routine check-up, the total revenue is maximized (not necessarily profit). An important question is whether the revenue maximizing price is the same around the country or if it is unique to every market.

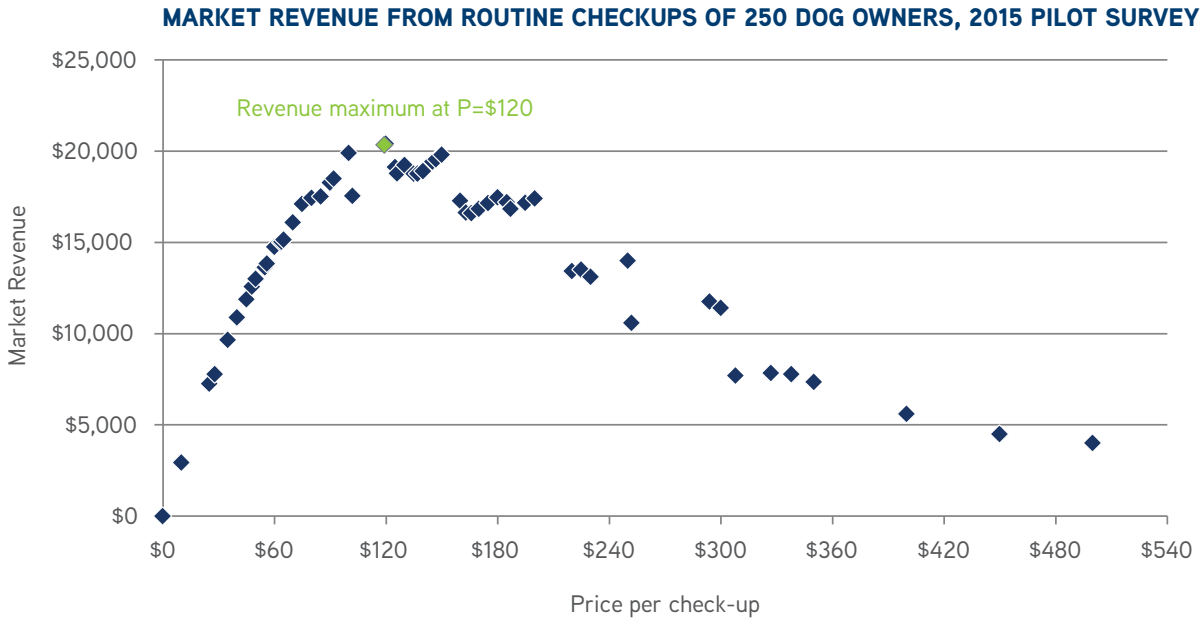


Figure 53

Determining the revenue maximizing price for various services and the factors that create any variation in this price between locations will provide important information to veterinary practices on or about the impacts of price on the demand for veterinary services.

In November of 2016 the first Metro Market Demand (MMD) surveys were conducted in Los Angeles and Boston and the national PDS will be fielded in the first quarter of 2017. The findings from the analysis of this survey data will be presented at the 2017 AVMA Economic Summit.

DEMAND FOR EQUINE AND BOVINE VETERINARY SERVICES

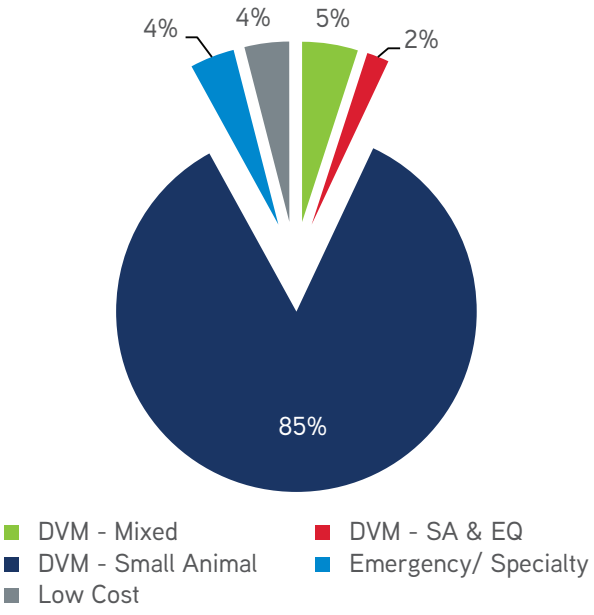
AVMA's VED and collaborators began research on the equine and bovine veterinary markets in 2016. Surveys of veterinary practitioners in these two segments of the profession were fielded and additional research is underway to measure the demand for veterinary services in these two segments and begin to understand the effect of various factors on demand.

VETERINARY PRODUCTS DEMAND AS A LEADING ECONOMIC INDICATOR

Roughly, 30 percent of the revenue in veterinary practices is derived from the sales of pharmaceutical products. When combined with vaccines, surgical supplies and other routine consumables in the exam room and surgical suite, the combined annual expenditures for these items represent approximately 25 percent of total operating expense for the typical companion animal practice. At the 2016 AVMA Economic Summit, Dr. Travis Meredith of Animalytix, Salisbury, Md., presented a new perspective on the use of these data as a leading indicator of the financial health of the veterinary marketplace. A public clearinghouse for industry sales and aggregated market share information, Animalytix has a comprehensive database of nearly $60 billion in animal health product sales of vaccines, pharmaceuticals, nutraceuticals and veterinary supplies from more than 500 manufacturers. This database has been developed from a partnership with animal health distribution companies and selected manufacturers to provide weekly or monthly sales reporting on more than 8,500 brands.

Historically, these data have been used by distributors to assist in the settlement of rebates and free goods programs, manage supply chain issues and conduct forecasting. In 2016, however, Animalytix launched a series of initiatives focused on the needs of the veterinary practice owner and/or business manager and providing insight into market changes across numerous geographic areas. Analysis of the data, utilizing key "sentinel" indicators, provides a view of macro and regional trends in treatment rates, perspective on changes in treated patient populations over time, as well as identifies opportunities and challenges for the profession.

ANIMALYTIX VETERINARY CONSUMPTION INDEX



What's In The Basket
Needles
Sutures
Syringes
White Goods
Fluids
Human Labeled Pharmaceuticals (Generics)
Euthanasia Products
Others

What's Not in the Basket
Canine Vaccines
Feline Vaccines
Flea & Tick Products
Heartworm Preventative Products
Other pharmaceuticals influenced by regional or seasonal epidemiology.

Figure 54

One valuable application of this information is the ability to assess the distribution of veterinary services based on product consumption. To achieve an objective metric across the population, Animalytix developed a Veterinary Consumption Index (VCI) utilizing a constant "market basket" of commonly used exam room and surgical suite consumables as a core indicator of commercial practice volume. Changes in the aggregate consumption rates for the VCI basket can then be used to assess growth across discrete geographic regions or among practice types (e.g., traditional small animal practice, emergency/specialty practices or low-cost providers such as spay/neuter and shelter operations).

THE ROLE OF ENTITY SIZE AND THE IMPACT ON MARKET DISPARITY

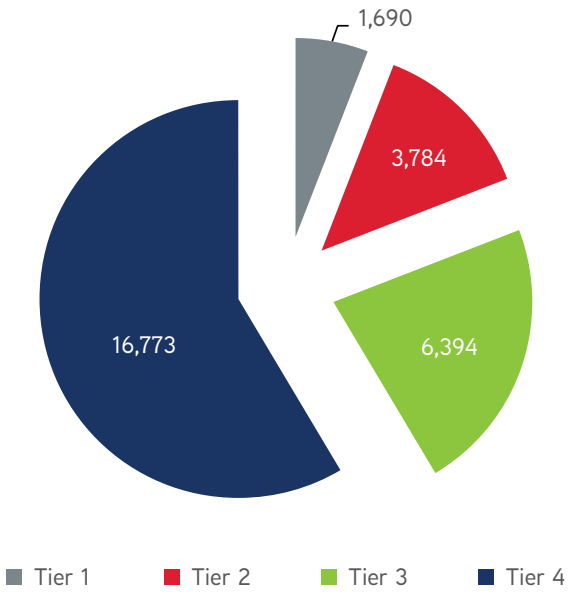


Figure 55

In addition to changes across geographic markets or practice types, the VCI can also be used to evaluate the concentration (size and quantity) of veterinary practices in the market. Animalytix has identified more than 28,000 unique locations serviced by a veterinarian which consume the bulk of vaccines, pharmaceuticals and supplies used in treatment of small animals. Purchasing volumes show that approximately 1,700 or 5.9 percent of the total number of locations consume 25 percent of all VCI product purchases (Tier 1). The second quartile (Tier 2) consists of 3,400+ practices or approximately 13.2 percent of total locations. Together, Tier 1 and 2 practices account for less than 20 percent of the total number of practices but 50 percent of all VCI product consumption. In contrast, the bottom quartile (Tier 4) reflects 60 percent of the total number of practices but collectively purchases only 25 percent of the total exam room and surgical suite consumables.

ROUGHLY, 30 PERCENT OF THE REVENUE IN VETERINARY PRACTICES IS DERIVED FROM THE SALES OF PHARMACEUTICAL PRODUCTS. WHEN COMBINED WITH VACCINES, SURGICAL SUPPLIES AND OTHER ROUTINE CONSUMABLES IN THE EXAM ROOM AND SURGICAL SUITE, THE COMBINED ANNUAL EXPENDITURES FOR THESE ITEMS REPRESENT APPROXIMATELY 25 PERCENT OF TOTAL OPERATING EXPENSE FOR THE TYPICAL COMPANION ANIMAL PRACTICE.

VCI DYNAMICS VARY BETWEEN MAJOR MARKETS

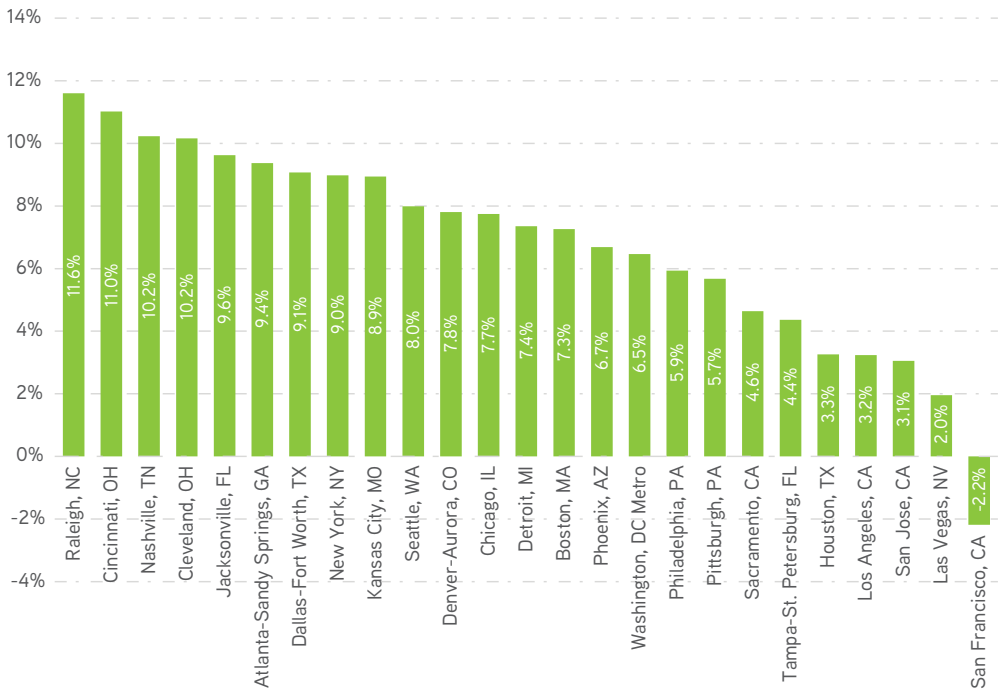


Figure 56

While the concentration perspective is valuable in understanding how entity size influences the overall market, the VCI can also be used to identify variations in performance between geographic markets. Measuring the percent change in the volume of sales for specific metropolitan markets provides an indication of the change in demand for veterinary services. This is an important measure and can help guide the MMD surveys to determine in which metro markets growth is or is not occurring and the underlying demographic or demand factors driving different results across these markets.

INHALANT ANESTHETIC CONSUMPTION AS A LEADING INDICATOR FOR SURGERY SUITE ACTIVITY

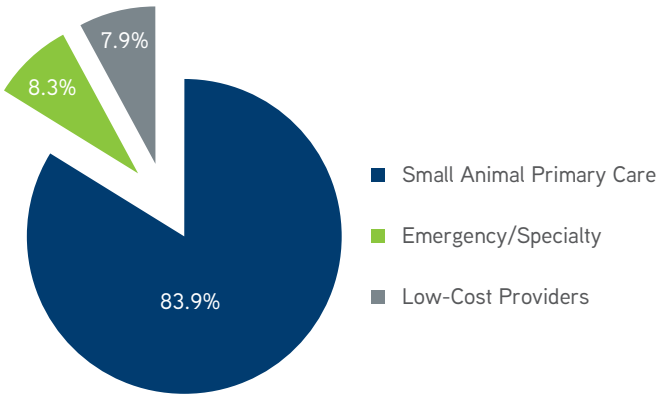
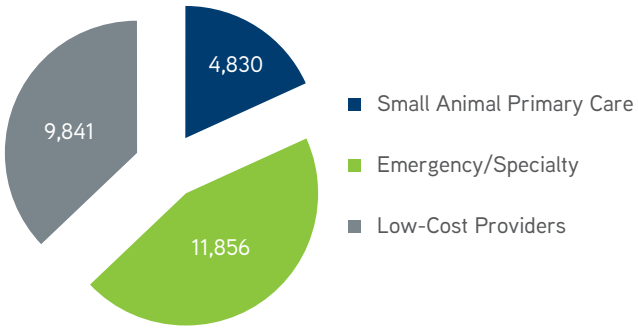


Figure 57

PER LOCATION INHALANT CONSUMPTION DYNAMICS, 2013-2016



The analysis of the product consumption market can also be used to evaluate changes in specific practice profit centers. For example, inhalant anesthetics can provide a useful indicator for surgical and dental activity. Inhalants are used specifically for advanced procedures requiring patient anesthesia, are consumed in unit increments and are utilized on an as-needed basis throughout the year. Use by practice type indicates where surgeries and dentals are being most performed and how that market share is changing over time. By examining the consumption patterns of inhalants across practice types, low-cost providers can be seen to be utilizing twice as much inhalant, and emergency/specialty practices 2.5 times as much inhalant as small animal primary care practices.

Analysis of these data over time will be useful in assessing whether the traditional small animal primary care practices continue to lose surgical volume to alternative providers or reverse recent trends and grow their relative share of surgical caseload.

The analysis of product consumption information provides valuable insight into the veterinary services market, geographically, by profit center and even for potentially monitoring the adoption of clinical standards over time. Coupled with the MMD surveys and the PDS, the profession can begin to build a more comprehensive picture of the market for veterinary services and better evaluate the factors driving change in the veterinary profession.

PET HEALTH INSURANCE AND VETERINARY EXPENDITURES

A persistent question in the veterinary profession is whether pet health insurance increases the demand for veterinary services. Unfortunately, again there is no published literature that addresses this question. There have been studies that have noted an association between higher levels of pet owner expenditures and pet health insurance.

An analysis of the impacts on pet expenditures resulting from the purchase of pet health insurance would best be done by capturing pet owner's pet health care decisions both with and without insurance. But it is impossible to have anyone own, and not own, pet insurance at the same time. Two alterantives exist: Collect a large enough set of observations of pet health care decisions by owners with and without pet health insurance. The data would compare similar pet types, ages and health as well as pet owners' socio-economic characteristics, to get close to comparing the same pet owner's decisions with and without pet insurance.

A second analytic option is to ask owners to respond to hypothetical questions about pet health decisions with and without pet insurance. For instance, asking how much a pet owner would be willing to spend for emergency surgery rather than euthanizing the pet. An initial field test of this question by AVMA VED collaborators at Mississippi State University[5] found that the choice of euthanasia (at a cost of $100) was reduced from 31 percent to 3 percent through the election of the emergency surgery and thus not only were current expenditures increased but future expenditures would also increase through the increase in lifespan of the pet.

These research results are preliminary. Complete results should be available by the 2017 AVMA Economic Summit.

CLIENT SPENDING WITH INSURANCE AND WITHOUT INSURANCE

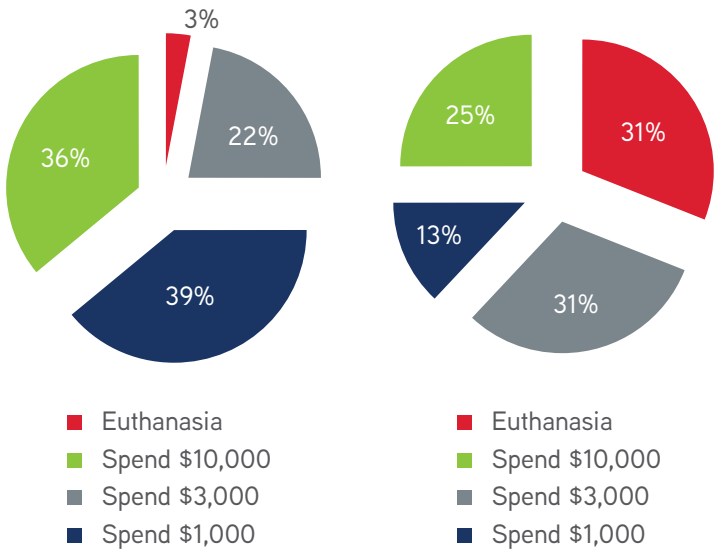


Figure 58

[5] Williams, Angelica, Keith Coble and Brian Williams.

PUBLIC HEALTH VETERINARY SERVICES

The public practice of veterinary medicine includes public health services such as monitoring and managing food safety and zoonotic diseases. A growing body of literature suggests that animal diseases are burdens to households, regions, countries, and society in general. The world population has doubled since 1960 and continues to grow, with nearly 1 billion people added every 13 years. Food security and malnutrition remain persistent world problems.

Sixty percent of all infectious diseases are zoonotic (Taylor et al. 2001) and 15 of the 35 leading communicable causes of death are zoonotic in nature. The zoonotic diseases adversely affect human health both through the adverse consequences on livestock and the direct consequences on human health. The primary commodities feeding into the global production of food are both crops and livestock. Four livestock and livestock products are ranked by value among the top 10 commodities produced in the world (FAO). Animal diseases reduce both the quality and quantity of these four livestock products, reducing the availability of protein for the human diet.

Because the monitoring and managing of zoonotic diseases is a public veterinary service, the decisions about the number of veterinarians required is a decision for state and federal governments. To ensure that there is an adequate quantity of these public veterinary services provided, governments need the best information on the trade-offs between the costs of prevention and the costs of treatment. More specifically, what are the avoided costs of zoonotic disease outbreaks versus the expenditures required to ensure that avoidance? And, this estimate of benefits (cost avoidance) to costs of adequate monitoring and management should be made for all potential zoonotic disease outbreaks rather than for each individual potential outbreak as many of the potential zoonotic diseases have similar geographical origins.

The AVMA VED is cooperating on research with the Paul G. Allen School for Global Animal Health and the School of Economic Sciences at Washington State University. This research is intended to develop a process for measuring the costs of zoonotic diseases and determining a level of monitoring and management that would maximize the benefit/cost ratio, and in so doing, calculate the optimal quantity of veterinary services (number of veterinarians) that should be purchased by state and federal governments.

To begin the development of a standard process for measuring benefits and costs, the research began by analyzing the recent avian influenza outbreak. For this specific zoonotic outbreak no documented human health event or costs to individuals occurred. However, approximately $879 million was spent on the outbreak and subsequent planning activities (Johnson et al 2016), $200 million was spent on indemnity payments, and $610 million on response activities on premises. In addition to these costs, poultry producers lost more than $1 billion and consumers paid higher prices for poultry products.

SUMMARY

The demand for veterinary services is the driving determinant for the number and compensation of veterinarians. Demand, the relationship between price of products and services and the quantity of those services, includes both consumers who have purchased pet health products and services from a veterinarian and people with animals that need care but who have not purchased the necessary goods and services.

Research to measure the impacts of prices and household incomes on veterinary goods and services continues along with looking at factors (e.g., pet health insurance, demographic characteristics) that explain the variation in these demand determinants. Additionally, research continues on understanding the role of various private practice strategies (or absence of them) on veterinary medical care purchasing decisions. Animals not receiving any veterinary care, as well as those receiving only a subset of the health care required to ensure a healthy animal, continue to be a very large share of the potential animal health care market. This gap between the current demand for veterinary medical services and the need for these services may exceed the profession's current capacity to provide services.

VETERINARY PRACTICES

The most profitable practices appear to be those that have best controlled their costs and maintained the lowest cost of acquiring new clients.

Terry O'Neil, of Katz, Sapper and Miller, an accounting firm that provides analytics for the Veterinary Study Groups, provided an overview of the financial performance of the more than 400 veterinary practices that provide practice financial data to KSM. Following the trend we saw in the robust market for veterinarians, veterinary practices' revenue growth and earnings before interest, taxes, depreciation and amortization – or EBITDA – has continued to show strong growth since 2013.

The most profitable practices appear to be those that have best controlled their costs and maintained the lowest cost of acquiring new clients. The most profitable practices have the lowest labor costs (total compensation) as a percent of total revenue, below 40 percent. These most profitable practices also have client acquisition costs below $25 per new client.

While the number of invoices per DVM full-time equivalent has increased, the average client transaction remained in the $150 range. Growth in revenue may have been a result of higher prices, an expanded bucket of services, or most likely both.

The KSM data and KPIs are one of the few sets that are available to provide a picture of the changing financial health of veterinary practice year to year. However, because of the great diversity in veterinary

practices both from the demographics of the communities they serve and the profit centers on which each practice focuses, these 411 practices are insufficient to provide national financial guidelines that may be applicable to any practice. Developing these industry standard KPIs for the various sized markets and the product and service focus of each practice is important to help guide the practices in strategies to improve financial performance.

In 2016, the AVMA VED began a major thrust into achieving the goal of improving the financial performance of veterinary practices. The AVMA Core practice management Continuing Education (Core CE) program, developed with Banfield, Henry Schein Animal Health, and KSM, was introduced at the AVMA annual convention in San Antonio, Texas. The Economic Advisory Research Council (EARC) was initiated with a Practice Finance Research Group to focus on developing methods and processes to collect and analyze practice financial data to provide standards for key financial performance indicators.

During the 2016 AVMA Economic Summit, Dr. Karen Felsted noted that, although a vast array of practice management resources is available, most veterinary practices are under-performing. There are potentially several reasons for the apparent failure of veterinary practices to utilize the available practice management resources to attain higher levels of financial performance. First, the resources are informative but neither organized nor, in many cases, actionable. Second, there are simply too many resources and veterinarians are paralyzed by initiative fatigue. And finally, there has been a focus in the profession on revenue and profitability rather than demand and return on investment.

PRACTICE MANAGEMENT CONTINUING EDUCATION

The AVMA Core CE program was developed to begin the process of organizing the practice management CE. The Core CE program focuses on the basic components of practice finance, operations, strategies and marketing/economics, providing specific action items and measures of success for these actions. In the strategies area, for example, specific experiential activities are used in the course to guide participants in the implementation of forward booking and strategies to improve compliance with practice standards.

The Core CE concept is to organize the available CE resources to deliver the information that will provide the building blocks for practice financial performance, and which will have the greatest impact on the financial performance of the practice, as well as assist practitioners in the implementation and use of these resources. For instance, a basic requirement in a practice is to be able to develop an income statement and use that income statement to construct a budget. Without the full implementation of these two financial practices, no other financial strategies are actionable.

The focus of the operations component is on the roles of the various practice employees: practice manager, veterinary technician, receptionist, veterinarian and veterinary owner. The expected performance of each is defined in the practice's budget. And in the economics/marketing component a compensation negotiation tool is provided that ties budget, operations and strategies together to determine what level of compensation can be expected for specific levels of employee performance.

At the AVMA Convention 2016 57 veterinary practices (practice owner and manager pairs) participated in the level-one Core CE program and are now attempting to implement 16 specific action items. VetPartners consultants are following up with each practice to evaluate the success of practices in implementing each action item. The AVMA VED will report on the success of this program at the 2017 AVMA Economic Summit.

At the AVMA Convention 2017 the level-one Core CE will be offered along with a new level-two Core CE. The AVMA VED will continue to monitor and evaluate the effectiveness of organizing the practice management continuing education resources and presenting them to a practice team. The Core CE program will continue to be refined based on its ability to improve the financial performance of the participating practices.

ECONOMIC ADVISORY RESEARCH COUNCIL

The purpose of the EARC is to provide leadership to the veterinary profession in all areas of economics. The Council will focus efforts on enhancing the demand for veterinary services, specifically, improving the access of all animals to appropriate levels of high-quality care. Currently all components of the data analytics within the profession are independent, many efforts are redundant, and there remains many gaps in data and information pertaining to important market relationships throughout the veterinary profession. The EARC will provide a forum for discussing the data and analytic needs of the profession and the sharing of data, analysis, concepts and ideas.

The EARC is a profession-wide organization established to govern data analytics for the veterinary profession. The EARC will take the broadest view of the veterinary markets and private practices to guide the collection, analysis and reporting of veterinary economic and financial data. Identifying the most important profession-wide objectives, measuring performance in achieving these objectives, determining what data need to be collected, identifying appropriate methods for the collection and management of data as part of this data analytics process, and ensuring that this information is put into the hands of those who can make it actionable, will be the fundamental activities of this council.

Over the last year, representatives from throughout the profession have discussed the need to focus research efforts, reduce overlap (particularly in data collection) and oversee information provided to the profession. Based on these and other issues, there has been widespread agreement on both the need for this council and for stakeholders' willingness to participate. The first meeting occurred at the AVMA Convention 2016.

The oversight provided by the EARC will reduce the need of our members to determine what information appearing in numerous publications is accurate and actionable. The EARC will also provide for a more efficient use of resources (no overlapping research) so that better progress can be made in areas of greatest concern.

The EARC began with three specific groups that are aligned with the three veterinary markets. Representatives from each of these groups may have a seat on the EARC, as may members of the AVMA Veterinary Economic Strategy Committee. The VESC provides a cohort of veterinary and industry professionals who have had considerable experience with data analytics in the veterinary profession as applied to veterinary economics. And, the VESC is responsible for assisting the AVMA Veterinary Economics Division in setting research priorities for the AVMA, the only professional association of veterinarians with an economics division.

The three groups organized in 2016 are the Pet Demographic Research Group and the Pet Insurance Research Group, both of which pertain to the market for veterinary services, and the Practice Finance Research Group.

The principle purpose of the EARC and each of the research groups within the EARC is to develop the objectives for the group, define the measure by which the objectives will be measured and the data analytics process needed to ensure that these objectives are achieved. Specific KPIs should be developed to measure each objective. The data analytics process including survey design and data collection, data management and processing, analysis, summary and reporting should have a well-defined schedule of annual activities.

Each group is currently establishing meeting times and member roles and outlining requirements for membership. The leadership of each of the groups will be from a member of the AVMA's VESC. The chair of the EARC will be the chair of the AVMA VESC.

The purpose of the PFRG is to improve the profitability of veterinary practices and increase the lifelong value of the DVM degree. There are certainly many practice management strategies that can be deployed to improve the quantity of pets visiting veterinary hospitals, and the quality of care pets receive through the purchase of veterinary products and services that will enhance the quality of life for the pet. However, the financial data from veterinary practices required to develop financial KPIs

for practices with different profit center focuses, demographic characteristics of their business areas, and size of practice is not currently available in a form that is useable. While the profession has long discussed the need for standardized definitions and measure, uniform standards have not yet been widely adopted and thus there are insufficient quantities of practices with comparable information to enable data collection and analysis to determine the best strategies to improve performance.

The PFRG established three lines of work, creating a single standard chart of accounts for all veterinary practices, standard diagnostic codes, a defined set of KPIs for veterinary practices and a financial literacy program to provide financial education to all veterinarians and veterinary practice employees on the topics practitioners in the field deem important, in the format they wish to receive it and at the time they need it. The progress of the PFRG towards accomplishing these goals will be reported at each meeting of the EARC and at the 2017 AVMA Economic Summit.

The focus on KPIs will follow the Dupont method of financial analysis. Currently the focus of the profession is on practice profitability, and the profession must begin to think about financial performance rather than practice profitability. The most important key financial performance indicator is return on assets (ROA). ROA is a financial performance indicator that includes both profitability – an indicator of the effectiveness of pricing and cost control strategies, and asset turnover – an indicator of how efficiently assets are used to generate sales. It is imperative that these two indicators of performance are measured, not only for every practice, but for each profit center within a practice, so that practices can be compared based on their markets to determine relative financial performance.

DUPONT ANALYSIS (ORIGINAL)

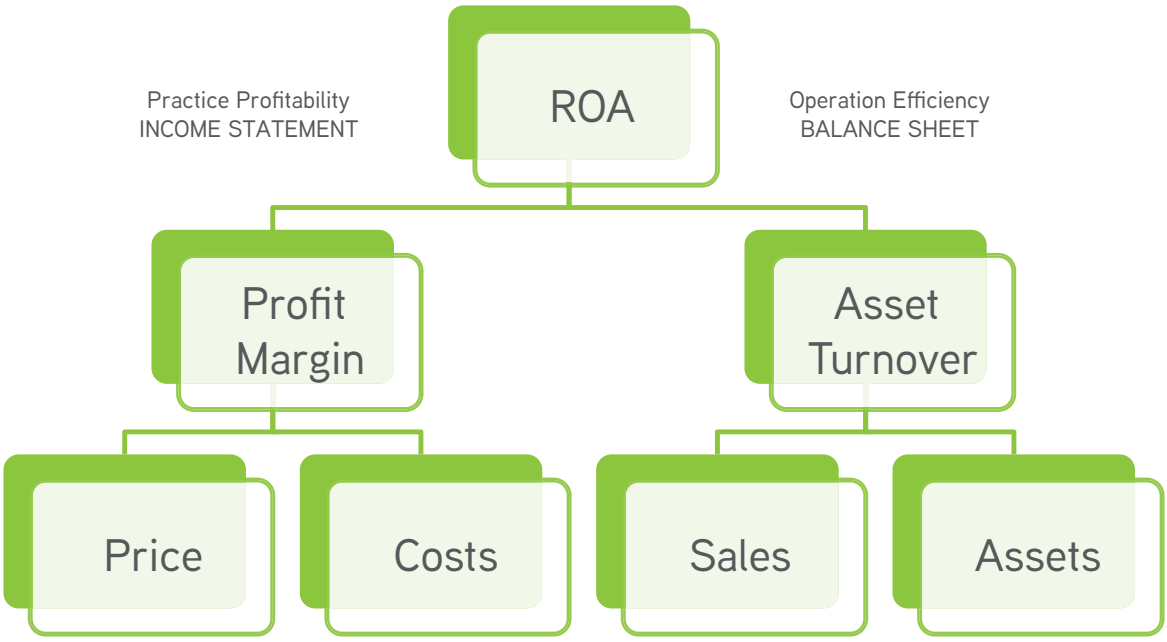


Figure 59

Using the KPIs for financial performance, ROA, profitability and asset turnover provides a more comprehensive review of the financial performance of a business. This is because it allows for a comparison across different business models: those that are able to set prices independently because they are in a less competitive market, and those that must set prices to remain competitive and then rely on the number of patients to generate returns.

The table below compares the financial performance of six major corporations. Ford has the best total revenue, but Microsoft has the best gross income and profit margin. Both of these companies produce a product but Microsoft's product has less competition than Ford's. Both Ford and Microsoft, however, require a large set of assets to generate revenue, and Ford does a better job using available assets to generate sales with an asset turnover index (ATI) of $0.67 of sales for every dollar of assets. Colgate, though, has a very good profit margin (17.39 percent) and also does the best job of the three companies in using its available assets to generate sales ($1.34 of sales for every dollar of assets) and thus has the greatest ROA at 23.32 percent. Clearly, in the decision as to which corporation would be the best investment (or which company you would prefer to purchase), Colgate with the very high ROA would be your choice.

FINANCIAL SUMMARIES FOR SELECTED MAJOR CORPORATIONS, 2015 (BILLIONS OF DOLLARS)

	Ford Motor	Henry Schein	Zoetis	Merck	Colgate	Microsoft
Total Revenue	$149.60	$10.63	$4.77	$39.50	$16.03	$85.30
Gross Income	$7.65	$0.73	$0.75	$6.93	$2.79	$20.18
Profit Margin	5.11%	6.90%	15.74%	17.54%	17.39%	23.66%
Total Assets	$224.93	$6.50	$7.91	$101.78	$11.96	$193.69
ATI	0.67	1.64	0.60	0.39	1.34	0.44
ROA	3.40%	11.29%	9.48%	6.81%	23.32%	10.42%

Table 9

SUMMARY

Nationally, the market for veterinary services continues to rebound from the last recession and many practices are beginning to reach or surpass the optimum capacity of the practice and are hiring more veterinarians. This improvement should continue through 2017. However, little is actually known about the overall performance of the more than 27,000 veterinary practices. Working with these practices to collect, analyze and report on financial KPIs should be a priority for the profession along with better understanding animal health care decisions of animal owners.

Evidence exists to suggest that the amount of veterinary services currently being provided falls short of the services that would be needed to provide all animals with the appropriate level of health care. The new AVMA metro market demand and pet demographic surveys; research on pet health insurance and on benefits and costs of managing zoonotic diseases; and the analysis of practice financial performance are directed toward understanding the factors that have created the gap between veterinary services delivered and services needed. Providing veterinarians with the strategies that could improve the demand for veterinary services and close the demand-need gap will require understanding these factors. And, closing this demand-need gap will lead to an increase in veterinary compensation, increasing the NPV of a veterinary degree and reducing the DIR for new graduates.

DISCUSSION

The body of knowledge in the economics of the veterinary profession is growing quickly, much faster than the use of this knowledge to improve the efficiency of the veterinary markets and the financial performance of veterinary practices. As a result, the AVMA is developing a comprehensive outreach program to assist veterinarians in understanding how to use this economic knowledge in their practice of veterinary medicine.

The "Fix the Debt" initiative is an important new initiative for the veterinary profession and is not the sole responsibility of the veterinary education community. The cost of education and the debt that new graduates carry with them into their professional careers will have a long term-effect on the performance of the veterinary markets. The reduction in public support for public education has persisted for nearly three decades and requires a response not only from those who determine the allocations of public funds to education, but also a response from the veterinary profession in developing new educational paradigms that can provide the same quality of graduates at a lower cost. Lowering the cost of education or reducing the rate of increase in the education costs to below the rate of inflation will help in the provision of veterinary services at prices that increase at less than the rate of inflation, closing the demand-need gap in veterinary services in both public and private practice.

But while it is clear that the cost of education and the debt of new graduates must be reduced, it is also clear that veterinarians must do more to increase the demand for their services and close the demand-need gap. Veterinarians cannot do this alone but will require both the information discussed in this report and assistance in turning this information into strategies that they can implement. The profession has been long on information but short on offering the assistance required to transform this knowledge into changes in actions to improve market efficiency and increase practice financial performance. The goal of the EARC is to develop a profession-wide data analytics process.

Data analytics is the process that collects and analyzes the data required to effectively improve the KPIs of the profession. The process is thus driven by the KPIs and so the first effort of the EARC will be to establish the KPIs for the profession.

A second major goal of the EARC will be to more efficiently use the profession's limited resources to facilitate effective research efforts. Rather than having numerous surveys by various entities collect the same information, the data analytics process should establish a data collection process for the entire profession. This reduces the number of times a veterinary professional must answer the same question, and more efficiently uses available resources to enable more research with the current level of resources.

As the economics of the profession continue to improve as a result of the expanding economy, it will be important to stay the course and not assume that the economic problems have been solved and that there is no longer a need for this research. Complacency has been a consistent problem for the profession and this has led to the absence of time series data – data necessary to understand economic problems and provide efficient solutions.

The AVMA's VED has laid out an aggressive program and schedule for research and is developing a strategy for effective outreach. Success of this initiative will depend on the contributions from and the cooperation of the profession and the entities involved in providing products and services to the profession.

TAKE YOUR PRACTICE TO THE NEXT LEVEL

AVMA Practice Profitability Core CE Sessions

Join over 6,000 veterinary professionals at AVMA Convention 2017 in Indianapolis and register for AVMA's Practice Profitability Core CE, part of the Practice Management Section. These are a must-attend series of interactive, experiential learning sessions especially designed for the practice owner and practice manager.

- Is your practice successful but you're looking to take it to the next level?
- Are you part of a practice that is struggling with making money?
- Do you want to know what to expect from the economy?
- Are you looking to improve the workplace of your organization?

The 12 hour Session will focus on:

- **Finance** - Basic accounting principles and the use of financial ratios to provide guidelines for tracking financial performance.
- **Operations** - All areas that pertain to the internal operations of the practice including staffing, staff assignments, team building, and goal implementation.
- **Strategies** - Focus on various approaches for improving the financial performance of the practice that impact client relationships and improve the internal functioning of the practice.
- **Economics/Marketing** - Information on the US economy, how the veterinary practice interacts with that economy and how to determine the size and competitiveness of local veterinary service markets.

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This report explores the demographics and employment of the veterinary profession: where veterinarians are located, what type of work they do, how much they are compensated, and how they are managing their educational debt. The report also measures unemployment and underemployment and identifies the contributing factors, and explores the performance of the market based on the value of the DVM degree.

The AVMA Report on the Market for Veterinary Services:

All demand for veterinarians and veterinary education begins with the demand for veterinary services. This report provides the latest information on the price of veterinary services, price and income elasticity, and the financial performance of veterinary practices. Our forecasts of capacity utilization and excess capacity for regions and types of practices provide an indication of the performance of this market.

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2017 AVMA & AAVMC Report on

THE MARKET FOR VETERINARY EDUCATION

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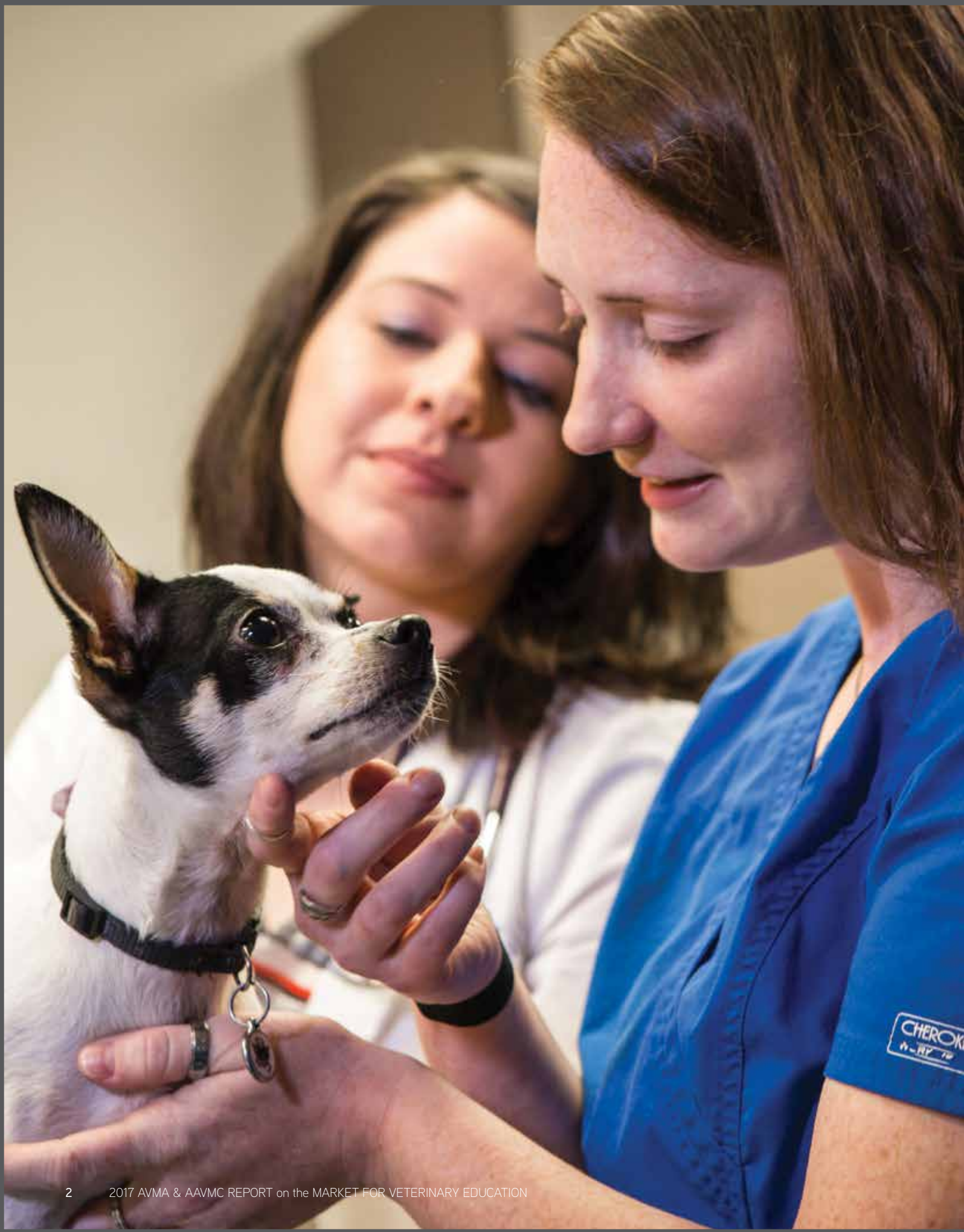

2017 AVMA & AAVMC Report on

THE MARKET FOR VETERINARY EDUCATION

Veterinary Economics Division
American Veterinary Medical Association
May 2017

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CONTENTS

LIST OF FIGURES AND TABLES

SUMMARY

Examining — and ultimately enhancing — the economics of any profession demands an understanding of its financial underpinnings and overall trends, as well as the ability to visualize the direction it is heading. Recording the profession's current economic position and then being able to measure change from this baseline is enabled by analyzing key performance indicators (KPI). By identifying points along the profession's progression, KPIs can help determine whether efforts made are moving it closer to desired outcomes.

In gauging the condition of the veterinary profession, the AVMA's Economics Division has identified as an important KPI, the industry's prevailing debt-to-income ratio (DIR). This ratio, as explained in this *2017 AVMA & AAVMC Report on the Market for Veterinary Education*, helps establish a picture of the connection between the demand and supply of new veterinarians through understanding the cost to obtain a DVM degree, and the subsequent income that is the payback to the veterinarian for acquiring it.

The AVMA computes the DIR using data drawn from a survey of graduating veterinary school seniors that asks about post-graduate plans, educational debt, starting salaries and other demographic information. While the DIR can vary due to differing levels of debt and salaries, and how the ratio is calculated, the AVMA's computed DIR reflects values held to a constant demographic distribution over time to account for changes in these. Survey respondents gave answers that are rounded estimates of what they *think* their debt to be, however, the actual value of the DIR is not as important as the magnitude of annual change and the direction of the DIR over time.

Some 14 percent of students surveyed by the AVMA in 2016 reported no debt, and 6.8 percent reported having obtained no job offers or invitations to pursue continuing education at the time the survey was conducted. Others elected to pursue additional education (35.6 percent reported getting an offer to pursue an internship, residency or continuing education) and about 7 percent did not answer the questions about their debt, income or other specific and relevant information. The AVMA has determined that the DIR in 2016 was 2.00; a rate that will create a financial hardship for graduates electing to service the debt with traditional repayment terms. Hence, a 1.4:1 debt to income ratio was determined as a rational goal for the profession.

WILLING APPLICANTS

Examining the extent that the pipeline to the veterinary field has been filled in recent years, the report notes that the number of applicants to veterinary medical colleges increased slightly in 2016, to 6,667, and increased even further in 2017 to 7,071-the highest since 1981. The report concludes that this change may indicate that the number of applicants no longer seems to be in a decline spotted in previous years.

How might pricing affect the demand for a veterinary education? In 2014, 53.3 percent of veterinary school applicants were willing to pay up to $150,000 for a seat, while in 2015 only 37.1 percent of the applicants were. In 2016, the percentage rose to 40.2. As strategies to improve the financial literacy of pre-veterinary students are implemented, measurement of the demand for veterianry college seats will be vital.

Based on Veterinary Medical College Application System (VMCAS) records of U.S. citizens who applied for seats at the 30 AVMA-accredited veterinary colleges in the United States, three AVMA-accredited Caribbean colleges, and 16 AVMA-accredited veterinary colleges in other countries, the applicant-to-seat ratio is determined to have remained relatively constant over the last four years — hovering at around 1.6:1 In 2016, U.S. veterinary colleges turned out more than 2,900 new veterinarians.

Equilibrium exists in a market when demand and supply curves intersect. At the point of intersection of these curves in the market for education, the willingness of the applicants to pay for seats is equal to the number of seats the colleges are willing to provide at that price. The equilibrium quantity and price for the 2015 applicants were 1,384 seats at a mean total cost of $197,242. In 2016 demand increased and the cost per seat increased. The number of lower-cost seats, however, increased: Applicants were willing to occupy 1,860 seats at a mean total cost of $180,590.

Although applicants have access to information on the costs of attending various schools, the factors that have bearing on their decision whether or where to attend are unknown. Additionally, not tracked are data comparing the difference between what applicants were willing to pay, and what graduates *actually* paid. When the 2016 applicants were asked, however, to estimate the debt load of the 2015 graduates, they had a relatively accurate idea of the debt load of new veterinarians.

FINDING WORK

The percentage of graduating veterinary students finding full-time employment or getting offers to pursue post-graduate education in the 2016 graduating class was 93.1 percent, the highest rate for the entire period under examination. Although the Great Recession had a direct impact on the number of students securing post-employment plans, the increasing number of new graduates finding employment or educational opportunities suggests that the economy has been gaining strength.

Also noteworthy is that the percent of graduates receiving some type of income opportunity is steadily increasing even though the number of graduates is concurrently increasing over the period. The number of new veterinarians finding full-time employment grew to 54.9 percent in 2016, from 48.9 percent in 2015. The number of new veterinarians not finding employment or receiving an invitation to pursue continuing education decreased from 11.9 percent in 2015 to 6.9 percent in 2016. In 2016 a record number of graduates found full-time employment prior to graduation!

Market distinctions among specialties were observed. From 2001 through 2016 the majority of new veterinarians reported finding full-time employment in the companion animal exclusive sector. New entrants into this sector declined throughout the period 2004 to 2012, however, with a slight increase between 2012 and 2014, followed by a downward turn in 2015. This trend took a turn in 2016 with an increase to 30.4 percent. Though the trend climbed from 2015 to 2016, the highest point, at 42 percent, occurred in 2004. Noteworthy is that the loss in the percent of graduates obtaining full-time employment in companion animal practices was offset by the 10 percent increase in graduates electing an internship opportunity.

New entrants into other sectors such as food animal, companion animal predominant, mixed practice and equine practice remained almost steady in the same period. The percentage of new veterinarians finding full-time positions in public practice has been consistently small but steady during this time. Between 2015 and 2016, the number of new veterinarians heading into federal government, college or university, and not-for-profit organizations increased while the number heading into uniformed services, state and local government, and industry declined.

NEW VETERINARIANS' EARNINGS – AND DEBT

From 2001 through 2016, the mean starting salary for new graduates increased from just under $40,000 to more than $58,000 – a mean increase of $1,220 per year over the period. Since 2009, private practice has offered the highest starting salaries. Salaries in public practice began lagging with the 2007-2009 financial crisis. Prior to that, salaries of new veterinarians in public practice and private practice were even. The effect of the recession on state and federal budgets has had a large impact on public practice incomes compared to the impact of the recession on private practice incomes.

Although starting salaries among new veterinarians in private practice have been on a steady incline, new veterinarians pursuing employment in the equine industry have consistently experienced the lowest starting salaries. For new veterinarians in 2016, food animal exclusive practice yielded the highest income, with those in companion animal exclusive practice and companion animal predominant practice following closely behind. New veterinarians employed at colleges or universities report the lowest starting salary among those in public practice.

When it comes to new veterinarian debt, the report indicates that over the last 16 years, the DVM degree debt of all veterinary students has been increasing at about $5,400 per year; for those reporting non-zero debt, the annual increase has been approximately $6,200. Between 2015 and 2016 mean DVM degree debt of all veterinary students increased by only $1,363 compared to an increase of $7,111 between 2014 and 2015. DVM debt incurred by new veterinarians varies by post-graduation plans.

Over the period 2001 through 2016 new veterinarians finding employment in public practice consistently had the lowest debt load, while new veterinarians pursuing internships and residencies had the highest. For each sector, whether public practice, private practice, advanced education, internships or residencies, however, the growth rate of DVM debt has continued to outpace the growth rate of starting salaries. To respond to the challenge that a considerable DIR presents to veterinary graduates, the report points to strategies to move the profession toward the goal of reaching a 1.4:1 DIR, and issues a call to every corner of the profession to make it happen.

INTRODUCTION

This report on the market for veterinary education is part of what is now the third edition of a series of annual reports, and offers updates on the first market along the supply chain culminating in veterinarians providing veterinary services. A sequel to last year's report, this report provides updates on the debt and income of new veterinarians along with information on veterinary college applicants, a breakdown of tuition, fees, living expenses by veterinary college and year, debt and income levels of new veterinarians, (demand for and supply of seats) and the important key performance indicator, the debt-to-income ratio.

Also continuing last year's collaboration, this report engages the Association of American Veterinary Medical Colleges (AAVMC) to produce a joint publication, a relationship through which we obtain applicant information from the VMCAS, and data on tuition, fees and estimated living expenses from the veterinary colleges. The primary goal of this partnership is to provide consistent data reporting across multiple channels along with convenient access to data in a single location.

In addition to VMCAS and AAVMC the source of much of the data presented is AVMA's annual "senior survey," which is distributed to graduating veterinary students, weeks before graduation. It solicits data on graduates' post-graduation plans, including job offers or continuing education prospects, location, debt levels, practice type and other relevant information. Although these data have been reported for more than a decade, the launch of this series of reports marks the beginning of the AVMA's effort to report trend data. Consequently, we produce weighted datasets along with an index to measure the economic impact on the market for new veterinarians while controlling for a changing demographic.

Controlling for a changing demographic became critical when analysis revealed that several demographic factors affected the starting salary of new veterinarians. Among these are gender, age, practice type, location of place of employment, debt load and work hours per week. For instance, new female veterinarians earn significantly less than new male veterinarians, holding all else constant. As a result, a profession with an increasing female population may appear to have a decreasing mean salary or at least decreasing with respect to the rate of inflation. The phenomenon, however, is an increase in the number of lower earning, female veterinarians entering the profession and deflating starting salaries, a trend independent of national veterinary labor market conditions involving the price and quantity demanded. This is just one example, but many demographic factors affect starting salaries and need to be controlled to attain an unbiased picture of the relationship between prices and quantity demanded in the national labor market for new veterinarians.

Although this process is relatively new to the veterinary profession it is a standard in economics. This analytical process to control for the characteristics of a good or bundle of goods to measure the impact of the quantity of supply and demand on price is a common practice in economics, producing what is termed a Laspeyres index, more commonly known as the Consumer Price Index. Such an index holds steady the quantity of a specific number and type of goods (basket of goods) purchased annually by consumers, creating an "apples-to-apples" comparison to determine the change in price as an indicator of inflation. Holding constant the demographic characteristics of new veterinarians, (i.e., a constant percentage of a certain gender, practice type and distribution by region) allows for the examination of how the changing number of graduates affects the income they receive.

Also tracked extensively in this report is the DIR, one of the KPIs for the veterinary profession. The ratio does not only measure the performance of the market for new veterinarians but also allows us to quantify the success of programs and strategies implemented to improve the economic performance of the market for veterinary education. As with the examination of income trends, the factors that affect the DIR are identified in the report to inform the profession of potential strategies for reducing the DIR to improve the performance of the profession.

The last section of this report focuses on the starting point of the supply side for the market for veterinary services, the market for education. The three vertically related markets of which the market for education is the starting point are the market

for education, the market for veterinarians and the market for veterinary services. These markets are separate but vertically related through inputs and price signals. That is, the triggers that stir demand for veterinary students should receive a signal from the prices paid for veterinarians and likewise the market for veterinarians should be signaled by the price of and demand for veterinary services signaled by the market for veterinary services. In addition, the cost for veterinary services is related to the costs of veterinary labor, which is related to the cost of veterinary education. And, the demand for seats at veterinary colleges, by applicants, which comes from the demand by animal owners for veterinary services, interacts with the supply of seats (price and quantity) to determine the number of students and the future supply of veterinarians.

The market for education is a complex market consisting of 30 AVMA-accredited veterinary colleges located in the United States, 19 AVMA-accredited colleges located outside the United States and dozens of other veterinary colleges not accredited by the AVMA, but graduates are able to enter the market for veterinarians through various channels.

In addition to an analysis of tuition and fees across colleges this report will analyze the student debt incurred by recent graduates as a result of tuition and fees, living expenses, and interest on student loans while in veterinary college. This distinction is made because the cost of living cannot be quantified as opportunity cost, or cost foregone to become a veterinarian as one has to "live" and incur living expenses whether or not they attend veterinary college. This report does, however, present a detailed description of the cost of living in various regions of the country as well as the tuition incurred to matriculate through veterinary college.

To create the largest impact on the economics of the profession, it is most effective to attack the debt challenges of new veterinarians, and the DIR, by engaging pre-veterinary students. Oftentimes, cautioning veterinary students about the impact of high debt levels and an unsustainable DIR is less effective because most have already secured large loans and can do very little about their circumstances at that time. On the other hand, while educating pre-veterinary students can be helpful, these students may not understand the effect of substantial debt on their anticipated lifestyle. These pre-veterinary students find the warnings illusory and remote from their present situation, but as the high DIR becomes more prominent among veterinarians across the profession, more of the pre-veterinary students will, through their increased contact with practitioners with a high DIR, begin to better understand the role of debt on lifestyles. Today's pre-veterinary students appear to know they may have excessive debt upon graduation, but they cannot pinpoint what that feels like when translated into daily life, such as having a used car long after graduation, the inability to own a home, or working long hours merely to make loan payments.

KPIs measuring the market for a veterinary education, mainly the DIR, are of particular importance to measuring the impact of implemented strategies. At the most basic level, the income awarded to veterinarians is indicative of animal owners' willingness to pay for veterinary services. This, in turn, represents consumers' willingness to pay for costs to train veterinarians to care for pet owners' animals. Essentially, the fact that the DIR is above 2.0 indicates that it costs a veterinarian twice as much to become trained than the cost in aggregate that animal owners are willing to pay for their services. In other words, the market is signaling that the actual cost of producing veterinarians exceeds the value society places on veterinay services. This report will also highlight strategies that, if implemented, could alleviate the high DIR challenge.

MARKET FOR EDUCATION KPI

The DIR is a snapshot in time of the state of new entrants into the profession. And, with a wide range of salaries and an ever wider range of debt levels, the DIR can vary immensely.

KPIs are of particular importance to determining whether a strategy or protocol is effective. For example, the charge of the AVMA Economics division is to enhance the economics of the veterinary profession. To enhance the economics of the profession requires knowledge of the current situation and expectations for the future. The KPIs provide a measure of the change from the baseline situation to the current situation to understand whether the profession's efforts are moving it closer to the desired outcomes.

An important KPI identified by the AVMA's economics division is DIR, which is essentially individual debt divided by individual income. This ratio captures the linkage between the demand and supply of new veterinarians as the debt is directly related to educational costs while the income is the payoff to the veterinarian for obtaining the DVM degree. Presenting this as an accurate representation of the market for new veterinarians, however, can be challenging.

To most accurately develop an index and determine a trend for the DIR requires that several current constraints be removed. The DIR that the AVMA calculates is derived from analyzing AVMA's senior survey. The senior survey is distributed each spring to the graduating seniors of the AVMA-accredited U.S. colleges. The survey asks seniors to report their post-graduate plans, educational debt, starting salaries and other basic demographic information. Some of the individual responses, however, are estimates rather than true values. Questions such as the number of hours expected to work per week, educational debt incurred, and annual

production expected are estimates made by students based on the information they have available. Students either don't have the exact values for specific data points or they have not made the effort to identify these values. For instance, respondents are unlikely to know precisely how many hours they will work per week and, as such, are even less likely to know what their level of production will be, as this will depend not only on hours worked, but on the availability of clients and the efficiency with which as veterinarians they are able to provide the services required. The level of debt at graduation can be determined, but respondents have provided answers that are clearly rounded estimates of what they believe their debt to be. Consequently, it is important to note that the actual value of the DIR is less important than the magnitude of annual change and the direction of the DIR over time.

The DIR is a snapshot in time of the state of new entrants into the profession. And, with a wide range of salaries and an ever wider range of debt levels, the DIR can vary immensely. Some students report no debt (14.2 percent of the 2016 graduating class), others report having obtained no job offers or invitations to pursue continuing education at the time the survey was distributed (6.8 percent in the 2016 graduating class). Others elect to pursue additional education (35.6 percent of the 2016 class reported receiving an offer to pursue an internship, residency or continuing education) and then there are some (an additional 7.0 of the 2016 graduating class) who simply do not answer the questions pertaining to their debt, income or other specific and relevant information.

In addition, the DIR has been calculated with many different formulas in the past. Some methods removed those respondents with zero debt, others included all respondents regardless of employment opportunity, and yet other methods simply found the mean debt from all those reporting debt and divided the mean income from all those reporting incomes regardless of whether each individual included had provided both an estimate of debt and income. How should interns, residents, those in continuing education programs receiving only a stipend or, of equal importance, those who failed to respond to the pertinent question, be classified? Should those who did not answer the debt or income questions be distributed as those who did? Ultimately, the method chosen to compute the DIR stems from the objective for the measure. To effectively improve the economics of the veterinary profession, a measure must accurately describe the current state of the profession consistently and uniformly over time so that trends can be identified. Again, it is important to understand that there are many possible methods for computing the DIR. The method used in this report was developed to provide the best indication of the state of the market for veterinary education and to measure the impacts on the performance of this market from the most encompassing strategies. For example, if the respondents with zero debt are not included, then any strategy that brings a veterinary graduate's debt to zero will be seen as having no effect on the DIR (and may show a negative impact), as once the respondent achieves a zero debt that observation is no longer included in the calculation.

The mean debt figure is computed by aggregating all the reported debt numbers and dividing the sum by the number of respondents reporting a debt number, including those reporting zero debt. There has been some talk about excluding those with zero debt, however, zero is well within a 95 percent confidence interval around the mean debt, and higher debt levels that lie outside the high end of the 95 percent confidence interval are included in the descriptive statistic.

The descriptive statistic for income reflects only those respondents reporting full-time employment. To identify the mean salary for new veterinarians, those pursuing internships or residencies and those receiving stipends from continuing education programs were omitted. Nonetheless, as mentioned in previous reports, if the compensation received for completing internships becomes identified as an economic decision to clear the markets of available new veterinarians, then the observations of income of new veterinarians completing internships will need to be included along with full-time employment opportunities.

Both the mean debt and the mean starting salary are important descriptive statistics, but neither is used to compute the DIR. The DIR is computed by finding the mean of the debt-to-income ratio for all of the graduates who reported a value for debt and full-time employment income. And these values are held to a constant demographic distribution over time so that there is no effect on the DIR as a result of changing demographics.

THE APPLICANT POOL FOR VETERINARY COLLEGES

As mentioned in previous reports, the market for veterinary services is the final entity in the vertically related veterinary markets. Applicants to the veterinary colleges represent the beginning of the supply chain, and for every applicant in VMCAS there are many potential applicants who have elected not to apply, but may do so as the conditions for entry change.

Over the last couple of years, the AVMA reported that the number of applicants to colleges of veterinary medicine was cyclical. In 2013, the number of applicants peaked at 6,769, dropped slightly to 6,744 in 2014 and dropped again in 2015 to 6,600. In 2016, however, the number of applicants increased slightly to 6,667 and increased even further in 2017 to 7,071. Although the peak during the last cycle occurred in 1998 at 6,783 applicants, the number of applicants in 2017 has been the highest since 1981. While we have been unable to determine a specific factor, or set of factors, potentially responsible for the cycle of applicants, the number of applicants may not follow a cyclical pattern or that pattern may need to be better defined. Regardless, the number of applicants no longer seems to be on a decline, at least not since 2015.

AAVMC VETERINARY SCHOOL APPLICANT FIGURES

AAVMC Internal Data Reports, 1980-2016

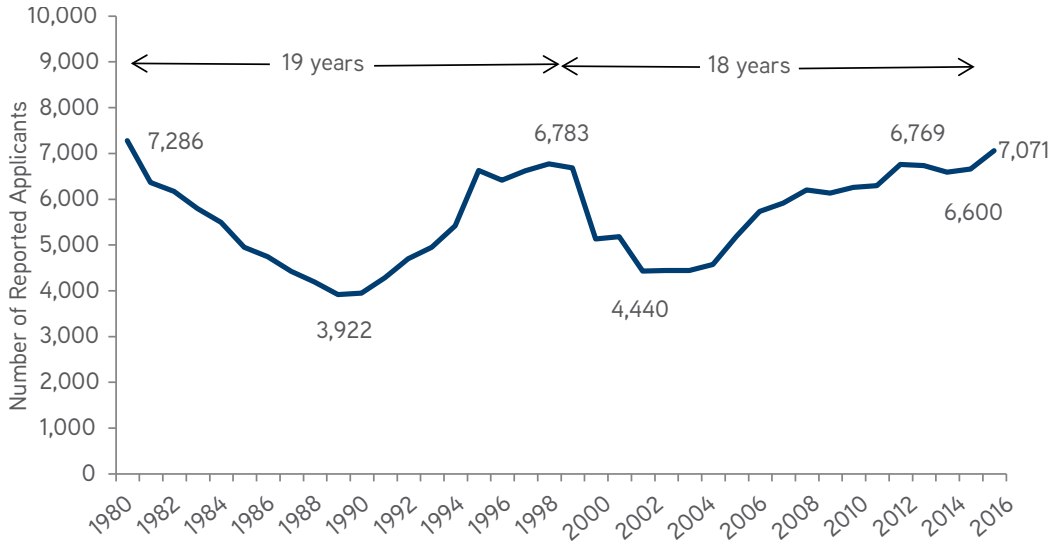


Figure 1

DEMAND FOR VETERINARY COLLEGE SEATS

Using the survey of the VMCAS applicants, the demand for veterinary college seats was determined. In this system, the applicants are able to, and often do, apply for multiple seats with the hopes of securing an agreement with at least one institution. Furthermore as a result, each veterinary college may face several applicants vying for one seat. Each year since 2014, the VMCAS applicants are surveyed to determine (among other factors) what they are willing to pay for the veterinary education. The willingness to pay expressed by each applicant for a seat yields a locus of price and quantity points that describes the demand for veterinary education, the relationship between the quantity of seats demanded, and the price for each seat that the applicants are willing to pay.

In the period of 2014 through 2016 the demand for a veterinary education has decreased then increased to below the starting point at constant price levels. This is illustrated in a shift to the left from 2014 to 2015 then a shift to the right in 2016, ending between the 2014 and 2015 curves.

The implication of this shift is that from 2014 to 2015, at the same price, fewer market participants (applicants) are demanding a veterinary education seat. More specifically, in 2014, 53.3 percent of applicants were willing to pay up to $150,000 for a veterinary education, while in 2015 only 37.1 percent of the applicants were willing to pay up to $150,000 for a veterinary education. In 2016, however, 40.2 percent of applicants were willing to pay up to $150,000 for a veterinary education, as depicted by a shift to the right of the demand curve. Measurement of this demand curve will be important as strategies to improve the financial literacy of pre-veterinary students are implemented. Will these strategies affect a shift in the applicant demand? More importantly, to track our potential successes, we must be able to measure the impact of strategies already employed.

APPLICANT DEMAND, 2014, 2015 & 2016

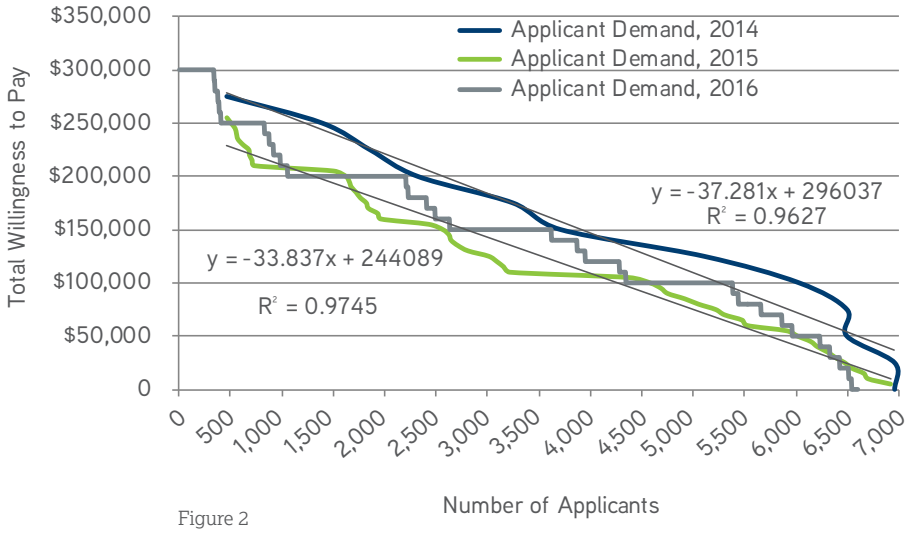


Figure 2

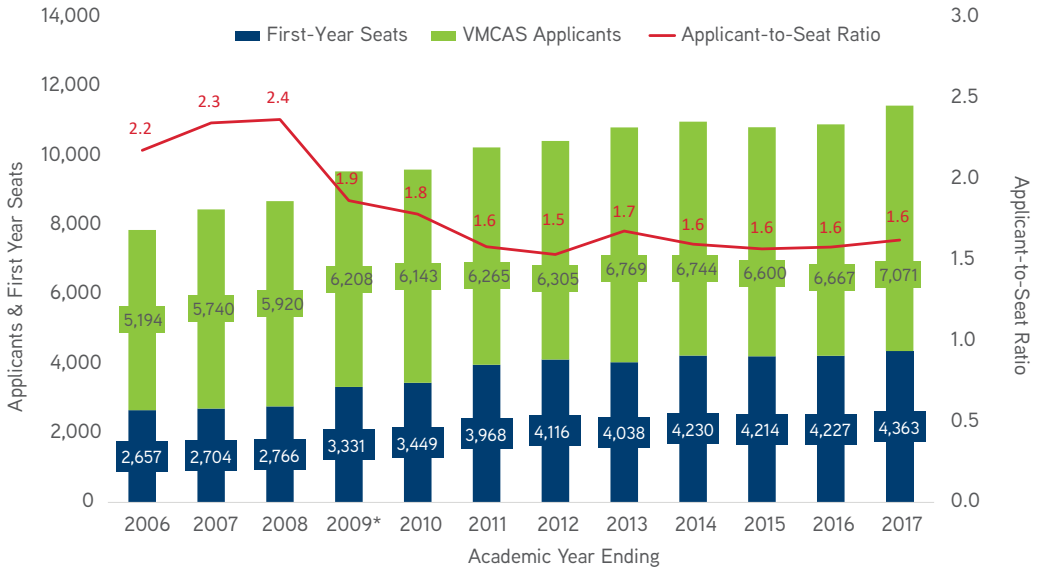
APPLICANT-TO-SEAT RATIO

Over the last four years, the applicant-to-seat ratio has remained relatively constant at 1.6. In 2016 there were 6,667 applicants through the VMCAS system and 4,227 available seats yielding an applicant-to-seat ratio of 1.57; and in 2017 there were 7,071 applicants and 4,363 available seats, producing an applicant-to-seat ratio of 1.62.

The seats available are located both within the United States and at foreign veterinary colleges and are occupied by U.S. first-year students. It is important to note, however, that the dip in the applicant-to-seat ratio in 2009 was primarily as a result of adding the U.S.-accredited foreign schools and not reflective of any major difference in the number of U.S. applicants or U.S. veterinary college seats.

VMCAS APPLICANTS AND FIRST-YEAR SEATS, U.S. AND INTERNATIONAL INSTITUTIONS

AAVMC Internal Reports, 2006-2016



**2009 is the first year data is available for AAVMC international members*

Figure 3

As found in previous years, the gradually declining applicant-to-seat ratio has yet to translate into an applicant pool of diminished quality. Over the period 2005 through 2017 there has been no significant difference in applicants' GPA or GRE scores. Simultaneously, there has also been no significant change in the North American Veterinary License Exam (NAVLE) pass rate.

HISTORICAL ANALYSIS OF THE APPLICANT POOL

	Pre-vet GPA	GRE Verbal	GRE Quantitative
2005	3.53	63%	45%
2006	3.55	63%	45%
2007	3.54	63%	45%
2008	3.57	63%	45%
2009	3.57	59%	40%
2010	3.57	54%	40%
2011	3.59	59%	40%
2012	3.59	63%	48%
2013	3.6	72%	64%
2014	3.59	72%	64%
2015	3.56	65%	54%
2016	3.55	66%	58%
2017	3.55	66%	57%

Table 1

VETERINARY COLLEGES SUPPLY OF SEATS

The number of seats available to U.S. students includes those seats available at the 30 AVMA-accredited veterinary colleges in the United States, three AVMA-accredited Caribbean Colleges, 16 AVMA-accredited veterinary colleges in other countries, and numerous other veterinary colleges across the globe. While the AVMA has members who graduated from more than 225 veterinary colleges, the VMCAS tracks only U.S. citizens who apply for seats at AVMA-accredited veterinary colleges. The seats currently occupied include the 2017 through 2020 graduating classes. Using the estimated number of graduates by source, there are currently an estimated 4,363 seats per year available to U.S. students: roughly 3,300 at the 30 U.S. colleges, 490 at the three Caribbean colleges and just more than 500 at the 16 AVMA-accredited foreign colleges. Because we have no information to suggest that any of these 49 veterinary colleges are planning to increase enrollments, we have forecast a constant number of seats beyond 2019.

U.S. VETERINARY GRADUATES, ALL SOURCES

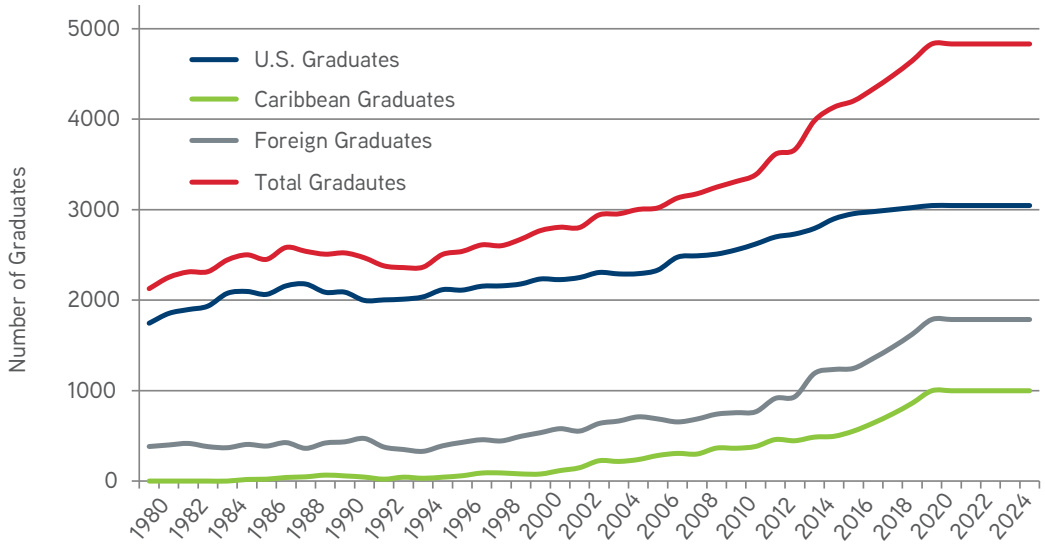


Figure 4

In 2016, veterinary colleges in the United States produced more than 2,900 new veterinarians. With colleges averaging four classes in the DVM program at any given point, equating to roughly 13,000 seats, the income generated by this sector is certainly sustainable at least for the next four years. For 2016 U.S. graduates, tuition and fees ranged from more than $69,000 to almost $225,000 for four years of matriculation through the DVM program. Western University supplied non-discounted seats at the highest prices while the Kansas State University supplied discounted seats at the least expensive prices. In the past, seats were separated by in-state (resident) and out-of-state (non-resident) designations. In-state seats were discounted based on the amount of state appropriations the college of veterinary medicine received either separately or through the general university. Out-of-state seats were considered non-discounted as these students were not provided the subsidy from the state appropriation. However, the designation of in-state and out-of-state is no longer appropriate for a number of reasons. Out-of-state student are able to gain state residency at some colleges. Others, who are considered out-of-state students, hold contract seats for which their home state pays the college for some, or all, of the out-of-state component of tuition and fees. Yet other out-of-state students receive scholarships or regional contract reimbursements for some or all of the out-of-state tuition and fees.

SUPPLY OF VETERINARY EDUCATION: TUITION & FEES AND TOTAL COST, 2016

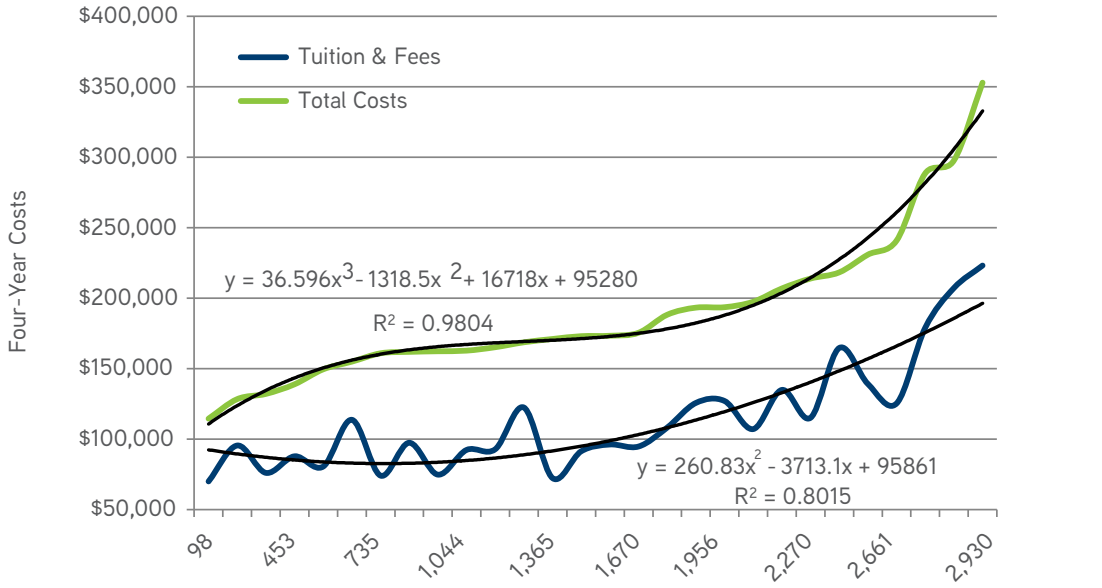


Figure 5

Equilibrium exists in a market at the point where the demand and supply curves intersect. At the point of intersection of the demand and supply curves in the market for education, the willingness of the applicants to pay for seats is just equal to the number of seats the colleges are willing to provide at that price. The equilibrium price and quantity for the 2015 applicants were 1,384 seats at a mean total cost of $197,242. In 2016, demand increased and the cost per seat increased but the number of lower-cost seats increased (supply shifted right). As a result, applicants were willing to occupy 1,860 seats at a mean total cost of $180,590. At present there are nearly 3,300 seats to be filled and a steady applicant pool. That Figure 6 represents what the 2016 applicants (2020 graduates) indicated they were willing to pay for a seat at a veterinary college and the actual cost of the seats available suggests expectations of costs that are below actual costs. Debt levels suggest that there is a considerable difference between what applicants report as their willingness to pay to attend veterinary school and what they will actually pay. Although applicants have access to information on the costs of attending various schools, the factors that are important in their decision to attend veterinary school or a specific veterinary college are unknown. Furthermore, those who seek education at an "in-state" school and those who are eligible for a discounted rate (contract seat or other form of scholarship) may well indicate a willingness to pay that is well below what they must accept to attend an out-of-state school. We are unable to track applicants to graduates to determine the difference between what the applicant was willing to pay and what they actually paid. The difference currently measured may simply be related to the selection of applicants that are willing to pay more for a seat.

SUPPLY AND DEMAND FOR VETERINARY EDUCATION, 2015 & 2016

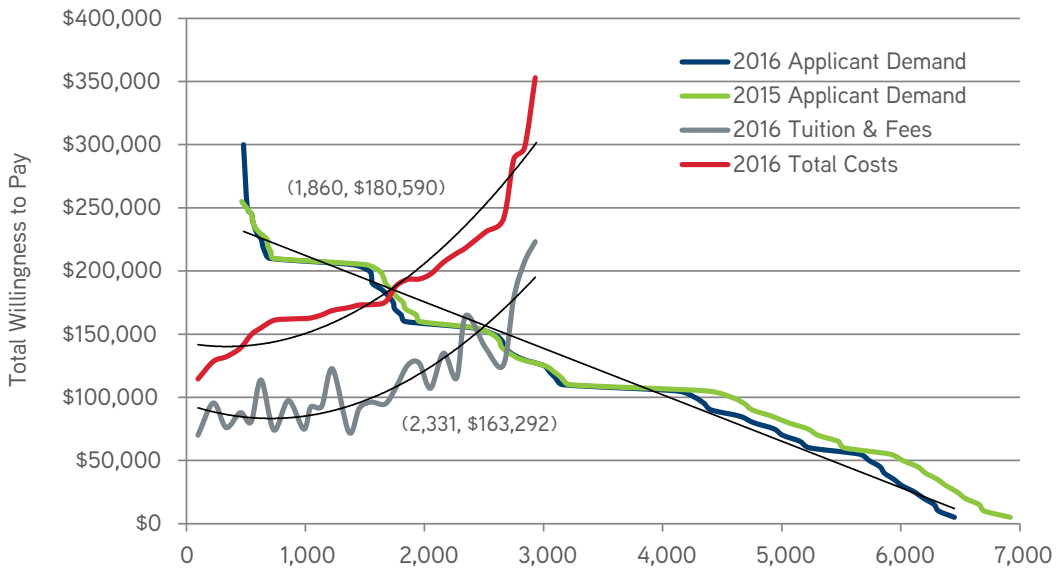


Figure 6

The following chart illustrates the aggregate, comprehensive value of tuition and fees, total cost and self-reported DVM debt. Similar to 2015 graduates, the majority of the graduating class had debt levels that lie below the total cost of matriculation through veterinary school. While in 2015 less than 2 percent of students had debt levels reaching more than $450,000 and about 11 percent reported having zero debt, in 2016 less than 1 percent of the graduating class had debt levels more than $450,000 and just over 14 percent reported having zero debt. In addition, as noted, determining what factors affect the debt-to-cost ratio for individual students will be important to developing strategies to increase the percentage of students who have debt that is less than the cost of their education.

SUPPLY OF VETERINARY EDUCATION AND DVM DEBT, 2016

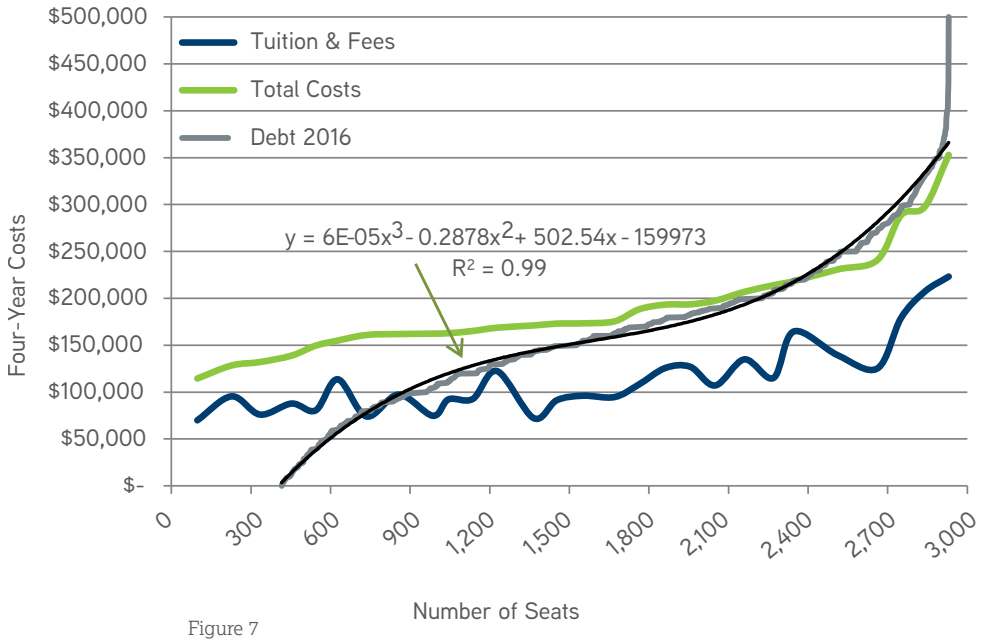


Figure 7

APPLICANTS ESTIMATE OF THE DVM DEBT

The 2016 applicants were asked to estimate the debt load of the 2015 graduates. The following chart depicts their responses. As a comparison, the actual 2015 reported debt load of the graduates is provided in the same chart. The applicants had a relatively accurate idea of the debt load of new veterinarians. This debt load, based on the starting salaries for new veterinarians is high, but not high enough to have deterred applicants from pursuing veterinary college.

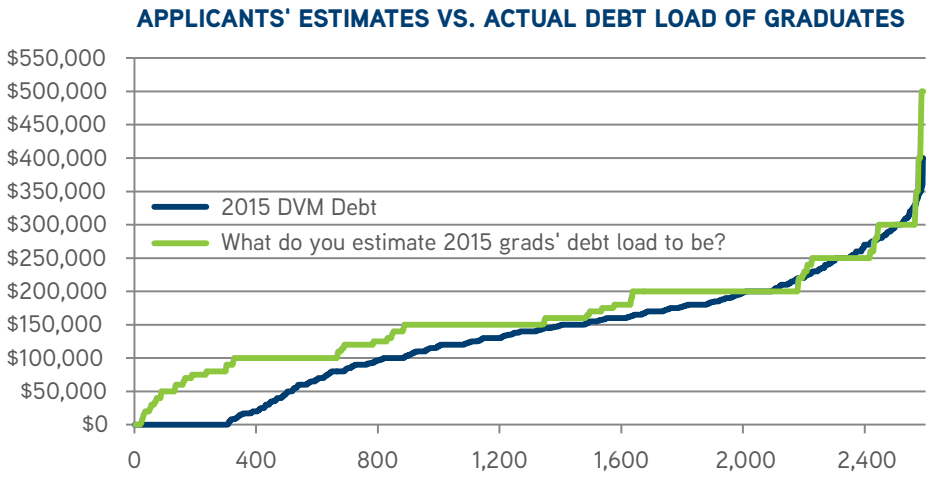


Figure 8

IN 2016 LESS THAN 1 PERCENT OF THE GRADUATING CLASS HAD DEBT LEVELS MORE THAN $450,000.

THE 2016 GRADUATING CLASS

In 2016, the senior survey was sent to 28 AVMA-accredited U.S. veterinary colleges and four U.S. accredited veterinary colleges located outside of the United States that had graduating seniors. The following table shows the response rates by school for the 2016 graduating class.

RESPONSE RATE BY VETERINARY COLLEGE, 2016

School Name	# of Graduates	Responses	Response Rate
Auburn University	116	116	100.0%
Colorado State University	130	85	65.4%
Cornell Veterinary College	100	99	99.0%
Cummings SVM at Tufts University	93	80	86.0%
Iowa State University	142	107	75.4%
Kansas State University	112	89	79.5%
Louisiana State University	85	85	100.0%
Michigan State University	109	83	76.1%
Mississippi State University	83	83	100.0%
North Carolina State University	98	98	100.0%
Oklahoma State University	88	88	100.0%
Oregon State University	55	53	96.4%
Purdue University	82	82	100.0%
Texas A&M University	130	124	95.4%
The Ohio State University	157	150	95.5%
Tuskegee University	69	69	100.0%
University of California-Davis	134	134	100.0%
University of Florida	110	99	90.0%
University of Georgia	98	98	100.0%
University of Illinois	116	82	70.7%
University of Minnesota	97	90	92.8%
University of Missouri-Columbia	108	107	99.1%
University of Pennsylvania	117	81	69.2%
University of Tennessee	79	75	94.9%
University of Wisconsin	79	79	100.0%
Virginia-Maryland College	117	116	99.1%
Washington State University	122	110	90.2%
Western University-California	104	81	77.9%
Total U.S. Schools	**2,930**	**2,643**	90.2%
Foreign Schools			
Ross University	255	121	47.5%
St. George's University	98	51	52.0%
University of Edinburgh	106	14	13.2%
University College, Dublin	103	10	9.7%

Table 2

As a result of the low participation rates of U.S. graduates at the foreign veterinary schools, we omitted these data from our analysis. Insufficient data inhibits identifying with certainty the statistical validity of these data with respect to representing the population of foreign graduates. Future reports will highlight the magnitude of data currently available on graduates of foreign institutions.

DESCRIPTIVE STATISTICS OF GRADUATES

From 2012 through 2016 the percentage of the graduating class reporting finding offers for jobs or to continue their education has been steadily increasing.

A major component of the senior survey addresses the post-graduate plans of the graduating veterinary students. Students were asked to report their plans after graduating, whether they planned to pursue an internship, residency, continuing education or full-time employment. They were also asked to report the location of any post-graduate employment or education. The following figure illustrates the percentage of new veterinarians finding employment or gaining acceptance into an educational program upon graduation. Although some students reported finding no employment at the time the survey was distributed, evidence from other AVMA surveys suggest that many of these new veterinarians found employment within a year of graduating.

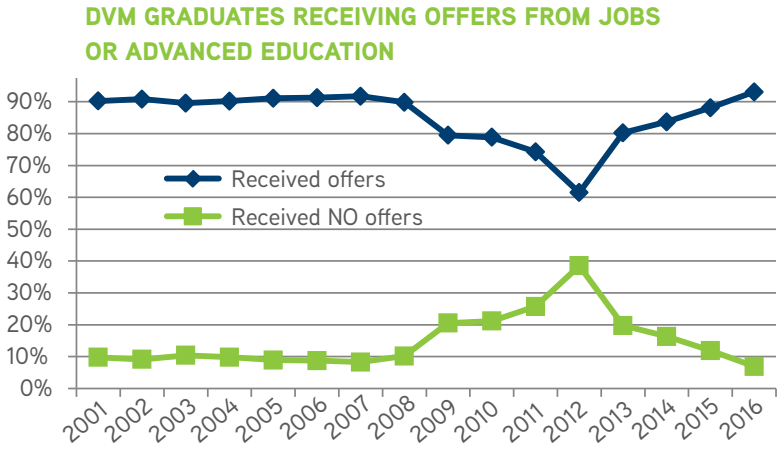


Figure 9

The percentage of graduating veterinary students finding full-time employment or getting offers to pursue post-graduate education in the 2016 graduating class was 93.1 percent, the highest rate for the entire period under examination. Although the recent economic recession had a direct impact on the number of students securing post-employment plans, the economy has been regaining ground, reflected in the increasing number of new graduates finding employment or educational opportunities. Also noteworthy is that the percent of graduates receiving some type of income opportunity is steadily increasing even though the number of graduates is simultaneously increasing over the period. The number of new veterinarians finding full-time employment showed an increase to 54.9 percent in 2016, from 48.9 percent in 2015. The number of new veterinarians not finding employment or receiving an invitation to pursue continuing education decreased from 11.9 percent in 2015 to 6.9 percent in 2016. Even more important is that in 2016 a record number of graduates found full-time employment prior to graduation – 64.4 percent – the second year in a row that a new record number of full-time employment was attained.

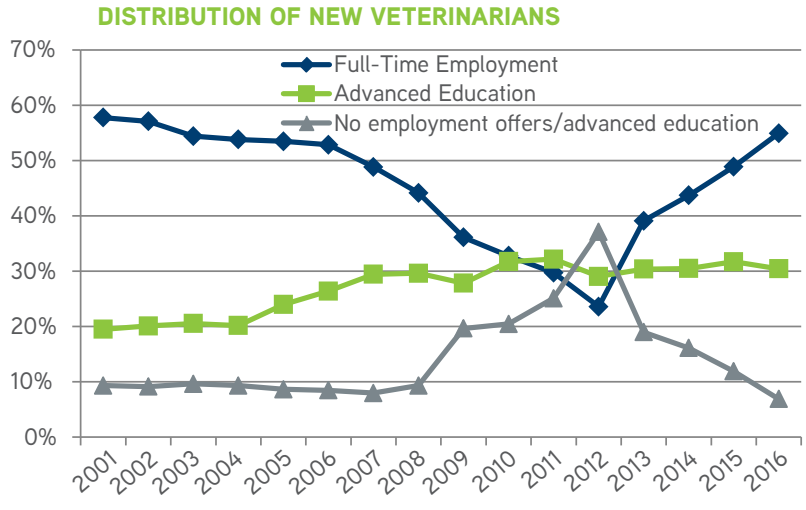


Figure 10

Throughout the period 2001 through 2016 the majority of new veterinarians reported finding full-time employment in the companion animal exclusive sector. New entrants into this sector declined throughout the period 2004 to 2012, however, with a slight increase between 2012 and 2014, followed by a downward turn in 2015. This trend took a turn in 2016 with an increase to 30.4 percent. Though the trend was upward from 2015 to 2016, the highest point was 42 percent in 2004. Of note is that the loss in the percent of graduates obtaining full-time employment in companion animal practices was offset by the 10 percent increase in graduates electing an internship opportunity.

New entrants into other sectors such as food animal, companion animal predominant, mixed practice and equine practice remained almost steady in the same period. As noted in previous reports, this observation should not be used to denote the overall supply and demand for new veterinarians in the respective sectors, as estimating this would require data on the ratio of jobs available in each type of practice to available job applicants.

DISTRIBUTION OF NEW VETERINARIANS: PRIVATE PRACTICE

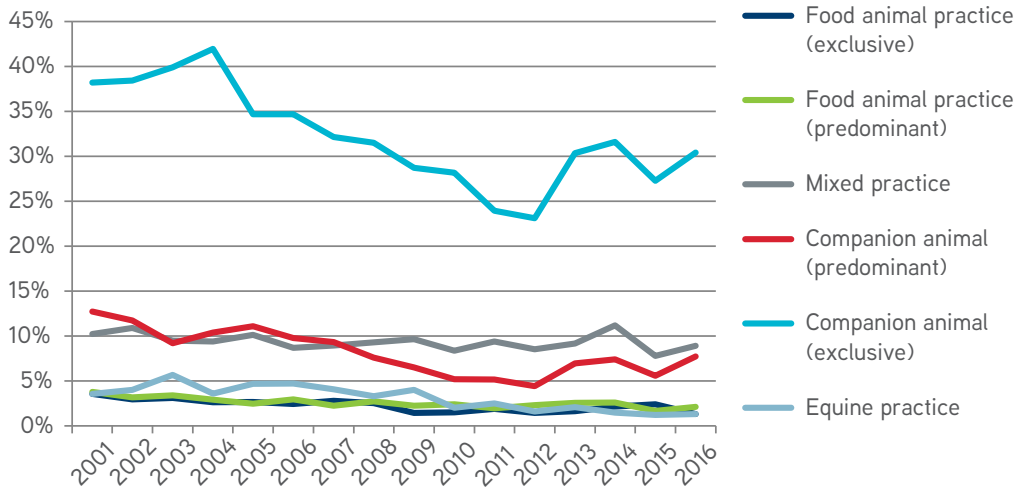


Figure 11

Over the period under examination, the percentage of new veterinarians finding full-time positions in public practice has been consistently small but steady. Between 2015 and 2016, the number of new veterinarians going into federal government, college or university, and not-for-profit organizations increased while the number of new veterinarians going into uniformed services, state and local government, and industry decreased.

DISTRIBUTION OF NEW VETERINARIANS: PUBLIC PRACTICE

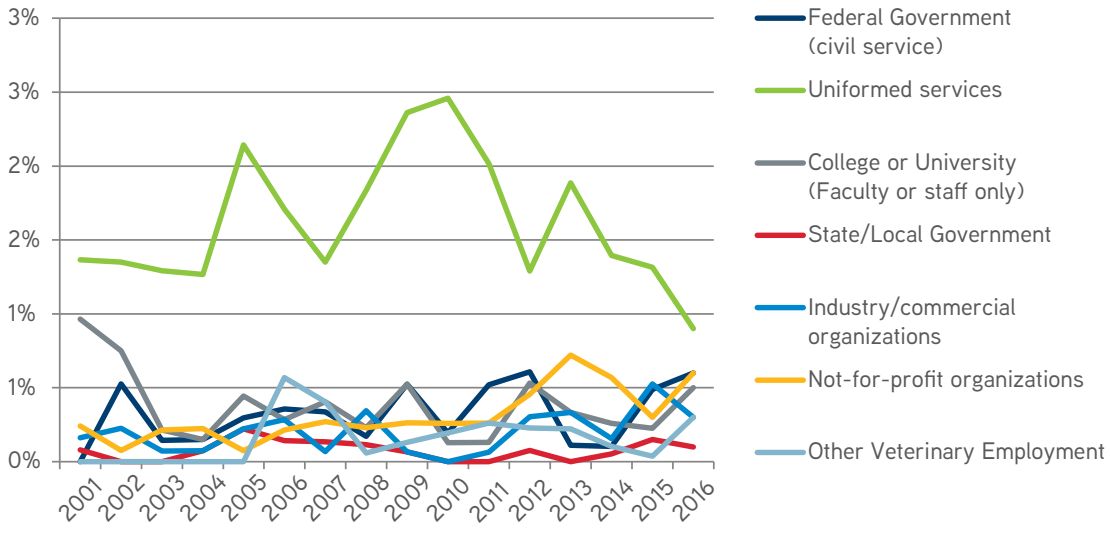


Figure 12

The percentage of new veterinarians pursuing career opportunities in private practice has increased from 56.9 percent in 2015 to 60.5 percent in 2016 while the percentage pursuing careers in public practice remained steady. Internship participation, however, has decreased from 35.6 percent in 2015 to 31.6 percent in 2016. As previously noted, the tradeoff between internships and private practice continues to be evident with the number of public practice entrants unaffected by changes in internship participation.

DISTRIBUTION OF NEW VETERINARIANS: PRIVATE, PUBLIC AND INTERNSHIPS

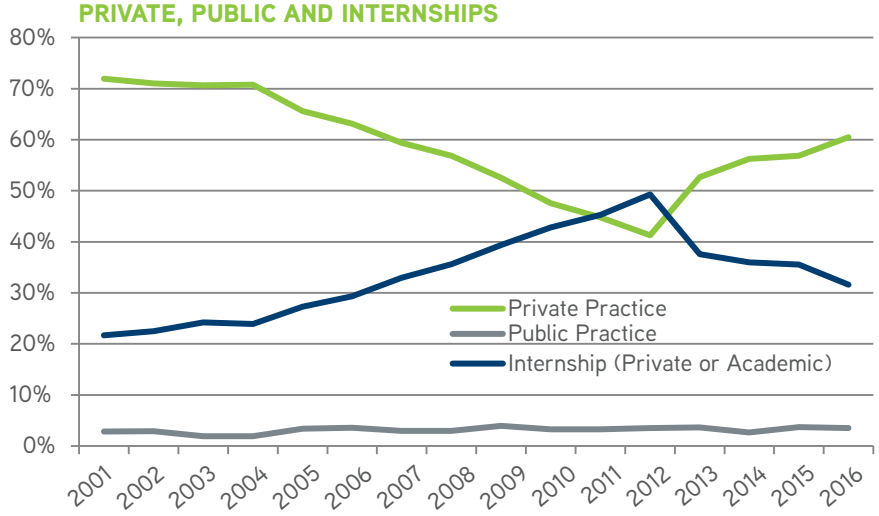


Figure 13

Although companion animal practice comprises more than two-thirds of the profession, over the last eight years, 75 percent of new veterinarians pursuing internships reported being in a companion animal focused internship. There has generally been no change in the distribution of new graduates pursuing the various species of internships. Over the last eight years, the second highest type of internships pursued by new veterinarians is equine focused with an average of 20 percent of those pursuing internships post-graduation.

SPECIES FOCUS OF INTERNSHIP

The percentage of new graduates pursuing advanced education after veterinary college has remained relatively constant between 2015 and 2016. After internships, the second largest group of continuing education activity is residency programs.

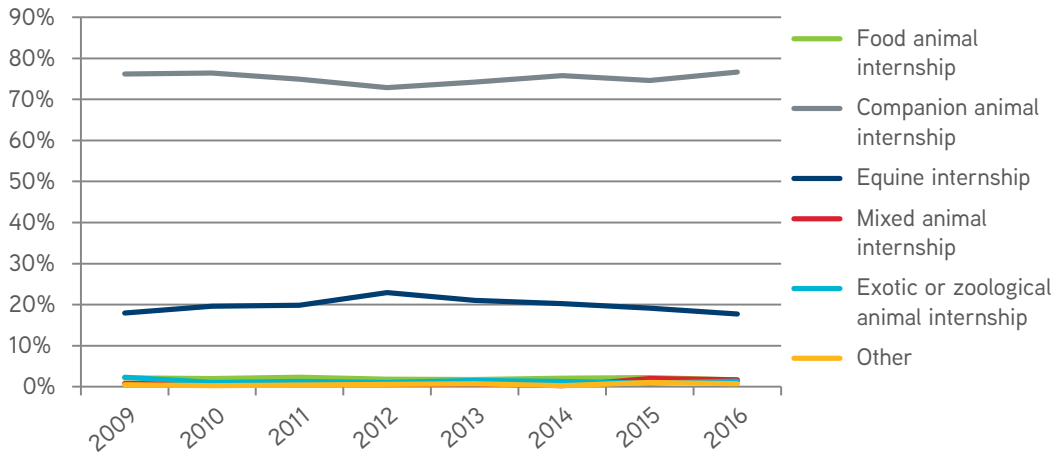


Figure 14

DISTRIBUTION OF NEW VETERINARIANS: ADVANCED EDUCATION

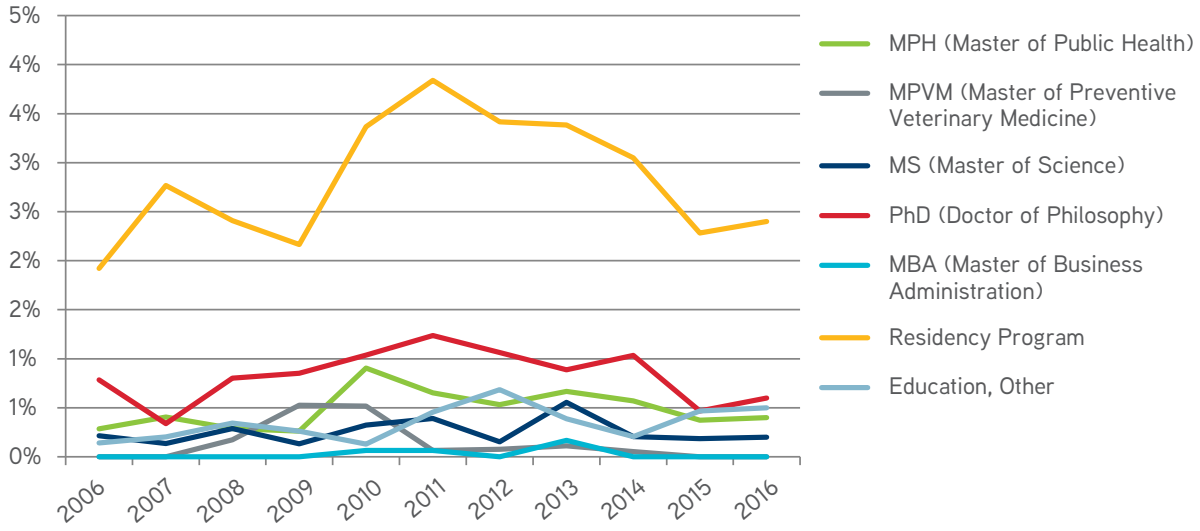


Figure 15

NEW VETERINARIAN INCOMES

Veterinarians in full-time positions in private practice have since 2010 consistently been the highest compensated group among the class, with veterinarians in public practice following close behind.

From 2001 through 2016, the mean starting salary for new graduates increased from just under $40,000 to more than $58,000. These numbers are inclusive of those finding full-time employment along with those pursuing internships, residencies and advanced education. This is a mean increase of $1,220 per year over the 16-year period, an increase from the estimated $1,050 per year increase over the 15-year period evaluated in 2015. More specifically, over the same period, those in private practice and public practice experienced an annual increase of $1,873 and $1,201, respectively.

Veterinarians in full-time positions in private practice have since 2010 consistently been the highest compensated group among the class, with veterinarians in public practice following close behind. The lowest compensated group within the class was of those pursuing internships, with mean annual earnings of $30,829 in 2016 and an annual increase of $522 per year (between 2006 and 2016).

Since 2009, private practice has offered the highest starting salaries. It was not until the 2007-2009 financial crisis that salaries in public practice began trailing behind. Prior to that, salaries of new veterinarians in public practice and private practice were toe to toe. The effect of the recession on state and federal budgets has had a large impact on public practice incomes compared to the impact of the recession on private practice incomes. Currently, as mentioned in previous reports, both are below their long-term trend but following a similar direction in terms of growth.

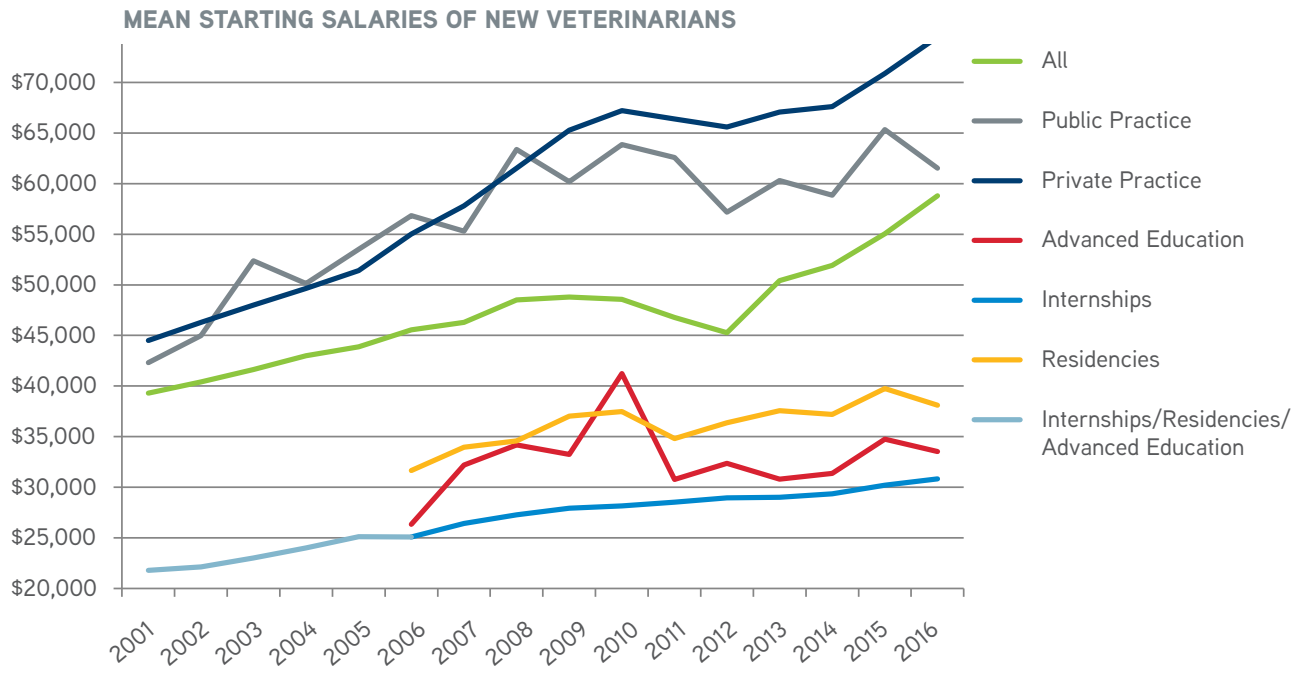


Figure 16

The weighted, mean starting salary for 2016 graduates finding full-time employment prior to graduation was $73,380, up from $70,117 in 2015. Figure 17 illustrates the mean starting salary. The amount of variation in salaries, one standard deviation around the mean, is indicated by the perforated lines on either side of the mean line. That is, 68 percent of new veterinarians employed in full-time positions earned between $57,000 and $89,000 in 2016.

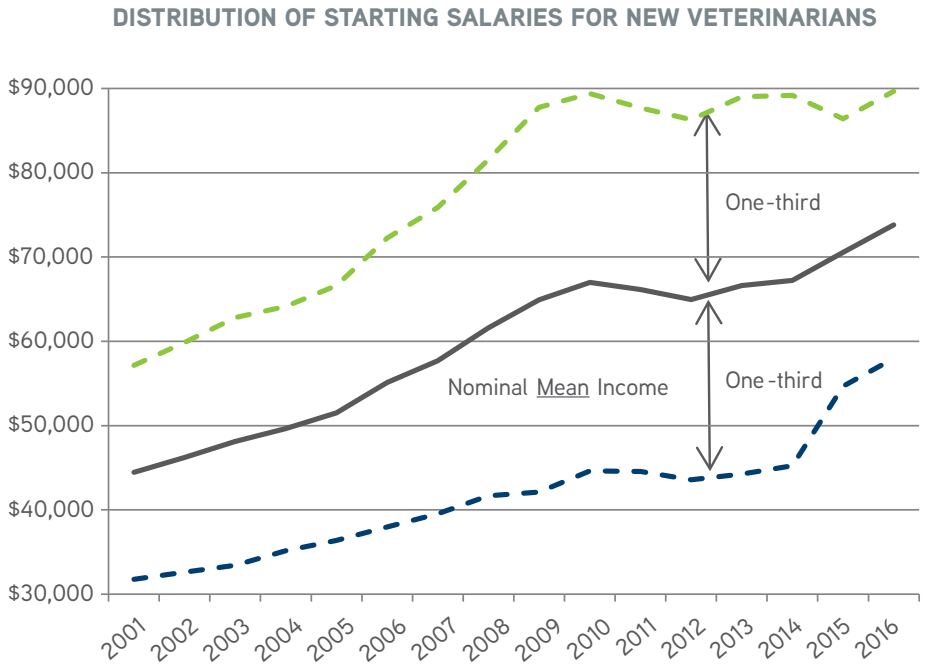


Figure 17

As noted in the previous chart, the mean starting salaries for two-thirds of the new veterinarians pursuing full-time employment had a range of more than $30,000. This variation in starting salaries is most evident among those in private practice and those in public practice. Although starting salaries among new veterinarians in private practice have been on a steady incline, new veterinarians pursuing employment in the equine industry have consistently experienced the lowest starting salaries. For new veterinarians in 2016, food animal exclusive practice yielded the highest income, with those in companion animal exclusive practice and companion animal predominant practice following closely behind.

MEAN STARTING SALARIES: PRIVATE PRACTICE

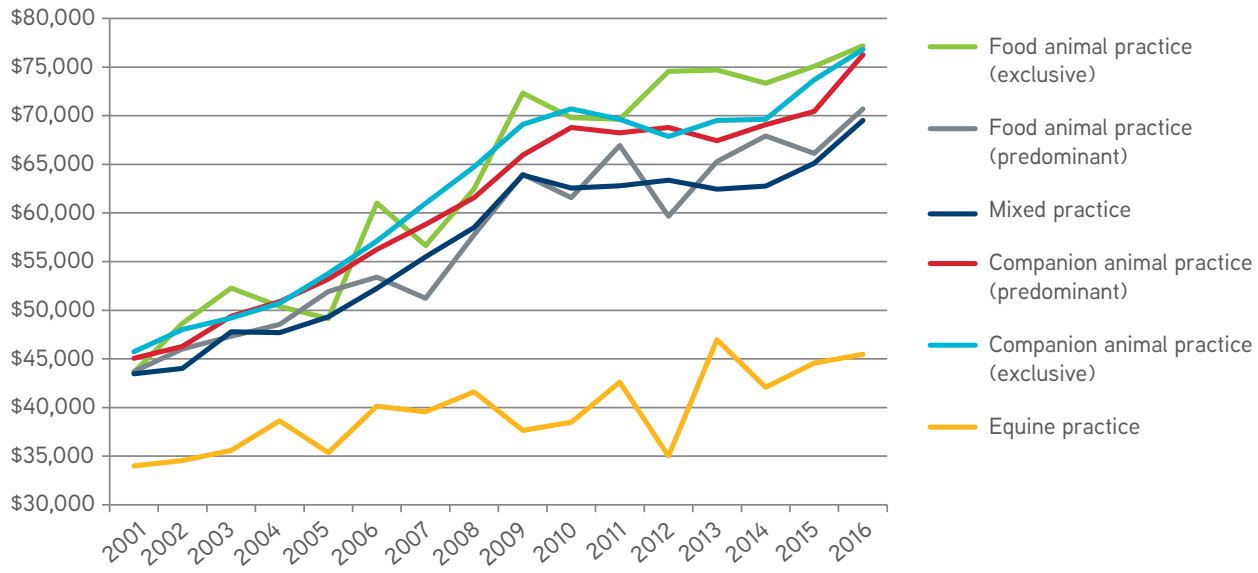


Figure 18

Since relatively few graduates reported finding employment in the public sector, the variability in incomes is much larger than that of private practice. As in previous years, however, starting salaries in industry continue to have the highest values versus other employment options in the public sector, with new veterinarians employed at colleges or universities reporting the lowest starting salary among those in public practice.

MEAN STARTING SALARIES: PUBLIC PRACTICE

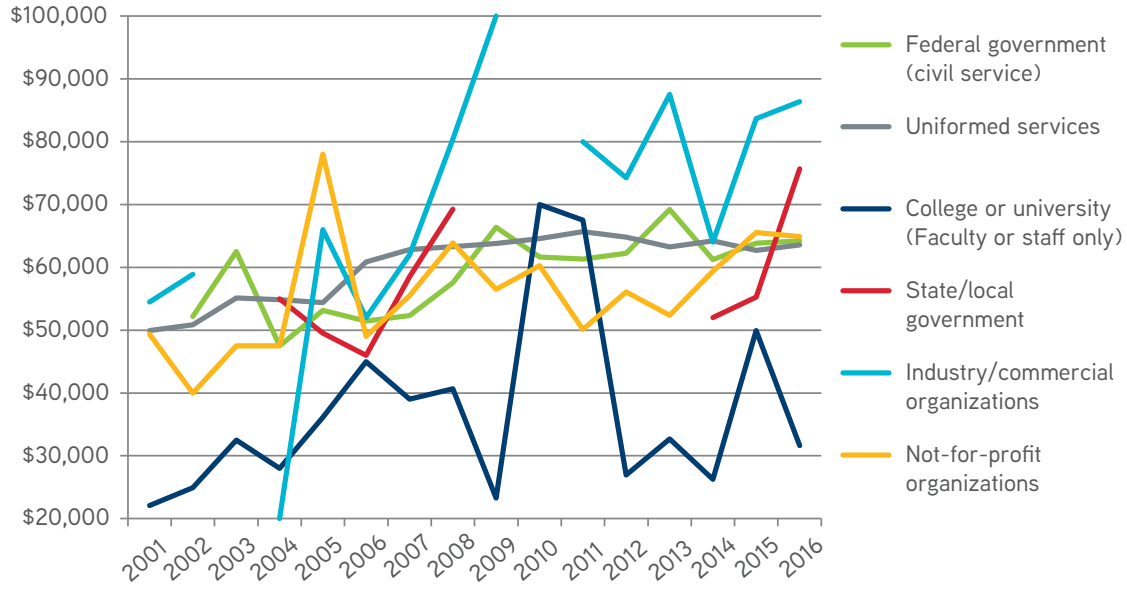


Figure 19

The variation in incomes among the various types of advanced education options is also large. While the income of those pursuing internships, residencies and PhD degrees are relatively stable, the income of those pursuing MS degrees is more volatile.

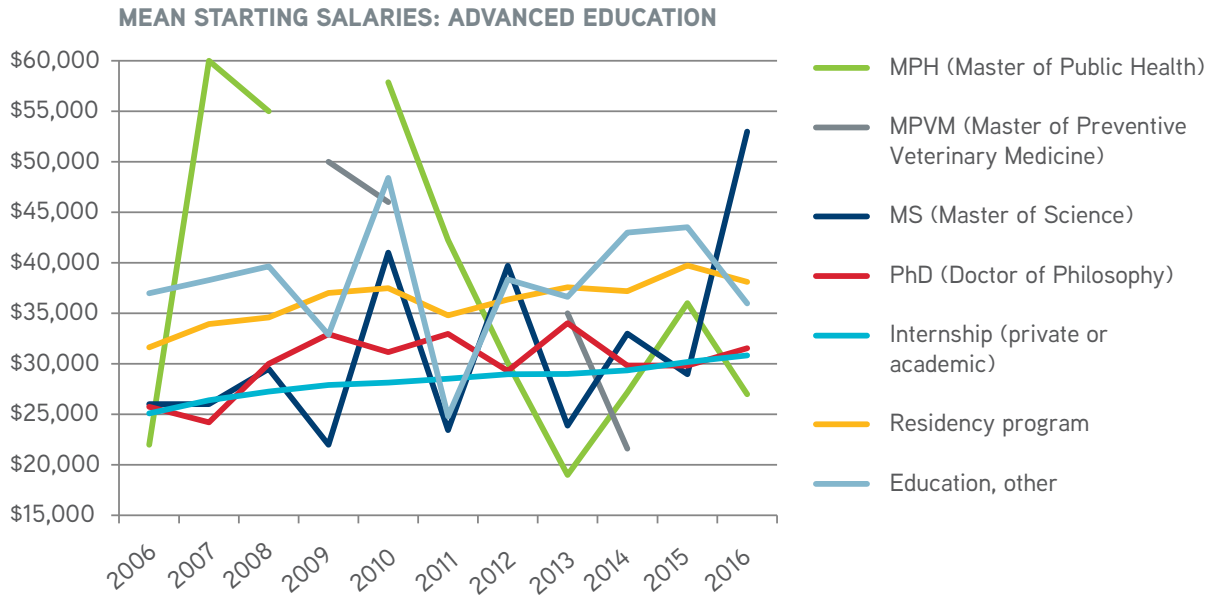


Figure 20

Numerous factors affect starting salaries: Outside of the economy, starting salaries can be influenced by the number of new veterinarians pursuing internships, a change in the gender distribution among new veterinarians, variation in the distribution of practice types new veterinarians pursue, and as a result of changing the location of employment. To accurately identify the trends in starting salaries impacted only by economic factors (general economic growth, the quantity of veterinarians supplied), an index is created to control for all other factors (changes in demographic characteristics, inflation).

The value of starting salaries, known as the real weighted mean income Index (RWI), measures the change in salary of a constant cohort of veterinarians, holding variables such as gender, practice type and location constant and controlling for inflation. The RWI produces a starting salary "index," a mean starting salary that represents the inflation-adjusted mean starting salary for a constant gender distribution, practice type distribution, and locational distribution for the new graduates who received full-time employment prior to graduation.

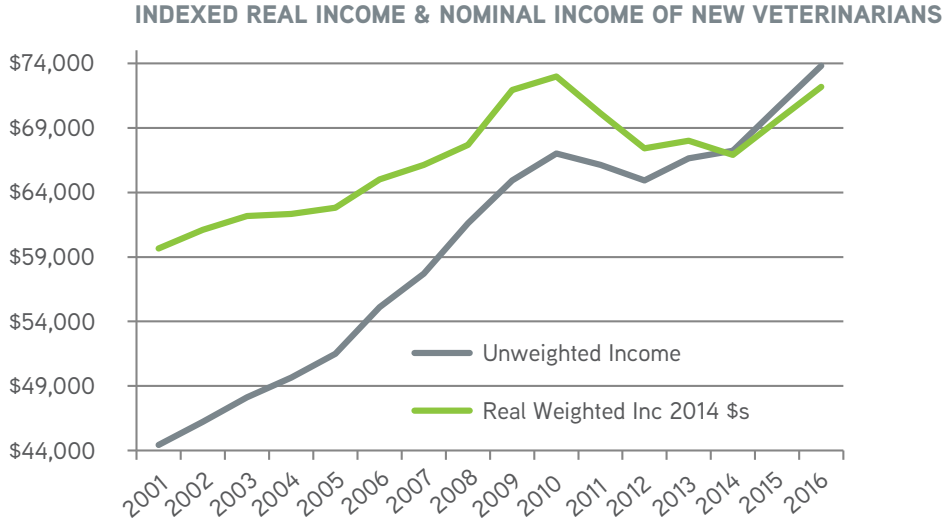


Figure 21

FACTORS AFFECTING INCOMES FOR NEW VETERINARIANS

Numerous factors explain the variation in income. The following table describes the effect on starting salaries of various factors identified by analyzing these starting salaries through a multiple linear regression in which the dependent variable is the starting salary of new veterinarians. The data used in this analysis comprise 16 years of responses from more than 92 percent of all graduates of the 28 U.S. veterinary colleges (35,056 total observations). The college, from which they graduated, DVM debt, age, gender, location, anticipated work hours per week, and post-graduate plans including options to pursue internships, residencies, advanced education and board certification; were all factors analyzed to understand impact on salaries.

The non-standardized coefficient indicates the dollar-value impact of the corresponding variable. Starting with a constant of $54,719.91, for example, the value of the coefficients (times the value of the factor) are added. For instance, a graduate in 2017 would have an estimated mean income of $82,495.53 ($54,719.91 plus 17 times 1,633.86).

The final column labelled 'sig' represents the significant variables. These values, also known as the p-values, are such that for a 'sig' less than 0.05, the coefficient of 'B' is statistically and significantly different from '0.' For instance, for Region 4 the p value is 0.927; this means it is not statistically and significantly different from the baseline, Region 3.

The standardized coefficients reveal the relative weight of each variable within the equation. For example, the graduation year with a standardized coefficient of 0.366 is more than four times as important as the anticipated work hours per week, which has a standardized coefficient of 0.085.

The unstandardized coefficient for the variable "year" is $1,633.86 and indicates that the mean starting salary for new veterinarians increases by $1,633.86 every year. This is the trend increase, however, and does not consider a change in the number of new veterinarians or a change in the general economic conditions (e.g., Gross Domestic Product [GDP]).

The coefficient for equine, negative $19,065, indicates that on average new veterinarians entering equine practice will receive a starting salary that is $19,065 less than new veterinarians going into a companion animal exclusive practice, the baseline variable. And new veterinarians going into internships make more than $35,000 less than those going into companion animal exclusive.

The factors that were included in this model produced an R square of 0.728. This indicates that the inclusion of all of these factors were able to explain 72.8 percent of the variation between the individually reported salaries and the estimated mean starting salary for all new graduates between 2001 and 2016.

NEW VETERINARIANS GOING INTO INTERNSHIPS MAKE MORE THAN $35,000 LESS THAN THOSE GOING INTO COMPANION ANIMAL EXCLUSIVE.

FACTORS AFFECTING STARTING SALARIES OF NEW VETERINARIANS

			Unstandardized Coefficients		Standardized Coefficients		
			B	Std. Error	Beta	T	Sig.
Demographics	Basic Info	(Constant)	54,719.91	812.932		67.312	0.000
		Year (Use Last 2 Digits of Grad Year)	1,633.86	19.160	.366	85.274	0.000
		Age	43.47	22.133	.007	1.964	.050
		Gender: F=1, M=0	-2,386.49	169.855	-.051	-14.050	.000
		Anticipated Hours per Week	-121.85	6.888	-.085	-17.689	.000
		Dvm Debt in Thousands	7.40	1.133	.026	6.531	.000
	Region (First Digit of Zip Code)	Region 0	1,639.68	319.404	.022	5.134	.000
		Region 1	2,656.51	313.630	.036	8.470	.000
		Region 2	1,380.24	285.920	.021	4.827	.000
		Region 3	0.00	0.000	0.000	0.000	0.000
		Region 4	26.89	292.721	.000	.092	.927
		Region 5	-888.74	343.266	-.011	-2.589	.010
		Region 6	-476.65	311.944	-.007	-1.528	.127
		Region 7	1379.71	289.721	.021	4.762	.000
		Region 8	2,225.67	304.669	.031	7.305	.000
		Region 9	4,370.12	285.263	.069	15.320	.000
		Outside of the U.S.	620.12	894.126	.003	.694	.488
	Additional Degrees Held	Admitted to DVM Program before Degree Earned	-69.58	229.629	-.001	-.303	.762
		Bachelors Degree					
		Masters Degree	439.57	301.491	.005	1.458	.145
		Doctorate Degree	-688.86	890.579	-.003	-.773	.439
		Other Professional Degree (MD, JD, Etc)	483.80	1366.533	.001	.354	.723
		Other Degree	-1,674.10	1040.275	-.006	-1.609	.108
Post-Graduate Plans	Private Practice	Food Animal (Exclusive)	810.85	517.430	.006	1.567	.117
		Food Animal (Predominant)	-3,022.06	475.340	-.024	-6.358	.000
		Mixed Practice	-4,247.25	265.994	-.062	-15.967	.000
		Companion Animal (Exclusive)					
		Companion Animal (Predominant)	-1165.31	276.886	-.016	-4.209	.000
		Equine	-19,065.10	444.506	-.161	-42.891	0.000
	Public Practice	Federal Government	-4,490.12	1239.928	-.013	-3.621	.000
		Uniformed Services	-1527.33	578.289	-.010	-2.641	.008
		College or University	-28,808.17	1226.762	-.083	-23.483	.000
		State or Local Government	-7714.21	2837.336	-.010	-2.719	.007
		Industry	8,978.44	1661.549	.019	5.404	.000
		Not-For-Profit	-9,616.10	1232.096	-.028	-7.805	.000
	Other	Other Veterinary Employment	-3,360.91	1939.756	-.006	-1.733	.083
	Enrolling in an Educational Progam	Masters of Public Health	-28,698.11	1911.078	-.053	-15.017	.000
		Masters of Preventative Veterinary Medicine	-27,232.01	4743.074	-.020	-5.741	.000
		Masters of Science	-35,238.42	1749.471	-.071	-20.142	.000
		PhD	-34,988.01	952.599	-.131	-36.729	.000
		MBA	-30,427.21	7497.996	-.014	-4.058	.000
		Internship	-35,627.23	244.469	-.781	-145.733	0.000
		Residency	-29,712.41	515.194	-.210	-57.672	0.000
		Education (Other)	-30,785.17	1 522.986	-.072	-20.214	.000

a. Dependent Variable: Sum of Base, Starting and Prod bonus incomes

	Sum of Squares	df	Mean Square	F	Sig.	
Regression	6.59E+12	41	160815331881	1432.140	.000b	
Residual	2.47E+12	21978	112290235			
Total	9.06E+12	22019				

R	R Square	Adjusted R Square	Std. Error of the Estimate
.853A	.728	.727	10596.70867

Table 3

THE IMPACT OF GDP AND N ON STARTING SALARIES OF NEW VETERINARIANS

As estimated in the above table, several demographic variables are significant in explaining the variation in the starting salaries of veterinarians. Salaries are not solely a function of location, practice type and gender, however, but also a function of the demand for veterinarians, which is driven by the demand for veterinary services. Consequently, GDP and the number of new veterinarians entering the workforce each year (N) also affect starting salaries. Real weighted income closely mirrors the predicted income that is a function of year, GDP and N, with a two-year to three-year lag. This lag is partially in response to an inefficient market caused by adaptive expectations that are typically a product of information asymmetry. That is, each year, instead of veterinary employers anticipating the upcoming year's market and acting accordingly, they react to last year's market causing a lag. This happens as a result of insufficient economic information or more accurately insufficient understanding of available economic information.

According to the *dvm360* article, "Starting salaries are up! (Let's not get too excited)," forming rational expectations to create better coordination among the veterinary markets will provide more sustainable growth in veterinary services, leading to reduced volatility in veterinary incomes.

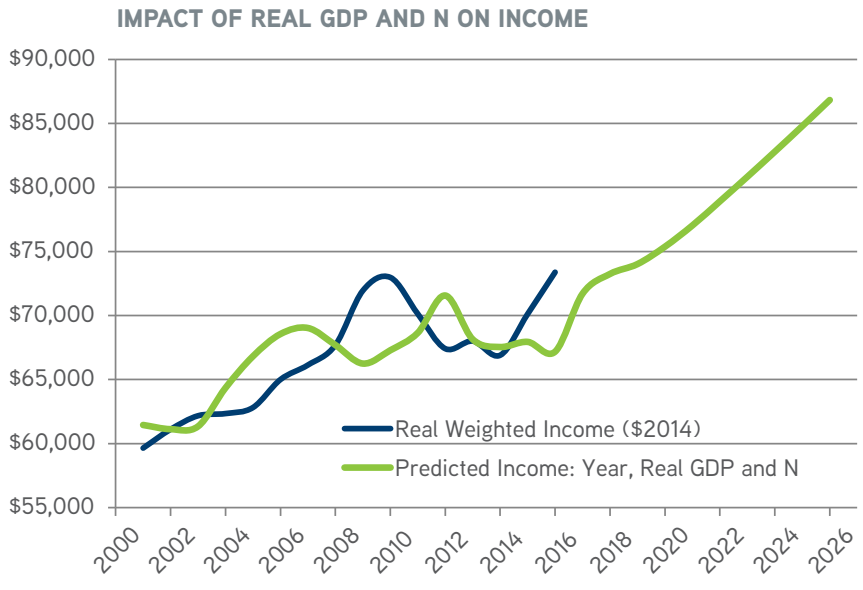


Figure 22

NEW VETERINARIAN DEBT

DVM debt incurred by new veterinarians varies by post-graduation plans.

Over the last 16 years, the DVM degree debt of all veterinary students has been increasing at approximately $5,400 per year; for those reporting non-zero debt, the annual increase has been approximately $6,200. Between 2015 and 2016 mean DVM degree debt of all veterinary students increased by only $1,363 compared to an increase of $7,111 between 2014 and 2015.

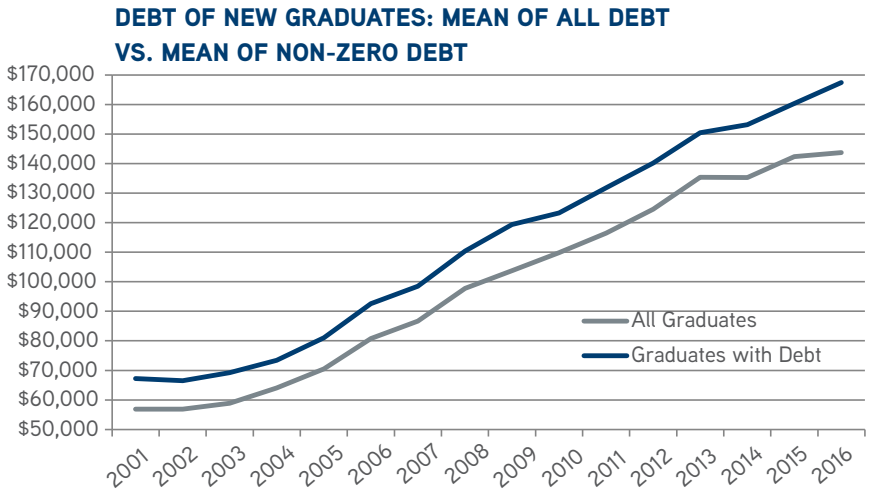


Figure 23

In 2015, the mean debt of all students was $18,041 less than the mean debt of persons reporting non-zero debt, with 11.9 percent of students reporting having no debt from veterinary college in 2015. In 2016, the mean debt of all students was $23,777 less than the mean debt of graduates reporting zero debt, a group that represents 14 percent of the population. This $23,777 is a 16.5 percent difference in debt.

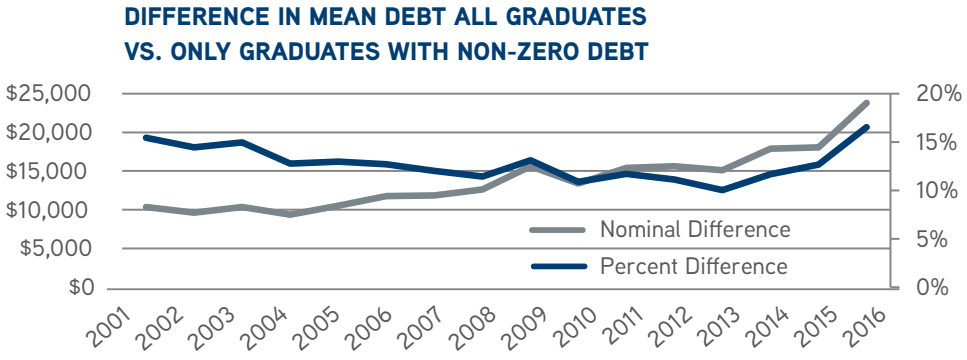


Figure 24

DVM debt incurred by new veterinarians varies by post-graduation plans. Over the period 2001 through 2016 new veterinarians finding employment in public practice consistently had the lowest debt load, while new veterinarians pursuing internships and residencies had the highest debt loads. As noted in previous reports, it is beyond the scope of this report to identify a research hypothesis as to why a significant difference exists in the DVM debt of new graduates based on post-graduation plans. We can hypothesize that perhaps veterinary students predisposed to public practice are more financially savvy. Or perhaps those with lower debt feel less constrained to enter lower paying careers in public practice. We can even also surmise that maybe those with higher debt feel more obligated to pursue higher paying careers through specialization that requires internships and residencies. There are certainly many plausible hypotheses to explain the larger differences in debt by post-graduate plans, but research on the factors that influence the career choices of graduating seniors is certainly needed.

DVM DEBT BY POST-GRADUATE PLANS

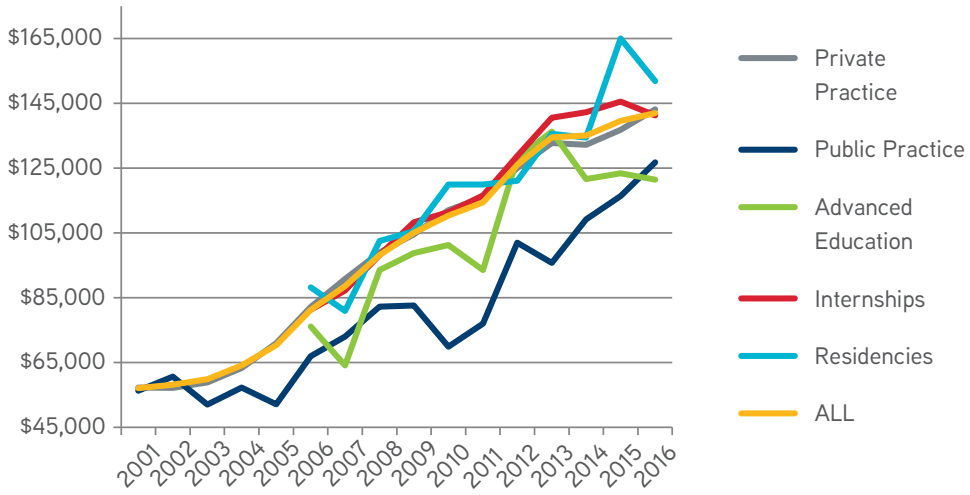


Figure 25

In 2015, the variation in DVM debt, within two standard deviations of the mean (95 percent of all new veterinarians) ranged from $0 to just more than $321,000. In 2016, the variation in DVM debt, within two standard deviations of the mean, ranged from $0 to more than $330,000. While those with zero debt are well within two standard deviations of the mean, 2.3 percent who are outside of two standard deviations have more than $320,000 in debt. The following table depicts the distribution, by school, of the 2.3 percent of the 2015 and 2016 classes who have more than $320,000 in debt.

From 2015 to 2016, Western University, University of Minnesota, Michigan State University, The Ohio State University, University of Tennessee and University of Pennsylvania had a reduction in the percentage of the class whose debt levels was more than $320,000. Tuskegee University and Kansas State University had large increases in the percentage of their graduating class with debt levels more than $320,000 from 2015 to 2016. Colorado State University, Iowa State University, Oklahoma State University, University of Georgia and Purdue University had a percentage of their class with debt more than $320,000 in 2016 from 0 percent in 2015; and Auburn University, Tufts University and North Carolina State University decreased the percentage of their class with more than $320,000 debt to 0 percent in 2016.

DISTRIBUTION BY COLLEGE OF STUDENTS WITH MORE THAN $320,000 DVM DEBT

	2015	2016
Western University-California	43.7%	35.6%
Tuskegee University	15.5%	22.1%
Kansas State University	2.8%	8.7%
University of Minnesota	14.1%	4.8%
Michigan State University	5.6%	4.8%
University of Tennessee	4.2%	3.8%
University of Pennsylvania	4.2%	2.9%
Louisiana State University	2.8%	2.9%
Colorado State University	0.0%	2.9%
Virginia-Maryland College	1.4%	1.9%
Iowa State University	0.0%	1.9%
Mississippi State University	0.0%	1.9%
Oklahoma State University	0.0%	1.9%
University of Georgia	0.0%	1.9%
The Ohio State University	1.4%	1.0%
Purdue University	0.0%	1.0%
Auburn University	1.4%	0.0%
Cummings SVM at Tufts University	1.4%	0.0%
North Carolina State University	1.4%	0.0%
Total	100.0%	100.0%

Table 4

Even within public and private practice, the DVM debt owed by new veterinarians varied greatly. For the 2015 graduating class, within private practice, 68 percent had a debt load between $50,000 and $222,500. Comparatively, for the 2016 class, 68 percent of graduates within private practice had a debt load between $54,500 and $232,000. Approximately 16 percent carry a debt load of more than $231,700, while the lowest 16 percent had debt below $54,000.

MEAN DVM DEBT: PRIVATE PRACTICE

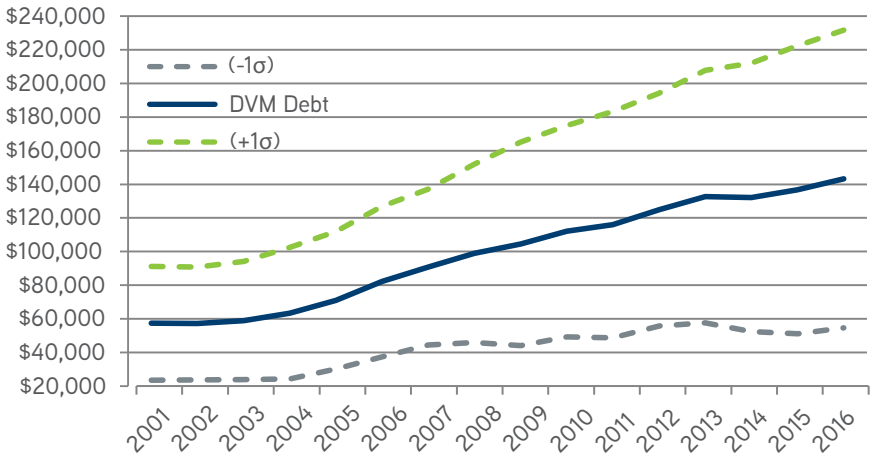


Figure 26

The variation in debt among new veterinarians pursuing public practice was also relatively large. Within the 2015 class, 68 percent incurred DVM debt between $35,000 and $198,000, however, in the 2016 class, 68 percent incurred debt between $37,000 and $216,000. Evidently, in the 2016 class more graduates pursuing public practice had larger debt levels, a range of $178,700 compared to the range of the debt levels of 2015 graduates, $161,210.

MEAN DVM DEBT: PUBLIC PRACTICE

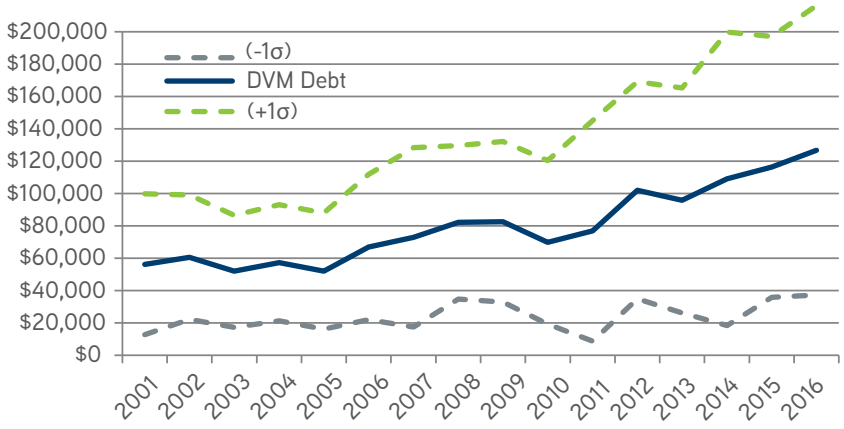


Figure 27

For each sector, whether public practice, private practice, advanced education, internships or residencies, the growth rate of DVM debt has continued to outpace the growth rate of the starting salaries of new veterinarians. Although the growth rates of debt and starting salaries prior to 2005 were comparable, the rate of growth in debt began to accelerate in 2006 and continued to grow much faster than incomes almost continually through 2016. The largest factor in the increasing debt is the cost of education. This increased cost of education is tied closely to the declining amount of state and federal funding received by the veterinary colleges. In addition, the proportion of female veterinarians, whose debt is significantly higher than male veterinarians, has increased over time, and now comprises more than 80 percent of each new class of veterinarians.

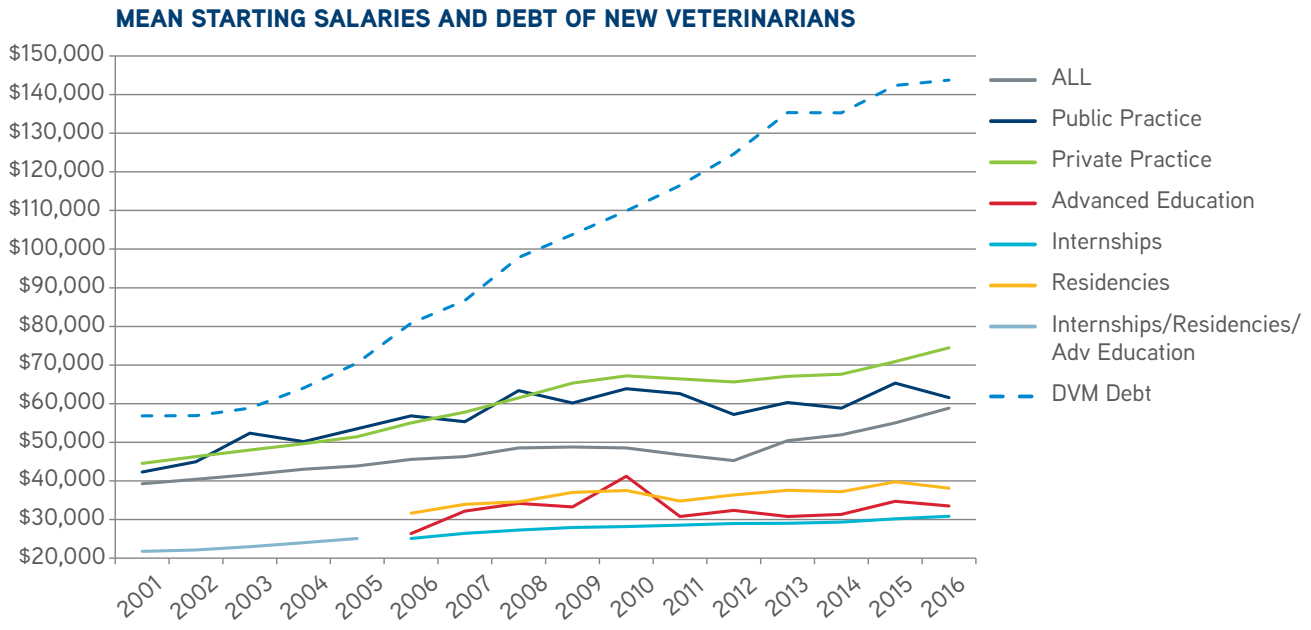


Figure 28

Not only are the starting salaries of female veterinarians significantly lower than those for men, in 2015, new female veterinarians had an average debt load of $7,500 more than new male veterinarians and $7,000 more in 2016. Female graduates have had higher veterinary college debts than their male counterparts throughout the observed period.

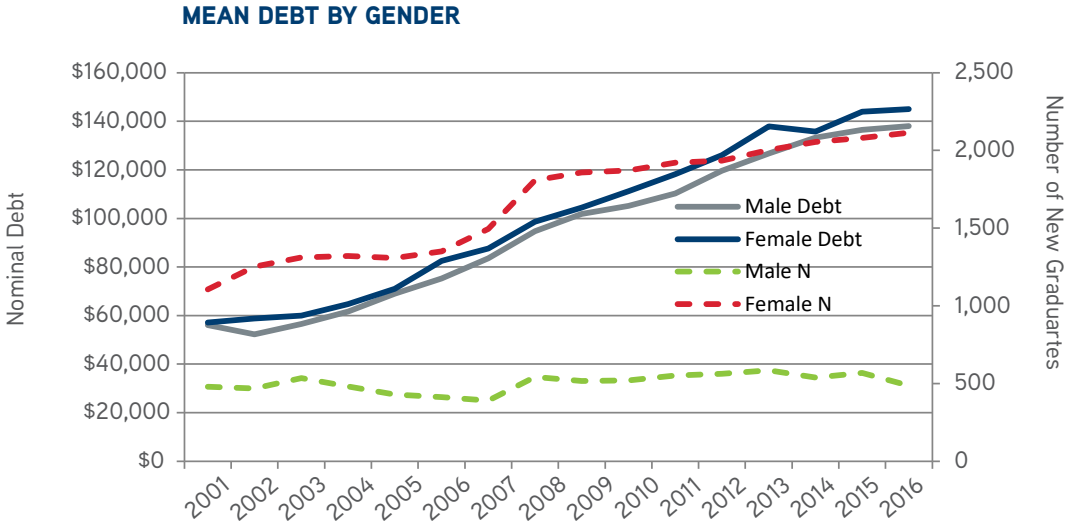


Figure 29

Over the last 16 years, discounted tuition and fees across veterinary colleges have increased by more than 400 percent. This increase was not steady across all colleges. The University of Pennsylvania increased tuition by 67 percent since 2000 while Kansas State University saw an increase of 418 percent. The average increase across all schools from 1999 through 2016 was 210 percent.

U.S. VETERINARY COLLEGES: TUITION AND FEES

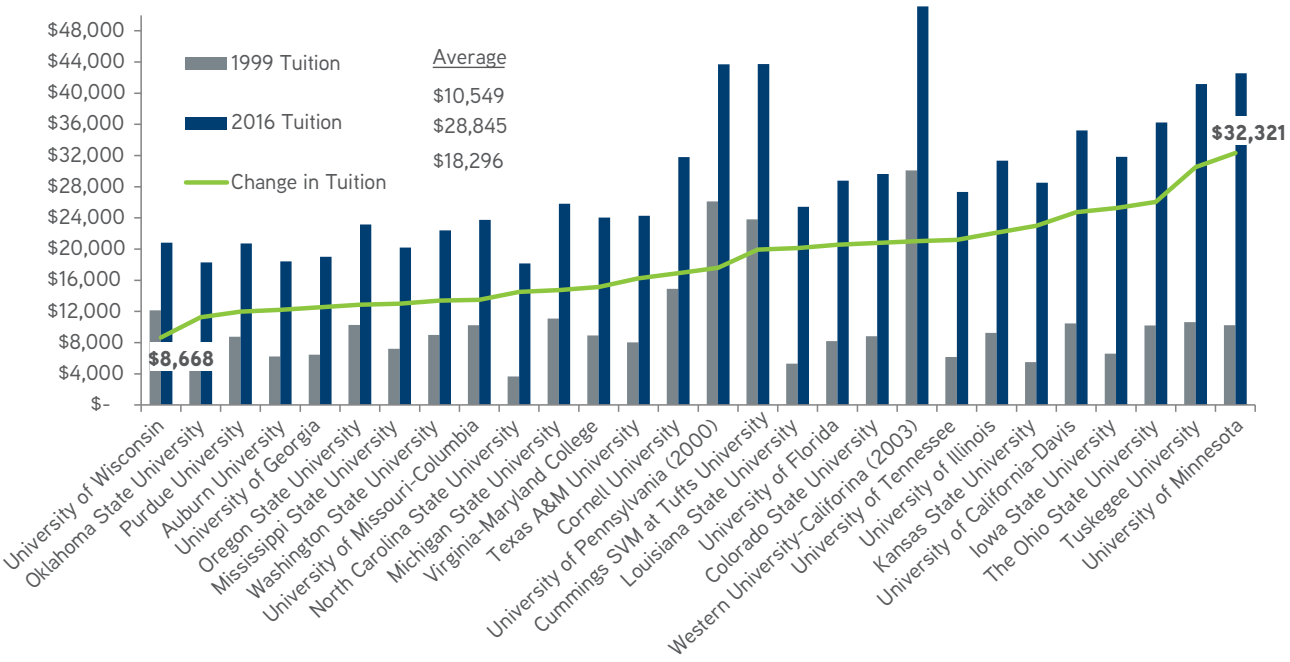


Figure 30

One significant factor contributing to the variation in the debt level of new veterinarians is their residency status. Residents are those who attend veterinary college in the state where they reside while non-residents are those who attend veterinary colleges outside of the state of their primary residence. At some institutions, however, students who entered the college as a non-resident may be able to attain residency status after their first year in veterinary college. As such, more appropriately, we refer to discounted and non-discounted seats. Discounted seats refer to those students who pay less than the full cost of attendance either because they are residents of the state where the veterinary college is located or because their state has a contract with the veterinary college to pay the out-of-state (non-residency) tuition and fees. Over the last 10 years, the mean debt of graduating veterinary students reporting resident status was more than $30,000 less than the mean debt of graduating veterinary students reporting non-resident status. In 2016, students graduating with residency status incurred a mean debt load that was almost $60,000 less than those graduating with non-residency status.

RESIDENT AND NON-RESIDENT DEBT

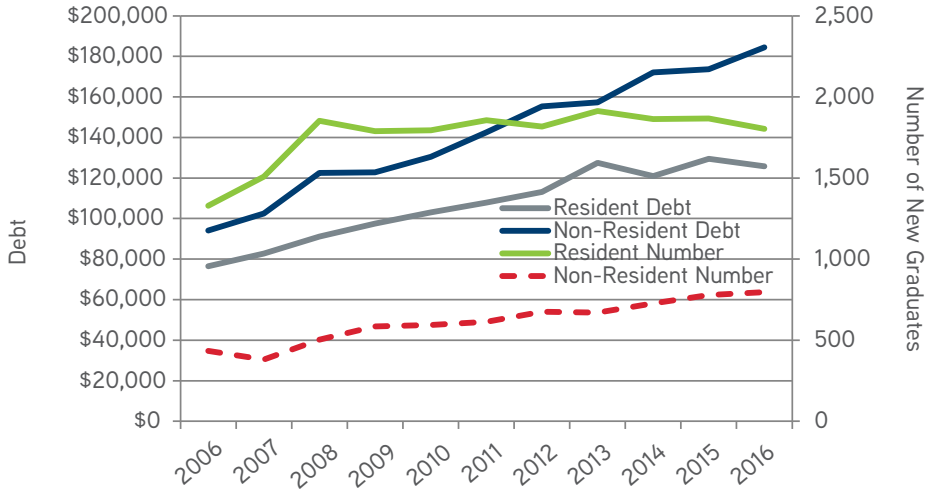


Figure 31

The following chart illustrates the number of new veterinarians graduating with debt and those graduating with no debt. Although the number of students with no debt has remained relatively constant from 2001 through 2015, with an increasing class size, the proportion has been shrinking. In 2001, 15.4 percent reported graduating with no debt and this proportion has been on a steady decline, with 11.2 percent reporting graduating with no debt in 2015. A large increase occurred in 2016, however, with just more than 14 percent of the graduating class reporting having no educational debt. This is the highest percent since 2003.

DEBT: ALL STUDENTS VS. ONLY STUDENTS WITH NON-ZERO DEBT

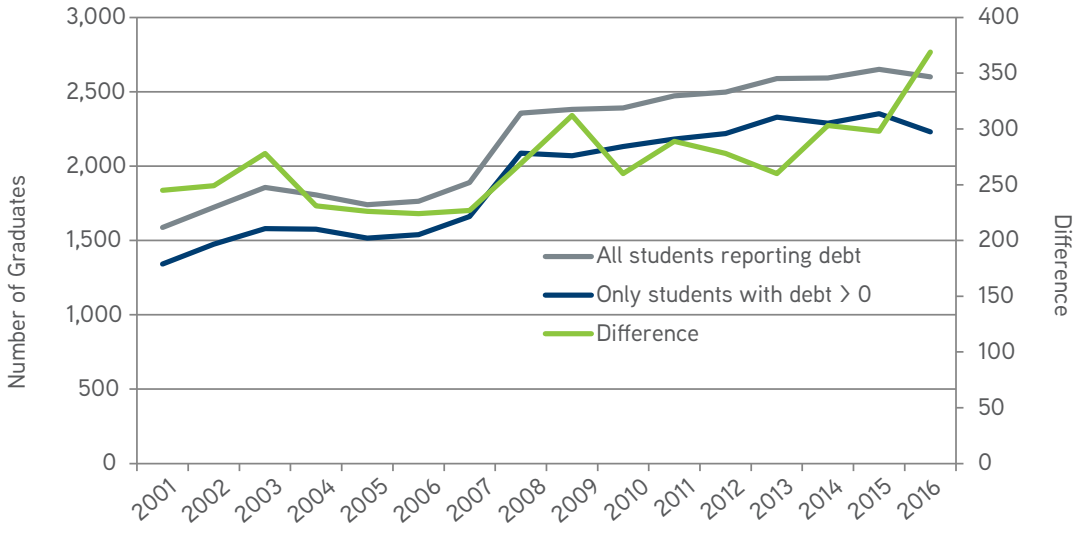


Figure 32

The following chart shows the proportion of new veterinarians with no debt.

NEW VETERINARIANS WITH NO DVM DEBT

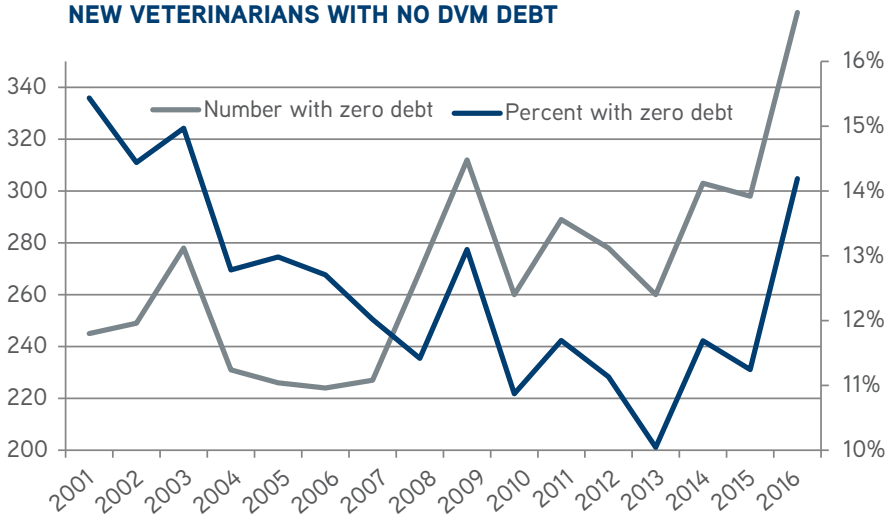


Figure 33

Similar to the methods used to determine the real weighted mean income index, we determine the real weighted mean DVM debt index (RWD) by measuring the annual change in the debt load of a constant cohort of graduates and adjusting for inflation. In 2014 dollars, The RWD nearly doubled from slightly more than $75,000 in 2001 to slightly more than $142,000 in 2016. To determine this measure the following were held constant: ratios of gender, the percentage of students in residency status, and the distribution of graduates across schools based on cost of tuition.

REAL INDEXED DVM DEBT AND UNWEIGHTED DEBT

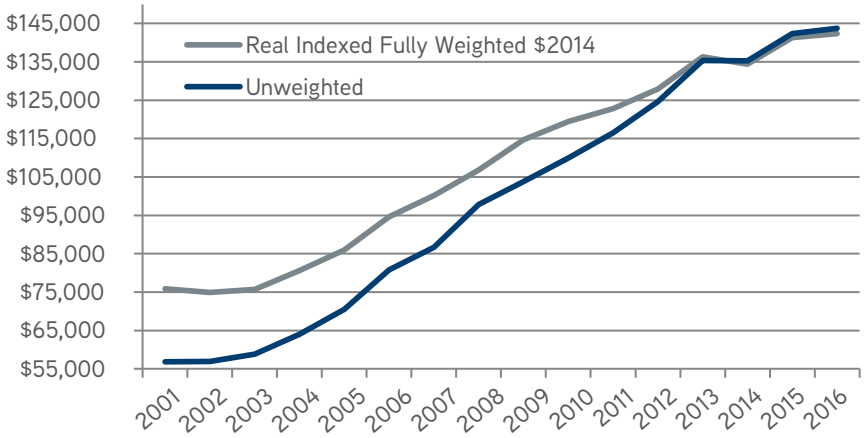


Figure 34

FACTORS AFFECTING DEBT FOR NEW VETERINARIANS

Similar to the methods used to determine the factors explaining the variation in income, a multiple linear regression was calculated to determine the factors significant in explaining the variation in debt. The factors under observation were the region in which the school is located, the tuition range, age, gender, income, residency status, and a time series factor – year of graduation.

Our baseline variables were schools in Region 3 and schools with "low tuition." Schools in Region 3 are those located in an area with a ZIP code beginning with 3. To determine tuition grade, we determined by year, the mean tuition and categorized as "low tuition" those schools with tuition falling within two standard deviations below the mean, "median tuition" those schools with tuition above the mean tuition but within two standard deviations above the mean, and schools labeled "pricey tuition" those with tuition two standard deviations above the mean tuition.

According to our regression model, new veterinarians graduating from schools in Region 6 had $8,794 more debt than new veterinarians graduating from schools in Region 3, and new veterinarians graduating from schools with "pricey tuition" had $67,410 more debt than those graduating from schools with "low tuition." Subsequent charts will illustrate the relationship between cost of living and student debt.

Female veterinarians graduated with more than $6,200 more debt, on average, than male veterinarians, and non-residents graduated with an average of $37,315 more debt than residents. In addition, each year, mean DVM debt increased by about $5,772.

As in the regression explaining the variation in income, the non-standardized coefficients in this regression explaining the variation in debt represents the dollar value attached to the variable in question whereas the standardized coefficients represents the relative value of each coefficient. For example, the standardized coefficient for "pricey tuition," 0.201, indicates that the debt incurred from graduating from a school that has pricey tuition carries more than six times more weight than the debt incurred from going to a school in Region 0, represented by a coefficient of 0.032.

Of importance is the unstandardized coefficient for year of the survey that indicates the mean value of costs has increased by nearly $5,800 per year. An additional finding of importance is that while the model explaining the variation in income was able to explain 71 percent of the variation with the factors available, this model explaining the variation in debt among students at graduation was only able to explain roughly 20 percent of the variation with the same set of variables. Thus, there are important variables that determine how much debt each student has at graduation that have not been included. Efforts to reduce the debt of graduates may not be successful until the factors that explain more of the variation in debt among graduates are discovered.

FACTORS AFFECTING DEBT OF NEW VETERINARIANS

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	$(11,644,493.8)	333,161		-34.952	.000
	Year of the survey	$5,772.4	166	.240	34.829	.000
	Region of School 0	$(13,360.7)	3,236	-.032	-4.129	.000
	Region of School 1	$(20,001.3)	2,448	-.068	-8.169	.000
	Region of School 2	$(3,768.3)	2,338	-.012	-1.612	.107
	Region of School 4	$10,600.7	2,043	.045	5.189	.000
	Region of School 5	$6,805.8	1,991	.027	3.419	.001
	Region of School 6	$8,794.0	1,965	.036	4.476	.000
	Region of School 7	$(13,864.8)	1,959	-.058	-7.078	.000
	Region of School 8	$(545.7)	2,748	-.001	-.199	.843
	Region of School 9	$3,290.1	2,048	.014	1.607	.108
	Median Tuition	$22,113.9	1,350	.136	16.386	.000
	Pricey Tuition	$67,410.2	2,665	.201	25.299	.000
	Age	$2,848.7	163	.120	17.507	.000
	Gender	$6,206.0	1,250	.034	4.966	.000
	Income	$0.10	0	.028	4.025	.000
	Resident/Non Resident	$37,315.2	1,222	.211	30.547	.000

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19996734882114	16	1249795930132	254.920	.000b
	Residual	88278114406640	18006	4902705454		
	Total	108274849288755	18022			

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.430a	.185	.184	70019.322

Table 5

EACH YEAR, MEAN DVM DEBT INCREASED BY ABOUT $5,772.

NEW VETERINARIAN DEBT-TO-INCOME RATIO

The debt-to income ratio ties together the market for education and the market for new veterinarians.

The debt-to-income ratio is an important measure of the economic performance of the market for veterinary education. The debt-to-income ratio ties together the market for education and the market for new veterinarians. By definition, the debt-to-income ratio measures what percentage of debt is covered by annual income. Although some economists suggest that a DIR of 1:1 might be the limit that should be considered to guarantee personal financial sustainability, this theory best applies to non-professional undergraduate degrees. Because the increases in income associated with experience is much greater for those with professional degrees, especially graduate professional degrees, the level of debt-to-income that can be serviced without posing serious financial stress is likely closer to 1.4:1.

A 1.4:1 debt-to-income ratio was determined as a first goal for the profession, as this level of debt to income is appropriate under projections of income and a standard repayment plan that translates into less than 10 percent of the graduate's disposable income being used to service the education debt five years after graduation.

The following chart illustrates several measures for the DIR. The first (highest DIR) represents the mean of the individual debt-to-income ratios. The middle line represents the mean of the individual debt-to-income ratios adjusted to maintain a constant cohort of veterinarians over time. The last (bottom line) provides the simple ratio of the mean of all reported incomes and all reported debt. In all cases, only the incomes of those graduates with full-time employment are included, and all reported debt values are included. In other words, the sample of observations of debt

is larger than the sample of income from graduates with full-time employment and thus this measure is inaccurate. The first two measures are based on graduates who have both incomes from full-time employment and reported debt (including a zero value). The AVMA DIR that is used as a KPI is the fully weighted, individual DIR or the RWI. The real weighted DIR in 2016 at 2.00 was not significantly different to that of 2015, 1.99.

DEBT-TO-INCOME RATIO MEASURES

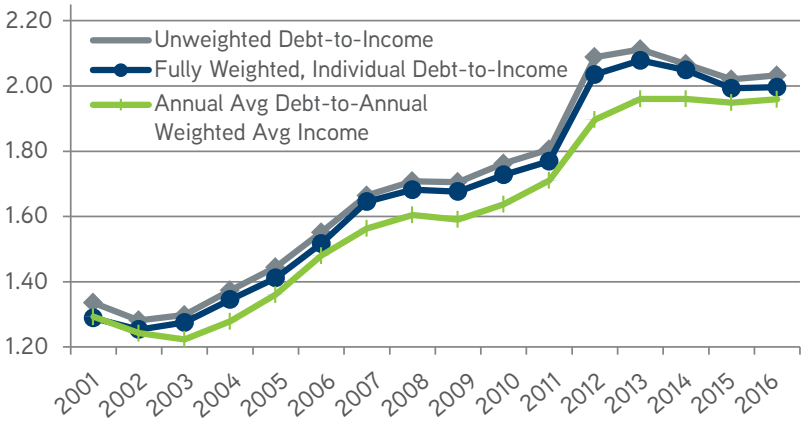


Figure 35

The debt-to-income ratio varies significantly by graduates' post-graduate plans. This is somewhat expected since practice type is significant in explaining the variation in incomes. The variation in income can also be explained by the shifting demand for veterinarians in the respective sectors. Consequently, in order to portray an accurate picture of the debt-to-income ratio of the profession, it is necessary to observe a constant cohort of veterinarians. This method prevents observing the effects of a changing demographic and attributing these to economic factors.

New veterinarians pursuing public practice have had, on average, the lowest debt-to-income ratio for most of the period, 2001 through 2016. However, in 2016 new veterinarians pursuing employment in private practice reported a debt-to-income ratio of 1.99, the lowest of the group, while new veterinarians pursuing employment in public practice had an increase in DIR from 1.85 in 2015 to 2.5 in 2016. On the other hand, new veterinarians pursuing internships had the highest debt-to-income ratio for most of the same period, with a mean debt-to-income ratio of 4.89 in 2015 and 4.69 in 2016, almost double that of those pursuing employment in public practice. The debt-to-income ratio of those pursuing full-time employment in private practice was the lowest among all practice type and continuing education categories.

DEBT-TO-INCOME RATIO BY POST-GRADUATE PLANS

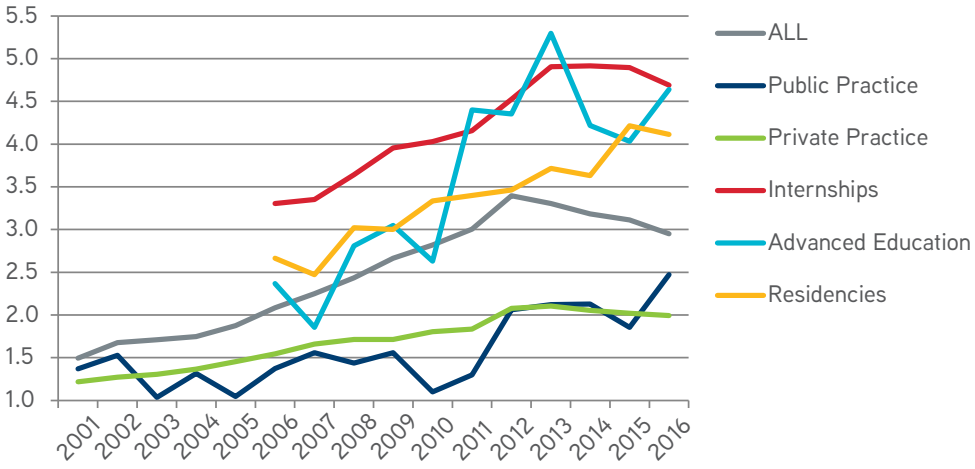


Figure 36

FACTORS SIGNIFICANT IN EXPLAINING THE DEBT-TO-INCOME RATIO

A regression of debt-to-income as a function of year, age, gender, whether the respondent had children, sought employment, received any offers, number of hours and weeks expecting to work, additional degrees held, location of anticipated place of employment, practice type, GDP lagged one year, and veterinary college, was performed. Results are provided in the table below.

The Ohio State University and companion animal predominant (the most populated sector for full-time employment) were omitted from the model as baselines.

The following factors were statistically significant in explaining the variation in the debt-to-income ratio of survey respondents, at a 5 percent level of significance: year of graduation, age, gender, hours they expect to work, GDP lagged one year, a few practice types (food animal, companion animal, mixed practice, equine, government services, industry and not-for profit) and the college of graduation. Out of 28 universities, 22 were significantly different from The Ohio State University in identifying the variation in the debt-to-income ratio as a result of the school. Veterinary colleges at Tuskegee University, Kansas State University, Tufts University, Michigan State University and University of Pennsylvania were not statistically different from The Ohio State University.

The unstandardized coefficient indicates the change to the constant debt-to-income ratio attributable to each characteristic (variable). For instance, women have a .185 higher mean debt-to-income ratio than men over the 2001 to 2016 period and each year of age adds .039 to the mean DIR.

FACTORS AFFECTING THE DEBT-TO-INCOME RATIO

		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
Basic Information	(Constant)	.043	.761		.057	.954
	Last 2 digits of grad year	.141	.015	.261	9.541	.000
	Age	.039	.004	.059	9.217	.000
	Gender: Female=1	.185	.032	.035	5.830	.000
	Have children: No=1	-.001	.055	.000	-.013	.989
	Seeking employment or adv educ	-.152	.153	-.006	-.990	.322
	Received offers	.232	.379	.004	.613	.540
	Anticipated work hours/week	.024	.001	.147	21.210	.000
	Work at least 48 weeks/year	.095	.103	.005	.920	.358
	GDP lagged 1 year	-2.560E-05	.000	-.061	-2.229	.026
Additional Degrees	Admitted before earning degree	.320	.307	.045	1.041	.298
	Bachelors degree	.586	.305	.101	1.920	.055
	Masters degree	.575	.310	.061	1.856	.064
	Doctorate degree	.206	.346	.007	.595	.552
	Other professional degree	-.060	.401	-.001	-.149	.882
	Other degree	.860	.360	.026	2.387	.017
Region of College	Region 0	.553	.286	.066	1.933	.053
	Region 1	.283	.286	.034	.989	.323
	Region 2	.146	.285	.020	.514	.607
	Region 3	.198	.284	.030	.695	.487
	Region 4	.036	.285	.005	.127	.899
	Region 5	.003	.289	.000	.011	.991
	Region 6	.142	.287	.017	.496	.620
	Region 7	.244	.286	.033	.852	.394
	Region 8	.154	.285	.019	.540	.589
	Region 9	-.023	.285	-.003	-.082	.934
	Region 10	.405	.324	.014	1.249	.212

Practice Type	Food animal practice (exclusive)	-1.559	.093	-.100	-16.722	.000
	Food animal practice (predominant)	-1.467	.089	-.100	-16.520	.000
	Mixed practice	-1.303	.050	-.167	-26.244	.000
	Companion animal practice (exclusive)	-1.293	.035	-.263	-36.758	.000
	Equine practice	-.727	.079	-.054	-9.223	.000
	Federal government (civil service)	-1.508	.229	-.038	-6.585	.000
	Uniformed services	-2.036	.105	-.114	-19.402	.000
	College or university (faculty or staff only)	-.278	.244	-.007	-1.140	.254
	State or local government	-.247	.516	-.003	-.479	.632
	Industry or commercial organizations	-1.645	.288	-.033	-5.708	.000
	Not-for-profit organizations	-1.130	.237	-.027	-4.760	.000
University	Auburn University	-.871	.090	-.070	-9.648	.000
	Tuskegee University	.044	.109	.003	.400	.689
	University of California-Davis	-.717	.099	-.055	-7.262	.000
	Colorado State University	-.485	.087	-.044	-5.581	.000
	University of Florida	-.455	.095	-.035	-4.779	.000
	University of Georgia	-1.118	.089	-.096	-12.634	.000
	University of Illinois	-.564	.087	-.052	-6.457	.000
	Iowa State University	-.338	.091	-.029	-3.733	.000
	Kansas State University	-.053	.088	-.005	-.601	.548
	Louisiana State University	-.797	.094	-.064	-8.443	.000
	Cummings SVM at Tufts University	-.031	.093	-.003	-.339	.734
	Michigan State University	.050	.084	.004	.593	.553
	University of Minnesota	.508	.096	.041	5.302	.000
	Mississippi State University	-.203	.100	-.015	-2.032	.042
	Purdue University	-.648	.106	-.040	-6.125	.000
	Cornell University	-.778	.086	-.070	-9.072	.000
	Oklahoma State University	-.776	.097	-.061	-8.036	.000
	University of Pennsylvania	.106	.097	.008	1.094	.274
	Texas A&M University	-1.280	.087	-.131	-14.791	.000
	Washington State University	-.717	.095	-.056	-7.532	.000
	University of Missouri-Columbia	-.663	.099	-.049	-6.671	.000
	Oregon State University	-.376	.128	-.019	-2.934	.003
	University of Tennessee	-.592	.098	-.043	-6.066	.000
	Virginia-Maryland College	-.586	.089	-.050	-6.574	.000
	North Carolina State University	-1.146	.095	-.088	-12.118	.000
	University of Wisconsin	-.407	.096	-.031	-4.249	.000
	Western University-California	2.035	.110	.129	18.496	.000

Table 6

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.554a	.307	.305	1.92345

Graduates of Western University have a mean DIR of 2.035 more than graduates of The Ohio State University, while graduates of Tuskegee, Kansas State, Tufts, Michigan State and the University of Pennsylvania have a DIR that is not significantly different from the DIR of graduates of Ohio State. This reflects the difference in costs across colleges. However, new veterinarians in the baseline practice type, companion animal predominant, had the highest mean DIR, with uniform services having the lowest mean DIR, 2.036 less than companion animal predominant. This reflects the difference in starting salary across different occupational paths.

DEBT AND INCOME OF THE 2016 GRADUATING CLASS

Among the respondents, 68 percent had a debt between $50,114 and $237,401 and 95 percent of the respondents had debt under $331,045.

The mean debt of all U.S. respondents reporting debt for the 2016 graduating class was $143,757.82 with a standard deviation of $93,646.57. The following chart illustrates the distribution of debt for the 2016 graduating class.

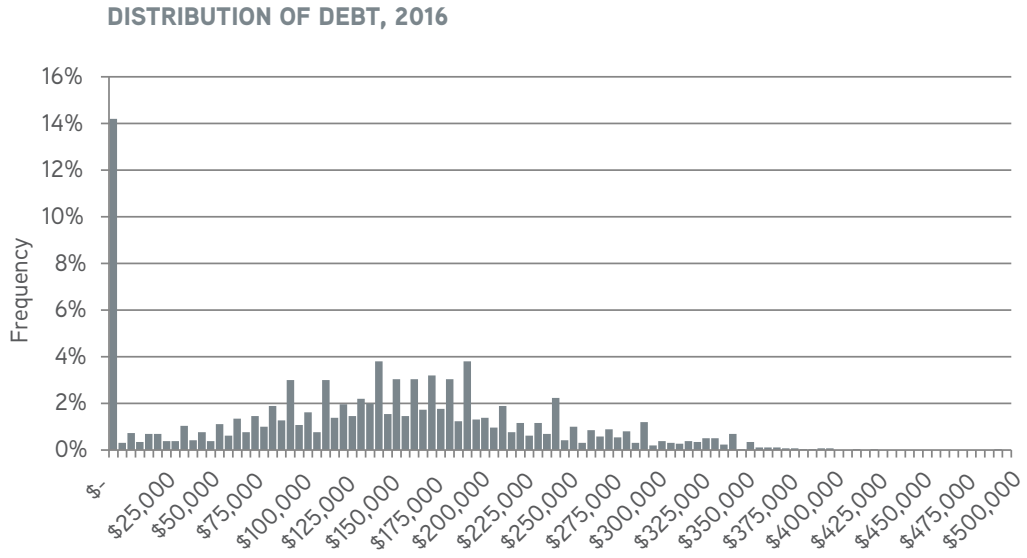


Figure 37

Among the respondents, 68 percent had a debt between $50,114 and $237,401 and 95 percent of the respondents had debt under $331,045. Observations beyond $350,000 may be considered statistical outliers (a point which falls more than 1.5 times the interquartile range above the third quartile or below the first quartile).

The mean debt of persons with debt under $331,045 was $159,064 excluding those with zero debt. We chose not to use the statistical definition of outlier and included all values of debt in the estimate of mean debt pending further review of these debt outliers.

The following chart illustrates the distribution of reported starting salaries, excluding internships and residencies. Internships, residencies and advanced education are all considered subsets of continuing education.

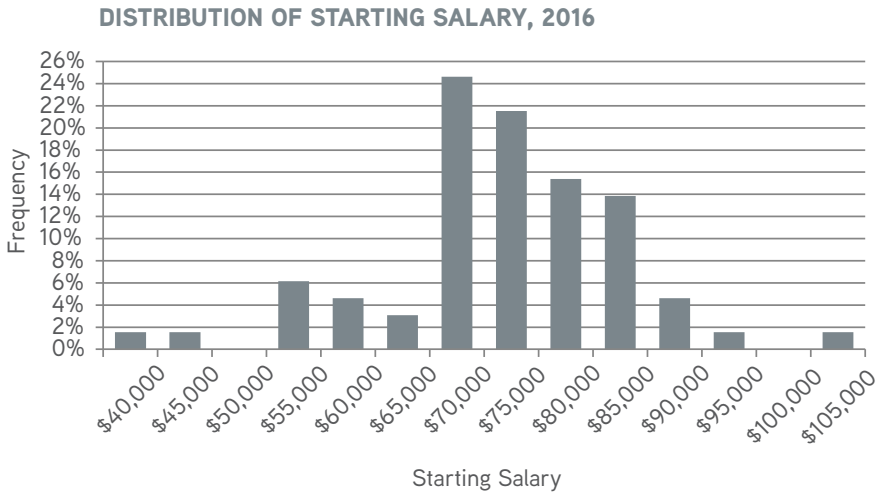


Figure 38

The distribution of starting salaries presented represents 55 percent of the 2016 graduating class. At the time the survey was distributed, only a portion of veterinary students had secured full-time employment or advanced education. The following chart, however, shows data from AVMA's employment survey that was sent to all 2014 graduates in March of 2016. These graduates have approximately one year of experience.

The mean income of new veterinarians with one year of experience is $68,696 with a 95 percent confidence interval of $38,019. That is, statistically, we are 95 percent confident that the mean income of veterinarians with one year of experience lies within plus or minus $38,019 of $68,696. This is reasonable since there is such a wide variation in types of practices coupled with types of continuing education segments.

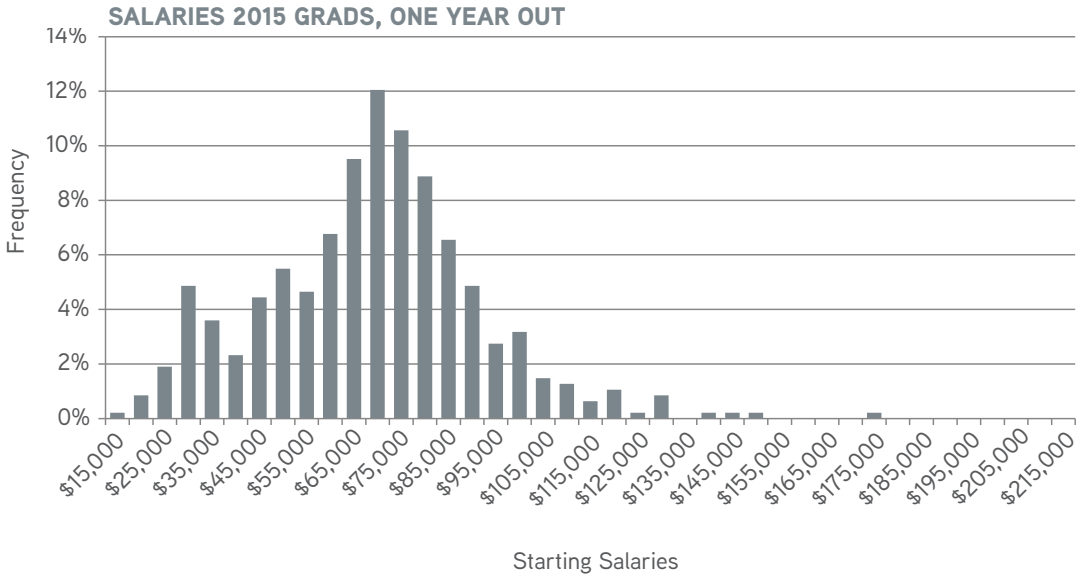


Figure 39

Using the individual reported debt and income, the distribution of the debt-to-income ratio is computed for all of those graduates who provided a value for debt and had indicated a starting salary for full-time employment prior to graduation. The distribution includes a large number of observations at both ends of what might otherwise be a normally distributed sample of graduates. More research is needed to understand what factors contribute to the large number of observations at both ends of the distribution. Most important in the illustration is that the majority (68.2%) of graduates have debt-to-income ratios at the beginning of their career that far exceed the 1.4:1 DIR that establishes an upper boundary for "acceptable" levels of financial stress.

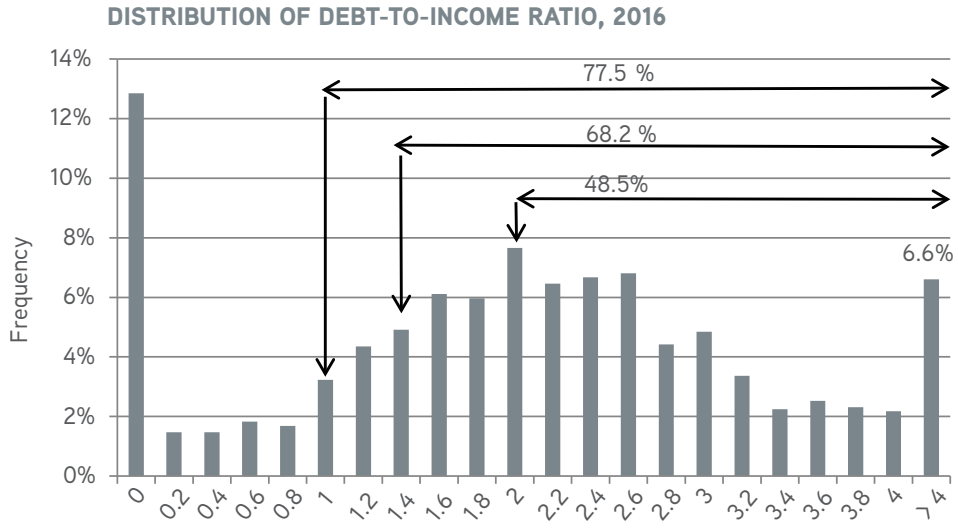


Figure 40

The following chart illustrates, in general, that debt levels are about double that of income levels. In addition, the distribution of incomes of new veterinarians finding full-time employment is much more condensed around the mean while the distribution of debt is more widely dispersed. These trends have been similar in past years.

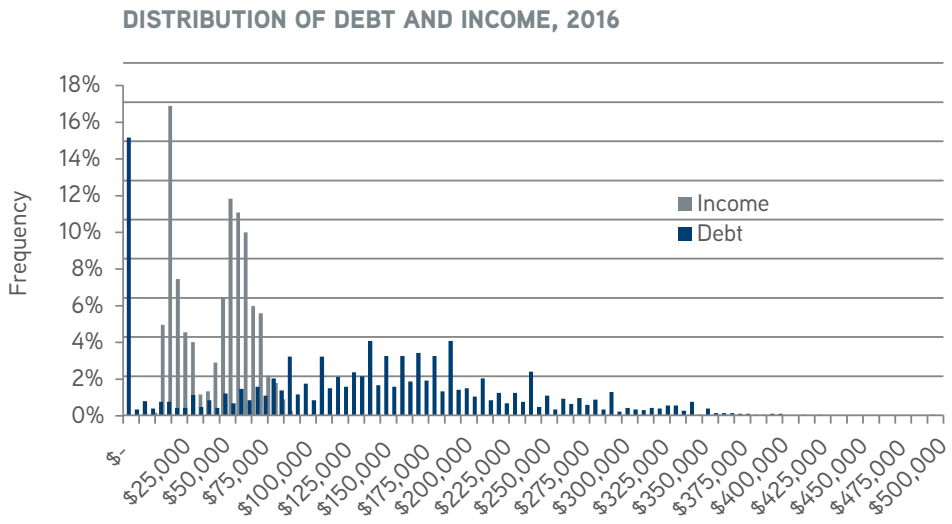


Figure 41

Since the income and debt data from the 2016 class only represents a portion of the class, the following chart is a sample of the population surveyed one year after graduation. Evidently, the debt and income numbers of the population one year post graduation closely mirrors the first years from the senior survey, indicating the validity of the senior survey results.

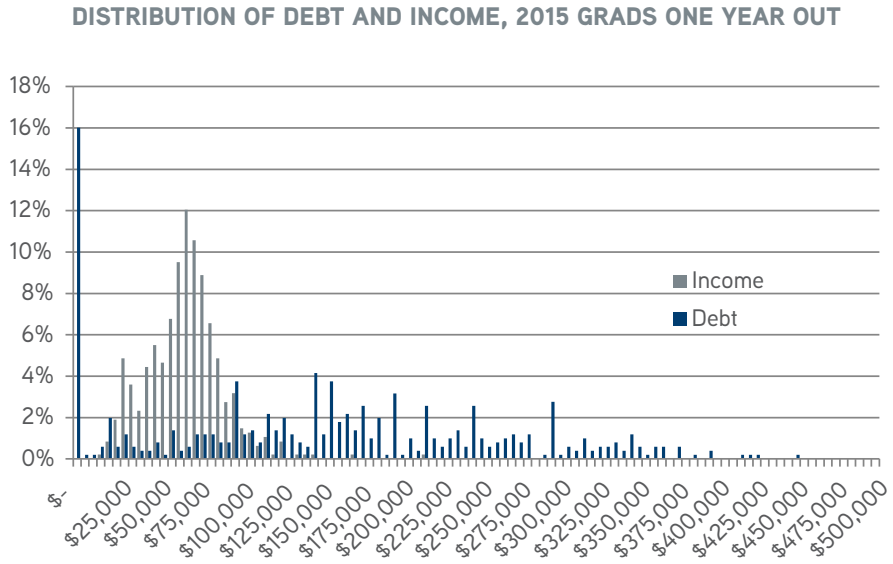


Figure 42

Mean debt for graduates of each of the U.S. veterinary colleges varied from slightly more than $80,000 to almost $260,000 in 2016. The mean debt for all graduates across all of the U.S. veterinary colleges was just more than $143,000. The school with the highest reported mean debt for 2016 was Western University and the lowest was Texas A&M. Each school had reported a mean debt that was significantly lower than Western University at a 5 percent level of significance, except Tuskegee University.

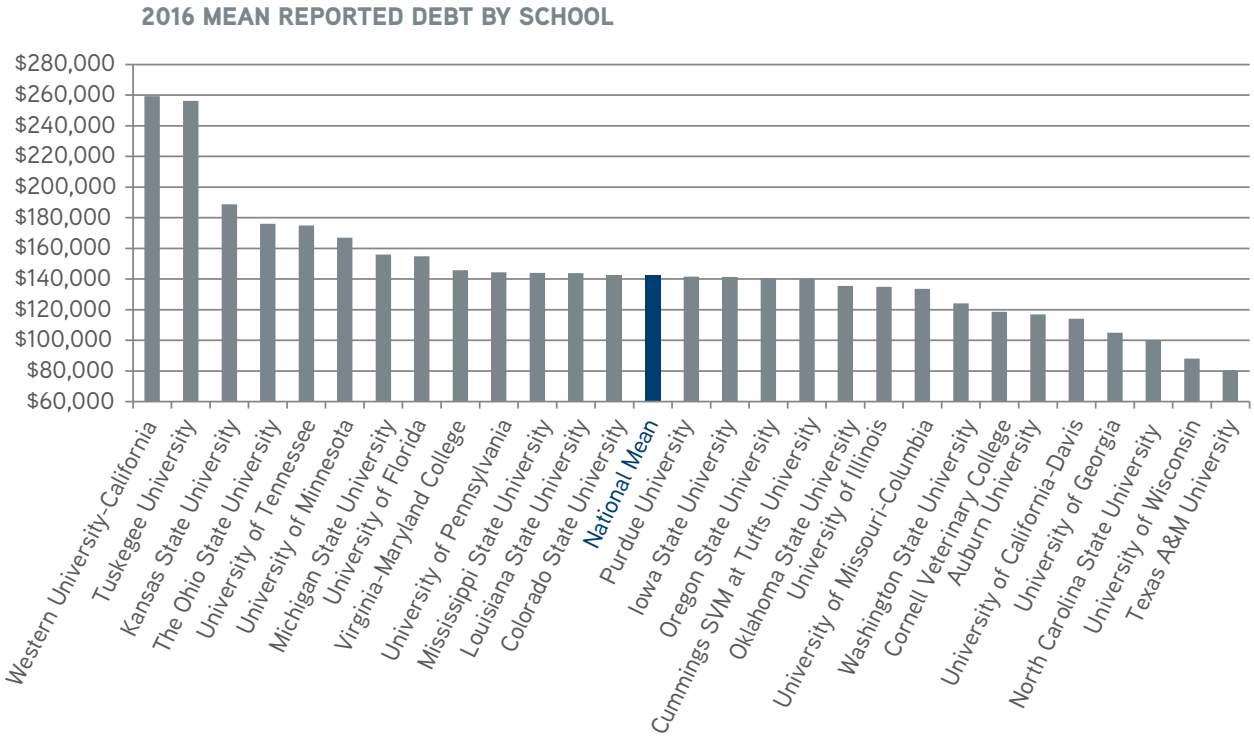


Figure 43

Using the reported residency status of graduates, four years of tuition is subtracted from the reported debt and a mean value of this difference is computed. If the reported tuition for four years was $80,000 and the DVM debt reported for four years was $170,000, for example, then the DVM debt over tuition in this instance would be $90,000 ($170,000-$80,000). Interestingly, several of the more expensive schools have a mean debt, for graduates, that is below the four-year tuition costs.

For students graduating as residents, or paying discounted tuition, the schools with the largest mean debt load above tuition are Tuskegee University, with a mean debt load of $125,000 above tuition, The Ohio State University, Western University and University of Tennessee with mean debt loads of $50,000 more than tuition. Schools with residents graduating with debt loads below tuition are Tufts University, at $50,000 below tuition, University of Pennsylvania, Cornell and UC-Davis, all with debt levels below tuition costs.

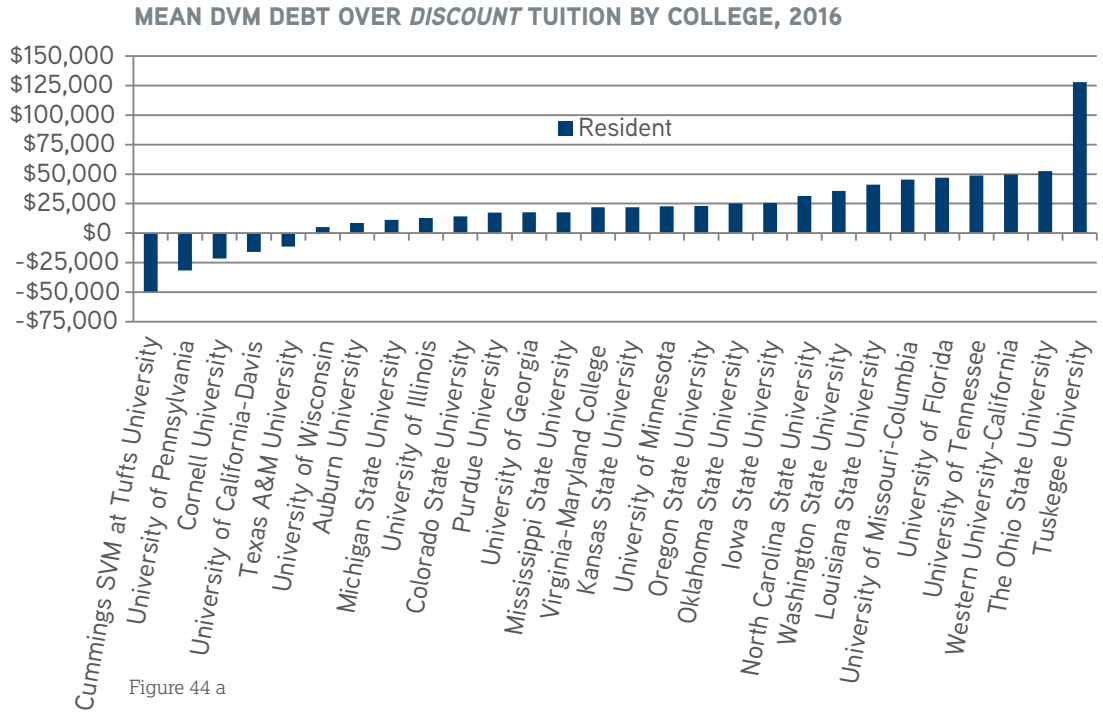


Figure 44 a

For students graduating with non-resident tuition, the schools with the highest mean debt load over tuition were Tuskegee, Western University, Oregon State University and University of Tennessee. Ohio State University, Texas A&M and University of Missouri-Columbia had non-resident students graduating with a mean debt load below the cost of tuition. Noteworthy, however, is that there are no discounted seats at Tuskegee and Western Universities.

MEAN DVM DEBT OVER *NON-DISCOUNT* TUITION BY COLLEGE, 2016

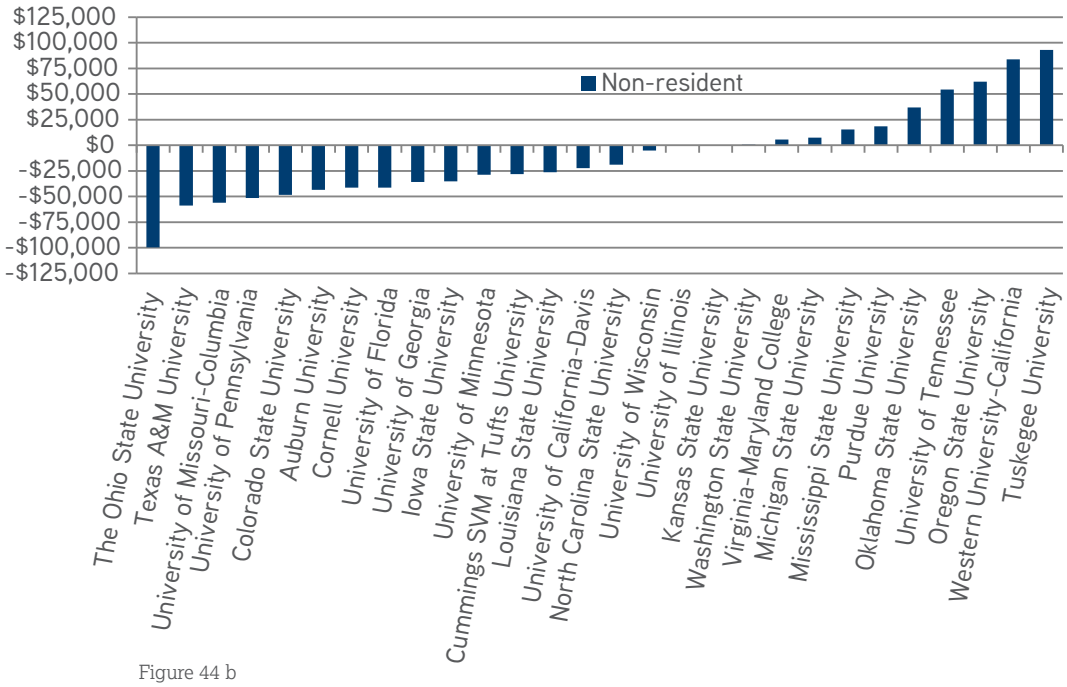


Figure 44 b

While mean debt over tuition (i.e., mean debt in dollar value greater than tuition) may be considered as an indication of how much money veterinary students may have potentially spent on living expenses. But, living costs vary by location within the United States. Data on the relative costs of living by state were obtained from the Missouri Economic Research and Information Center, https://www.missourieconomy.org/indicators/cost_of_living/. These values represent those relative costs of living in various locations for the third quarter of 2016. In addition, according to the *JAVMA* article, "Are students accumulating unreasonable amounts of debt?" the mean expenditure incurred by students for living expenses, by school, was generally less than the living expenses amount recommended by the respective schools.

An illustration of the four-year cost of living by school using the U.S. average of $50,000 as a baseline is provided in the figure below. As an example, for this illustration we assume a student budgets $12,500 per year for four years, as a baseline (national average), then we determine how much this would be in the other states to maintain the same standard of living, as would be provided by $50,000 in the national average. The most affordable veterinary school with respect to cost of living, two years in a row, is Mississippi State University where only $42,950 is necessary to maintain the standard of living that $50,000 would provide on average in the United States. The most expensive veterinary schools with respect to cost of living are University of California-Davis and Western University-California, where $67,950 is necessary to maintain the standard of living that $50,000 would provide on average in the United States. The college of veterinary medicine with a cost of living closest to the U.S. average is the University of Minnesota where $50,400 is necessary to sustain a lifestyle afforded to the average U.S. resident with $50,000 of disposable income.

THIRD QUARTER 2016 COST OF LIVING

	Index	Baseline ($50,000)	College of Veterinary Medicine
Alabama	91.2	$45,600	Auburn University, Tuskegee University
Alaska	131.1	$65,550	
Arizona	98	$49,000	
Arkansas	87.1	$43,550	
California	135.9	$67,950	University of California-Davis, Western University-California
Colorado	103.8	$51,900	Colorado State University
Connecticut	127.7	$63,850	
Delaware	101.4	$50,700	
District of Columbia	151.6	$75,800	
Florida	98.3	$49,150	University of Florida
Georgia	91.4	$45,700	University of Georgia
Hawaii	167.9	$83,950	
Idaho	92.1	$46,050	
Illinois	94.6	$47,300	University of Illinois
Indiana	89.5	$44,750	Purdue University
Iowa	91	$45,500	Iowa State University
Kansas	89.9	$44,950	Kansas State University
Kentucky	90.5	$45,250	
Louisiana	94.8	$47,400	Louisiana State University
Maine	110.8	$55,400	
Maryland	125.5	$62,750	
Massachusetts	133.4	$66,700	Cummings SVM at Tufts University
Michigan	89	$44,500	Michigan State University
Minnesota	100.8	$50,400	University of Minnesota
Mississippi	85.9	$42,950	Mississippi State University
Missouri	90.4	$45,200	University of Missouri-Columbia
Montana	100.8	$50,400	
Nebraska	91.6	$45,800	
Nevada	103.3	$51,650	
New Hampshire	117	$58,500	
New Jersey	121.9	$60,950	
New Mexico	96.5	$48,250	
New York	131	$65,500	Cornell Veterinary College
North Carolina	93.9	$46,950	North Carolina State University
North Dakota	99.4	$49,700	
Ohio	93.8	$46,900	The Ohio State University
Oklahoma	89.2	$44,600	Oklahoma State University
Oregon	115.6	$57,800	Oregon State University
Pennsylvania	101.4	$50,700	University of Pennsylvania
Rhode Island	120.7	$60,350	
South Carolina	99.2	$49,600	
South Dakota	103.7	$51,850	
Tennessee	89.4	$44,700	University of Tennessee
Texas	90.7	$45,350	Texas A&M University

Utah	93	$46,500	
Vermont	121.1	$60,550	
Virginia	100.8	$50,400	Virginia-Maryland College
Washington	105.2	$52,600	Washington State University
West Virginia	93.4	$46,700	
Wisconsin	96.8	$48,400	University of Wisconsin
Wyoming	91.8	$45,900	
Grand Total	**100**	**$50,000**	

Table 7

The following chart illustrates the mean DVM debt over tuition by college coupled with the cost of living depending upon the state in which the school is located.

For the non-discount seats which are primarily made up of non-residents there is a large distribution of debt around the cost of tuition. Namely, The Ohio State University has mean debt levels of almost $100,000 less than the cost of tuition whereas graduates of Tuskegee University report mean debt levels of almost $100,000 more than the cost of tuition. Furthermore, as mentioned, debt levels above tuition may be an indication of the cost of living. However, the cost of living at The Ohio State University, Ohio, and Tuskegee University, Alabama, are both below the mean cost of living at the national level. This leaves more questions as to explaining the variation in the debt levels above cost of living at these institutions.

MEAN DVM DEBT OVER *NON-DISCOUNT* TUITION BY COLLEGE AND COST OF LIVING, 2016

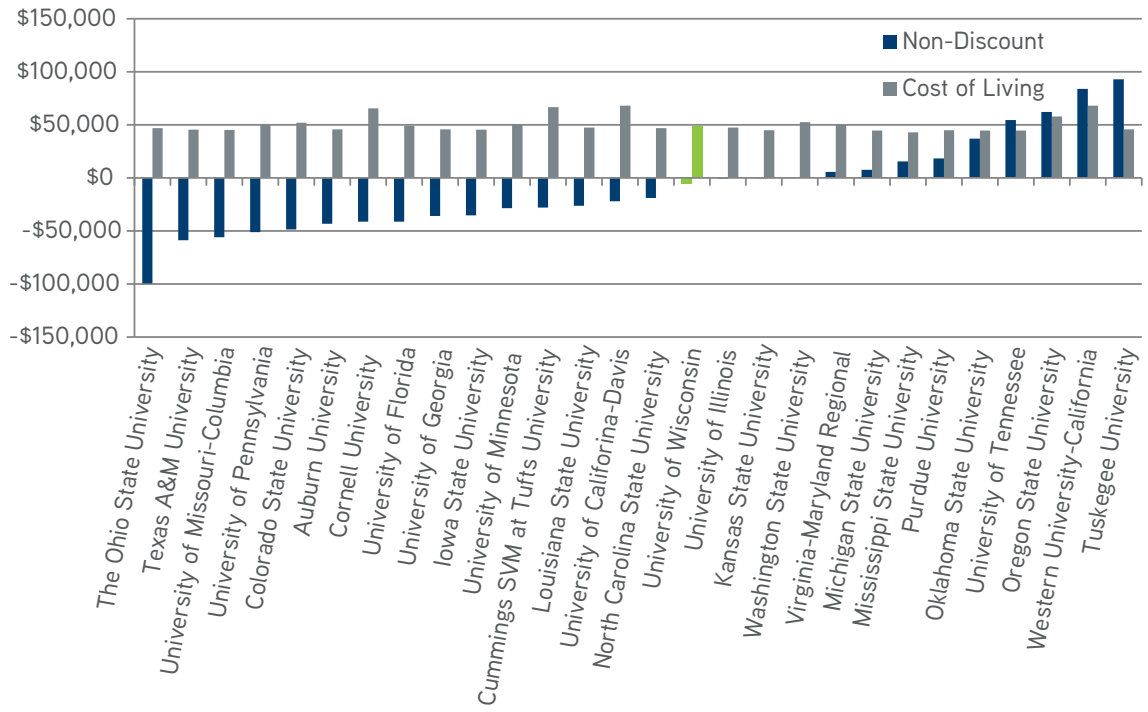


Figure 45a

For discounted seats, primarily comprised of residents and students whose home states hold contracts with their college to ensure they pay resident tuition, the mean debt load ranges from almost $50,000 below the cost of tuition at Tufts University and almost $120,000 above the cost of tuition at Tuskegee University.

MEAN DVM DEBT OVER *DISCOUNT* TUITION BY COLLEGE AND COST OF LIVING, 2016

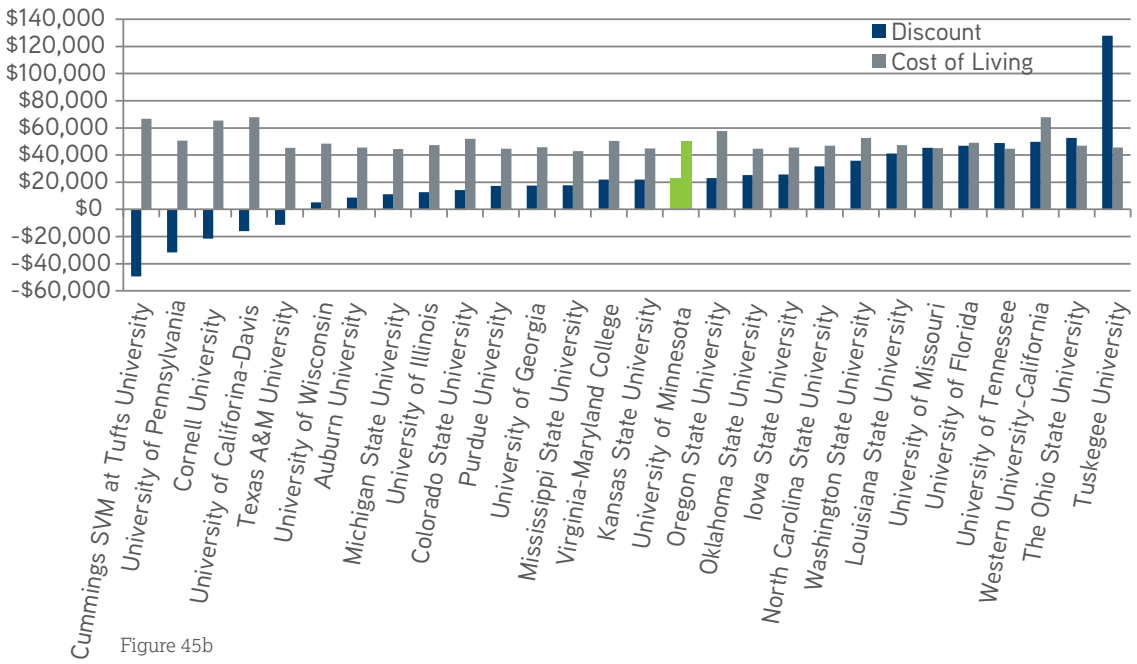


Figure 45b

In the following chart, the number of graduates, mean debt upon entering veterinary college, mean debt upon graduating from veterinary college, mean starting salary and post graduate plans, are mapped out by school.

In 2016, UC-Davis had the largest percentage of the class pursuing advanced education, inclusive of internships and residencies, at 61 percent. Purdue University had the highest proportion of new graduates pursuing public practice at 9 percent of the class, and Washington State University had the highest percentage new veterinarians reporting pursuing full-time employment in private practice at 84 percent of the class.

DEBT LEVELS ABOVE TUITION MAY BE AN INDICATION OF THE COST OF LIVING.

NUMBER OF GRADUATES, POST-GRADUATION PLANS AND MEAN DEBT AND INCOME BY SCHOOL, 2016

Veterinary Medical College	2016 Grads	Mean Debt upon Entering Veterinary College			Mean Debt upon Graduating from Veterinary College		
	N	Mean	N	Std. Deviation	Mean	N	Std. Deviation
Washington State University	110	$9,507	110	$24,605	$133,650	110	$78,286
University of Missouri-Columbia	107	$10,778	107	$17,837	$144,277	107	$78,390
University of Florida	99	$7,632	95	$16,807	$162,364	95	$94,955
Iowa State University	107	$16,950	105	$21,624	$158,391	105	$83,489
Texas A&M University	124	$9,942	124	$20,447	$90,476	124	$67,480
Oregon State University	53	$14,679	53	$23,127	$155,349	53	$90,838
Oklahoma State University	88	$8,699	88	$16,224	$144,196	88	$91,627
Louisiana State University	85	$5,855	83	$13,892	$149,629	84	$89,560
Virginia-Maryland College	116	$13,370	115	$20,855	$160,556	114	$108,534
Michigan State University	83	$9,480	81	$15,759	$165,346	82	$97,709
Auburn University	116	$9,487	116	$17,280	$126,342	116	$89,875
Kansas State University	89	$10,881	84	$16,571	$199,445	86	$104,438
Mississippi State University	83	$14,341	82	$28,325	$158,109	83	$119,787
Colorado State University	85	$18,390	84	$27,935	$161,083	85	$98,979
University of Georgia	97	$8,760	97	$17,253	$113,778	97	$86,496
The Ohio State University	150	$18,419	146	$33,250	$194,363	147	$96,227
Tuskegee University	69	$26,112	67	$42,514	$282,368	67	$112,045
Purdue University	82	$11,818	80	$19,364	$153,178	82	$87,751
University of Illinois	82	$14,677	82	$18,682	$149,651	82	$91,458
University of Wisconsin	79	$10,949	79	$18,794	$99,142	79	$60,782
University of Tennessee	75	$14,208	74	$23,222	$189,050	74	$100,654
North Carolina State University	97	$12,653	97	$21,310	$112,616	97	$64,947
University of Minnesota	89	$13,809	89	$23,957	$180,672	89	$101,719
University of Pennsylvania	81	$16,514	80	$29,337	$160,767	81	$118,432
Cummings SVM at Tufts University	80	$17,758	80	$36,042	$158,016	80	$116,208
Western University-California	81	$15,386	79	$26,515	$277,952	79	$125,763
Cornell Veterinary College	99	$12,478	96	$22,793	$130,931	98	$87,907
University of California-Davis	134	$9,265	133	$24,235	$123,327	134	$98,810
Total	**2,640**	**$12,741**	**2,606**	**$23,762**	**$155,291**	**2,618**	**$102,633**

Table 8

Veterinary Medical College	Mean Starting Salary			Distribution of Post-Graduate Plans			
	Mean	N	Std. Deviation	Private Practice	Public Practice	Advanced Education	Total
Washington State University	$67,780	91	$19,123	77	4	11	92
University of Missouri-Columbia	$63,045	101	$20,278	78	1	21	100
University of Florida	$67,903	90	$24,681	69	3	18	90
Iowa State University	$63,403	94	$19,424	71	3	19	93
Texas A&M University	$67,782	98	$23,433	74	1	22	97
Oregon State University	$60,891	51	$22,847	37	0	14	51
Oklahoma State University	$61,549	73	$22,690	51	3	19	73
Louisiana State University	$64,705	65	$23,732	44	1	19	64
Virginia-Maryland College	$64,026	100	$24,021	67	4	28	99
Michigan State University	$58,736	70	$21,285	46	5	19	70
Auburn University	$60,559	98	$22,045	65	4	30	99
Kansas State University	$60,051	76	$23,525	48	5	24	77
Mississippi State University	$58,187	69	$24,705	42	3	23	68
Colorado State University	$58,620	79	$26,277	47	1	30	78
University of Georgia	$56,100	86	$24,006	50	2	31	83
The Ohio State University	$58,679	129	$25,504	78	6	46	130
Tuskegee University	$62,687	47	$27,554	28	4	15	47
Purdue University	$59,029	57	$23,616	33	5	18	56
University of Illinois	$56,221	73	$22,059	43	2	28	73
University of Wisconsin	$53,268	69	$23,464	38	0	30	68
University of Tennessee	$54,731	55	$24,810	30	2	22	54
North Carolina State University	$53,306	83	$23,093	46	4	33	83
University of Minnesota	$56,283	78	$23,237	40	6	32	78
University of Pennsylvania	$51,272	78	$25,720	32	1	45	78
Cummings SVM at Tufts University	$48,334	67	$21,730	27	2	38	67
Western University-California	$52,339	68	$24,153	26	0	39	65
Cornell Veterinary College	$48,522	86	$23,419	33	5	47	85
University of California-Davis	$51,690	114	$26,041	44	1	70	115
Total	**$58,746**	**2,245**	**$23,996**	**1,364**	**78**	**791**	**2,233**

The following table highlights veterinary competencies and skill sets based on the respondent's perceived preparation by their veterinary college, labelled as "expectation" followed by the respondent's experience while on the job, labelled as "experience." Ultimately, the table illustrates, by school, whether the respondents' perceived preparation by their college, or expectation, is aligned with their findings while on the job, or experience.

Among the tasks measured were doing a physical exam, conducting a history taking, diagnosing lameness, and giving anesthesia.

CLINICAL COMPETENCIES, EXPECTATION AND EXPERIENCE BY SCHOOL

		Auburn University		Tuskegee University		University of California-Davis		Colorado State University		University of Florida		University of Georgia	
		Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Do a physical examination	Expectation	4.00	29	4.42	12	3.97	39	3.98	60	4.04	24	4.13	30
	Experience	4.38	29	4.58	12	4.26	39	4.37	60	4.25	24	4.70	30
Do history taking	Expectation	3.97	29	4.17	12	4.28	39	4.23	60	4.38	24	4.27	30
	Experience	4.41	29	4.50	12	4.46	39	4.53	60	4.13	24	4.73	30
Diagnose lameness	Expectation	3.48	29	3.42	12	3.41	39	3.23	60	3.48	23	3.00	30
	Experience	3.69	29	3.83	12	3.82	39	3.78	60	4.25	24	3.87	30
Diagnose and prescribe treatment for parasitic diseases	Expectation	3.93	29	4.42	12	3.59	39	3.23	60	3.63	24	4.03	30
	Experience	4.48	29	4.25	12	3.97	39	4.02	59	4.13	24	4.50	30
Give anesthesia	Expectation	3.45	29	3.17	12	3.79	39	4.02	60	3.88	24	3.67	30
	Experience	4.14	29	3.92	12	4.13	39	4.33	60	4.29	24	4.27	30
Do fluid therapy	Expectation	3.66	29	3.25	12	3.74	39	3.83	60	3.88	24	3.83	30
	Experience	4.31	29	3.92	12	4.10	39	4.30	60	4.21	24	4.43	30
Give an intravenous injection	Expectation	4.14	29	4.42	12	4.26	39	3.97	60	4.50	24	3.60	30
	Experience	4.62	29	4.67	12	4.47	38	4.58	60	4.50	24	4.60	30
Develop/adapt vaccination protocols	Expectation	3.90	29	4.17	12	3.51	39	3.68	60	3.75	24	4.07	30
	Experience	4.52	29	4.50	12	4.77	39	4.38	60	4.25	24	4.80	30
Advise clients on nutrition	Expectation	2.76	29	3.33	12	3.08	39	2.67	60	2.96	24	2.90	30
	Experience	3.62	29	3.67	12	3.85	39	3.30	60	3.33	24	3.93	30
Develop diagnostic plans for difficult cases	Expectation	3.52	29	3.25	12	3.72	39	3.20	60	3.63	24	3.27	30
	Experience	4.14	29	4.00	12	4.08	39	4.15	60	4.00	24	4.07	30
Investigate potential toxin exposure	Expectation	3.21	29	2.92	12	3.21	39	2.63	60	2.88	24	2.53	30
	Experience	3.79	29	3.50	12	3.85	39	3.68	60	3.46	24	3.70	30
Prescribe medications	Expectation	3.69	29	3.58	12	3.72	39	3.53	59	4.13	24	3.37	30
	Experience	4.34	29	4.42	12	4.51	39	4.35	60	4.42	24	4.70	30
Interpret cytologic specimens	Expectation	3.03	29	3.33	12	3.00	39	3.13	60	3.50	24	3.00	30
	Experience	3.34	29	3.75	12	3.67	39	3.77	60	3.50	24	3.23	30
Interpret post-mortem specimens	Expectation	3.21	29	4.50	12	3.51	39	3.47	60	3.42	24	3.13	30
	Experience	3.55	29	4.25	12	4.18	39	4.35	60	3.79	24	3.57	30
Interpret ultrasound examinations	Expectation	3.07	29	3.00	12	3.41	39	2.43	60	3.04	24	2.17	30
	Experience	3.55	29	4.50	12	3.59	39	3.90	60	3.88	24	3.10	30
Interpret radiographs	Expectation	3.38	29	3.17	12	3.67	39	3.18	60	3.42	24	2.93	30
	Experience	3.66	29	3.92	12	3.71	38	3.92	60	3.63	24	3.53	30
Interpret hematologic values	Expectation	3.86	29	3.92	12	4.00	39	3.77	60	4.17	24	3.70	30
	Experience	4.10	29	4.00	12	3.97	39	4.35	60	4.17	24	4.03	30
Diagnose/prescribe therapy for gastrointestinal disease	Expectation	3.59	29	3.83	12	3.77	39	3.54	59	3.71	24	3.62	29
	Experience	4.24	29	4.17	12	4.13	39	4.20	59	4.25	24	4.34	29
Diagnose/prescribe therapy for dermatological disease	Expectation	3.86	29	3.33	12	3.56	39	3.36	59	3.83	24	3.14	29
	Experience	4.03	29	3.83	12	3.56	39	4.05	59	4.38	24	4.03	29
Diagnose/prescribe therapy for endocrine disease	Expectation	3.48	29	3.50	12	3.44	39	3.20	59	3.54	24	3.38	29
	Experience	3.97	29	3.67	12	3.97	39	4.08	59	4.00	24	3.86	29
Diagnose/prescribe therapy for cardiac disease	Expectation	3.14	29	2.67	12	2.77	39	3.10	59	3.21	24	3.00	29
	Experience	3.66	29	3.33	12	3.54	39	4.03	59	3.75	24	3.55	29

University of Illinois		Iowa State University		Kansas State University		Louisiana State University		Cummings SVM at Tufts University		Michigan State University		University of Minnesota		Mississippi State University		Purdue University		Cornell University	
Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
4.18	33	4.09	34	3.91	32	3.78	27	3.94	36	4.00	35	4.00	34	4.08	26	4.29	24	4.04	24
4.36	33	4.32	34	4.34	32	4.12	26	4.46	35	4.34	35	4.44	34	4.23	26	4.42	24	3.92	24
4.18	33	4.18	34	3.97	32	4.19	27	4.03	36	4.06	35	4.30	33	4.27	26	4.29	24	4.17	24
4.48	33	4.24	34	4.28	32	4.23	26	4.49	35	4.43	35	4.53	34	4.27	26	4.42	24	4.58	24
3.27	33	3.06	34	2.97	31	3.52	27	3.47	36	3.23	35	3.24	34	3.12	26	3.42	24	3.13	24
3.85	33	3.35	34	3.56	32	4.00	26	3.88	34	3.66	35	3.50	34	3.73	26	3.83	24	3.75	24
3.55	33	3.50	34	3.72	32	3.96	27	3.36	36	3.03	35	3.41	34	3.92	26	4.04	24	3.29	24
4.36	33	3.79	34	3.97	32	4.42	26	4.03	34	4.31	35	4.12	34	4.15	26	4.33	24	3.88	24
3.73	33	3.65	34	3.63	32	3.85	27	4.03	36	3.80	35	3.74	34	4.00	26	3.83	24	3.54	24
4.06	33	4.00	34	3.78	32	4.35	26	4.29	35	4.29	35	4.32	34	4.04	26	4.08	24	4.13	24
3.55	33	3.74	34	3.44	32	3.81	27	4.06	36	3.69	35	3.68	34	3.92	26	3.75	24	3.67	24
4.03	33	4.03	34	3.72	32	4.35	26	4.11	35	4.00	35	4.24	34	4.27	26	4.08	24	4.17	24
4.09	33	3.94	34	4.00	32	4.15	27	4.11	36	3.77	35	4.18	34	4.46	26	4.33	24	4.08	24
4.69	32	4.47	34	4.63	32	4.81	26	4.71	35	4.46	35	4.53	34	4.50	26	4.54	24	4.42	24
2.79	33	3.53	34	3.44	32	3.59	27	3.28	36	3.23	35	3.41	34	3.77	26	3.63	24	3.83	24
4.33	33	4.24	34	4.53	32	4.69	26	4.51	35	4.54	35	4.62	34	4.12	26	4.50	24	4.25	24
2.61	33	2.26	34	2.06	32	3.11	27	3.56	36	2.60	35	3.41	34	2.65	26	2.75	24	3.04	24
3.45	33	3.06	34	3.19	32	3.88	26	4.03	35	3.86	35	3.82	34	3.27	26	3.13	24	3.79	24
3.33	33	3.26	34	3.13	32	3.56	27	4.06	36	3.57	35	3.56	34	3.50	26	3.79	24	3.50	24
3.91	33	3.65	34	3.94	32	4.12	26	4.23	35	4.26	35	4.26	34	3.81	26	3.79	24	4.29	24
3.06	33	2.94	34	2.22	32	2.89	27	3.11	36	2.63	35	3.06	34	2.88	26	3.29	24	2.88	24
3.36	33	3.29	34	3.28	32	3.54	26	3.80	35	3.66	35	3.53	34	3.42	26	3.75	24	3.58	24
3.67	33	3.50	34	3.47	32	3.52	27	4.00	36	3.60	35	3.79	34	3.58	26	4.00	24	3.54	24
4.58	33	4.15	34	4.13	32	4.15	26	4.46	35	4.29	35	4.47	34	4.27	26	4.33	24	4.46	24
3.21	33	3.09	34	2.88	32	3.59	27	3.53	36	2.89	35	3.47	34	3.12	26	3.13	24	3.38	24
3.42	33	3.38	34	3.31	32	4.08	26	3.58	36	3.37	35	3.82	34	3.31	26	3.13	24	3.46	24
3.48	33	3.97	34	3.13	32	3.26	27	3.47	36	3.37	35	3.53	34	3.54	26	3.00	24	3.04	24
4.06	33	4.09	34	3.63	32	4.62	26	5.00	36	4.46	35	4.32	34	3.88	26	4.17	24	4.08	24
2.85	33	2.38	34	2.44	32	2.74	27	3.19	36	3.06	35	2.71	34	2.19	26	2.04	24	3.08	24
3.70	33	3.74	34	3.50	32	3.96	26	3.83	36	4.06	35	4.21	34	3.19	26	3.71	24	4.13	24
3.27	33	3.44	34	3.41	32	3.52	27	3.36	36	3.29	35	3.32	34	3.04	26	3.50	24	3.50	24
3.67	33	3.88	34	3.50	32	3.73	26	3.86	36	3.66	35	3.71	34	3.54	26	3.58	24	4.13	24
3.70	33	4.00	34	3.66	32	4.07	27	3.81	36	3.77	35	4.06	34	3.62	26	4.21	24	3.92	24
4.00	33	4.26	34	3.88	32	4.31	26	3.92	36	4.14	35	4.15	34	3.81	26	4.04	24	4.17	24
3.36	33	3.21	33	3.34	32	3.77	26	3.75	36	3.34	35	3.74	34	3.69	26	3.96	24	3.54	24
4.00	33	4.06	33	3.91	32	4.38	26	4.06	36	4.06	35	4.06	34	4.50	26	4.08	24	4.38	24
3.28	32	3.85	33	3.22	32	4.00	26	3.00	36	3.00	35	4.03	34	3.42	26	2.58	24	3.42	24
4.15	33	3.91	33	3.44	32	4.35	26	3.81	36	3.71	35	4.03	34	4.08	26	3.79	24	3.67	24
3.34	32	3.28	32	3.22	32	3.54	26	3.78	36	3.29	35	3.50	34	3.58	26	3.96	24	3.50	24
3.82	33	3.73	33	3.68	31	3.96	26	3.78	36	3.77	35	3.82	34	4.19	26	4.08	24	4.04	24
2.38	32	2.91	33	2.78	32	3.27	26	3.64	36	3.26	35	3.15	34	2.65	26	3.00	24	3.46	24
3.48	33	3.28	32	3.48	31	3.38	26	3.67	36	3.80	35	3.33	33	3.58	26	3.33	24	4.08	24

		Oklahoma State University		University of Pennsylvania		Texas A&M University		Washington State University		University of Missouri-Columbia		The Ohio State University		Oregon State University	
		Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Do a physical examination	Experience	3.79	24	4.11	35	4.39	71	4.00	23	3.97	34	4.00	39	3.81	21
	Expectation	4.08	24	4.60	35	4.55	71	4.26	23	4.41	34	4.45	38	4.48	21
Do history taking	Experience	3.96	24	4.09	35	4.56	71	4.17	23	4.09	34	4.33	39	3.90	21
	Expectation	4.21	24	4.54	35	4.59	71	4.17	23	4.38	34	4.50	38	4.38	21
Diagnose lameness	Experience	3.29	24	3.26	35	3.48	71	2.87	23	3.12	33	3.38	39	3.29	21
	Expectation	3.83	24	4.20	35	3.96	71	3.30	23	3.79	33	4.05	38	3.86	21
Diagnose and prescribe treatment for parasitic diseases	Experience	4.29	24	3.46	35	4.15	71	3.74	23	3.62	34	3.74	39	3.24	21
	Expectation	4.29	24	4.14	35	4.38	71	4.26	23	4.15	34	4.50	38	3.81	21
Give anesthesia	Experience	3.46	24	3.31	35	4.15	71	3.83	23	3.70	33	3.90	39	4.29	21
	Expectation	3.92	24	4.11	35	4.41	71	4.22	23	3.71	34	4.37	38	4.95	21
Do fluid therapy	Experience	3.58	24	3.54	35	4.04	71	3.35	23	3.71	34	3.69	39	3.71	21
	Expectation	4.46	24	4.37	35	4.46	71	4.22	23	4.12	34	4.32	38	4.48	21
Give an intravenous injection	Experience	3.96	24	3.94	35	4.34	71	3.87	23	4.03	34	4.26	39	4.14	21
	Expectation	4.63	24	4.83	35	4.72	71	4.39	23	4.62	34	4.82	38	5.00	21
Develop/adapt vaccination protocols	Experience	3.67	24	3.15	34	4.01	71	3.78	23	3.32	34	4.05	39	3.14	21
	Expectation	4.25	24	4.57	35	4.79	71	4.65	23	4.03	34	4.76	38	4.62	21
Advise clients on nutrition	Experience	2.29	24	2.91	35	3.35	71	2.70	23	2.50	34	3.10	39	2.38	21
	Expectation	3.33	24	3.89	35	3.92	71	3.43	23	3.47	34	3.84	38	3.90	21
Develop diagnostic plans for difficult cases	Experience	3.13	23	3.83	35	3.99	71	3.70	23	3.32	34	3.49	39	3.33	21
	Expectation	3.88	24	4.26	35	4.27	71	3.96	23	3.85	34	4.18	38	4.10	21
Investigate potential toxin exposure	Experience	2.91	23	3.14	35	3.24	71	3.17	23	2.79	34	2.74	39	2.71	21
	Expectation	3.33	24	3.80	35	3.77	71	3.57	23	3.35	34	3.53	38	3.33	21
Prescribe medications	Experience	3.52	23	3.40	35	4.01	71	3.74	23	3.65	34	3.90	39	3.62	21
	Expectation	4.38	24	4.37	35	4.66	71	4.17	23	4.41	34	4.65	37	4.43	21
Interpret cytologic specimens	Experience	2.83	24	2.89	35	3.48	71	3.13	23	3.59	34	3.08	39	3.57	21
	Expectation	3.57	23	3.29	35	3.59	70	3.48	23	3.85	34	3.29	38	3.76	21
Interpret post-mortem specimens	Experience	2.92	24	3.37	35	3.55	71	3.00	23	3.32	34	3.45	38	3.62	21
	Expectation	3.43	23	4.09	35	4.34	70	3.96	23	4.12	34	3.95	38	3.71	21
Interpret ultrasound examinations	Experience	2.17	24	2.89	35	2.62	71	2.61	23	2.27	33	2.41	39	2.71	21
	Expectation	3.61	23	3.97	35	4.11	70	4.74	23	3.26	34	3.24	38	4.71	21
Interpret radiographs	Experience	3.58	24	3.60	35	3.68	71	3.43	23	3.15	34	3.67	39	3.19	21
	Expectation	4.00	23	3.97	35	3.89	70	3.57	23	3.74	34	4.13	38	4.05	21
Interpret hematologic values	Experience	3.50	24	3.94	35	4.23	71	3.70	23	3.85	34	3.79	39	4.05	21
	Expectation	4.13	23	4.11	35	4.43	70	3.96	23	3.97	34	4.32	38	4.38	21
Diagnose/prescribe therapy for gastrointestinal disease	Experience	3.46	24	3.56	34	4.00	70	3.61	23	3.62	34	3.46	39	3.38	21
	Expectation	4.17	24	4.63	35	4.44	70	4.30	23	4.06	34	4.26	38	4.19	21
Diagnose/prescribe therapy for dermatological disease	Experience	3.13	24	3.41	34	3.80	70	3.22	23	3.62	34	3.74	39	2.57	21
	Expectation	4.00	24	4.03	35	4.17	70	4.17	23	4.00	34	3.95	38	3.86	21
Diagnose/prescribe therapy for endocrine disease	Experience	3.25	24	3.50	34	3.69	70	3.61	23	3.47	34	3.54	39	3.10	21
	Expectation	3.87	23	4.34	35	4.13	70	3.96	23	3.68	34	4.11	38	3.95	21
Diagnose/prescribe therapy for cardiac disease	Experience	3.00	24	3.44	34	3.77	70	3.74	23	3.12	34	3.62	39	3.43	21
	Expectation	3.79	24	4.09	35	4.04	70	4.00	23	3.59	34	3.97	38	3.81	21

University of Tennessee		Virginia-Maryland College		North Carolina State University		University of Wisconsin		Western University-California		Ross University		St. George's University		Other		St. Matthew's University		National	
Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
3.85	27	3.91	35	4.05	22	4.29	24	4.41	27	4.23	80	4.23	26	4.23	86	4.83	6	4.09	1079
4.26	27	4.46	35	4.36	22	4.50	24	4.59	27	4.46	80	4.62	26	4.40	85	4.50	6	4.40	1075
4.00	26	4.31	35	4.32	22	4.50	24	4.52	27	4.28	80	4.35	26	4.31	86	4.83	6	4.24	1077
4.37	27	4.63	35	4.41	22	4.71	24	4.41	27	4.45	80	4.46	26	4.41	85	4.67	6	4.45	1075
3.04	27	3.66	35	3.05	22	3.29	24	3.70	27	3.43	80	3.88	26	3.24	85	4.00	6	3.32	1075
4.07	27	4.03	35	3.64	22	3.63	24	4.00	27	3.96	79	4.46	26	3.75	85	3.83	6	3.84	1072
3.81	27	3.80	35	3.68	22	3.63	24	3.56	27	3.79	80	3.65	26	3.69	86	3.67	6	3.68	1079
4.22	27	4.51	35	4.09	22	4.38	24	4.33	27	4.30	80	4.58	26	4.34	85	4.33	6	4.24	1073
3.70	27	4.03	35	3.91	22	4.17	24	3.52	27	4.08	80	3.65	26	3.50	86	4.00	6	3.80	1078
3.85	27	4.51	35	4.23	22	4.38	24	4.30	27	4.31	80	4.15	26	4.12	84	4.33	6	4.21	1074
3.67	27	3.80	35	3.55	22	3.79	24	3.67	27	3.80	80	3.65	26	3.58	86	4.33	6	3.73	1079
4.04	26	4.37	35	3.95	22	4.29	24	4.44	27	4.26	80	4.24	25	4.27	84	4.67	6	4.23	1072
4.15	27	4.21	34	4.09	22	3.83	24	4.33	27	4.25	80	4.27	26	3.92	86	4.67	6	4.11	1078
4.22	27	4.68	34	4.36	22	4.57	23	4.85	27	4.62	79	4.62	26	4.63	84	4.83	6	4.61	1069
3.59	27	4.20	35	4.23	22	3.75	24	4.22	27	3.66	80	3.69	26	3.62	86	3.83	6	3.66	1078
4.07	27	4.74	35	4.27	22	4.75	24	4.89	27	4.46	80	5.08	26	4.43	84	4.50	6	4.52	1074
3.48	27	3.60	35	3.45	22	2.83	24	3.22	27	3.28	80	2.96	26	2.65	86	4.17	6	2.94	1079
3.56	27	4.11	35	3.91	22	3.75	24	3.93	27	3.90	80	4.08	26	3.33	84	4.17	6	3.67	1074
3.19	27	3.66	35	3.77	22	3.92	24	3.78	27	3.44	80	3.54	26	3.31	86	4.17	6	3.53	1078
3.89	27	4.23	35	4.27	22	4.38	24	4.22	27	4.04	80	4.04	26	3.94	84	4.67	6	4.08	1074
2.56	27	3.00	35	3.18	22	2.67	24	3.19	27	3.15	80	2.88	26	2.71	86	3.50	6	2.92	1078
3.33	27	3.94	35	3.59	22	3.54	24	3.78	27	3.79	80	4.00	26	3.60	84	4.17	6	3.62	1074
3.41	27	3.89	35	3.82	22	3.92	24	3.70	27	3.86	80	3.69	26	3.62	86	4.50	6	3.71	1077
4.26	27	4.63	35	4.45	22	4.75	24	4.48	27	4.41	80	4.50	26	4.49	83	4.83	6	4.44	1072
3.11	27	2.97	35	3.41	22	3.46	24	3.59	27	3.13	80	3.38	26	3.11	85	3.50	6	3.21	1078
3.37	27	3.54	35	4.14	22	4.00	24	4.00	27	3.49	80	3.31	26	3.40	84	4.00	6	3.54	1073
3.11	27	3.43	35	3.18	22	3.88	24	3.48	27	3.44	80	3.54	26	3.38	85	3.50	6	3.41	1077
3.74	27	4.40	35	3.14	22	4.25	24	4.11	27	4.16	80	4.38	26	4.13	84	3.50	6	4.10	1073
2.48	27	2.83	35	2.32	22	2.88	24	3.41	27	2.66	80	2.50	26	2.54	85	3.83	6	2.68	1077
3.37	27	3.74	35	3.73	22	3.88	24	4.07	27	4.00	80	3.77	26	3.49	84	4.00	6	3.79	1073
3.74	27	3.83	35	3.55	22	3.54	24	3.63	27	3.45	80	3.35	26	3.25	85	4.00	6	3.43	1078
3.63	27	3.97	35	4.09	22	3.88	24	3.96	26	3.79	80	3.92	26	3.62	84	4.00	6	3.79	1071
3.93	27	4.11	35	4.18	22	4.42	24	3.93	27	3.89	80	3.81	26	3.69	84	4.33	6	3.90	1077
3.85	27	4.29	35	4.50	22	4.21	24	4.22	27	4.16	80	4.27	26	3.99	84	4.50	6	4.14	1073
3.41	27	4.00	34	3.67	21	3.63	24	3.59	27	3.59	80	3.65	26	3.65	85	4.17	6	3.63	1070
4.19	26	4.50	34	4.25	20	4.13	24	4.15	27	4.28	80	4.35	26	4.38	85	4.83	6	4.25	1068
3.59	27	3.68	34	3.76	21	4.08	24	3.26	27	3.40	80	3.46	26	3.45	85	3.67	6	3.47	1069
3.73	26	4.32	34	4.05	20	4.13	24	4.19	27	3.96	80	3.58	26	4.01	84	4.33	6	3.99	1067
3.35	26	3.82	34	3.76	21	3.79	24	3.67	27	3.51	80	3.31	26	3.55	85	3.83	6	3.50	1067
3.73	26	4.24	34	3.95	20	3.92	24	4.07	27	3.98	80	3.88	26	3.88	84	4.50	6	3.95	1065
2.69	26	3.47	34	3.52	21	3.33	24	3.33	27	3.13	80	2.92	26	3.42	85	4.33	6	3.21	1068
3.23	26	3.97	34	3.80	20	3.71	24	3.85	27	3.68	80	4.00	26	3.76	83	4.50	6	3.73	1063

CLINICAL COMPETENCIES, EXPECTATION AND EXPERIENCE BY SCHOOL

		Auburn University		Tuskegee University		University of California-Davis		Colorado State University		University of Florida		University of Georgia	
		Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Diagnose/prescribe therapy for respiratory disease	Expectation	3.24	29	3.08	12	3.18	39	3.02	59	3.21	24	3.07	29
	Experience	3.76	29	3.67	12	3.62	39	3.85	59	3.75	24	3.72	29
Diagnose/prescribe therapy for renal disease	Expectation	3.55	29	3.42	12	3.62	39	3.58	59	3.63	24	3.28	29
	Experience	3.93	29	4.08	12	4.18	39	4.33	58	4.13	24	3.90	29
Diagnose/prescribe therapy for neurological disease	Expectation	3.24	29	2.83	12	3.44	39	3.12	59	3.13	24	3.34	29
	Experience	3.93	29	3.42	12	3.59	39	3.81	59	3.29	24	3.69	29
Diagnose/prescribe therapy for ocular disorders	Expectation	2.62	29	3.58	12	3.79	39	2.81	58	2.96	24	3.14	29
	Experience	3.24	29	3.83	12	3.77	39	3.54	59	3.46	24	3.59	29
Perform orthopedic surgery	Expectation	2.14	29	3.67	12	1.87	39	2.14	59	2.46	24	2.50	30
	Experience	4.76	29	6.50	12	5.15	39	4.73	59	4.83	24	4.27	30
Perform soft tissue surgery	Expectation	2.93	29	3.50	12	2.92	39	2.78	59	3.50	24	2.60	30
	Experience	3.93	29	4.33	12	3.82	39	3.83	59	4.25	24	4.00	30
Spay or neuter	Expectation	3.45	29	4.33	12	3.62	39	3.19	59	4.00	24	3.13	30
	Experience	4.41	29	5.17	12	4.31	39	4.51	59	4.63	24	4.07	30
Manage reproductive programs	Expectation	3.28	29	4.00	12	3.13	39	2.80	59	3.38	24	3.17	30
	Experience	4.24	29	5.17	12	4.87	39	4.90	59	4.54	24	5.00	30
Evaluate disease outbreaks	Expectation	3.69	29	4.50	12	3.21	39	2.73	59	2.79	24	3.07	30
	Experience	4.28	29	5.42	12	5.15	39	4.85	59	3.75	24	4.30	30
Evaluate new drugs/products	Expectation	3.45	29	3.25	12	3.13	39	3.07	59	3.58	24	3.10	30
	Experience	3.90	29	3.83	12	3.85	39	3.69	59	3.96	24	4.03	30
Interpret medical literature	Expectation	3.62	29	3.50	12	3.77	39	3.15	59	3.79	24	3.62	29
	Experience	3.83	29	4.42	12	4.00	39	3.56	59	3.88	24	4.07	30
Deal with people	Expectation	3.21	29	3.83	12	3.56	39	3.78	60	3.46	24	3.40	30
	Experience	4.00	29	4.42	12	4.21	39	4.25	60	4.17	24	4.03	30
About veterinary medicine as a business	Expectation	1.76	29	2.00	12	2.59	39	2.67	60	2.79	24	2.57	30
	Experience	3.31	29	3.17	12	3.51	39	3.13	60	3.88	24	3.60	30
Giving educational presentations to the community	Expectation	2.59	29	3.92	12	2.97	39	2.98	60	3.13	24	2.67	30
	Experience	3.90	29	4.83	12	4.54	39	4.80	60	4.50	24	4.37	30
Communicating with clients	Expectation	3.24	29	3.83	12	3.62	39	3.77	60	3.54	24	3.57	30
	Experience	4.07	29	4.50	12	4.26	39	4.25	60	4.21	24	4.53	30

University of Illinois		Iowa State University		Kansas State University		Louisiana State University		Cummings SVM at Tufts University		Michigan State University		University of Minnesota		Mississippi State University		Purdue University		Cornell University	
Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
2.78	32	2.94	33	2.81	32	3.31	26	3.36	36	3.06	35	3.12	34	3.15	26	3.29	24	3.38	24
3.76	33	3.50	32	3.55	31	3.88	26	3.61	36	3.66	35	3.64	33	3.85	26	3.46	24	4.17	24
3.34	32	3.42	33	3.63	32	3.58	26	3.97	36	3.60	35	3.79	34	3.42	26	4.00	24	3.75	24
3.97	33	3.84	32	3.87	31	4.19	26	4.08	36	4.03	35	4.00	33	4.08	26	3.96	24	4.54	24
2.63	32	3.18	33	2.75	32	3.08	26	3.83	36	2.89	35	3.12	34	2.81	26	3.83	24	3.42	24
3.67	33	3.19	32	3.45	31	3.46	26	3.72	36	3.43	35	3.52	33	3.38	26	3.58	24	4.17	24
3.56	32	3.30	33	3.41	32	3.54	26	3.25	36	2.86	35	3.21	34	2.38	26	3.38	24	3.33	24
3.82	33	3.41	32	3.97	31	3.65	26	3.75	36	3.17	35	3.75	32	3.35	26	3.88	24	3.96	24
1.79	33	1.61	33	1.84	32	3.27	26	3.17	36	2.66	35	3.15	34	2.35	26	2.92	24	2.25	24
4.73	33	4.61	33	3.88	32	4.92	26	6.56	36	5.40	35	5.91	34	3.38	26	6.46	24	6.29	24
2.88	33	3.45	33	2.78	32	3.58	26	2.83	36	2.74	35	3.00	34	3.69	26	3.71	24	3.17	24
4.09	33	4.13	32	3.91	32	4.38	26	4.03	36	3.74	35	3.68	34	4.12	26	4.25	24	5.21	24
3.52	33	4.03	33	3.50	32	4.08	26	3.58	36	3.49	35	3.65	34	4.81	26	4.58	24	3.75	24
4.45	33	4.82	33	4.50	32	4.81	26	4.69	36	4.54	35	4.45	33	4.81	26	4.83	24	5.54	24
3.21	33	3.18	34	3.50	32	3.19	26	2.78	36	2.20	35	2.71	34	3.54	26	3.42	24	2.96	24
5.44	32	4.26	34	5.50	32	4.88	26	5.22	36	4.57	35	4.85	34	4.69	26	4.88	24	4.46	24
3.12	33	3.03	34	3.72	32	2.69	26	2.92	36	2.86	35	2.76	34	3.96	26	3.13	24	2.79	24
5.22	32	4.03	34	4.91	32	4.42	26	5.20	35	4.29	35	4.79	34	4.73	26	4.75	24	3.25	24
2.94	33	3.12	33	2.69	32	2.69	26	3.53	36	2.66	35	3.18	34	3.23	26	3.33	24	3.21	24
3.82	33	3.64	33	3.72	32	3.38	26	3.72	36	3.77	35	3.67	33	3.88	26	3.67	24	4.08	24
3.36	33	3.55	33	3.03	32	3.12	26	3.67	36	3.09	35	3.79	34	3.73	26	3.75	24	3.42	24
3.88	33	3.88	33	3.56	32	3.69	26	3.72	36	3.97	35	3.65	34	3.92	26	4.00	24	3.71	24
2.79	33	3.15	33	2.75	32	2.96	26	3.25	36	3.06	35	3.71	34	2.73	26	3.29	24	3.21	24
4.09	33	4.00	33	3.75	32	3.85	26	4.00	36	4.03	35	3.91	34	3.54	26	3.79	24	3.92	24
2.15	33	2.36	33	1.94	32	2.50	26	2.47	36	2.26	35	2.71	34	2.62	26	2.63	24	2.21	24
3.39	33	3.21	33	3.34	32	3.23	26	3.19	36	3.57	35	3.32	34	2.81	26	2.92	24	3.58	24
2.67	33	2.85	33	2.97	32	2.81	26	2.81	36	2.86	35	3.24	34	3.35	26	3.00	24	2.83	24
4.52	33	4.58	33	3.88	32	4.92	26	5.08	36	4.34	35	4.15	34	4.77	26	4.04	24	4.33	24
2.94	33	3.33	33	3.09	32	3.00	26	3.31	36	3.31	35	3.76	34	3.42	26	3.42	24	3.50	24
4.18	33	3.94	33	3.97	32	4.19	26	4.08	36	4.00	35	4.18	34	3.81	26	3.79	24	4.46	24

		Oklahoma State University		University of Pennsylvania		Texas A&M University		Washington State University		University of Missouri-Columbia		The Ohio State University		Oregon State University	
		Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Diagnose/prescribe therapy for respiratory disease	Experience	3.00	24	3.24	34	3.40	70	3.09	23	3.03	34	3.26	39	3.05	21
	Expectation	3.54	24	4.09	35	3.96	70	3.70	23	3.56	34	3.76	38	3.90	21
Diagnose/prescribe therapy for renal disease	Experience	3.42	24	3.59	34	3.74	70	3.78	23	3.68	34	3.67	39	3.33	21
	Expectation	4.54	24	4.37	35	4.24	70	4.43	23	4.24	34	4.13	38	4.29	21
Diagnose/prescribe therapy for neurological disease	Experience	2.88	24	3.21	34	3.67	70	3.57	23	3.26	34	3.36	39	2.90	21
	Expectation	3.33	24	3.97	35	3.93	70	3.52	23	3.41	34	3.76	38	3.33	21
Diagnose/prescribe therapy for ocular disorders	Experience	3.42	24	3.18	34	2.16	70	3.48	23	3.50	34	3.31	39	2.19	21
	Expectation	3.96	23	3.94	35	3.36	69	3.78	23	3.65	34	3.47	38	3.29	21
Perform orthopedic surgery	Experience	1.46	24	2.97	35	2.63	70	2.70	23	1.76	34	1.92	39	2.19	21
	Expectation	4.96	24	5.80	35	4.33	70	4.17	23	4.12	34	4.58	38	5.48	21
Perform soft tissue surgery	Experience	2.88	24	3.11	35	3.51	70	3.43	23	2.68	34	3.59	39	3.00	21
	Expectation	4.13	24	4.34	35	4.26	70	4.13	23	4.18	34	4.53	38	4.67	21
Spay or neuter	Experience	3.83	24	3.34	35	4.36	70	3.91	23	3.09	34	4.45	38	4.24	21
	Expectation	4.67	24	5.00	35	4.84	69	4.74	23	4.62	34	5.24	38	5.05	20
Manage reproductive programs	Experience	3.00	24	2.86	35	3.21	70	3.17	23	2.79	34	2.92	39	3.19	21
	Expectation	4.96	24	5.26	35	5.34	70	5.17	23	4.68	34	4.37	38	4.86	21
Evaluate disease outbreaks	Experience	2.79	24	2.94	35	3.63	70	3.30	23	2.74	34	3.26	39	3.19	21
	Expectation	4.13	23	5.37	35	4.97	70	4.35	23	4.53	34	5.42	38	5.19	21
Evaluate new drugs/ products	Experience	3.00	24	3.34	35	3.50	70	3.17	23	3.15	34	3.36	39	3.48	21
	Expectation	3.79	24	3.71	35	4.06	70	3.52	23	3.94	34	4.18	38	3.95	21
Interpret medical literature	Experience	3.29	24	3.80	35	3.86	70	3.57	23	3.50	34	3.74	39	3.76	21
	Expectation	3.67	24	3.60	35	3.96	70	3.52	23	3.82	34	4.03	38	3.81	21
Deal with people	Experience	3.04	24	3.00	35	3.40	70	3.61	23	3.00	34	3.54	39	3.10	21
	Expectation	4.00	24	4.46	35	4.14	70	3.96	23	3.74	34	4.29	38	4.62	21
About veterinary medicine as a business	Experience	1.83	24	2.97	35	2.79	70	2.57	23	1.97	34	2.90	39	2.33	21
	Expectation	3.29	24	3.51	35	3.89	70	3.43	23	2.91	34	3.50	38	4.57	21
Giving educational presentations to the community	Experience	2.42	24	3.17	35	3.04	70	2.70	23	2.29	34	2.77	39	3.10	21
	Expectation	4.92	24	5.60	35	4.71	70	4.48	23	3.62	34	4.21	38	4.95	21
Communicating with clients	Experience	3.29	24	3.00	35	3.51	70	3.86	22	3.29	34	3.87	39	3.14	21
	Expectation	4.00	24	4.43	35	4.22	69	3.96	23	4.00	34	4.29	38	4.81	21

Table 9

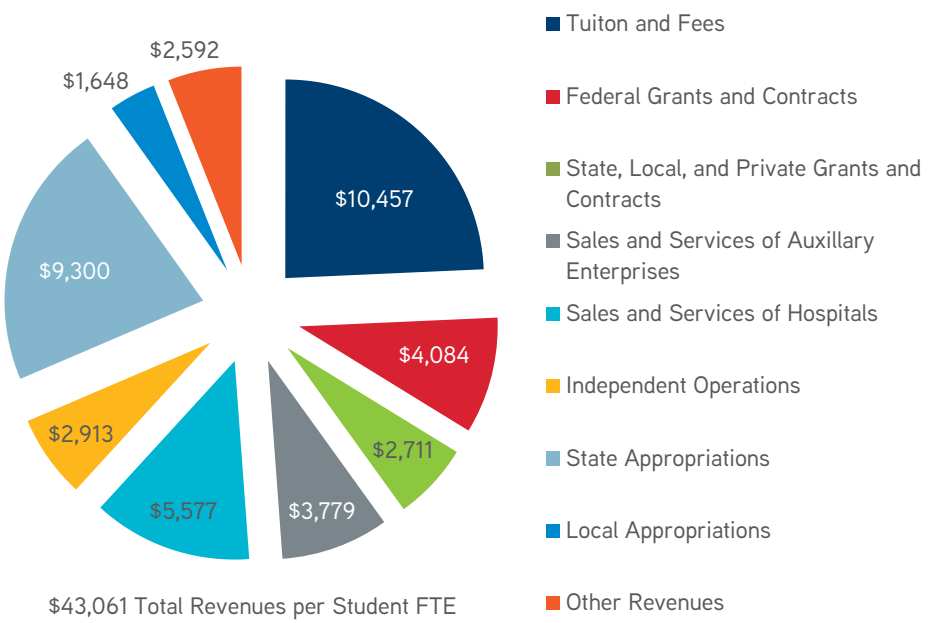
University of Tennessee		Virginia-Maryland College		North Carolina State University		University of Wisconsin		Western University-California		Ross University		St. George's University		Other		St. Matthew's University		National	
Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
3.04	26	3.64	33	3.33	21	3.29	24	3.22	27	3.25	80	3.27	26	3.36	85	4.00	6	3.20	1067
3.38	26	3.91	34	3.75	20	3.83	24	3.67	27	3.75	80	3.73	26	3.87	82	4.67	6	3.76	1062
3.81	26	4.18	34	3.95	20	4.17	24	4.07	27	3.61	80	3.58	26	3.73	85	4.50	6	3.68	1067
4.00	26	4.47	34	4.45	20	4.29	24	4.41	27	4.03	80	4.12	26	4.15	82	4.83	6	4.16	1061
3.23	26	3.65	34	3.33	21	3.67	24	3.19	27	2.98	80	3.46	26	3.18	85	4.00	6	3.24	1068
3.31	26	3.71	34	3.65	20	4.04	24	3.56	27	3.34	80	3.69	26	3.62	82	4.33	6	3.61	1062
3.65	26	3.56	34	3.70	20	3.83	24	2.89	27	2.69	80	2.85	26	2.92	85	3.67	6	3.09	1066
3.62	26	3.94	34	3.90	20	4.17	24	3.30	27	3.23	80	3.62	26	3.52	82	4.33	6	3.60	1059
2.00	27	2.26	34	3.59	22	1.83	24	2.52	27	2.35	80	2.58	26	2.40	84	1.83	6	2.38	1072
3.93	27	5.44	34	5.95	22	5.58	24	4.81	27	4.29	79	5.04	26	4.20	84	2.17	6	4.85	1070
2.93	27	3.06	34	3.27	22	3.04	24	3.26	27	3.43	80	3.50	26	3.06	83	3.67	6	3.15	1071
4.00	27	4.18	34	4.68	22	4.58	24	4.26	27	4.00	80	4.08	26	3.81	83	3.67	6	4.12	1069
3.48	27	3.56	34	3.77	22	3.71	24	4.30	27	3.91	80	4.08	26	3.48	82	3.83	6	3.77	1069
4.37	27	4.62	34	5.09	22	5.33	24	4.78	27	4.65	80	4.50	26	4.35	83	4.00	6	4.67	1067
2.67	27	3.29	34	3.23	22	3.96	24	2.96	27	2.95	80	2.81	26	3.04	85	2.50	6	3.06	1074
3.56	27	5.03	34	5.82	22	6.25	24	5.52	27	4.50	80	4.50	26	4.61	85	3.67	6	4.86	1072
2.92	26	3.44	34	3.50	22	3.50	24	3.38	26	3.14	80	2.96	26	3.50	84	3.00	6	3.19	1071
4.00	27	4.94	34	5.27	22	5.42	24	5.38	26	4.06	80	4.04	26	4.77	84	3.17	6	4.68	1068
3.04	27	3.41	34	3.14	21	3.67	24	3.44	27	3.24	79	2.85	26	3.27	85	3.17	6	3.21	1071
3.96	27	3.97	34	4.24	21	4.13	24	4.15	27	3.97	78	3.81	26	3.77	84	3.83	6	3.86	1067
3.44	27	3.71	34	3.86	21	3.67	24	4.30	27	3.57	79	3.35	26	3.64	84	3.83	6	3.58	1069
3.93	27	4.15	34	4.19	21	3.75	24	4.26	27	3.85	79	3.73	26	3.98	83	5.33	6	3.87	1068
3.41	27	3.40	35	3.14	21	3.58	24	4.19	27	3.25	80	3.31	26	3.44	84	3.17	6	3.32	1073
3.96	27	4.29	35	4.38	21	4.38	24	4.37	27	4.23	80	4.19	26	4.16	83	4.33	6	4.11	1071
2.33	27	2.66	35	3.05	20	2.42	24	2.93	27	2.48	80	2.35	26	2.55	83	2.33	6	2.49	1071
2.78	27	3.74	35	4.24	21	3.33	24	3.52	27	3.56	80	3.38	26	3.53	83	3.17	6	3.44	1071
2.85	27	3.00	35	2.67	21	3.17	24	3.19	27	2.89	80	2.69	26	3.08	83	3.00	6	2.92	1072
4.22	27	4.77	35	4.33	21	4.08	24	4.89	27	3.96	80	4.15	26	4.51	83	5.67	6	4.48	1071
3.63	27	3.66	35	3.62	21	3.79	24	4.04	27	3.48	80	3.15	26	3.46	83	3.50	6	3.47	1071
4.00	27	4.60	35	4.48	21	4.42	24	4.56	27	4.25	80	4.19	26	4.16	82	4.33	6	4.21	1069

FACTORS THAT REDUCE THE COSTS OF VETERINARY EDUCATION

As noted previously, numerous factors reduce the veterinary student's costs of veterinary education. These include regional exchanges and state-to-state contractual arrangements, changing residency status, and scholarships.

The public universities and colleges receive funds from state and local governments to assist state resident students with the cost of education. The National Center for Educational Statistics provides information on the number of students, faculty and staff, degrees granted and finances of public and private degree-granting and non-degree-granting institutions in the United States, both nationally and by state. Revenues from non-operating (state and local appropriations and other non-operating sources) and operating sources (tuition and fees, grants and contracts, and sales of products and services) are tracked by academic year. These "non-operating" sources of revenue as a percent of the total revenue comprised just fewer than 40 percent of the total national average revenue per full-time equivalent (FTE) student, or roughly $43,000 in 2014.

PER-STUDENT REVENUES FOR FOUR-YEAR PUBLIC INSTITUTIONS, 2014



$43,061 Total Revenues per Student FTE

Figure 46

While tuition and fees comprise approximately $10,500 per student FTE of the total revenue for these four-year public institutions, the expenditures on instruction per student FTE was roughly $9,900 in 2014, a total expenditure per FTE student of $40,033.

PER-STUDENT EXPENDITURES FOR FOUR-YEAR PUBLIC INSTITUTIONS, 2014

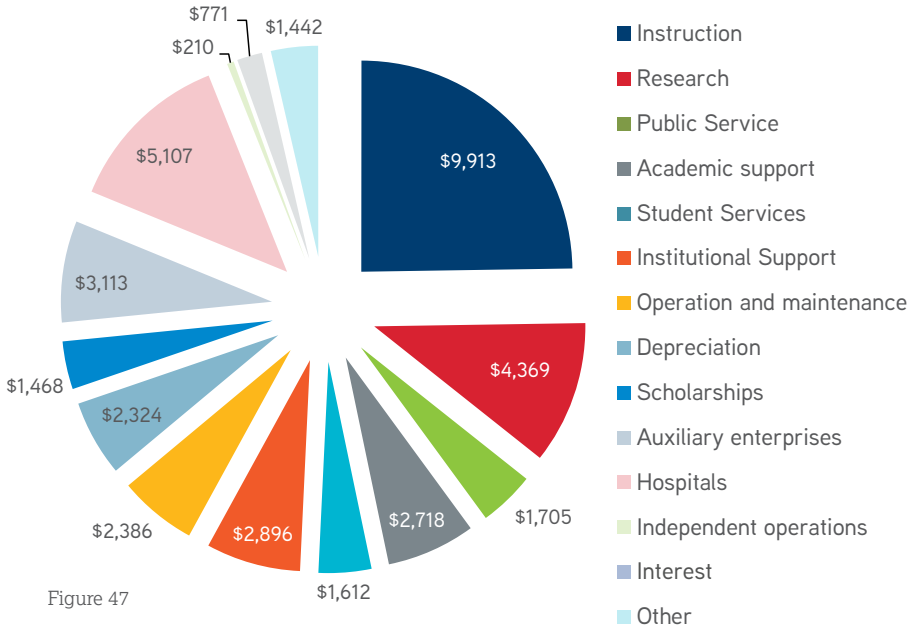


Figure 47

The state and local contribution to the total revenues of the four-year public institutions vary considerably by state from a low of 15.2 percent in Colorado to a high of 58.2 percent in Wyoming.

NON-OPERATING REVENUE AS A PERCENT OF TOTAL REVENUE FOR PUBLIC POST-SECONDARY INSTITUTIONS, 2014

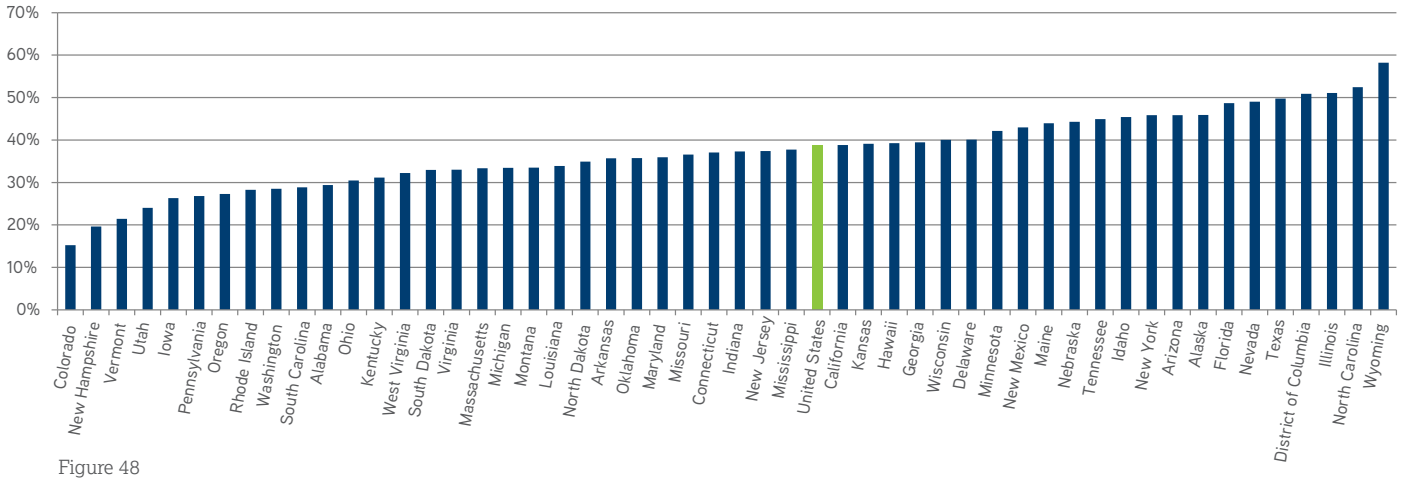


Figure 48

If non-operating revenues were an important factor in the price of a DVM seat, the share of the non-operating revenue as a percent of total revenue would be expected to be closely aligned with the annual level of tuition and fees charged by the colleges of veterinary medicine in each state. However, there is no statistical relationship between these two variables. In fact, some of the veterinary colleges in states where the share of non-operating revenues is higher than the national average (e.g., Florida) also have higher than average veterinary college tuition rates while other states where the share of non-operating revenues is lower than the national average (e.g., Alabama) have veterinary college tuition rates that are below the average for all veterinary colleges. This suggests that there may be reasons internal to the various public colleges that are driving the tuition rates for the veterinary colleges.

OPERATING REVENUE AS A PERCENT OF TOTAL REVENUE FOR PUBLIC POST-SECONDARY INSTITUTIONS, 2014

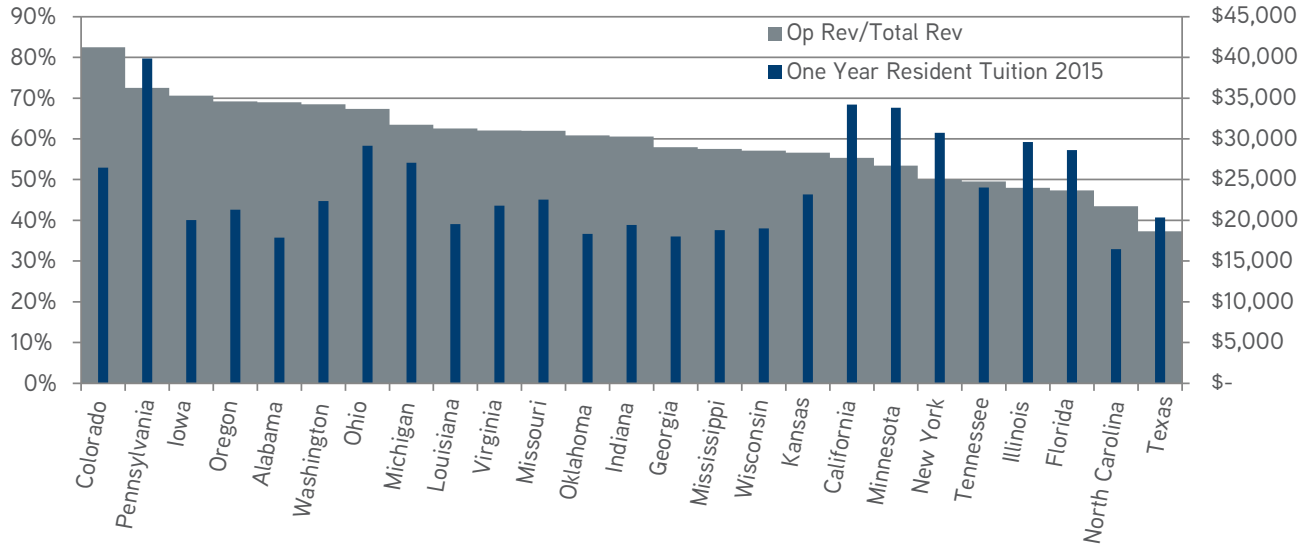
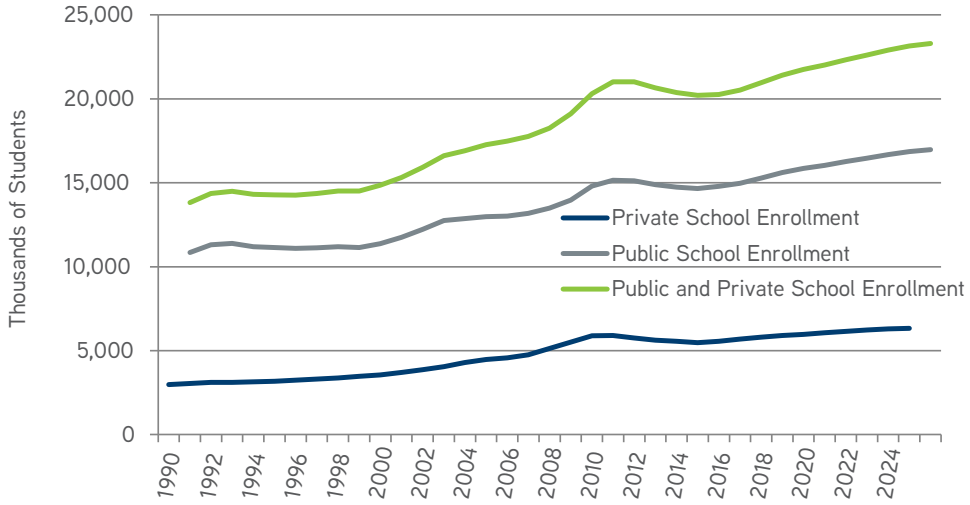


Figure 49

ENROLLMENT IN DEGREE-GRANTING POST-SECONDARY INSTITUTIONS

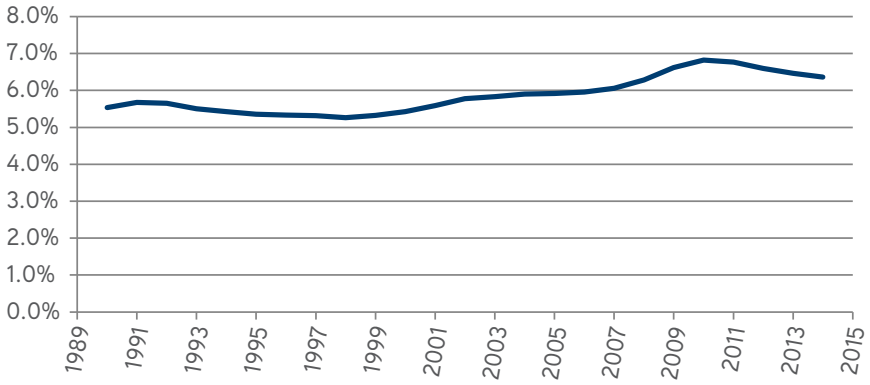


Reference: National Center for Educational Statistics

Figure 50

The enrollment levels did decline during the post-recession period from 2010 to 2014, however, reducing the share of operating revenue and increasing the costs per student FTE. And, because the non-operating revenues also declined during the same period, public institutions were faced with a decline in both operating and non-operating revenue and were required to either cut expenditures or increase tuition and fees (and/or other operating sources of revenue such as scholarship funding or grants and contracts), or do both.

ENROLLMENT IN POST-SECONDARY EDUCATION AS A PERCENT OF POPULATION



Reference: National Center for Educational Statistics

Figure 51

Considering only the revenues from tuition and fees and state appropriation, this cycle of reduced revenue per student FTE at each period of economic recession can be seen along with the declining share of state appropriations and the increasing share of tuition and fees. More important is the contrast with the total revenue from these two revenue sources compared to the level of FTE enrollment over time. The total revenue from these two major sources of funding for public education have remained nearly flat for almost three decades at $12,000 per student FTE while the total number of student FTEs over the same period has risen by 50 percent, an additional 4 million student FTEs.

EDUCATIONAL APPROPRIATIONS AND NET TUITION REVENUE

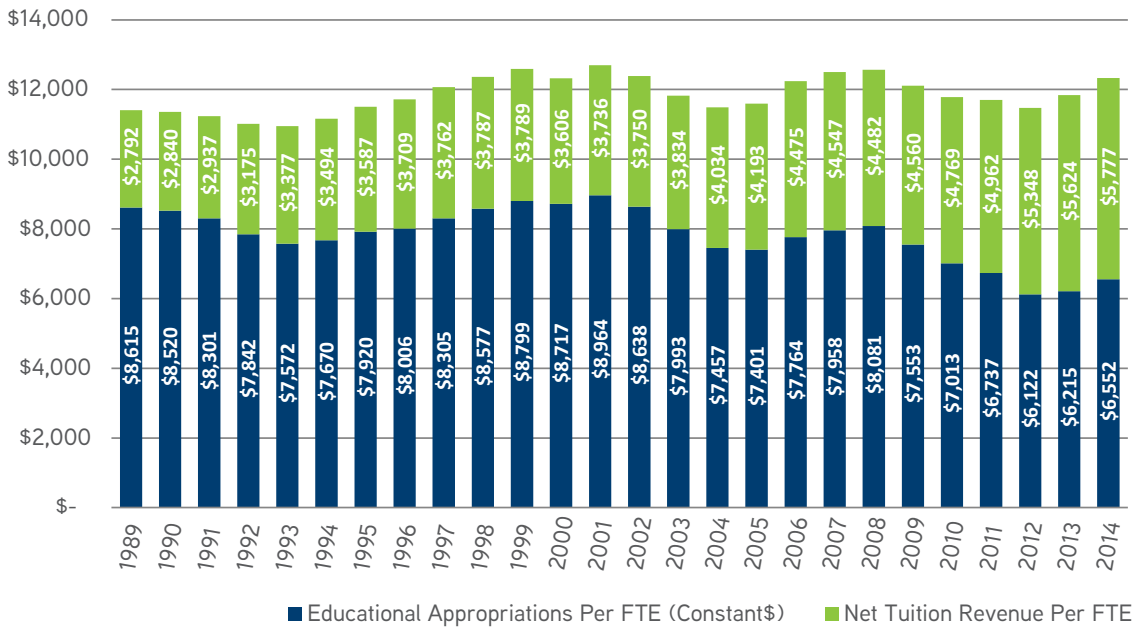


Figure 52

Also, during the last three decades the graduation rate has increased across bachelors, masters and doctorial levels. In 1990, only one in nine of the total enrolled students graduated with one of the three degrees, while today that number has improved to one in seven. However, even this graduation rate is inefficient as administrators attempt to spread costs evenly across remaining students.

ENROLLMENT AND GRADUATES AS A PERCENT OF U.S. POPULATION

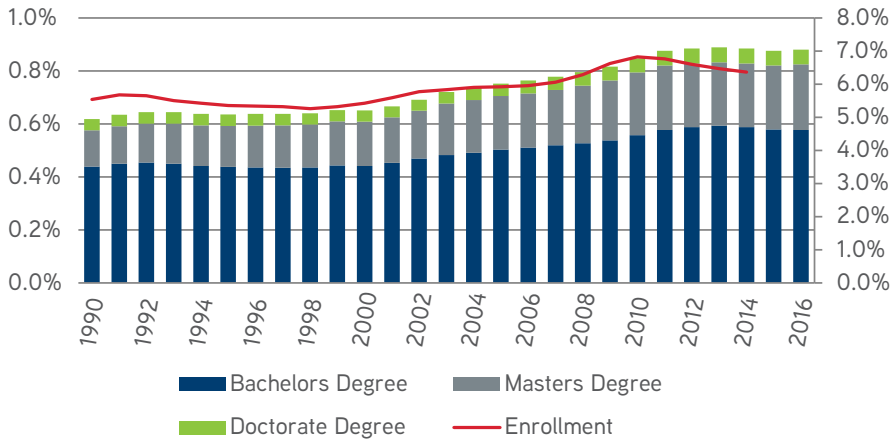


Figure 53

The dollars spent per student enrolled today is two and a half times what it was in 1990. In real 2010 dollars, the total cost of public education per student has risen by $10,000, from just more than $15,000 in 1990 to roughly $25,000 today. The reasons for this increasing cost per student are many but certainly include those that are common problems in today's economy, such as the rising costs of retirement and health care, the increased financial burden associated with regulations and accountability requirements, and the cost of staying current with the latest technology.

DOLLARS SPENT PER STUDENT ENROLLED

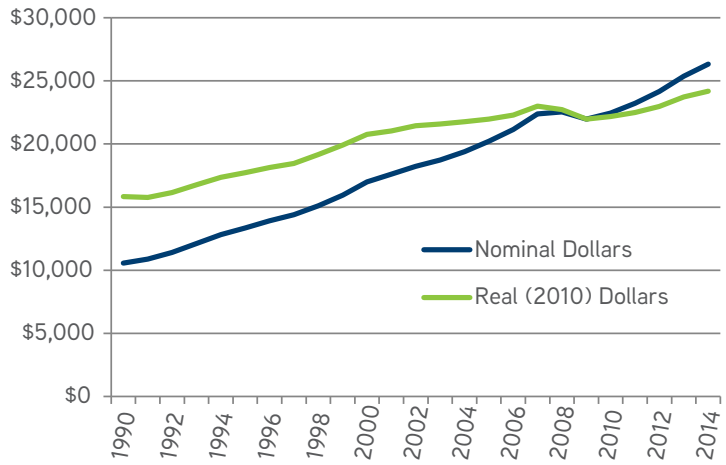


Figure 54

The cost for a college degree, however, is seven times greater than the cost per student enrolled. And, this points to a larger problem in our educational system that is driving costs: efficiency in production. That students require more years to obtain a degree than a degree program warrants, and that less than 40 percent of students obtain a degree is an indication of an inefficient system. The capacity required to provide education to those enrolled is considerably greater than what is needed to graduate students. This excessive capacity is expensive to maintain and places upward pressure on the costs of education.

A school that is staffed for 20,000 students, for example, would consider having four classes of 5,000 students each and the costs of providing this education less sources of non-operating income could be allocated across these students. As the initial class of 5,000 declines each year over the four-year period, however, costs will have to rise as there are fewer students over which to spread the same costs. First-year student retention rates vary from 60 percent to more than 90 percent and represent a large loss in revenues that can only be translated into higher tuition for those remaining.

DOLLARS SPENT PER COLLEGE DEGREE

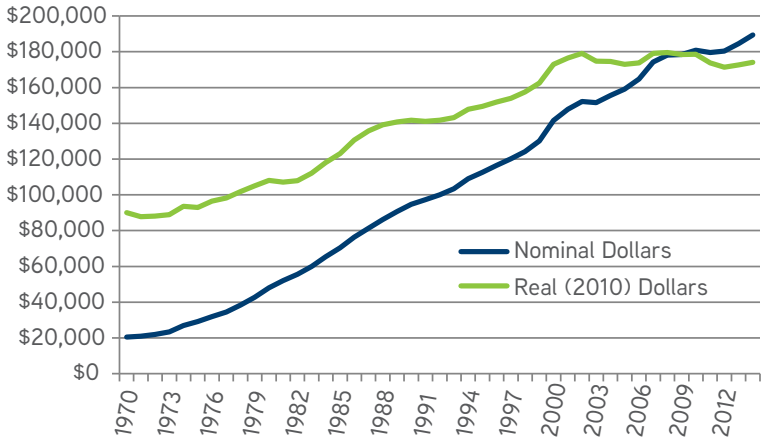


Figure 55

REGIONAL EXCHANGES AND STATE-TO-STATE ARRANGEMENTS

There are 25 U.S. public colleges of veterinary medicine, and because two of these are in a single state (Auburn University and Tuskegee University in Alabama), the majority of states do not have a state-supported, lower-cost veterinary college available for their residents. The public colleges charge different rates for resident and non-resident tuition. The need for differences in tuition and fees were developed long ago and based on the non-resident's home state sharing the funding of the total cost. The rationale was that taxpayers in the state in which the college was located should not have to bear the cost of providing an education to students who were not from that state, since upon completion of their education most would probably return to the state from which they came. Because the state would receive no benefit from the public expenditure of funds for a non-resident's education, taxpayers should not be required to pay these costs. Today, the decline in state support for public education combined with the fact that some non-resident students are remaining in the state where they obtain their education requires new justification for the large discrepancy between resident and non-resident tuition in some states.

In the late 1940s and 1950s, several regional compacts were formed in order to share publicly funded higher education resources. The Southern Regional Education Board (SREB; www.sreb.org) was created in 1948 by Southern governors and legislators, and the Western Interstate Commission for Higher Education (WICHE; www.wiche.edu) was established in 1953 by Western governors. More than 65 years later, both compacts continue to operate regional contract exchanges that significantly reduce the cost of professional healthcare education for students who reside in a state without a public veterinary program (as well as other healthcare fields). Two additional regional compacts serve the Midwest and the Northeast: The New England Board of Higher Education (NEBHE; www.nebhe.org) and the Midwest Higher Education Compact (MHEC; www.mhec.org), but neither operate a similar program for DVM education.

Without these regional programs, non-resident students would be required to pay much higher tuition and would be at a distinct disadvantage upon graduation. Instead, the student's home state provides a "support fee" to the enrolling institution to reduce the student's tuition (students enrolled in a public program typically pay the resident rate) and give them preferential admission as a non-resident.

In the 2016-17 academic year, seven WICHE states without public veterinary colleges (Arizona, Hawaii, Montana, Nevada, New Mexico, North Dakota and Wyoming) spent $5.38 million to reduce tuition costs for 167 new and continuing DVM students studying at one of the five fully-accredited cooperating veterinary colleges in the western U.S. states. Western states supporting DVM students paid $32,400 per student in 2016-17. Institutions participating in WICHE's Professional Student Exchange Program (PSEP) for veterinary medicine are Colorado State University, Oregon State University, Washington State University, Western University of Health Sciences, and the University of California-Davis.

In the 2016-17 academic year, five SREB states without public veterinary colleges (Arkansas, Delaware, Kentucky, South Carolina and West Virginia*) spent more than $9 million to reduce tuition costs for 309 new and continuing DVM students studying at one of the six fully-accredited participating veterinary colleges. In the SREB region, the veterinary medicine program rate is $31,100 per student for academic year 2016-17. Institutions participating in SREB's Regional Contract Program (RCP) for veterinary medicine are Auburn University, Louisiana State University, Mississippi State University, Oklahoma State University, Tuskegee University and University of Georgia.

**West Virginia is phasing out participation in the RCP program.*

Many veterinary colleges, both public and private, have contractual arrangements with other states without public veterinary colleges. These arrangements often lower educational costs or simply provide access to non-residents.

IMPROVING THE DEBT-TO-INCOME RATIO

There has been very little connection between the market for education and the market for graduates with respect to relative price and quantities.

The debt-to-income problem in the veterinary profession is not new, having been discussed numerous times over the past five decades. What is new, however, is the current size of the problem. As illustrated earlier, the current 2:1 mean debt-to-income ratio for graduates from the U.S. colleges of veterinary medicine began to expand from a longer-term plateau of around 1.4:1 in 2006. However, the mean obscures the fact that the debt-to-income ratio is more than 4:1 for nearly 7 percent and greater than 1.4 for more than 68 percent of U.S. graduates. And, this does not include the U.S. students from foreign veterinary colleges where the debt-to-income ratio is likely to be well over the mean.

The rise in tuition and the increased emphasis on recruiting and retention by universities was certainly (at least in part) a response to reduced public (state and federal) funding. However, the sharp rise in tuition met legislative resistance and the public universities resorted to raising fees (outside the jurisdiction of most state legislatures) and to increasing efforts to enroll more students (increased seats) – and to ensuring that students stayed enrolled (higher retention rates).

The rising costs of tuition and fees and the rising number of students increased the supply of graduates as well as the cost of their future veterinary services to animal owners. The increase in the number of seats, especially during the last economic recession, forced the supply of new veterinarians to increase faster than the increase in the demand for the services from these graduates based on the current business models of veterinary practices. Part of this new disequilibrium was from the cost-push of the supply and part of it was the absence of growth in quantity demanded for veterinary services. More importantly, there has been very little connection between the market for education and the market for graduates with respect to relative price and quantities.

HISTORICAL PERSPECTIVE

Before assigning blame for the high DIR that plagues the veterinary profession, a review of the decisions by and overall conditions at the colleges should be considered. And, the outcomes of today need to be considered in the context of decisions that were made in the early part of the new millennium.

A considerable body of research has indicated that the rise in tuition, as a percent of public higher education revenue, over the last two decades stems from declining public support for all public education. Other factors contributing to increased costs per student include the cost of administration, increasing pension and health care costs, and the increasing state and federal regulations that require reporting for compliance.

As noted earlier, the growth in tuition occurred during and just after the recessions of 2001 and 2008 as state and federal legislators cut taxes to stimulate the economy and reduced public support of colleges both in response to declining budgets and shifting priorities. The result of the reduced public support was the increasing share of the total cost that was paid by students as indicated below. It must be noted that during each recession federal and state budgets were cut or held constant in nominal dollars and thus public education, which is a large share of most state budgets, had to be cut. But during the economic expansions following each recession, education budgets rarely returned to where they had been prior to the recession. The result was the step increase in the percent of public higher education that tuition accounted for, each step up resulting from the recession that occurred before it.

NET TUITION AS A PERCENT OF PUBLIC HIGHER EDUCATION TOTAL EDUCATIONAL REVENUE, U.S., FISCAL 1989-2015

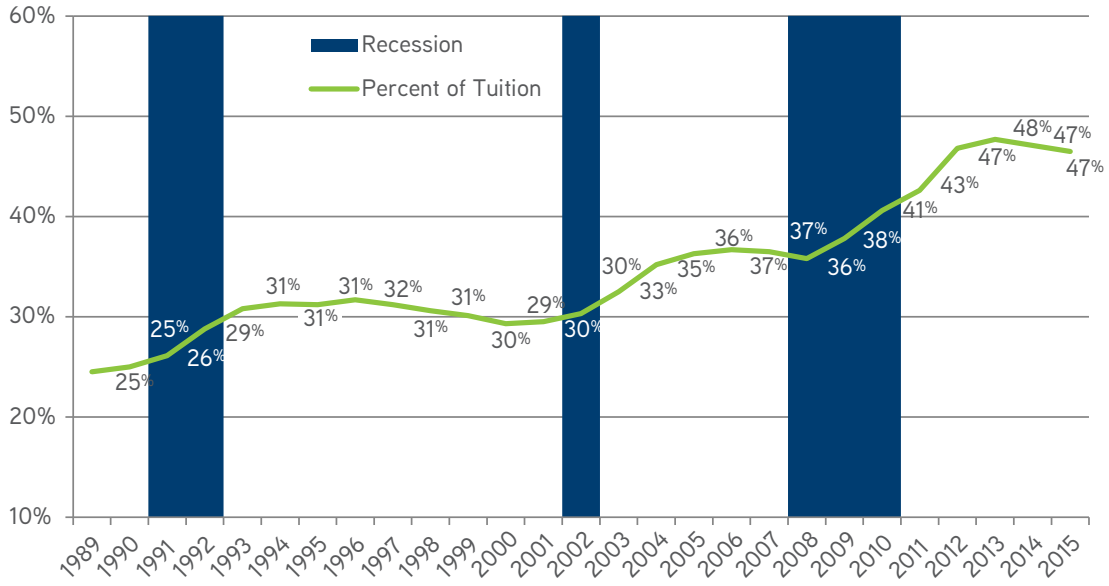


Figure 56

A deeper look at the budgets of the universities finds that growth in professional staff between 2001 and 2014 occurred at a rate of 41.3 percent for all higher education institutions, but only at a rate of 29.5 percent for public institutions. At the same time, there has been an overall decline in non-professional staff at both institutions of higher education and public institutions. Faculty has been the main component of increased staffing, adding nearly 400,000 positions, while roughly 400,000 other professionals have been added between 2001 and 2014. The increasing number of graduate assistants and other professionals may well reflect the growing trend for non-tenure track teaching and research positions, and the need for professional services to manage federal and state reporting requirements.

DISTRIBUTION OF FACULTY AT UNIVERSITIES

	2014	2011	2001	
All institutions	**3,969,226**	**3,840,980**	**3,083,353**	**28.7%**
Professional staff	**3,011,700**	**2,923,961**	**2,132,150**	**41.3%**
Executive/administrative/managerial	259,646	238,718	206,292	25.9%
Faculty (instruction/research/public service)	1,582,360	1,523,615	1,113,183	42.1%
Graduate assistants	363,416	355,916	261,136	39.2%
Other professional	806,278	805,712	551,539	46.2%
Non-professional staff	**957,526**	**917,019**	**951,203**	**-3.6%**
Technical and para-professionals	155,804	196,651	202,283	-2.8%
Clerical and secretarial	480,789	426,174	452,948	-5.9%
Skilled crafts	76,412	60,664	64,801	-6.4%
Service and maintenance	244,521	233,530	231,171	1.0%

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Winter 2011-12, Human Resources component, Fall Staff section.

Table 10

During the 2001 to 2014 time period, employment growth in private institutions occurred at a faster rate than that for public institutions of higher education. Non-professional staff saw greater reduction in the public versus the private institutions. A major component of the reduction in non-professional staff was the reduction in clerical and secretarial staff at the public institutions. Reduced clerical and secretarial staff in public institutions resulted from the adoption of improved communication and word processing technology, and the transfer of some duties to professional staff occurred as budget constraints were imposed.

DISTRIBUTION OF FACULTY AT PUBLIC INSTITUTIONS

	2014	2011	2001	
All public institutions	**2,527,284**	**2,484,820**	**2,136,970**	**18.3%**
Professional staff	**1,913,785**	**1,865,269**	**1,477,953**	**29.5%**
Executive/administrative/managerial	139,745	112,473	107,288	30.3%
Faculty (instruction/research/public service)	968,734	953,230	771,124	25.6%
Graduate assistants	287,852	285,905	219,475	31.2%
Other professional	517,454	513,661	380,066	36.1%
Non-professional staff	**613,499**	**619,551**	**659,017**	**-6.0%**
Technical and para-professionals	95,984	145,098	148,116	-2.0%
Clerical and secretarial	301,625	273,357	305,067	-10.4%
Skilled crafts	55,470	45,597	48,975	-6.9%
Service and maintenance	160,420	155,499	156,859	-0.9%

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Winter 2011-12, Human Resources component, Fall Staff section.

Table 11

Over the period from 2001 to 2014, the full-time equivalent enrollment increased from just fewer than 16 million to nearly 20.7 million students, a 30 percent increase. As mentioned earlier, there has been a decline in full-time equivalent student enrollment since 2010 as the economy has improved. During the same period, professional and non-professional staff increased from just more than 3 million to nearly 4 million, a 28.7 percent increase. The combination of more students and increased staff led to an increasing student to staff ratio of 5.2:1 to 5.5:1 by 2011, but this has returned to the level of 5.2:1 in 2014, with the number of students to faculty falling from 14.3:1 to 13.8 to 1 by 2011 and further declining to 13.1:1 in 2014. Even more remarkable is the rate at which the student to non-professional staff has increased from 16.7:1 in 2001 to 22.9:1 in 2011 and then falling to 21.6:1 by 2014.

DISTRIBUTION OF FACULTY AND TOTAL STUDENTS

Total Students	20,663,464	20,994,113	15,927,987	31.8%
	2014	2011	2001	
All institutions	**5.2**	**5.5**	**5.2**	**0.8%**
Professional staff	6.9	7.2	7.5	-8.2%
Executive/administrative/managerial	79.6	87.9	77.2	3.1%
Faculty (instruction/research/public service)	13.1	13.8	14.3	-8.7%
Graduate assistants	56.9	59	61	-6.8%
Other professional	25.6	26.1	28.9	-11.3%
Non-professional staff	**21.6**	**22.9**	**16.7**	**28.9%**
Technical and para-professionals	132.6	106.8	78.7	68.4%
Clerical and secretarial	43.0	49.3	35.2	22.2%
Skilled crafts	270.4	346.1	245.8	10.0%
Service and maintenance	84.5	89.9	68.9	22.6%

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Winter 2011-12, Human Resources component, Fall Staff section

Table 12

In real dollars, annual tuition costs actually fell between 2001 and 2014, from $12,664 to $12,266 per student as the real dollar value of state support for public higher education fell from $86 billion to $77 billion.

REVENUES AND STATE SUPPORT

	FY	State Support for Public and Independent Higher Education	Net Tuition	Total Educational Revenues	FTE Enrollment Net of Medical Students	Tuition as a Percent of Total Educational Revenue	Tuition per Student FTE
U.S.	2001	86,119,423,844	32,331,485,498	109,760,257,081	8,667,368	29.50%	12,664
U.S.	2014	76,948,133,078	64,343,050,029	136,608,613,721	11,137,541	47.10%	12,266

Table 13

In many institutions the protection of undergraduates from tuition and fee increases as a matter of political necessity shifted more of the burden for off-setting declining public revenues and increasing cost to the graduate and professional programs. The only source of revenue that was available to these programs was tuition and fees and this could be gained through raising the price of a seat or increasing the number of seats without increasing staff or fixed expenses. While the colleges have continually been admonished by members of the veterinary profession for increasing the number of seats, failure to have done so would have driven the costs of seats considerably higher.

NUMBER OF SEATS IN U.S. VETERINARY COLLEGES

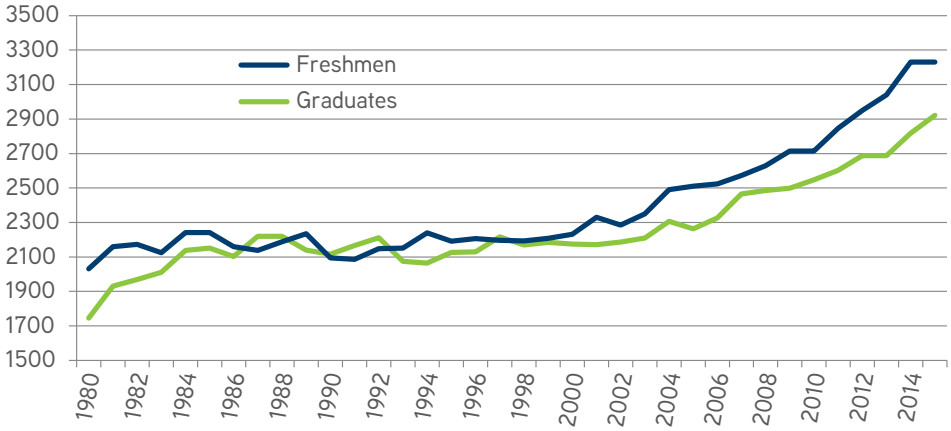


Figure 57

Politically, there is an important message here. For at least the last three decades the public has been defunding public education at the same time the real costs of operating these schools has risen. In short, for the veterinary profession this has shifted the burden of providing animal health from the taxpayer to the animal owner. The food animal owner has faced considerable friction in passing these increased veterinary costs to animal protein consumers as they are constrained by the competition from other protein providers. For the pet owner, pet health expenditures compete for a share of shrinking real disposable income with other expenditures that have risen for reasons similar to those of veterinary services.

Clearly the subsidization of animal health care services by the public funding of the institutions that produce veterinarians has benefited animal owners in the past, and now these owners will be required to pay a larger share of the cost of maintaining the health of their animals. But veterinary medicine is not only a private good but a public good: By ensuring that all pets have rabies vaccinations reduces the risk that any member of society (pet owner or not) contracts rabies; and ensuring that some major zoonotic disease does not become a spillover event that severely reduces the supply of animal protein ensures that every American (and, in fact, every human) has the cheapest access to any source of protein.

Veterinarians perform both a private and a public service and thus should receive compensation from both entities. The compensation from the public occurred in the past through the public support of veterinary education. This support reduced the cost of education to the veterinary student and allowed the student to attain a standard of living that was somewhat unfettered by student debt. Today this scenario no longer exists and, in fact, many veterinarians now pay the full cost of their education, receiving no public support and still provide public services. In economics this is known as a market failure: Consumers are obtaining benefits without paying for them. And, the first role of government is to ensure against market failures. Hence we have rules to prevent market failure (anti-trust laws, fines for pollution, regulations to prevent pollution, and taxation to provide for important public goods such as national defense).

Clearly, the emphasis on lower taxes and declining public services has shifted the costs of various goods and services from taxpayers to the consumers of those goods and services. The rise in human health care costs can find a source in the reduced public support for medical education. And this is true for nearly every product and service that requires a college educated employee to develop, manufacture, sell or deliver. The question is why this cascading effect of lower taxes and public support of education hit the veterinary profession so hard? The debt is only one half of the equation. The other half is income. So while all professions have had the same problem with cost of education and the associated student debt, the only remaining answer is that the veterinary profession must have a much more severe problem with income.

SETTING A NEW TARGET

As mentioned in previous reports, the current growth in the mean debt-to-income ratio is unsustainable. An appropriate near-term target would be to reduce the ratio from the current 2:1 to 1.4:1. There are four groups that must be involved in this effort: the general public, veterinary colleges, veterinary students, and veterinary employers. Before we begin to discuss the strategies to reduce the debt to income ratio, however, closer look at the source of the debt is in order.

The values for debt and income are reported by students prior to graduation, and for 2016, out of 2,932 graduates, 2,600 reported a value (including zero) for debt, but only 1,424 reported both a debt and income from full-time employment. Using these data, the DIR was computed for each school. Assuming there is no difference in income of the graduates of each school, the higher the DIR the greater the cost of tuition and fees. The following table illustrates the mean DIR of 2016 graduates, by school, who secured full-time employment.

DEBT-TO-INCOME RATIO BY SCHOOL, 2016, FULL-TIME ONLY

Veterinary Medical College	Mean	N	Std. Deviation
Tuskegee University	3.6613	32	2.44716
Western University - California	3.2289	26	1.69348
Kansas State University	2.6916	52	1.64776
University of Minnesota	2.5659	46	1.57459
Michigan State University	2.5294	50	1.94381
The Ohio State University	2.4450	81	1.47246
Colorado State University	2.2650	47	1.61308
University of Pennsylvania	2.2447	33	1.30823
University of Illinois	2.1566	44	1.59330
University of Florida	2.1508	68	1.55781
University of Tennessee	2.1062	32	1.15614
Oregon State University	2.0765	37	1.46118
Mississippi State University	2.0743	46	2.23513
Total/National Mean	**2.0322**	**1,424**	**1.49291**
Louisiana State University	2.0278	44	1.17456
Virginia-Maryland College	2.0207	69	1.32811
Cummings SVM at Tufts University	1.9863	29	1.41549
Washington State University	1.9681	80	1.22865
University of Missouri-Columbia	1.9120	79	1.03730
Oklahoma State University	1.9075	53	1.21615
Iowa State University	1.8884	73	1.00137
University of California-Davis	1.7925	44	1.15669
University of Georgia	1.7831	52	1.69783
Cornell Veterinary College	1.7586	38	1.67597
Purdue University	1.6145	39	1.02890
Auburn University	1.5967	67	1.21627
North Carolina State University	1.5291	50	1.14030
University of Wisconsin	1.4167	38	1.14020
Texas A&M University	1.0212	75	.77726

Table 14

DEBT-TO-INCOME RATIO BY SCHOOL, 2016 ALL GRADUATES

	Mean	N	Std. Deviation
Western University - California	6.0337	67	3.76665
Tuskegee University	5.3852	48	4.25297
University of Tennessee	4.2311	55	3.5571
Kansas State University	3.8177	75	2.93959
The Ohio State University	3.7849	128	3.24625
University of Minnesota	3.5101	78	2.6809
University of Pennsylvania	3.4653	79	3.16399
Mississippi State University	3.3524	73	3.31999
Cummings SVM at Tufts University	3.3102	69	3.02122
Michigan State University	2.9771	71	2.50379
Cornell Veterinary College	2.9687	87	2.75478
Oregon State University	2.9414	51	2.45222
Total/National Mean	**2.9274**	**2,257**	**2.70727**
Colorado State University	2.9009	78	2.27205
University of Illinois	2.8038	70	2.26365
University of Florida	2.7657	85	2.25526
Purdue University	2.7611	59	2.69455
Virginia-Maryland College	2.6399	99	2.36174
University of California-Davis	2.6389	120	2.54839
Iowa State University	2.5975	94	2.13256
Oklahoma State University	2.5488	73	1.94725
Louisiana State University	2.5138	66	1.89737
University of Missouri-Columbia	2.4868	100	2.02123
University of Georgia	2.2739	89	2.29146
North Carolina State University	2.2713	84	1.83083
Auburn University	2.2214	98	2.17841
Washington State University	1.9503	92	1.45572
University of Wisconsin	1.9035	68	1.67982
Texas A&M University	1.3606	101	1.58046

Table 15

Schools with the highest DIR for the 2016 graduating class were Western University, Tuskegee University and University of Tennessee. Conversely, schools with the lowest DIR for 2016 graduates were Washington State University, University of Wisconsin and Texas A&M University.

By comparison, we can use the tuition and fees and the living costs estimated by each school to calculate a mean total cost (tuition plus living expenses) to income ratio for each school. These two tables can then be used to compare the debt-to-income and cost-to-income for each school.

TOTAL COST-TO-INCOME RATIO BY SCHOOL, 2016

	Mean	N	Std. Deviation
University of Pennsylvania	9.3593	78	4.21400
Cummings SVM at Tufts University	7.5144	67	3.13049
Western University - California	6.8158	68	2.60808
Cornell Veterinary College	6.0165	86	2.87891
University of California-Davis	5.9106	114	2.61559
Kansas State University	5.1517	76	3.08381
The Ohio State University	5.0581	129	2.81320
Colorado State University	4.9549	79	2.32411
Mississippi State University	4.7351	69	2.96055
Total/National Mean	**4.5481**	**2,245**	**2.82381**
University of Minnesota	4.5399	78	2.13014
Michigan State University	4.4790	70	2.36858
University of Wisconsin	4.4072	69	2.20797
University of Tennessee	4.3204	55	2.68309
Auburn University	4.2734	98	2.36879
Louisiana State University	4.2603	65	2.06156
Oklahoma State University	4.2359	73	3.20224
University of Florida	4.0234	90	2.07610
Purdue University	4.0005	57	2.52685
University of Illinois	3.8192	73	1.77621
North Carolina State University	3.7328	83	1.72852
Oregon State University	3.7092	51	2.15914
Iowa State University	3.5470	94	1.94674
University of Missouri-Columbia	3.3494	101	1.64864
Washington State University	3.3344	91	1.88168
University of Georgia	3.2778	86	1.96670
Virginia-Maryland College	3.2065	100	1.87515
Texas A&M University	3.1233	98	1.77524
Tuskegee University	2.0029	47	2.13073

Table 16

Only the survey responses were used to determine the accuracy of the reported debt values. Whether the values include interest charges, when debts were incurred, or the value of interest charges that would have accumulated (what year or semester the costs were incurred) is not ascertained. The interest charges can be estimated assuming that the total costs were distributed over the total number of semesters and a 7.0 percent interest rate was charged. The total interest payments that would have accumulated with full payment of tuition and living expenses are computed for the veterinary college education provided at each college for discounted and non-discounted seats. The following table provides the ratio of total cost to income assuming the interest charges are included as part of the costs.

TOTAL COST PLUS INTEREST-TO-INCOME RATIO BY SCHOOL, 2016

	Mean	N	Std. Deviation
University of Pennsylvania	10.8500	78	4.88517
Cummings SVM at Tufts University	8.7112	67	3.62910
Tuskegee University	8.1590	47	4.33549
Western University - California	7.9014	68	3.02348
Cornell Veterinary College	6.9747	86	3.33744
University of California-Davis	6.8520	114	3.03219
Kansas State University	5.9722	76	3.57498
The Ohio State University	5.8637	129	3.26126
Colorado State University	5.7441	79	2.69428
Mississippi State University	5.4893	69	3.43208
Total/National Mean	**5.3947**	**2245**	**3.30963**
University of Minnesota	5.2630	78	2.46942
Michigan State University	5.1924	70	2.74583
University of Wisconsin	5.1092	69	2.55964
University of Tennessee	5.0086	55	3.11044
Auburn University	4.9540	98	2.74607
Louisiana State University	4.9388	65	2.38991
Oklahoma State University	4.9106	73	3.71227
University of Florida	4.6642	90	2.40676
Purdue University	4.6377	57	2.92931
University of Illinois	4.4275	73	2.05911
North Carolina State University	4.3273	83	2.00383
Oregon State University	4.3000	51	2.50304
Iowa State University	4.1119	94	2.25681
University of Missouri-Columbia	3.8829	101	1.91123
Washington State University	3.8655	91	2.18138
University of Georgia	3.7999	86	2.27995
Virginia-Maryland College	3.7172	100	2.17381
Texas A&M University	3.6207	98	2.05798

Table 17

The tables above can be combined to provide an indication of how well students have been able to keep debt below costs. That is, have they had some method of ensuring that they keep a lid on expenses such that the amount of debt that they accumulate while in veterinary college is less than the total cost of attendance? This should not be used as an indicator of the students' ability to manage their finances but rather an indication of the ability of the students to draw upon other sources of income or be frugal in managing their finances.

In general, the tables above would indicate that the DIR is certainly a problem with 25 schools having a DIR of 2:1 or higher. And, the mean value of debt to total costs (tuition, living and interest) being substantially less than 1.0 would seem to imply that the problem of high debt to income is a problem of the high cost of education only, albeit one of considerable variation among the schools.

However, looking at the distribution of debt to total costs for each reporting student by college indicates that some students have not found sufficient outside resources or are not frugal in their finances such that their debt exceeds the total cost of the education. This group comprises nearly 10 percent of the reporting students (254) who had full-time employment with just 13 schools having a percentage of students with "excessive" debt greater than the average of all 28 U.S. colleges (9.6 percent).

DEBT-TO-COST AND DEBT-TO-COST PLUS INTEREST BY SCHOOL, 2016

	D:C Ratio	D:(C+I) Ratio
University of Tennessee	.9635	.8311
Western University - California	.8708	.7512
Virginia-Maryland Regional	.8574	.7396
Tuskegee University	.8031	.6361
University of Minnesota	.7918	.6830
Iowa State University	.7596	.6552
The Ohio State University	.7539	.6503
University of Illinois	.7535	.6500
Kansas State University	.7527	.6493
University of Missouri-Columbia	.7482	.6454
Oregon State University	.7437	.6415
Purdue University	.7327	.6320
University of Georgia	.7277	.6278
University of Florida	.6952	.5996
Oklahoma State University	.6916	.5966
Michigan State University	.6858	.5915
Washington State University	.6781	.5849
Total/National Mean	**.6671**	**.5740**
Mississippi State University	.6591	.5686
Louisiana State University	.6352	.5479
North Carolina State University	.6177	.5328
Colorado State University	.6109	.5269
Auburn University	.5400	.4658
Cornell Veterinary College	.5110	.4408
University of Wisconsin	.4745	.4093
University of California-Davis	.4718	.4070
Cummings SVM at Tufts University	.4675	.4033
Texas A&M University	.4631	.3995
University of Pennsylvania	.3816	.3292

Table 18

Although all schools report an average debt-to-cost ratio below 1, many schools have a proportion of the students graduating with debt above the respective schools' reported total cost of attendance plus interest. University of Tennessee and Virginia-Maryland College veterinary colleges both have more than 35 percent of their students graduating with more debt than total cost of attendance plus interest. Tufts University, Cornell University, University of Pennsylvania, Texas A&M University and the University of Wisconsin had no graduates in 2016 in this category.

DEBT BELOW AND ABOVE TOTAL COST PLUS INTEREST BY SCHOOL, 2016

	Is my debt greater than total cost plus interest?			
	Debt Below Total Cost Plus Interest	Debt Above Total Cost Plus Interest	Total	Percent (Debt Over TC + Int)
University of Tennessee	46	29	75	38.7%
Virginia-Maryland College	72	44	116	37.9%
Western University - California	63	18	81	22.2%
Oklahoma State University	69	19	88	21.6%
University of Georgia	78	19	97	19.6%
University of Illinois	68	14	82	17.1%
University of Minnesota	74	15	89	16.9%
Mississippi State University	72	11	83	13.3%
Oregon State University	47	6	53	11.3%
University of Missouri-Columbia	95	12	107	11.2%
Iowa State University	96	11	107	10.3%
Washington State University	99	11	110	10.0%
The Ohio State University	135	15	150	10.0%
Purdue University	77	5	82	6.1%
Louisiana State University	80	5	85	5.9%
University of Florida	94	5	99	5.1%
Kansas State University	85	4	89	4.5%
Auburn University	112	4	116	3.4%
North Carolina State University	95	2	97	2.1%
University of California-Davis	132	2	134	1.5%
Tuskegee University	68	1	69	1.4%
Michigan State University	82	1	83	1.2%
Colorado State University	84	1	85	1.2%
Cummings SVM at Tufts University	80	0	80	0.0%
Cornell Veterinary College	99	0	99	0.0%
University of Pennsylvania	81	0	81	0.0%
Texas A&M University	124	0	124	0.0%
University of Wisconsin	79	0	79	0.0%
Total/National Mean	**2,386**	**254**	**2,640**	**9.6%**

Table 19

We can apply the same criteria to all students who reported debt inclusive of those who did not secure a full-time employment opportunity prior to graduation (2,661 of 3,018). There remain 11 colleges that exceed the national average percent of students with excessive debt but two schools, The Ohio State University and Tuskegee, moved their position relative to the national average. On the basis of all students reporting debt, the percent of Ohio State students with excessive debt is now larger than the national average; while Tuskegee now has less than the national average percent of students with excessive debt. Using all students reporting debt, we found that 273 out of 2,661 students (10.3 percent) had excessive debt. That is, these 273 students had more debt than was estimated for the cost from tuition and fees, living expenses and interest charges. The total amount of excessive debt was $9,181,367.99.

FIX THE DEBT

The AVMA and AAVMC are attempting to tackle the high DIR through a collaborative Fix the Debt initiative. Launched back in April during a summit hosted by the Michigan State University College of Veterinary Medicine, the initiative has really taken shape, moving from discussion to action.

They are tackling the issue from a variety of angles, each of which is being addressed by strategic working groups comprised of representatives from across the profession, including veterinary students, colleges of veterinary medicine, state and allied associations, practice owners and other experts. Their collective goal is to reduce the debt-to-income ratio, which now stands at about 2:1, to 1.4:1. It's not going to be easy getting there, but their strategy is designed to help gradually reduce the ratio to a more manageable level that will lead to a better place for young professionals both professionally and personally.

The working groups are focused on two areas – reducing debt and increasing income – but rest assured that each group is working toward the collective goal of reducing that debt-to-income ratio. The focus areas and the strategies associated with each are:

Reducing debt:

- Increasing scholarship endowments
- Enhancing student financial literacy
- Streamlining the veterinary school curriculum
- Advocating to governments
- Minimizing the cost of borrowing
- Increasing income:
- Building professional skills and competencies
- Improving workplace on-boarding
- Focusing on preventive medicine
- Increasing practice ownership literacy
- Expanding career option awareness

STRATEGIES TO REACH THE GOAL

As noted above, strategies to improve the DIR for veterinary graduates must come from every corner of the profession and address each point in the supply chain between applicant and the provision of veterinary services where costs are added, as well as consider the components of demand for veterinarians and veterinary services. While we have made a case in this report for moving the profession to a 1.4:1 DIR target, and provided four major goals for doing so, we have yet to provide any specific strategies for the profession to consider in attempting to hit the proposed DIR target. Specific strategies that may be used to accomplish each of the goals noted in this paragraph are suggested below and delineated into one of the major goal areas:

- general public strategies;
- veterinary college applicant and student strategies;
- veterinary college strategies; and
- public and private practices strategies.

This should not be considered either as a complete list or a list of definitive solutions. These are suggested strategies that should be evaluated based on their ability to achieve a desired level of DIR reduction against the overarching mission of providing a well-defined future role of veterinarians in society.

First and foremost is the need to quickly begin to collect detailed data on education costs per discounted and non-discounted seat at each of the 49 AVMA-accredited colleges of veterinary medicine. The precise values of expenditures for each student as well as the amount borrowed and the interest payment for each amount borrowed must be tracked. Starting salaries for all new veterinarians must be collected so that a more exact debt-to-income ratio can be determined and measurable progress made towards its reduction.

Second is the need to also quickly begin to collect a standard set of financial data on veterinary practices to enable the evaluation of financial performance standards for veterinary practices. There are an estimated 25,000 to 30,000 veterinary practices in the United Sates that range from one-doctor- to multiple-doctor-practices, from private to public to corporate practices, and from less than $500,000 to many millions in gross sales.

Third is the need to gain a profession-wide referendum on the debt-to-income ratio so that every veterinary professional understands that they own the problem. This is not just a public tax/revenue problem; a problem of veterinary colleges having too high of costs, too many seats, or too many non-discounted seats; or one of veterinary practices leaving too much demand unrealized. The high debt-to-income ratio is a problem for the profession and of the profession. The DIR KPI should be considered by every veterinarian in their business and professional decisions.

THE GENERAL PUBLIC STRATEGIES

1) Eliminate the interest payment on student loans while in school.

This is not just a veterinary profession problem but a problem that permeates society. Veterinary medicine can provide the leadership to develop a legislative initiative for federal and state legislatures.

2) Reduce the interest rate to be more in line with the risk of the loan.

Information on veterinary student loan defaults should be collected and, based on the findings of this research, a case made to prevent charging interest rates for veterinary student loans in excess of the rates charged for loans with similar default rates.

VETERINARY COLLEGE APPLICANT AND STUDENT STRATEGIES

1) Reduce the hours of potential veterinary applicants' unpaid experience.

The average applicant has more than 2,000 hours of "service" hours that may be paid or unpaid. The willingness of pre-veterinary students to accept unpaid opportunities provides the wrong message (providing free services) and steals their income-earning ability needed to prepare for the financial obligation of their education.

2) Increase the awareness of the cost of veterinary education.

While many potential applicants to veterinary college have information on the costs of attending veterinary school and the associated student loan debt, most are quick to agree that they have little understanding of what these levels of student debt mean to their standard of living. Programs that provide examples of the consequences of high debt on living standards of current veterinarians and strategies to assist potential applicants in saving funds and/or acquiring outside resources to bring to veterinary college can be developed to better prepare students acquire the finances required to reduce the student loan burden.

3) Reduce the cost of living expenses of veterinary college students.

Provide average expenditure information for each veterinary college to each student to help them understand how their expenditure pattern compares to their peers. Few students understand the importance of small decisions to overall debt obligations.

VETERINARY COLLEGE STRATEGIES

1) Institutionalize a connection between the education and veterinary markets.

Currently there is no connection between the markets for veterinary education and the market for veterinarians. That is, veterinary colleges are currently tasked with producing veterinarians that meet veterinary medical competencies. There is no requirement that these graduates are able to meet economic standards. The gainful employment provision in the Higher Education Act is such a requirement. Schools are held accountable for meeting a mean DIR for their graduates. While the gainful employment provision is currently only applicable to private foreign institutions, this provision may find its way into all colleges, public and private.

2) Conduct research to develop the same or better quality treatments at lower cost.

In one recent study in North Carolina, more than 75 percent of veterinary clients had household incomes in excess of $100,000 and yet this level of income represents only roughly 10 percent of all U.S. households. Our veterinary medical research institutions must help to discover veterinary techniques that enable veterinarians to provide veterinary services at lower costs.

3) Develop pilot projects to measure the economic implications of new teaching models.

Can the length of time in school be shortened or the cost per year reduced? What are the costs and benefits of the new 2+2 programs such as the joint program between Alaska and Colorado State University or the distributive model of several of the newer veterinary colleges? Compare the costs of providing education across different educational models already in use. Data on impact on debt load for the reduction of the pre-vet to three years may already be available from schools that offer early-entry-type programs (e.g., Purdue has a 3+1 system already); the need exists to identify all the schools that offer similar programs.

4) Explore the differences between schools that have highest/lowest internship rates among their graduates.

While internships are not included in the current DIR, the lost income and the interest on loans during the internship certainly increase the post-graduate DIR of new veterinarians. The profession needs to understand the benefits and costs of internships and the factors associated with veterinary graduate decisions to seek an internship opportunity.

5) Mandate financial education requirements for faculty to improve awareness of economics of practice.

For several decades, veterinarians both within and external to academia have proposed adding financial education to the veterinary curriculum. Integrating finance within the current veterinary curriculum and providing incentives to discuss costs of treatments may produce greater innovation in cost-reducing practices from veterinary students not bound by tradition. A first effort for the profession is to define financial literacy and ensure that both faculty and students achieve the goal of attaining it. Ideally, the long-term goal would be for faculty to teach practice economics within rotations. Short-term, efforts may require a combination of prerequisites and/or an online or certificate course run by AVMA/Veterinary Managment Groups. Another side of this is to work to help the veterinary teaching hospitals increase efficiency. Perhaps veterinary colleges willing to participate in a pilot could be identified.

6) Encourage economies of size and/or specialization of schools.

The improvement of distance education technology offers an opportunity to veterinary colleges to evaluate opportunities to share faculty. In addition, schools may be able to reduce costs by collectively sharing specialization. For instance, several schools could share services of one school that has a specialization in dairy, another has specialization in equine, and yet another in small ruminates.

7) Improve veterinary graduate readiness/confidence.

Regardless of the degree program, students' greatest impediment at graduation is self confidence. Confidence is gained from experience. Veterinary graduates must be prepared to enter public or private practice with the knowledge and ability to improve the value of veterinary medicine. The goal of a 1.4:1 DIR will only be accomplished by increasing the starting salaries of graduates. This can only be accomplished if new graduates are prepared and confident in their ability to improve the value they bring to their employer.

PUBLIC AND PRIVATE PRACTICE STRATEGIES

1) Increase financial literacy of veterinary practice owners.

While the veterinary colleges may be tasked with ensuring economic viability of their graduates, practice owners must be tasked with ensuring they have the ability to reward the success of the colleges' programs. If graduates are not rewarded for their contribution to the value of a practice, veterinary colleges cannot be successful in ensuring an economically sustainable graduate. The profession must develop standards of financial performance of veterinary practices to enable veterinary colleges to evaluate the performance of their graduates.

2) Enhance the demand for Veterinarians.

Veterinarians play a critical role in animal health and welfare that spills over into human health. The role of veterinarians in the surveillance and management of zoonotic diseases, food security and areas such as the importance of the human animal bond on human health are not well understood by the general public or those charged with making the resource allocation decisions. All practicing (public and private) veterinarians may improve the demand for veterinarians by working together and, with industry partners, bringing economic analysis to decision makers on the benefits and costs to society of increased veterinary professionals in providing public services. While the veterinary profession has long extolled the "need" for more veterinary professionals in the public practice areas, little action has occurred as these expressions of need have not included measures of benefits and costs associated with the increased involvement of veterinarians.

3) Increase the value of graduates.

How many animals are not receiving the level of care necessary to ensure good health is certainly unknown, but it is clear that some animals have not been seen by a veterinarian and others have not received all of the care required to guarantee good health. Quantifying the amount and location of the animal health care shortfalls should be a top priority for the profession so that strategies can be developed to reach specific goals with respect to both the percentage of animals unseen by veterinarians and the percentage that are seen but have not received the minimum standard of health care.

DISCUSSION

This report takes an exploratory and analytical approach to the market for new veterinarians and the market for education, honing in on veterinary education. Observed are new veterinarians over the period 2001 through 2016, including their post-graduate plans, their income levels, debt levels and their debt-to-income ratios.

New veterinarians are a subset of students who are identified through the survey of VMCAS applicants. The AAMVC has just begun its study of these applicants' decision process and willingness to pay for veterinary education. This is an important area of research that will be productive over time and is necessary to better understand how to aid these potential veterinary students in preparing for the financial requirements of their education.

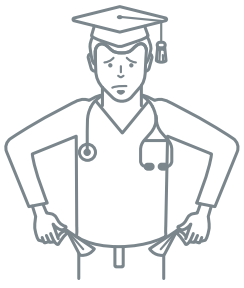
As applicants matriculate veterinary college they eventually graduate and become new veterinarians. The main source of data for new veterinarians is AVMA's senior survey, which is distributed to graduating seniors just a few weeks before graduation. This survey solicits information on veterinary students' career plans, starting salary, debt and other specific demographics. However, the survey data has limitations. There is no information on expenditure patterns of the students: not on the actual costs of their education and any interest payments on the loans they have acquired. While each veterinary college provides the exact cost of tuition and fees for residents and non-residents and an estimate of living expenses, limited information is available on the role of scholarships or other forms of external support, to provide for an exact estimate of costs per student or the amount paid per student. This information will be important in developing strategies to reduce the DIR.

The senior survey has been distributed by the AVMA for decades and although the organization has made attempts to expand the respondent pool to AVMA-accredited institutions outside the United States, the data so far gathered are primarily comprised of responses from the 28 U.S.-located veterinary colleges. This is a shortcoming in this research piece since a proportion of U.S. students attend AVMA-accredited foreign colleges and return to the United States to find jobs and repay student loans. As might be expected, these students tend to have significantly larger debt loads and consequently present higher debt-to-income ratios. The AVMA will continue to work with the AAVMC to collect data on the graduates from the AVMA-accredited foreign veterinary colleges.

This report, which is a follow up to the *2016 AVMA & AAVMC Report on the Market for Veterinary Education*, is in large part a replacement for AVMA's "Facts and Figures" feature report previously published in *JAVMA*. The intention here is to go beyond a year-to-year comparison of mean income and toward the use of an index that measures the impact of the economy on a constant cohort of veterinarians. Annual updates on the model of new graduates' starting salaries, debt, and debt-to-income levels will also be provided. These models will help us and veterinary applicants and students predict their starting salary and debt at graduation and assist them in developing personal strategies for managing their post-graduate finances to maximize their standard of living.

We pose four major strategies and multiple tactics for our goal to reduce the DIR over time. Each of these strategies is based on economic concepts but while some have current evidence to support their implementation, others will require further research to determine their economic feasibility. As noted, the list is not exhaustive and we have received a number of alternative strategies such as substituting the seats available to U.S. veterinary applicants for proposed veterinary assistants or foreign nationals. These additional strategies require the development of new programs rather than the restructuring or reorganizing of existing programs.

The market for veterinary education is a critical market for the veterinary profession, but a market that is not performing optimally. Many new veterinarians are ill-prepared for the financial stress that awaits them; and the percentage of consumers who are unwilling to pay a price for their services in line with veterinarians' education costs continues to decline. The result will continue to be an increase in untreated animals that also pose a threat to human health. In attempting to select optimal strategies the focus should be on those strategies that will reduce the DIR while increasing the potential for meeting the veterinary needs of all animals.



MANY NEW VETERINARIANS ARE ILL-PREPARED FOR THE FINANCIAL STRESS THAT AWAITS THEM.

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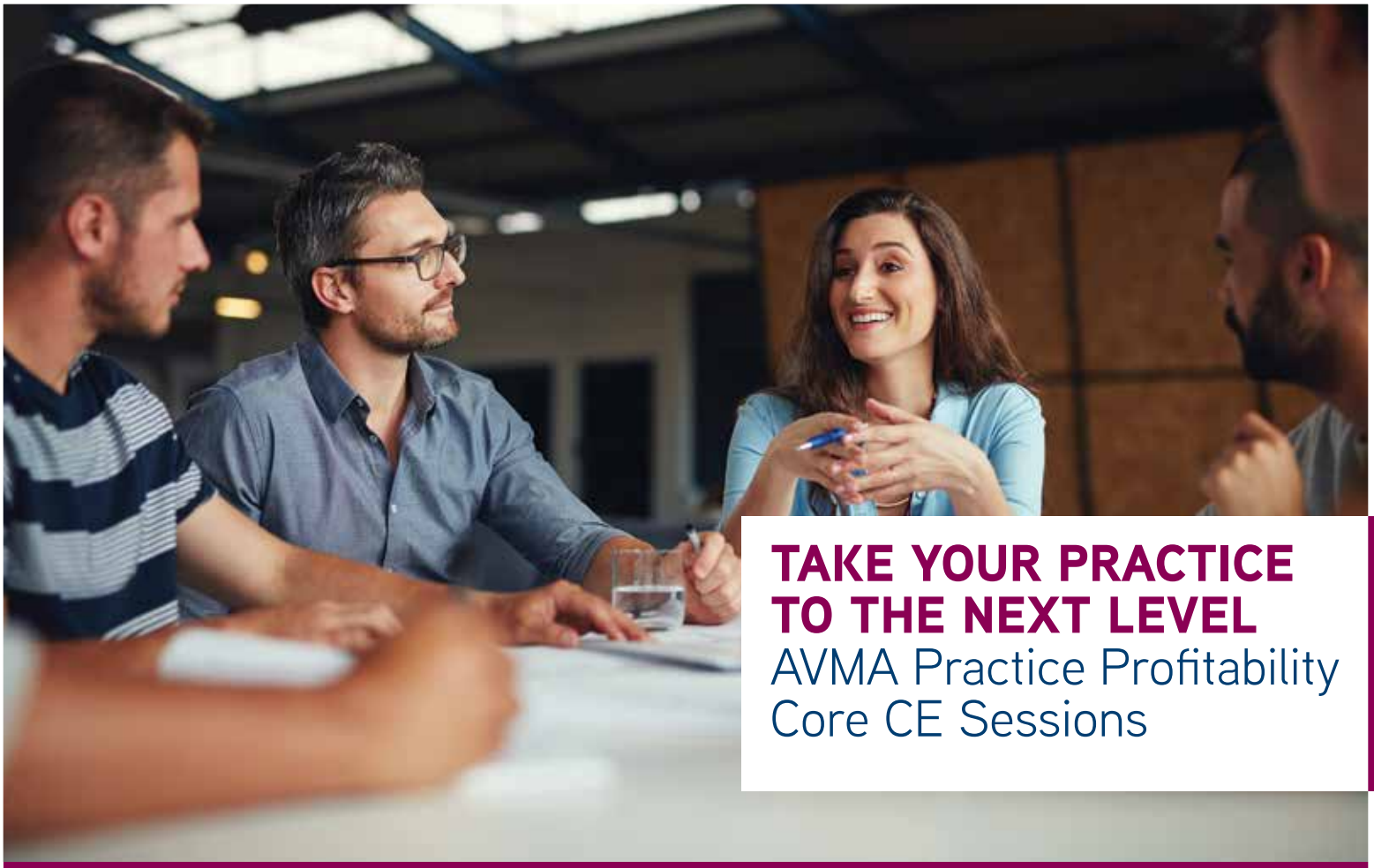

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2017 AVMA Report on

THE MARKET FOR VETERINARIANS

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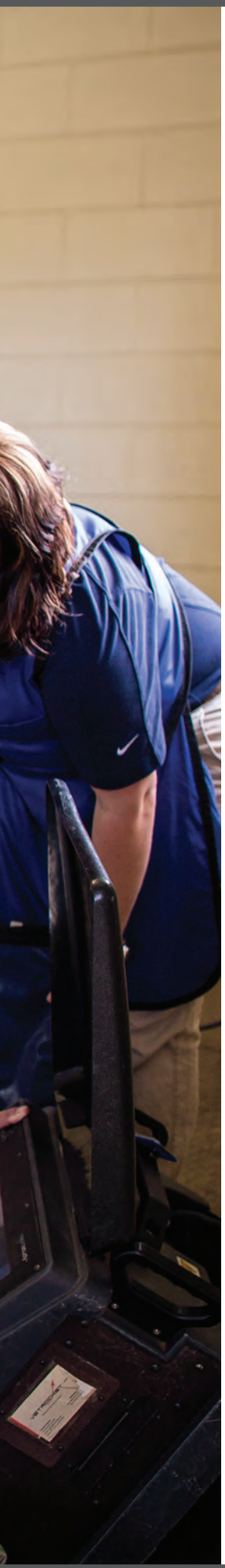

2017 AVMA Report on

THE MARKET FOR VETERINARIANS

Veterinary Economics Division
American Veterinary Medical Association
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CONTENTS

LIST OF FIGURES AND TABLES

LIST OF FIGURES AND TABLES

SUMMARY

The market for veterinary labor continued to gain ground in 2016 and nationally is hitting on all cylinders. But there are still considerable maldistribution problems that are creating variations in unemployment, underemployment, incomes, wellness and other labor market indicators such as the net present value of the DVM degree. These variations occur regionally, by state and within states, by gender and by practice type. And the continued increasing scarcity of veterinary labor should help to ameliorate this maldistribution. A compilation of key indicators by region is provided at the end of this summary.

While the number of new veterinarians entering the workforce is nearly 4,500 per year, the number leaving is nearly 2,000, for a net gain of roughly 2,500. The current number of active veterinarians is estimated at approximately 108,000 and thus there are roughly 3,300 people per veterinarian in the United States. At the rate of current population growth and growth in the number of veterinarians, however, only 2,400 new people are being added for every new veterinarian. More importantly, while the cost of veterinarians continues to rise, the median household income of the increased population is not expanding.

The recent economic expansion has maintained a low unemployment rate in veterinary medicine and the changing structure of the veterinarian workforce has helped to create an even larger negative underemployment rate. The larger number of graying veterinarians coupled with the increased number of women in the profession is reducing the number of hours in a veterinary FTE and this has led to an actual reduction in the total number of veterinary FTEs, even while the number increases.

The number of jobs exceeded the number of applicants on the AVMA's Veterinary Career Center (VCC) in 2016 but there were still markets where the number of applicants exceeded the number of jobs by more than 10:1; in other markets employers went begging for applicants and found none. This disparity led to sharply rising veterinary incomes in some areas with no growth in incomes in other areas.

Veterinary wellness, talked about throughout the profession with major concern, does not appear different from other specialized professions, such as medical doctors, engineers and lawyers, when assessed through the ProQoL tool that measures compassion fatigue. As such, this tool might not be the correct one to measure veterinary health, particularly since it describes a portion of the profession that registers in the high end of burnout and secondary traumatic stress.

Because the market for veterinarians sits as the crossroads of the market for veterinary services – which drives the demand for veterinarians – and the market for veterinary education – the source of the pipeline of veterinarians – the market is affected by, and is responsive to changes in these two vertically related markets. Problems in either market become problems in the market for veterinarians and this leads to inefficiency in the market until adjustments are made.

Market adjustments occur when the market players make informed decisions. The purpose of this report is to enhance the decision-making process by providing the best information available for veterinarians to tap for employment and career decisions. Toward this end, those who complete AVMA surveys enable the collection and analysis of data to report on the markets, providing invaluable information to assist veterinarians. These obliging professionals are the source of change in the profession.

SNAPSHOT OF VETERINARY PROFESSION BY REGION

Region Of Workplace	Statistic	Change In Hours Desired	Total Personal Income
0	Mean	-.6525	$78,567.66
	N	118	669
	Std. Deviation	22.60479	$410,199.69
1	Mean	-3.7900	$110,925.56
	N	70	182
	Std. Deviation	20.21163	$78,633.38
2	Mean	-3.8846	$109,468.58
	N	78	264
	Std. Deviation	17.55195	$169,859.44
3	Mean	.3483	$97,563.48
	N	89	257
	Std. Deviation	20.63597	$68,488.24
4	Mean	-6.2188	$106,840.41
	N	64	205
	Std. Deviation	16.76705	$154,861.27
5	Mean	-4.6290	$83,577.57
	N	62	152
	Std. Deviation	19.47528	$56,752.28
6	Mean	-3.2155	$96,239.16
	N	58	196
	Std. Deviation	21.61447	$77,253.60
7	Mean	-8.3658	$138,455.14
	N	149	504
	Std. Deviation	18.58296	$251,928.32
8	Mean	-7.3462	$114,760.18
	N	130	364
	Std. Deviation	18.48453	$105,342.24
9	Mean	-4.1705	$96,585.41
	N	88	291
	Std. Deviation	20.89257	$71,295.60
Outside the United States	Mean	3.0556	$90,521.71
	N	9	24
	Std. Deviation	28.63394	$77,875.41
Total	Mean	-4.4009	$103,611.86
	N	915	3108
	Std. Deviation	19.96571	$232,265.46

Table 1

Burnout Score	Unemployed In Veterinary Medicine	S/D Ratio (Externally Sourced)	Years Of Experience Of Respondent	Percentage Female
23.4686	3.6%	0.495	21.5725	55.2%
542	14		669	
7.87013			18.06996	
26.5220	3.9%	0.474	14.7473	66.5%
182	8		182	
6.56687			12.37588	
25.9470	2.1%	0.614	13.7045	70.5%
264	6		264	
6.81177			11.39558	
26.2724	2.7%	2.079	12.8949	73.7%
257	8		257	
6.37161			11.70906	
26.1268	3.1%	0.792	14.1073	71.2%
205	7		205	
6.60463			11.98521	
26.3750	3.9%	0.739	12.2500	68.4%
152	7		152	
5.60725			11.30449	
25.9337	2.9%	0.762	12.9031	62.6%
196	6		196	
6.05282			11.64456	
24.5805	1.1%	1.088	19.0516	58.3%
503	6		504	
6.44537			14.45530	
25.9176	1.8%	0.489	15.1978	69.7%
364	7		364	
6.29214			12.08393	
26.7869	2.5%	0.401	11.9072	75.9%
291	8		291	
6.49795			10.40963	
28.0000	18.9%		11.9583	65.2%
24	7		24	
6.10773			11.70834	
25.4570	2.7%	0.780	16.1573	65.6%
2980	84		3108	
6.78177			14.15599	

REGIONS OF THE UNITED STATES

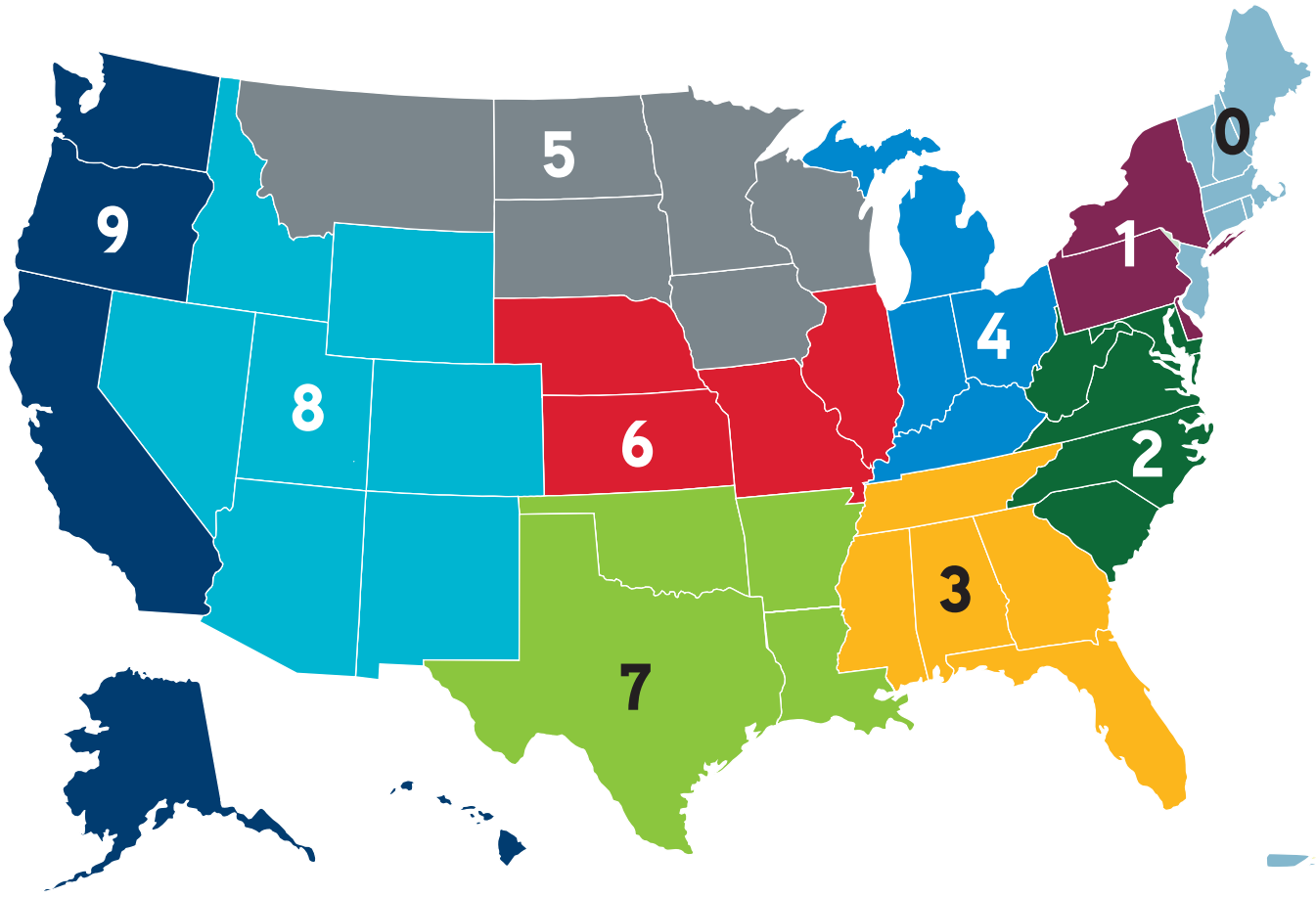


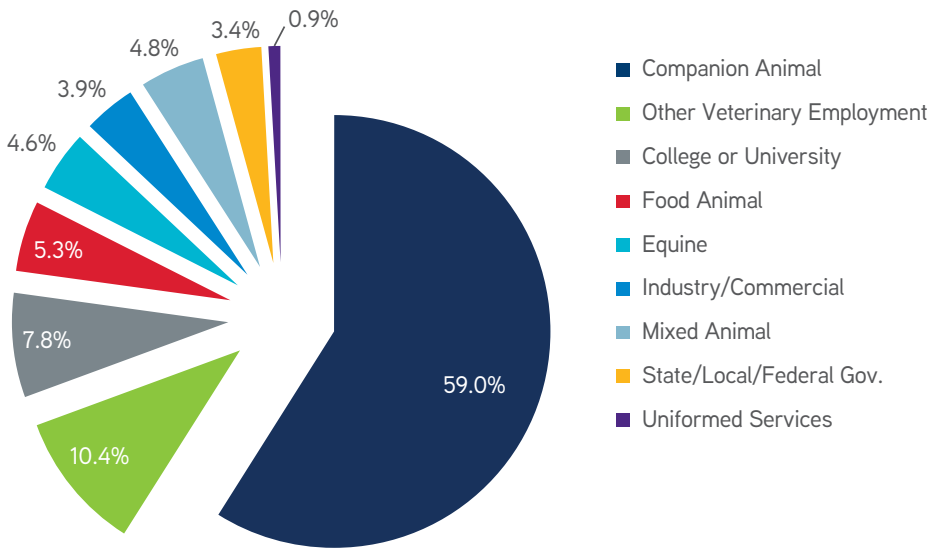
Figure 1

INTRODUCTION

For the third year in a row, the market for veterinarians is increasingly robust with declining levels of unemployment, increasing levels of negative underemployment, larger year-to-year increases in mean starting salaries and the number of graduates who have obtained full-time employment prior to graduation, and an increasing number of employment postings on the AVMA Veterinary Career Center. In fact, for the first year since 2008, the number of employment opportunities posted on VCC exceeded the number of applicants, with many of these opportunities remaining unfilled through the end of 2016.

The market for veterinarians is the market of convergence between the market for veterinary education and the market for veterinary services. In this market, the equilibrium price and quantity in the market for veterinary services collides with the price and quantity equilibrium from the market for veterinary education. The number of veterinarians produced by veterinary colleges at a specific cost per veterinarian should confront an income offered by employers that is derived from the willingness of animal owners to purchase veterinary services from veterinary hospitals. This juxtaposition of the cost of veterinarians with the value of services perceived by animal owners, however, presumes that veterinary practices are able to translate the demand for veterinary services into the value accorded the veterinarian producing these services. Unfortunately, few veterinary practices use the value of output per veterinarian to establish veterinary incomes. And even fewer owners understand the relationship between price of services, quantity of services demanded and veterinary incomes. While all three veterinary markets (education, veterinarian, and veterinary services) will rarely, if ever, have equilibriums that are in alignment, the markets should tend to induce resources to move in the direction of the equilibrium prices and quantities. That is, in each of the markets, movement of resources should occur to produce a quantity

VETERINARY POPULATION, 2016



Estimated number of veterinarians as of December 31, 2016: 107,995

Figure 2

of output that just meets quantity demanded at a price that is acceptable to both consumers and producers.

In 2016 there were an estimated total of roughly 107,995 veterinarians actively engaged in the profession, in public or private practice, and roughly 17,000 veterinary students in the pipeline to become veterinarians. The largest segment of the profession is engaged to provide medical services to animals in private and corporate practices. Of these practices, companion animal practices employed the largest number of veterinarians (59 percent), followed by food animal (5.3 percent), equine (4.6 percent) and mixed animal practices (4.8 percent). In public practice, colleges and universities employ the most veterinarians, followed by industry, and state and local governments.

The percent of veterinarians identifying their practice type as companion animal in 2016 continues to decline, while those identifying food animal, mixed animal and equine as their practice type increased, and a substantial increase occurred of those who selected "other" as their employment type.

The national market for veterinarians remains robust for the second straight year. The single largest source of the continued improvement in the market for veterinarians has been the growth in the U.S. economy. And, because the growth in the U.S. economy has not occurred uniformly in all sectors of the economy, and those sectors are not uniformly distributed throughout the United States, the economic improvement has not occurred uniformly throughout the country. As such, veterinary markets might not be robust locally or in every practice type. To the extent that veterinarians are mobile, both in location and practice type, the differences in the market that occur as a result of maldistribution should be self-corrective. Lower-income, unemployed or underemployed veterinarians would, in a competitive market, relocate to seek higher-paying employment opportunities. To the extent that mobility is constrained as a result of licenses, experience, technical skills, living costs and/or family situations, the variations in incomes will persist.

In 2015, the unemployment rate in veterinary medicine (4.5 percent) remained below the national average and was not significantly different from 2014. To better align with the national unemployment statistics, however, new questions were added to the 2016 Census of Veterinarians Survey. Controlling for retirement (48.2 percent) and a return to education (12.9 percent) when estimating unemployment for those who were actively seeking employment but had not found work (38.8 percent), the unemployment rate in veterinary medicine that is comparable to the national unemployment rate was actually 1.7 percent in 2015.

Underemployment was again negative in 2015, with more veterinarians indicating they wish to work fewer hours for less compensation than those who wish to work more hours for more compensation. The total number of veterinarians that would be required to eliminate the negative underemployment was 3,391 (40 hours per week equals one FTE). Of course, the indivisibility of labor makes eliminating the negative underemployment difficult, as few veterinarians will wish to work the 5-10 hours per week in several practices that would be required, because underemployment – both positive and negative – occurs in small numbers of hours distributed throughout the nation and across practice types.

The ability of markets to adjust depends on information. Veterinarians will not relocate or change career paths without knowledge of the benefits that can be accrued as a result of the move. For this reason, the AVMA's Veterinary Economics Division is providing "salary calculators," tools that provide the relative importance of various demographic factors in determining veterinary incomes. Of course, these are mean incomes and a great deal of variation in income remains unaccounted for by the factors in the model. Some of these factors are unique to the individual, such as personality, lifestyle and energy level.

AVMA's Veterinary Economics Division is also developing a geographical information system tool to identify "hot" and "cold" markets for veterinarians to help new veterinarians and those who desire a change in their current employment gain a better picture of the spatial variations in the markets for veterinarians. To the extent that the constraints to mobility allow, the availability of this information to the profession should reduce the income difference between veterinarians over time and also diminish the time required for those changes to occur.

NATIONAL LABOR MARKETS

As the demand for goods and services throughout the economy increases, firms will hire new labor to produce the new output needed to meet this demand.

The market for veterinarian labor is connected through price to all other labor markets. Increases in the demand for veterinarians, in theory, should move in the same direction as the national level of demand for labor. As the demand for goods and services throughout the economy increases, firms will hire new labor to produce the new output needed to meet this demand. The number of jobs (people employed) will rise, and unemployment will fall. Thus, national employment estimates from the Bureau of Labor Statistics (BLS) provide a good indicator for what might be happening in the market for veterinarians.

The Conference Board provides an indicator of the job market through their Help Wanted Online (HWOL) Data Series. Information about this series was provided in the *2016 AVMA Report on the Market for Veterinarians*.

The HWOL series (labor demand), in combination with the BLS measure of unemployment (labor supply), provides an overall picture of the U.S. labor market. The HWOL job listings began to decline in 2007 and reached a bottom in early 2009 and then showed continued growth until the fall of 2015. The number of jobs posted nationally peaked in November of 2015 at just more than 5.5 million and has declined since, reaching a low of just under 4.9 million jobs posted in May of 2016. Unemployment mirrored the trend in the HWOL data. The low point for unemployment occurred at the same time that the posted jobs in HWOL hit a high. Unemployment then began to climb and reached a peak at the same time that the number of jobs posted online hit the low point. Unemployment has declined continually since 2009, hitting a low of just under 7.8 million in January of 2016. As noted in the *2016 AVMA Report on Veterinary Markets*, these are important indications that the economy may have reached its zenith in the business cycle.

U.S. LABOR AND SUPPLY DEMAND, SEASONALLY ADJUSTED

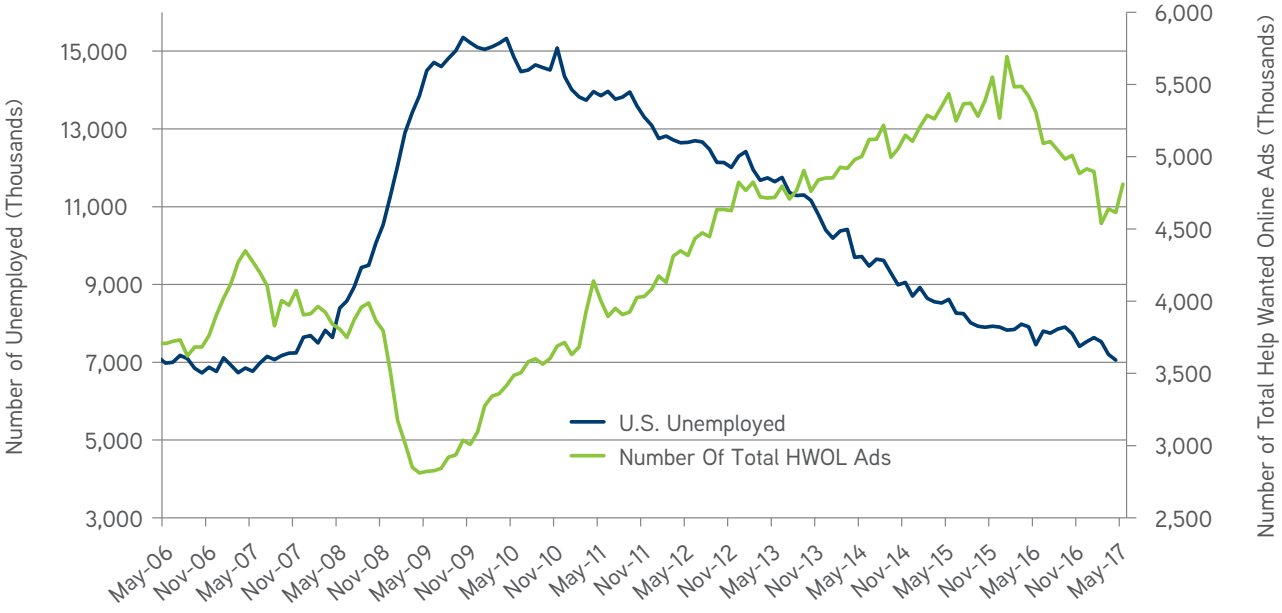


Figure 3

A simplified measure of the national labor markets is the supply/demand (S/D) ratio. The S/D ratio is the number of unemployed divided by the number of jobs posted online. The S/D ratio provides an indication of the general tightness of the national labor market and indicates the extent to which the national labor supply and demand is out of balance. At the height of the recession, there were more than five unemployed persons seeking each available employment opportunity. Relative scarcity of labor was very low, and wage growth suffered. The S/D ratio fell continuously since the last recession reaching a low of 1.38:1 in late 2015 but has shown an increasing trend through 2016 and is now roughly 1.5:1. This suggests that there are three unemployed persons for every two employment opportunities and thus the relative scarcity of labor is quite high compared to what it was in 2009. The declining S/D ratio, or increasing labor scarcity, should create increasing pressure on wage growth.

S/D RATIO: JOB APPLICANTS TO AVAILABLE JOBS

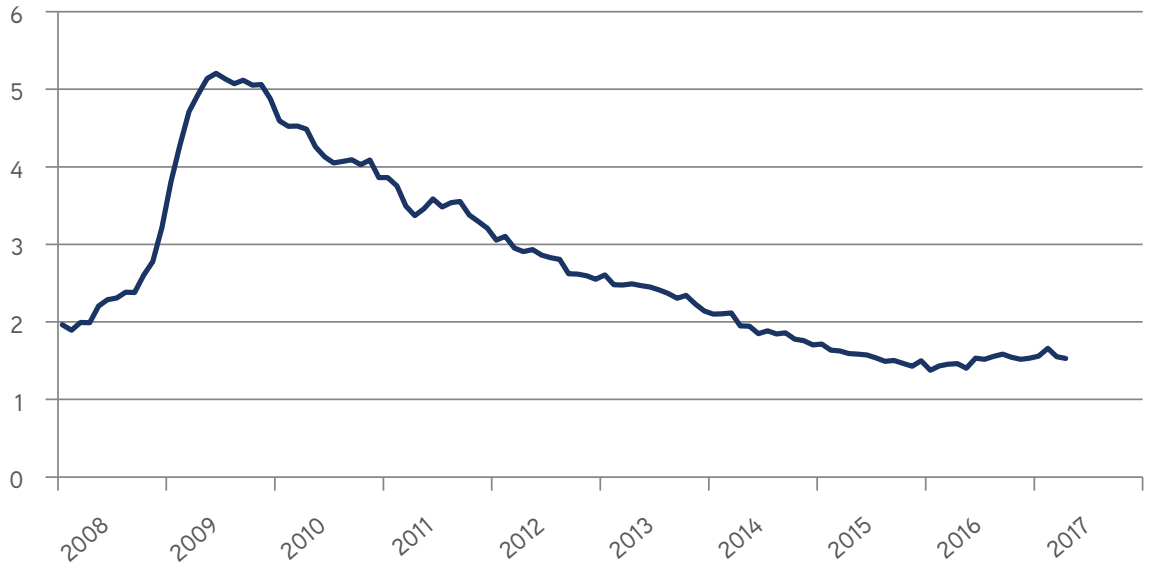


Figure 4

While providing an overall indicator of the national aggregate labor market, the S/D ratio may vary considerably by occupation and geographic location. Over time, the S/D ratios across regions and occupations would begin to equilibrate (become similar) if individuals were equally mobile, had information on all employment opportunities and there were no barriers to entry into the various occupations. In practice, none of these conditions hold and thus the S/D ratio maintains differences between occupations and locations even though all may change over time. The table below provides the S/D ratio for the 10 top occupations by posted jobs and the associated mean hourly wage rate for two different periods. In June of 2013, the national S/D ratio was 2.45:1, and, as noted earlier, the national S/D ratio is now approximately 1.5:1. For some of the occupations listed below, such as "Food Preparation and Serving Related," the S/D ratio declined substantially between the two periods but remained above the national average. For "Computer and Mathematical Science" and "Management," the S/D ratio increased between the two periods but remained far below the national average with the demand for employees exceeding the available pool of potential applicants. As a result of the differences in the changes in the S/D ratios, the wage rate changes between the two periods were considerably different as well.

S/D RATIO AND WAGE RATES FOR HELP WANTED ONLINE, 2013 AND 2017

	June 2013 HWOL		May 2017 HWOL	
Occupation	Ratio	Mean Wage	Ratio	Mean Wage
Sales and Related	1.54	$18.37	1.57	$19.50
Computer and Mathematical Science	0.17	$39.43	0.29	$42.25
Office and Administrative Support	1.75	$16.78	1.37	$17.91
Healthcare Practitioners and Technical	0.44	$35.93	0.15	$38.06
Management	0.77	$53.15	0.78	$56.74
Transportation and Material Moving	1.72	$16.28	1.90	$17.34
Business and Financial Operations	0.87	$34.14	1.00	$36.09
Food Preparation and Serving Related	3.45	$10.38	2.76	$11.47
Installation, Maintenance and Repair	0.94	$21.35	0.74	$22.45
Education, Training and Library	0.57	$38.51	1.55	$26.21

Table 2

The relationship between the S/D ratio and the wage rate can be illustrated by graphically comparing the points and finding the mathematical relationship (line). This relationship represented by the blue (2013) and red (2016) lines can be seen to have become steeper over the last three years. This implies that at higher wage rates, a small change in the S/D ratio results in a large increase in the wage rate.

THE WAGE RATE AND S/D RATIO RELATIONSHIP

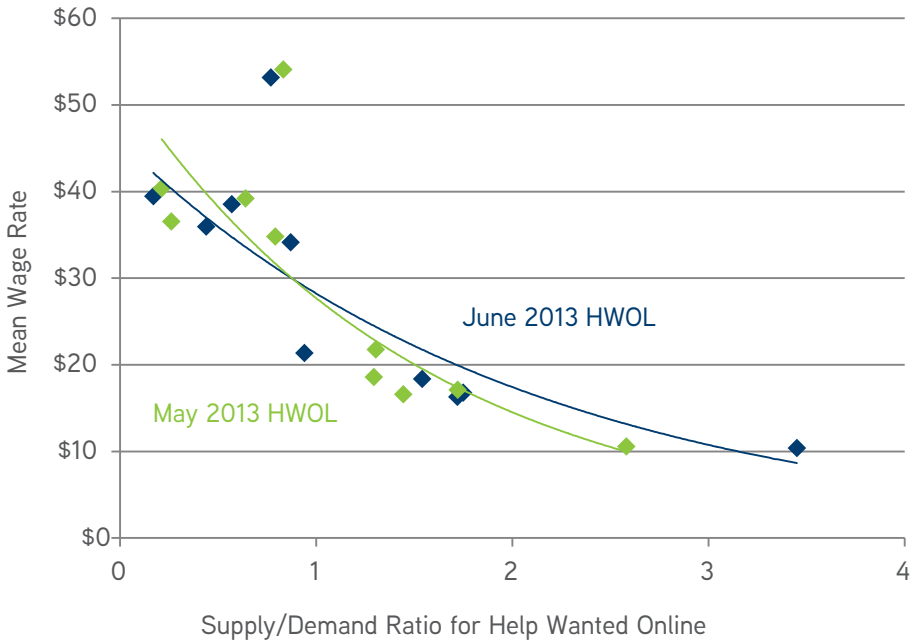


Figure 5

The market for veterinary labor can be compared to the national labor market through the use of the information collected on the AVMA's Veterinary Career Center with respect to posted employment opportunities and posted applications for employment.

From 2008 to 2016 we have plotted the employment opportunities and applicants posted monthly on the VCC site. Prior to the recession in 2008 and 2009 the number of employment opportunities exceeded the number of applicants. However, after the recession when the S/D national ratio hit a high of more than five applicants looking for every employment opportunity nationally, the number of applicants exceeded the number of employment opportunities for veterinarians nationally. While the national S/D ratio fell by half in 2012 (roughly 2.5 applicants for every job), in the veterinary profession the number of applicants per employment opportunities peaked and starting salaries for new veterinarians bottomed along with the percentage of graduates who were able to obtain full-time employment opportunities prior to graduation.

While the national S/D ratio hit a low point in 2016 (less than 1.5:1), the number of applicants for the available veterinary employment opportunities fell below one for the first time since before the last recession and new graduate starting salaries hit an all-time real income level along with a record number of new graduates finding full-time employment prior to graduation. The relationship between the national S/D ratio and the VCC applicant-to-jobs ratio suggests a lag time between the national labor market and the veterinary labor market. This agrees with economic theory. As the economy reaches a peak, inventories begin to accumulate and companies lay off workers. The national S/D would show fewer Help Wanted Online employment opportunities and the rising unemployment would produce more applicants. Over time, unemployment benefits and savings would dry up and pet-owning households would reduce their demand for veterinary services. As this demand declined, the number of employment opportunities would decline but the number of potential new employees would not. This process appears, from this data, to take three-four years to occur, and this information should help veterinary practices prepare for the next recession.

VETERINARY CAREER CENTER JOBS AND APPLICANTS

Figure 6

Not all the employment opportunities on the VCC are for DVMs. Some of the opportunities are for the various staff positions in a veterinary hospital. More than 86 percent of the posted jobs do, however, require a DVM degree.

VCC DESCRIPTIVE STATISTICS OF JOBS, 2016

Education Level	Frequency	Percent
2-year Degree	378	3.2%
4-year Degree	151	1.3%
DVM or Equivalent	10,420	86.9%
Doctorate	214	1.8%
High School	524	4.4%
Master's	22	0.2%
Some College	281	2.3%
Total	11,990	100%

Table 3

While the DVM is the predominant requirement for employment opportunities listed on the VCC and represents the predominant registered applicant looking for employment, the veterinarian comprised only 44 percent of the total number of registered users of the VCC in 2016[1]. Thus, there were roughly 10,420 DVM job postings that were seeking 3,422 applicants. In comparison to the S/D ratios of other professionals, this 0.33 S/D would suggest that the mean salary would be in the ballpark of $45-$50 per hour. Assuming an average hourly work week of 45 hours, the average salary of a veterinarian should be $105,000 to $117,000.

VCC DESCRIPTIVE STATISTICS OF USERS, 2016

Registered User	Experience Level of Registered User				
	< 1	1 to 7	7 +	Any Level	Total
Veterinarian	888 (35%/26%)	1,529 (51%/45%)	891 (49%/26%)	114 (26%/3%)	3,422 (44%)
Veterinary Student	677 (26%)	121 (4%)	17 (1%)	73 (17%)	888 (11%)
Veterinary Technician	253 (10%)	620 (21%)	410 (22%)	40 (9%)	1,323 (17%)
Not Listed	729 (29%)	725 (24%)	518 (28%)	215 (48%)	2,187 (28%)
Total	2,547 (100%)	2,995 (100%)	1,836 (100%)	442 (100%)	7,820 (100%)

Table 4

A comparison of the U.S. S/D ratio and the VCC ratio illustrates a pattern that may suggest a long lag time between changes in the U.S. S/D and changes in the veterinary labor market. This will be an important relationship to observe over time to determine the exact relationship between the two series and how that relationship can be used by veterinary practices to minimize the impacts of a recession.

VCC RATIO OF JOB APPLICANTS TO AVAILABLE JOBS

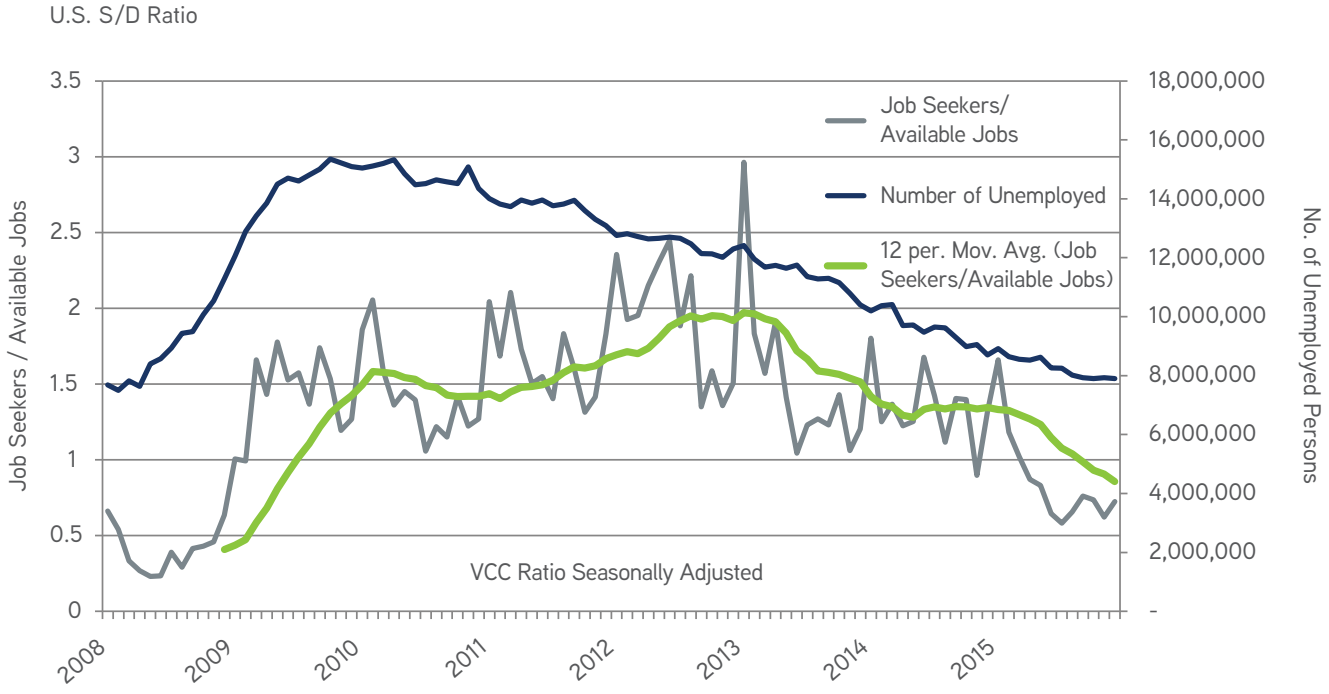


Figure 7

[1] The total column includes VCC-registered applicants who indicated their job level and experience level in the VCC database, and excludes those applicants who did not provide both types, or who provided neither type, of information.

NATIONAL AND STATE VETERINARIAN MARKET

In 2015 and 2016, national surveys of the veterinary profession were conducted using an employment survey (2015), a compensation survey (2015), a practice-owners survey (2015) and the Census of Veterinarians (2016). At the same time that the national surveys were conducted by selecting a sample of the national population of veterinarians (AVMA members and nonmembers), surveys were also fielded from the populations of veterinarians from the American College of Laboratory Animal Medicine/American Society of Laboratory Animal Practitioners (ACLAM/ASLAP), American Association of Bovine Practitioners (AABP), American Association of Equine Practitioners (AAEP), and the states of Indiana, Texas, Colorado and Arizona. These state and practice-type association surveys were fielded in addition to the national surveys to assist in identifying the validity of the segmentation, by practice type and region, of the national survey information and to provide a more extensive look at the diversity of the profession. This section summarizes the initial findings of surveys. More extensive analysis is currently being conducted and the results of this analysis will be presented at the 2017 AVMA Veterinary Economic Summit, in the 2018 AVMA Economic Report series and through special reports for each of the associations.

The AVMA sample that received the surveys was a subset of the total veterinary population while the other samples were the actual membership of each of the associations. Thus, the response rates for the associations provide information on a much larger portion of their respective populations than does the AVMA response.

SAMPLE SIZE AND RESPONSE RATES

	Sample Size	Total Respondents	Rate of Response
AVMA - 2016	21,638	2,545	11.8%
Texas	3,212	354	11.0%
Colorado	1,408	133	9.4%
Arizona	860	102	11.9%
Indiana*	2,098	457	21.8%
AABP*	4,573	934	20.4%
AAEP	5,943	986	16.6%
ACLAM/ASLAP*	2,503	855	34.2%

***Data are from the AVMA:**
-2015 Employment Survey
-2015 Compensation Survey
-2016 Census of Veterinarians

Table 5

The demographics of each of the samples were compared starting with the year of graduation. The AVMA sample follows a distribution where the number of respondents increases as their year of graduation draws closer to the present. Of course, the number of new graduates per year has increased over time but was essentially flat during the 1980s and 1990s. And, the number of people who have left the profession as a result of retirement, change in profession, injury or death has increased with years in the profession. Thus, the largest segment of the veterinary population is the group of veterinarians who graduated during the period 2010 through 2015 and the smallest is the 1950s cohort. Distribution of age follows a similar pattern. Among the allied association survey populations, only Indiana and the AAEP samples follow a similar pattern. The differences in this pattern from those of the other associations could be a result of response bias or a reflection of the demographics of the association. If the latter is the case, the reasons for the variations need to be investigated.

RESPONDENTS BY YEAR OF GRADUATION

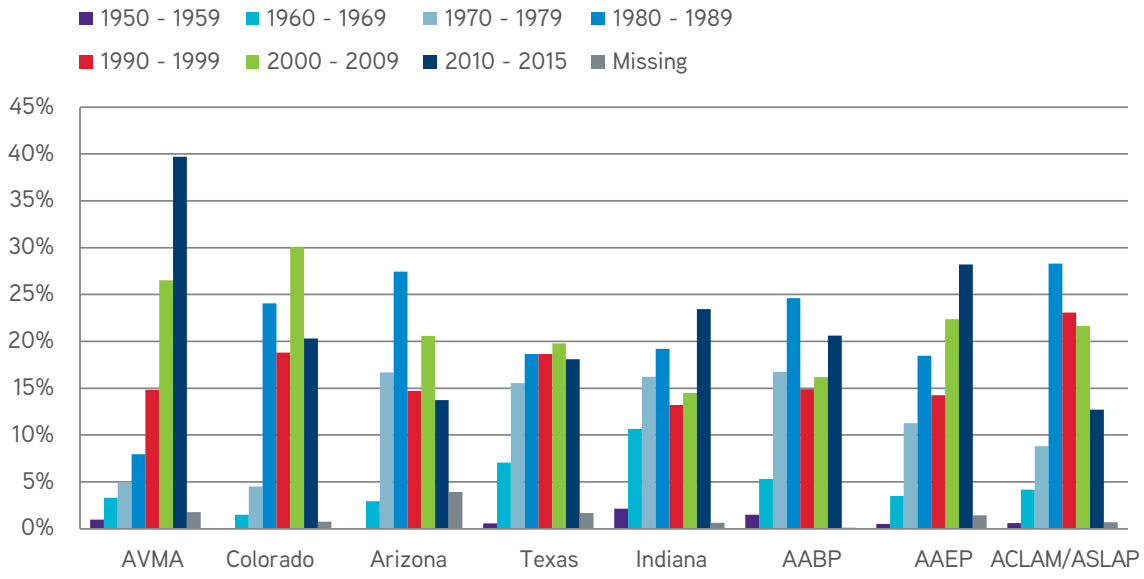


Figure 8

RESPONDENTS BY AGE GROUP

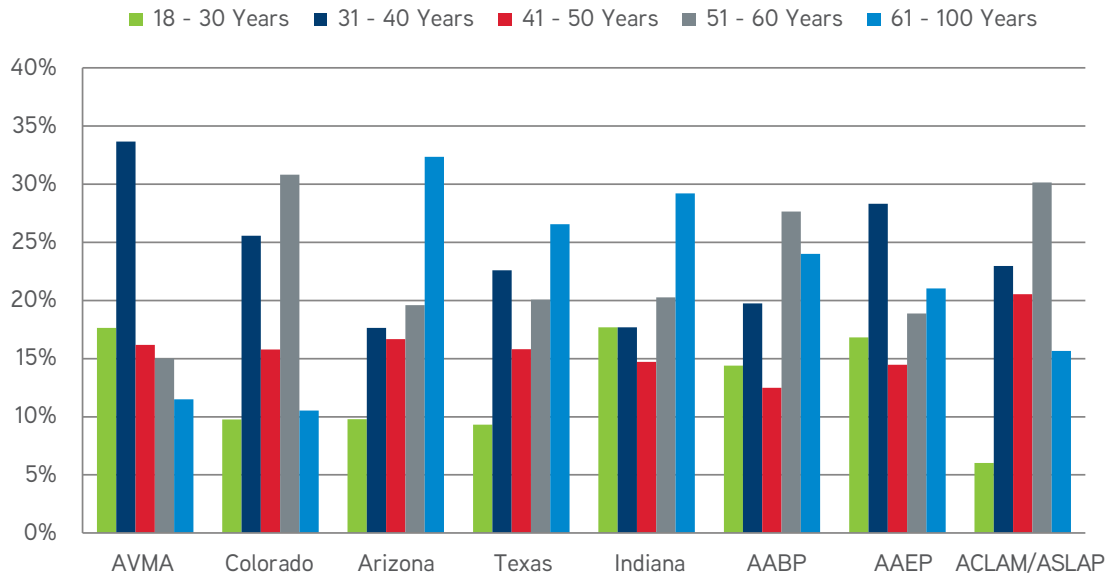


Figure 9

The variation in gender was also considerable across the various associations. While the gender distribution of the AVMA sample contains a higher percentage of women than is representative of the profession as a whole, and this difference requires the reweighting of the summary statistics (e.g., unemployment, underemployment), for the other associations, the gender distribution – as with the graduation year – might be due to sample response bias or actually reflect of the distribution. In either case, understanding the factors that contribute to either response bias or a difference in distribution should be evaluated.

RESPONDENTS BY GENDER

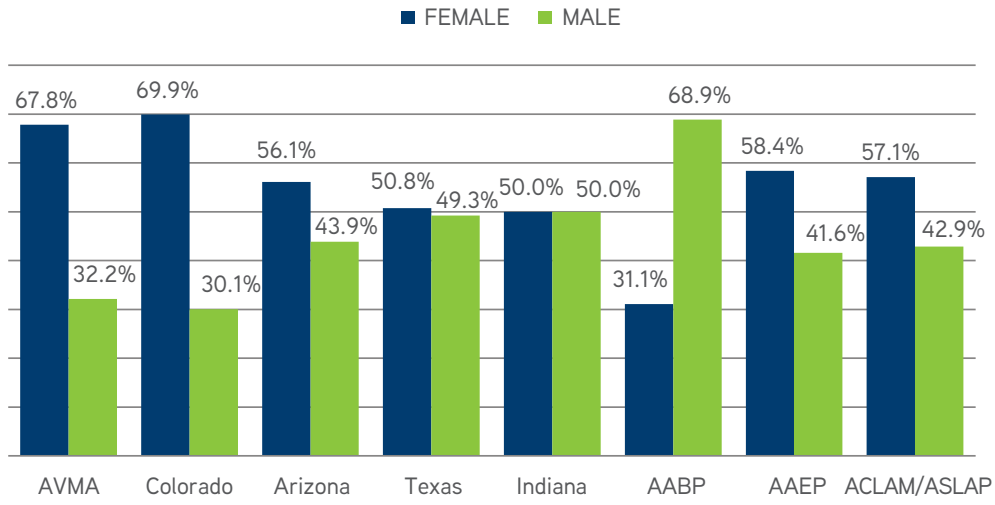


Figure 10

Nationally, 26 percent of Americans described where they live as urban, 53 percent said suburban and 21 percent said rural. The U.S. Census has no designation for "suburban," however, and the combined population of those indicating suburban or urban (81 percent) is equivalent to the census estimate that 81 percent of the population is urban.

For all samples of veterinarians except the ACLAM/ASLAP (ACLAM) sample the percentage of those responding that they practice in urban/suburban areas is less than the 81 percent noted by the U.S. Census. Indiana, AAEP and AABP were more strongly rural than the national populations or the other veterinary samples.

RESPONDENTS BY TYPE OF COMMUNITY

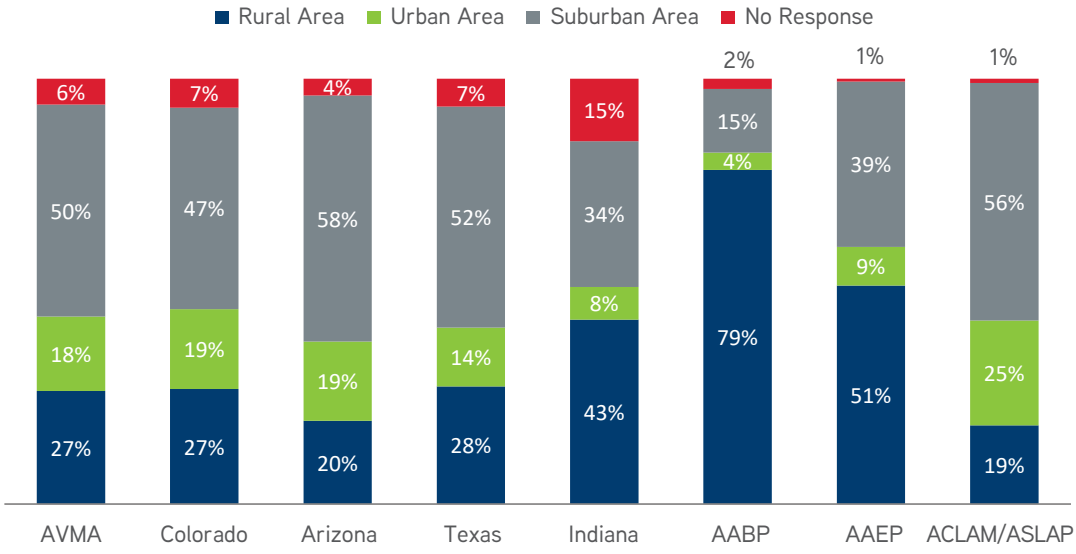


Figure 11

The distribution by practice type across the various samples indicates that for the nation and states there was little difference, with the majority (approximately 60 percent) of veterinarians involved in companion animal medicine and the next largest practice type being college or university workers (10 precent-20 percent). As might be expected, ACLAM/ASLAP was predominately in the college or university and industry practice types while AABP was predominately food and mixed animal and AAEP was predominantly equine or gave no response.

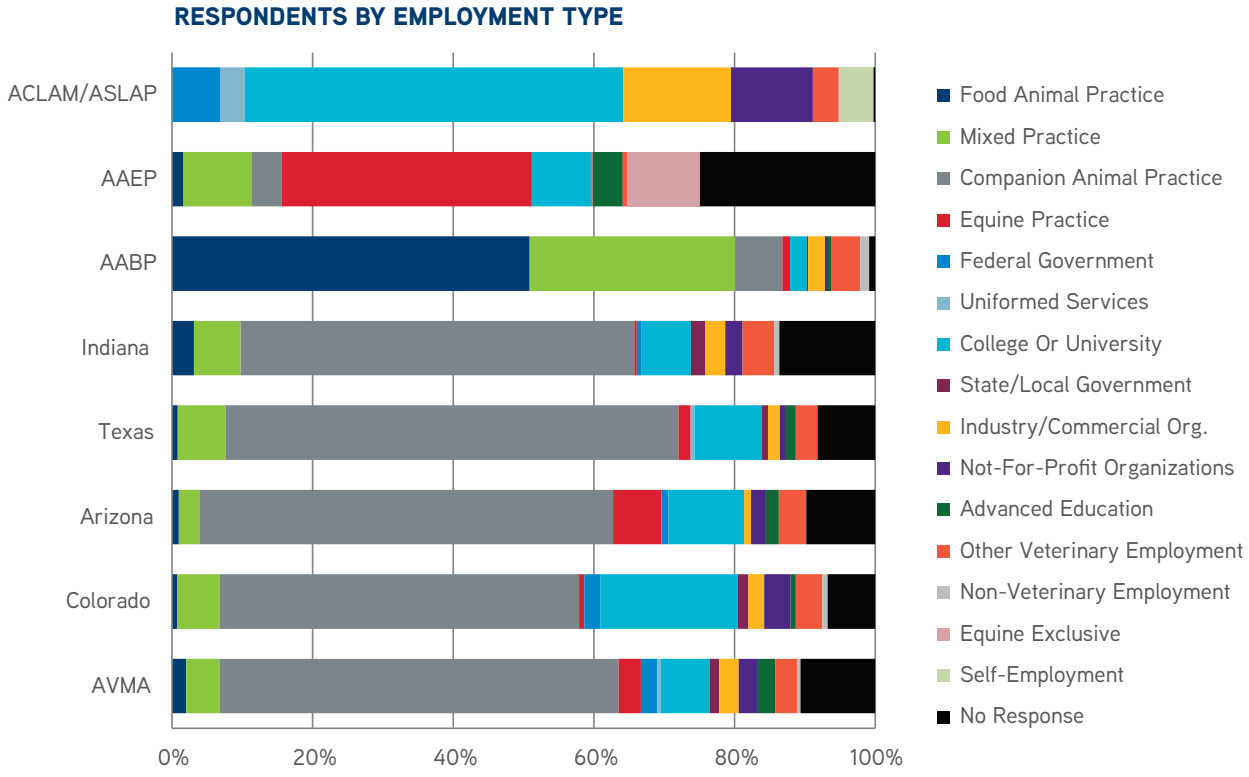
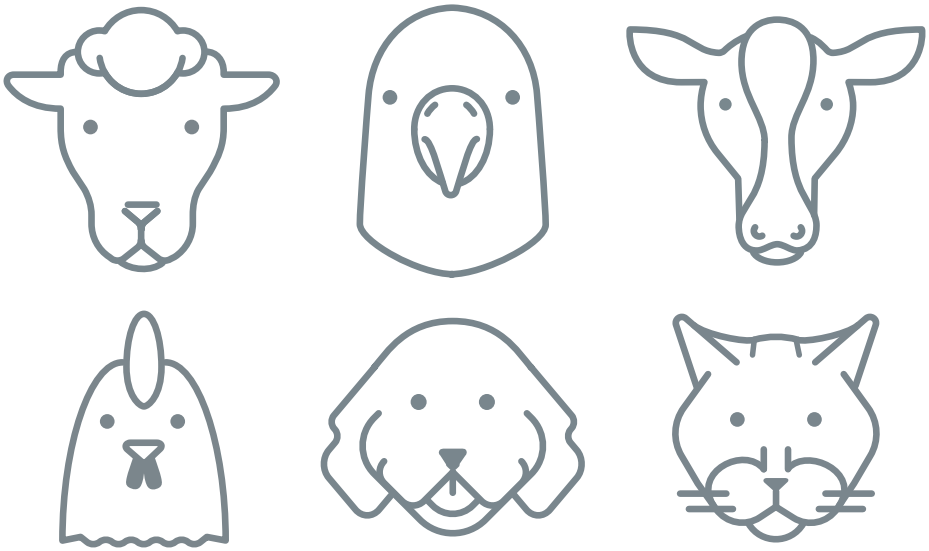


Figure 12



VETERINARY INCOMES

Incomes in 2016 across the various associations were fairly consistently distributed...

Incomes in 2016 across the various associations were fairly consistently distributed, with those making between $100,000 and $150,000 the predominant income group. In addition, except for the ACLAM sample, the distributions are skewed left, suggesting that the median income is to the left of the mean.

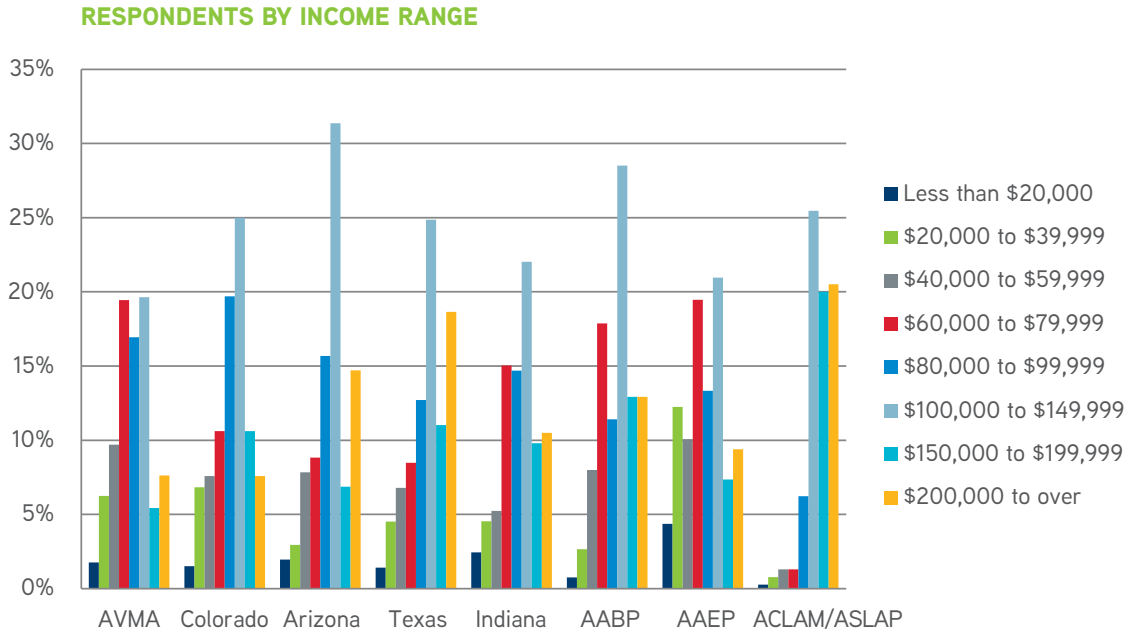


Figure 13

The income for the national sample varies by both graduation year and practice type. Figure 14 represents the mean income (points) by graduation year, as well as the range of incomes within one standard deviation of either side of the mean (line). Incomes increase with experience and the range of incomes also increases as experience increases for the first two decades post-graduation and then the mean income growth slows and declines along with the variation in income.

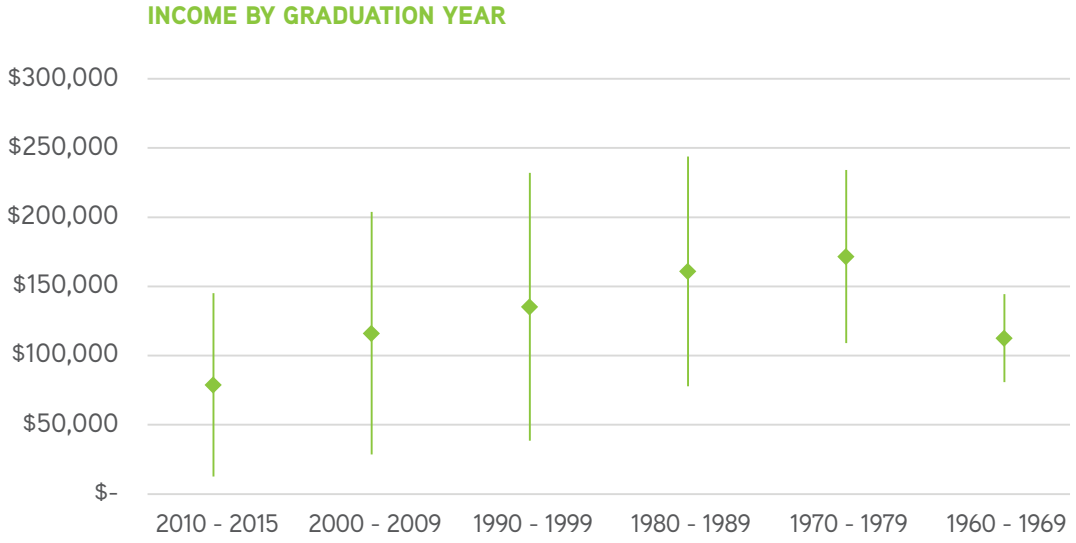


Figure 14

The difference in both mean incomes and the range of incomes within one standard deviation of the mean vary by practice type. Incomes for industry veterinarians has the highest mean income and along with companion animal medicine and college and university practice types has the greatest range of reported incomes within one standard deviation of the mean.

MEAN PROFESSIONAL INCOME BY PRACTICE TYPE, 2016

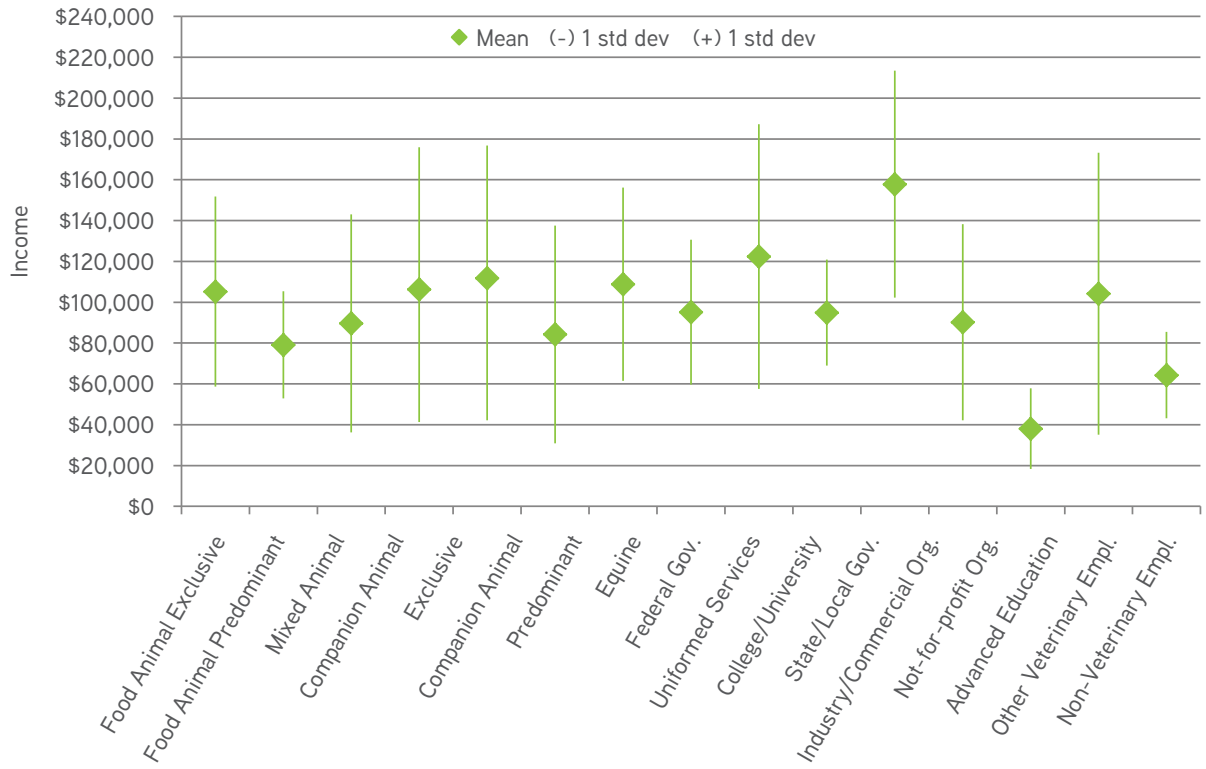


Figure 15

The distribution of incomes by practice type can also be illustrated by describing the mean income at percentiles. Mean income across all practice types for all levels of experience was just over $106,000 in 2016, placing the mean veterinarian income above the 90th percentile of all U.S. workers.

INCOME PERCENTILES BY PRACTICE TYPE, 2016

Private Practice	10%	25%	Median	75%	90%	Mean	Std. Dev.	Obs.
Food Animal Exclusive*	*	$75,000	$84,500	$125,000	*	$104,429	$46,575	22
Food Animal Predominant*	*	$62,500	$70,000	$92,500	*	$78,325	$26,213	20
Mixed Animal	$50,000	$61,000	$75,000	$95,000	$190,000	$88,865	$53,421	99
Companion Animal Predominant	$51,236	$70,000	$85,000	$120,000	$180,000	$105,483	$64,935	195
Companion Animal Exclusive	$60,860	$74,000	$90,000	$120,000	$188,000	$111,036	$69,673	942
Equine	$40,583	$50,000	$65,000	$92,000	$190,000	$83,427	$53,292	74
Total Private Practice	$55,000	$70,000	$87,000	$120,000	$185,000	$106,509	$66,849	1,352
Public Practice	**10%**	**25%**	**Median**	**75%**	**90%**	**Mean**	**Std Dev**	**Obs**
Federal Gov.	$59,000	$73,757	$107,500	$134,426	$175,000	$108,055	$47,290	52
Uniformed Services*	*	$74,500	$92,397	$102,500	*	$94,400	$35,510	12
College/University	$62,000	$88,000	$106,000	$137,000	$200,000	$121,593	$64,797	163
State/Local Gov.	$52,000	$82,000	$96,000	$105,000	$130,000	$94,128	$25,935	29
Industry/ Commercial Org.	$89,000	$115,000	$150,000	$200,000	$228,000	$157,070	$55,532	67
Not-for-profit Org.	$45,000	$62,000	$82,500	$104,500	$130,000	$89,420	$48,020	52
Interns, Residents, & Adv. Educ.	$27,000	$28,000	$32,000	$39,500	$50,000	$37,254	$19,774	58
Other Veterinary Empl.	$42,000	$64,000	$86,700	$110,000	$170,000	$103,393	$69,030	55
Non-Veterinary Empl.*	*	*	$57,500	*	*	$63,500	$21,148	3
Total Public Practice	$33,500	$65,000	$99,700	$131,623	$190,000	$106,950	$62,964	491
All Employment Types	$50,000	$70,000	$90,000	$120,000	$188,000	$106,627	$65,820	1,843

*Note: due to a lack of observations, some table entries have been removed to protect privacy.

Table 6

Using the percentile table to illustrate the effect of experience on income for all practice types indicates that within two decades in the workforce the median income of veterinarians exceeds the median income of the 90th percentile of all U.S. workers. And, as noted earlier, median income begins to drop off after four decades of employment, as veterinarians move towards retirement.

INCOME PERCENTILES BY EXPERIENCE LEVEL, 2016

Years of Experience	10%	25%	Median	75%	90%	Mean	Std. Dev.	Obs.
0	$32,310	$45,000	$50,500	$65,000	$84,000	$57,291	$22,950	66
1-4	$35,000	$55,000	$70,000	$82,000	$100,000	$69,881	$24,862	528
5-9	$52,000	$72,000	$90,000	$110,000	$137,000	$94,790	$39,164	374
10-19	$67,000	$82,000	$102,000	$140,000	$197,000	$119,716	$66,549	433
20-29	$70,000	$84,000	$114,500	$185,000	$250,000	$141,793	$84,418	246
30-39	$75,000	$110,000	$140,000	$200,000	$300,000	$166,999	$83,387	89
40+	$50,000	$90,000	$140,000	$210,437	$295,000	$156,471	$91,956	37
All Levels	$50,000	$70,000	$90,000	$120,000	$188,000	$106,627	$65,820	1,773
*Note: due to a lack of observations, some table entries have been removed to protect privacy.								

Table 7

The impact of additional education on income is illustrated in the table below. Generally there is little impact of additional degrees on income but there is a statistically significant increase in income as a result of obtaining board certification.

INCOME PERCENTILES BY ADDITIONAL EDUCATION, 2016

Years of Experience	10%	25%	Median	75%	90%	Mean	Std. Dev.	Obs.
DVM only	$51,236	$75,000	$102,000	$150,000	$220,000	$125,841	$83,453	181
DVM and Specialized Degree (JD, MD, etc.)	...	$72,000	$96,000	$144,000	...	$105,921	$53,307	25
DVM & Bachelor's	$50,000	$68,000	$84,000	$110,000	$165,000	$100,461	$62,515	1,263
DVM & Master's	$51,000	$75,000	$100,000	$135,000	$195,000	$113,873	$66,419	297
DVM & PhD	$81,000	$100,000	$124,000	$160,000	$200,000	$134,868	$54,827	77
Board Certification	10%	25%	Median	75%	90%	Mean	Std. Dev.	Obs.
Board Certified	$70,000	$100,000	$130,000	$188,000	$250,000	$148,548	$76,468	291
Not Board Certified	$50,000	$68,000	$85,000	$110,000	$155,000	$98,771	$60,519	1,551
All Levels	$50,000	$70,000	$90,000	$120,000	$188,000	$106,627	$65,820	1,843
*Note: Due to a lack of observations, some table entries have been removed to protect privacy.								

Table 8

In some of the practice types, such as college and university, there are significant differences in incomes associated with different positions. Positions such as college administrators or deans or higher make significantly more than all other veterinary employees, while administrative positions below the dean make the next highest level.

SUMMARY STATISTICS FOR VETERINARIANS IN COLLEGE/UNIVERSITY POSITIONS

	Median	Mean	Std. Dev.	Freq.
Professor: (Assistant, Associate, or Full)	$106,000	$113,305	$51,767	108
Executive: CEO/Vice President/ Chief Administrator/Dean	$230,000	$243,667	$116,249	6
Manager: Division Director/ Department Chair/Section Head	$160,000	$164,111	$72,813	21
Clinician	$85,000	$75,962	$30,599	21
Researcher	$50,000	$50,667	$22,304	6
Other	$84,000	$96,026	$81,220	12
Total	**$104,000**	**$116,074**	**$66,514**	**174**

*Some values rounded to protect privacy.

Table 9

VETERINARY SALARY WORKSHEET

Questions pertaining to veterinarian incomes are one of the most frequent requests received from veterinarians by the AVMAs Veterinary Economics division. The worksheet below was developed using a multiple regression model with available factors found to significantly affect veterinary incomes. The regression model used observations of veterinary incomes from AVMA surveys between 2001 and 2016, including more than 50,000 observations. Thus, the worksheet provides the mean salary for specific demographic characteristics based on historic observations. This worksheet can be used to provide veterinarians with an understanding of how years of experience, practice ownership, location of employment, practice type, gender and education or training beyond the doctor of veterinary medicine degree has affected incomes in the recent past. The worksheet was not intended, however, to be used by either employee or employer in setting or negotiating income. Veterinary incomes should reflect the value of veterinary services provided and the financial performance of the overall operation.

EXPERIENCED VETERINARIAN SALARY CALCULATOR

Category	Description	My Input	Male	Female	Product
Step 1	For ALL of the following items, enter a value in the "My Input" column:				
Basic Information	Constant	1	$43,337	$35,335	
	Last Two Digits of the Current Year	17	$2,639	$1,467	
	Mean Work Hours Per Week		$330	$95	
	Practice Owner (1=yes, 0=no)		$4,806	$3,079	
Step 2	For ONE of the following experience categories, enter a "1" in the "My Input" column:				
Years of Experience[1]	1		$0	$16,784	
	2-3		$21,056	$42,960	
	4-6		$35,324	$52,113	
	7-9		$48,940	$60,035	
	10-14		$63,952	$62,457	
	15-19		$70,793	$68,860	
	20-29		$81,562	$75,030	
	30+		$74,554	$85,673	
Step3	For ONE of the following U.S. regions, enter a "1" in the "My Input" column:				
Employment Region (first digit of ZIP code)	Region 0 (ME, NH, VT, MA, CT, RI, NJ, PR)		$6,988	$9,860	
	Region 1 (DE, PA, NY)		$0	$6,874	
	Region 2 (DC, MA, NC, SC, VA, WV)		$0	$2,751	
	Region 3 (AL, FL, GA, MS, TN)		$0	$0	
	Region 4 (IN, KY, MI, OH)		-$7,336	-$5,300	
	Region 5 (IA, MN, MT, ND, SD, WI)		-$8,201	-$2,713	
	Region 6 (IL, KS, MO, NE)		$0	$0	
	Region 7 (AR, LA, OK, TX)		-$7,367	$0	
	Region 8 (AZ, CO, ID, NM, UT, WY)		$7,688	$4,668	
	Region 9 (AK, CA, HI, NV, OR, WA)		$0	-$4,874	
Step 4	For ONE of the following practice types, enter a "1" in the "My Input" column:				
Private Practice	Food Animal (exclusive)		$0	-$4,874	
	Food Animal (predominant)		-$8,831	-$11,476	
	Mixed Animal		-$5,668	-$7,403	
	Companion Animal (exclusive)		$0	$0	
	Companion Animal (predominant)		$0	-$4,531	
	Equine		$0	-$9,287	
Public Practice	Federal Government		-$8,583	$3,863	
	Uniformed Services		-$14,967	-$7,829	
	College or University		-$17,617	-$12,617	
	State or Local Government		-$29,079	-$11,543	
	Industry		$15,537	$23,900	
	Other Public		-$13,245	-$5,626	
Step 5	For ANY of the following Additional Qualifications, enter a "1" in the "My Input" column:				
Additional Qualifications	Master's Degree (MS, MBA, MA, etc)		$0	$3,078	
	Doctorate Degree (besides DVM)		$7,899	$7,831	
	Residency Completed		$3,833	$3,702	
	Board Certified		$13,132	$14,983	
Step 6	For EVERY entry in the "My Input" column, multiply by the number in either the "Male" or "Female" column and enter the result in the "Product" column.				
Step 7	Add ALL of the entries in the "Product" column. This is the mean salary for your situation:				

[1]For "Years of Experience," take the current year and subtract your year of graduation from veterinary college, as well as any time spent out of the workforce or as a full-time student.

Table 10

EARLY CAREER SALARIES OF BOARD-CERTIFIED VETERINARIANS

Among the many factors that may motivate veterinarians to become board certified is increased compensation. This type of specialization leads not only to an increase in the breadth of one's skillset, but also a refinement; focusing on one area of a skillset makes a veterinarian faster and more efficient, which leads to higher compensation.

In the experienced veterinary salary calculator, it was shown that while accounting for all other factors, a higher mean income is obtained by both board certification ($13,132 for men and $14,983 for women) and having served in a residency ($3,833 for men and $3,702 for women). That is important to know, but a real question faced by veterinarians – particularly those who may have only worked in advanced education positions, such as internships and residencies – is how to determine just how much they should seek for a post-board certification starting salary. The answer is not straightforward because the interpretation of the survey questions appears to be inconsistent across survey respondents. To counter this inconsistency, the table below provides income summary statistics for a small variety of experience levels.

Through other analyses, when all factors are simultaneously taken into consideration, including hours worked, region of the United States, other advanced degrees, practice type, practice ownership, and years of experience, we find that a residency adds between $2,527-$3,732 of income per year and board certification adds an additional amount between $14,599-$16,388 per year, or just short of $20,000 together. This information could influence the career decision of someone thinking of seeking board certification. Once that decision has been made, however, and a new board-certified veterinarian enters the workforce, he or she needs information to negotiate a starting salary and knowing the $20,000 premium for all board-certified veterinarians won't help them. They can't simply ask for a $20,000 premium, because they have been board certified.

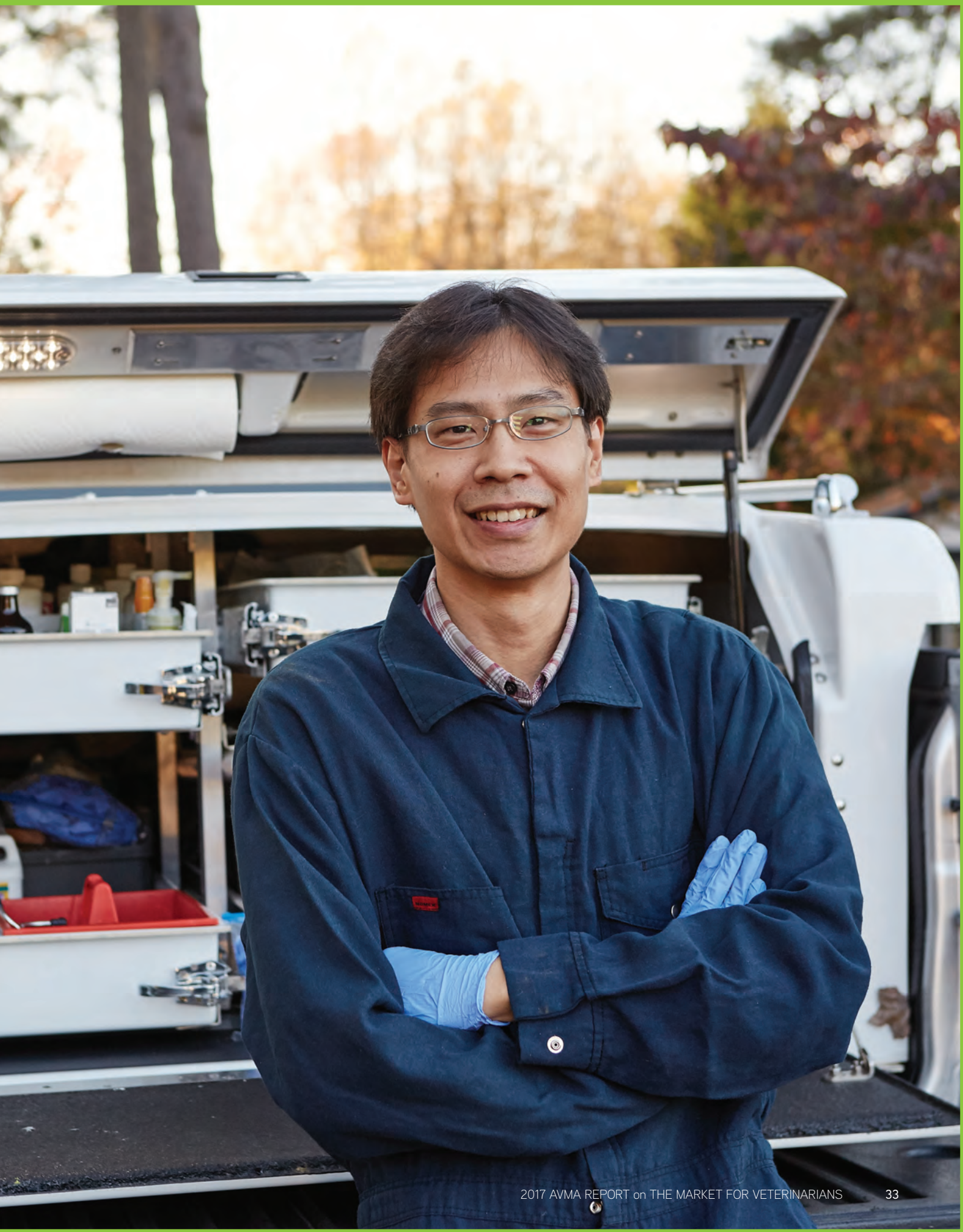
The data used to create the following table are from the 2016 AVMA Census of Veterinarians. While a survey respondent's starting salary after the subject has become board certified isn't specifically asked, an educated guess can be made based on the number of years since the reported (DVM) graduation. The table below gives the summary statistics for those in the survey who are five, six and seven years post-graduate with their DVM degree, who are board certified, and whose income listed is for the prior year, 2015. For example, someone who graduated five years ago would be from the DVM class of 2010 reporting income for the 2015 year. For a traditional student, this would correspond to graduating in 2010, interning in 2011, serving in a residency from 2011-2014, and earning a full-time income from 2014-2015. This calculation gets complicated, however, because not everyone is a traditional student: Some will take a longer or shorter time to go through internships and residencies; some might take time off between DVM graduation and an internship/residency; some might study longer for exams; and some might face a variety of other complicating circumstances. There are few data points meeting these criteria, so it is not possible to look at each board-certified specialty.

EARLY CAREER SALARIES OF BOARD CERTIFIED VETERINARIANS, 2016

DVM Graduation Year	Observations	Median	Mean	Std. Dev.
2010	50	$103,200	$103,454	$57,741
2009	9	$124,000	$125,778	$42,384
2008	8	$120,000	$130,500	$44,117
2010***	40	$116,000	$121,228	$49,800
**** Excludes observations below $60,000, which are presumably residents' salaries.				

Table 11

Both the mean and median salaries for those indicating they are board certified are well above the mean and median salaries of those not board certified with an equivalent level of education, and represent a large increase, approaching $50,000 over the starting salaries of those veterinarians who are recent graduates.



VETERINARIAN EMPLOYMENT

THE SURVEY INSTRUMENTS

In 2014 and 2015, two AVMA surveys collected data on employment and income of U.S. veterinarians. The first survey, the Employment Survey, was initiated in 2014 with the purpose of quantifying unemployment and underemployment. The sample frame for the Employment Survey was drawn from the AVMA database of veterinarians that includes all graduates from U.S. veterinary schools; U.S. graduates from AVMA-accredited foreign colleges; and any other veterinarians who have sought AVMA membership at any time in the past. The sample frame included AVMA members and non-members who graduated one, five, 10, 15 (only in the 2015 survey) and 25 years prior.

The second survey, the Veterinary Compensation Survey, formerly known as the Biennial Economic Survey, is conducted to gauge compensation trends among the veterinary profession. The sample frame is randomly drawn from all veterinarians for whom the AVMA has contact information.

In 2016 the employment survey and the compensation survey were combined to reduce the number of national surveys and provide a more comprehensive set of information for each respondent. The new survey, referred to as the census of veterinarians is fielded in January and February and questions cover events that occurred in or over the previous year.

AVMA SURVEYS RESPONSE RATES

	2014	2015	2016
Employment Survey	22.7%	19.0%	
Compensation Survey	14.7%	11.8%	
Census of Veterinarians			11.8%

Table 12

SAMPLE RESPONDENTS AND AVMA DATABASE BY PRACTICE TYPE

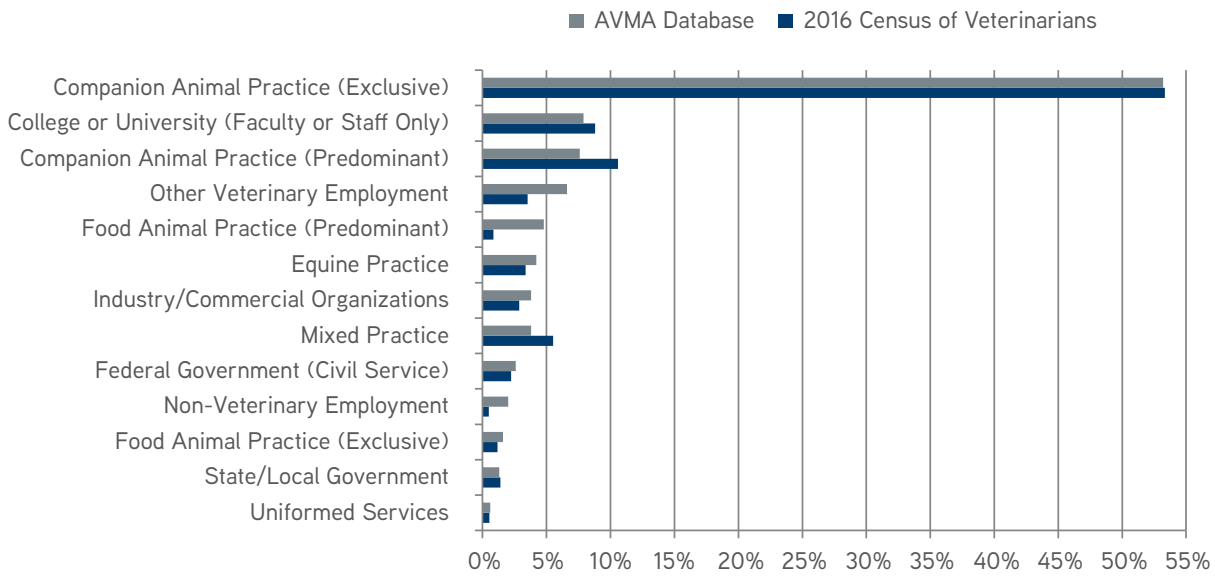


Figure 16

The respondents to both surveys represented the distribution of veterinarians across the profession by practice type and region, generally, but there were not sufficient responses to provide detailed information for each practice type in each region.

SAMPLE RESPONDENTS, AVMA DATABASE AND U.S. POPULATION BY REGION

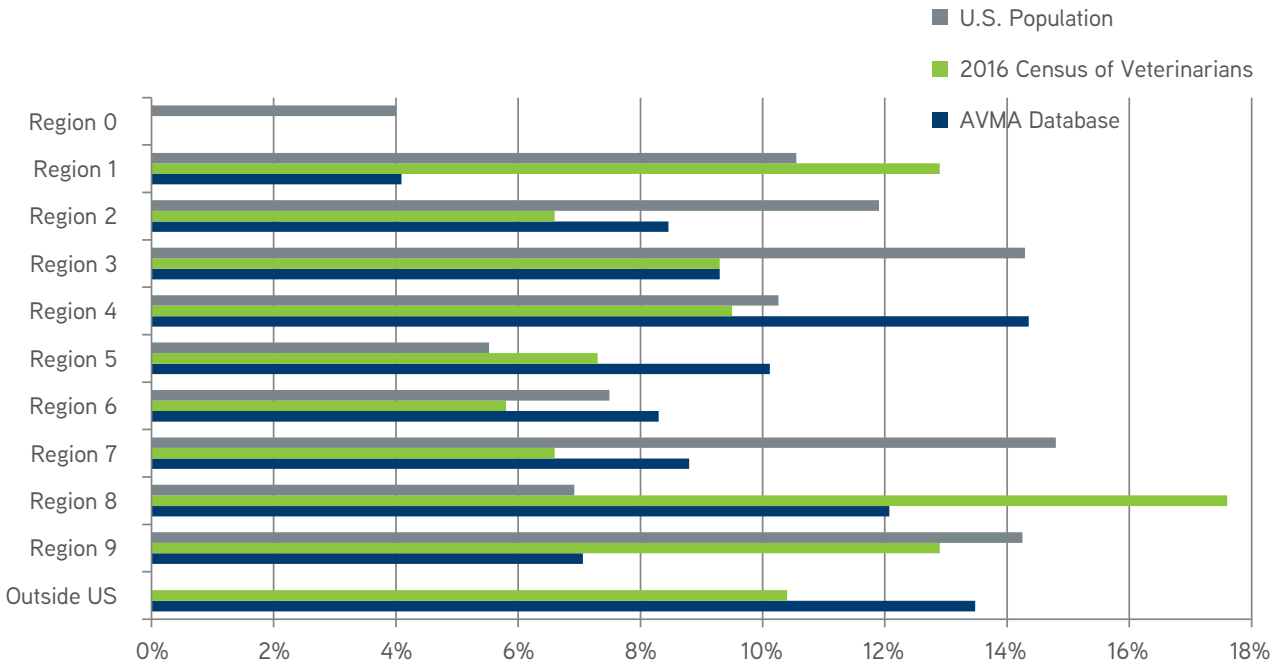


Figure 17

[2] Region is identified by the first digit of the zip code. A map of the regions can be found on page 13 of the 2016 AVMA Report on the Veterinary Markets.

The distribution of gender varies by survey and, again, generally represents a larger share of females in the profession compared to males.

Because of the differences in distribution by practice type, region and gender, and between surveys, descriptive statistics for each survey must be weighted to reflect the change in the distribution of veterinarians across these factors to provide an accurate measure for each variable over time. A higher percentage of females than males responded to the survey compared to the gender distribution found in the profession.

SAMPLE RESPONDENTS AND AVMA DATABASE BY GENDER

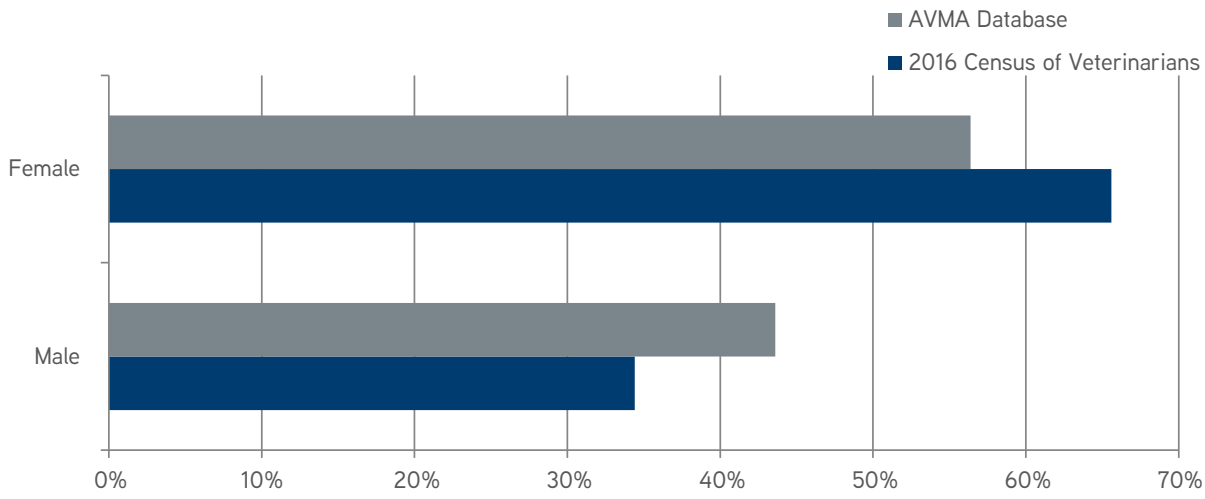


Figure 18

The higher percentage of female respondents corresponds to the higher number of early career veterinarians who responded, as the majority of these early career veterinarians are female.

2016 CENSUS OF VETERINARIANS, AVMA DATABASE

	2016 Census of Veterinarians	AVMA Database		
	N	Percent	N	Percent
2006-2015	1,313	42.7%	35,657	27.8%
1996-2005	738	24.0%	27,728	21.6%
1986-1995	488	15.9%	24,711	19.3%
1976-1985	288	9.4%	20,830	16.2%
1966-1975	171	5.6%	11,797	9.2%
1956-1965	71	2.3%	5,849	4.6%
1946-1955	9	0.3%	1,782	1.4%
Missing	56			
Total	**3,134**			

Table 13

There was, however, very little difference in the distribution of respondents by veterinary college attended, compared to the veterinary population, except that graduates of Texas A&M responded at twice the rate as graduates of any other U.S. veterinary college and graduates of veterinary colleges outside of the United States and the Caribbean.

SAMPLE RESPONDENTS AND AVMA DATABASE BY VETERINARY COLLEGE ATTENDED

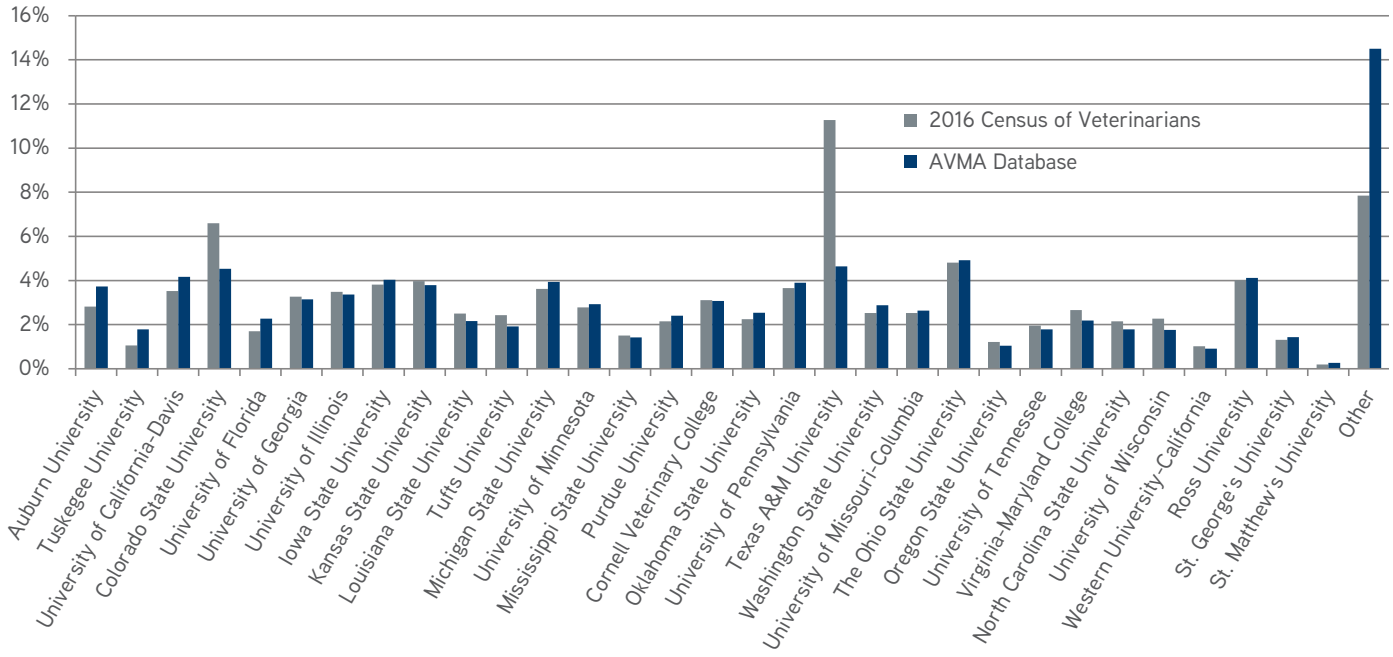


Figure 19

UNEMPLOYMENT

Since 2014, the AVMA has been estimating the unemployment rate. As noted earlier, each survey is conducted at the beginning of the year and reports the unemployment rate for the previous year. Thus, the 2016 Survey provides the unemployment rate for 2015, and the same is true for the underemployment rate and veterinary education outcomes assessments for the veterinary profession.

Summary Statistics

The 2014 Employment Survey indicated that the 2013 unweighted unemployment rate was 3.3 percent, with 1.7 percent of respondents not responding to the question. The 2015 Employment Survey indicated that the 2014 unweighted unemployment rate was 4.4 percent, with 1.2 percent of respondents not responding to the question. The confidence interval around the 2014 and 2015 surveys was .81 percent and .85 percent, respectively, and thus the two rates are not statistically different. In 2016, the census survey was used to indicate the 2015 unweighted unemployment rate of 4.5 percent, with 0.4 percent of the respondents not responding to this specific question.

To better align with the BLS estimates of unemployment a set of new questions was asked in 2016 to determine how many of those unemployed were actively seeking employment (the BLS definition). Eliminating respondents who indicated they were unemployed in 2015 because they were not actively seeking employment and those who were seeking enrollment in an internship, residency or advanced education yielded an unemployment rate of 1.7 percent, which is well below the 4.6 percent national unemployment rate reported for 2015.

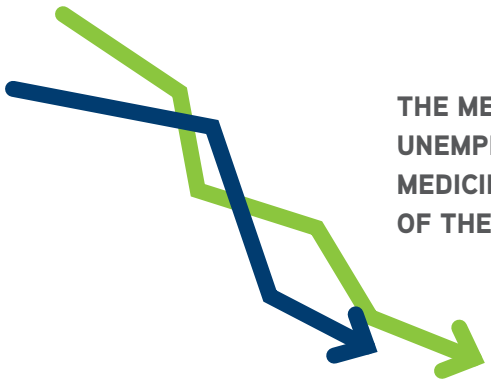
UNEMPLOYMENT RATE: 2016 SURVEY

Are you currently employed in veterinary medicine?	2014 Survey	2015 Survey	2016 Survey
Yes	95.0%	94.4%	89.0%
No	3.3%	4.4%	4.5%
Retired			6.1%
Missing	1.7%	1.2%	0.4%

If unemployed, are you seeking employment in veterinary medicine?	2014 Survey	2015 Survey	2016 Survey
Seeking employment in veterinary medicine			38.8%
Seeking enrollment in an internship, residency, or advanced education program			12.9%
Not seeking employment (and not retired)			48.2%

Unemployment Rate			1.7%

Table 14



THE MEAN NUMBER OF WEEKS UNEMPLOYED IN VETERINARY MEDICINE HAS DECLINED EACH OF THE LAST THREE YEARS...

The surveys also sought the length and duration of unemployment in the veterinary profession by each of the respondents. The mean number of weeks unemployed in veterinary medicine has declined each of the last three years while the number of isolated periods of unemployment has not shown any significant change and remains near two periods.

LENGTH AND DURATION OF UNEMPLOYMENT

		Mean	N	Std. Dev.	Minimum	Maximum
2014 Survey	How many weeks have you been unemployed in veterinary medicine?	55.7	60	49.7	1	156
	How many isolated periods of unemployment have you had?	1.7	57	1.3	1	10
2015 Survey	How many weeks have you been unemployed in veterinary medicine?	47.9	65	48.5	0	156
	How many isolated periods of unemployment have you had?	2.1	63	1.7	1	10
2016 Survey	How many weeks have you been unemployed in veterinary medicine?	36.5	93	20.3	0	52
	How many isolated periods of unemployment have you had?	1.6	66	1.1	0	5

Table 15

Unemployment by gender and year of graduation over the last three years has generally shown higher unemployment rates for females compared to males, and unemployment rates across all graduation years and gender have generally remained lower than the national average unemployment rate.

UNEMPLOYMENT BY GENDER AND YEAR OF GRADUATION

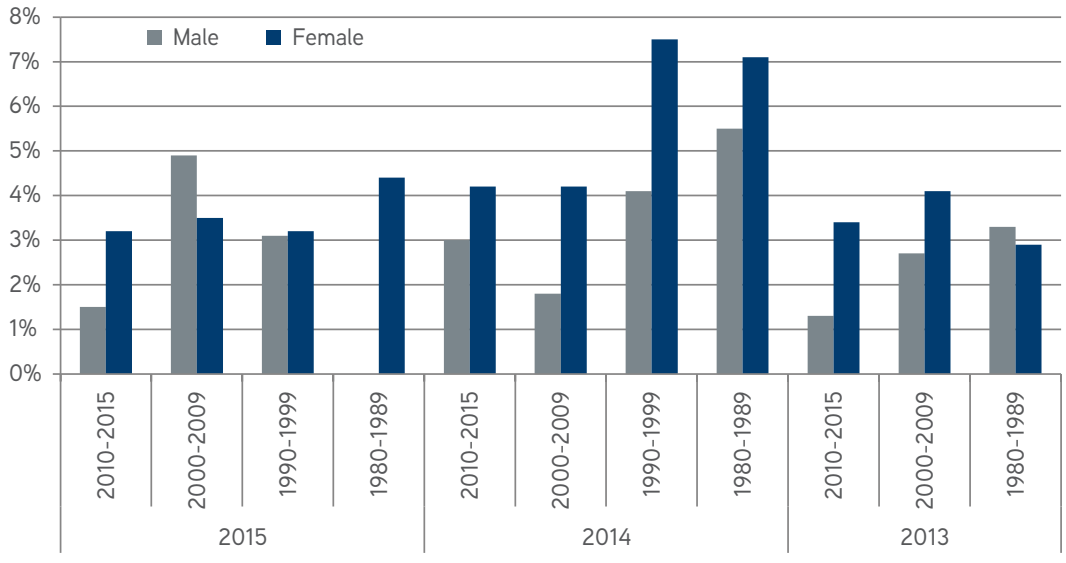


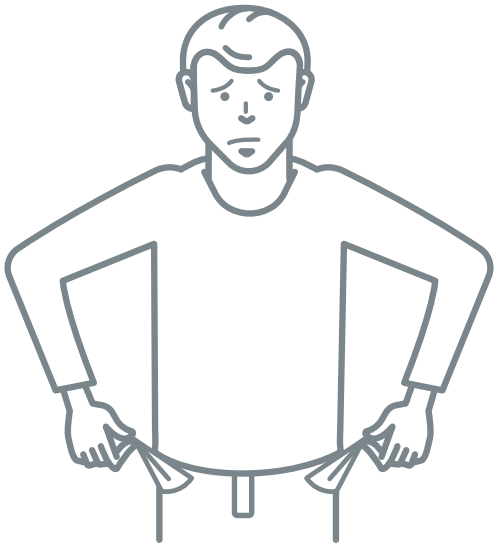
Figure 20

Unemployment also varied by region with the Northeast region (Region 0) having the highest unemployment rate (4.8 percent) and the south central region (Region 7), which comprises Arkansas, Louisiana, Oklahoma and Texas, having the lowest unemployment rate (0.9 percent). Texas is one of the states that must import veterinarians, as the supply from Texas A&M is insufficient to meet the state's demand for veterinarians. This demand has been found to pull a large number of veterinarians from adjacent states and thus creates a relatively low supply/demand ratio for the region as a whole.

REGION AND EMPLOYMENT STATUS, 2016

	Working full time in veterinary medicine	Working part time in veterinary medicine	Unemployed in veterinary medicine	Retired from veterinary medicine	Total
Region 0	83.2%	10.7%	3.6%	2.6%	100.0%
Region 1	77.7%	12.6%	3.9%	5.8%	100.0%
Region 2	77.2%	14.2%	2.1%	6.6%	100.0%
Region 3	78.0%	11.8%	2.7%	7.4%	100.0%
Region 4	81.5%	9.7%	3.1%	5.7%	100.0%
Region 5	72.6%	15.1%	3.9%	8.4%	100.0%
Region 6	78.2%	13.6%	2.9%	5.3%	100.0%
Region 7	79.1%	14.5%	1.1%	5.3%	100.0%
Region 8	78.3%	14.1%	1.8%	5.8%	100.0%
Region 9	78.1%	14.1%	2.5%	5.3%	100.0%
Outside U.S.	67.6%	5.4%	18.9%	8.1%	100.0%
Total	**78.6%**	**13.0%**	**2.7%**	**5.6%**	**100.0%**

Table 16



UNEMPLOYMENT IS ALSO AFFECTED BY THE CHOICE OF FIRSTEMPLOYMENT, WITH THOSE FIRST EMPLOYED IN ADVANCED EDUCATION, OTHER VETERINARY EMPLOYMENT, AND STATE AND LOCAL GOVERNMENT HAVING THE HIGHEST UNEMPLOYMENT.

Unemployment is also affected by the choice of first employment, with those first employed in advanced education, other veterinary employment, and state and local government having the highest unemployment.

FIRST VETERINARY EMPLOYMENT AND CURRENT EMPLOYMENT STATUS

	Working Full Time In Veterinary Medicine	Working Part Time In Veterinary Medicine	Unemployed In Veterinary Medicine	Retired From Veterinary Medicine	Total
Food Animal Practice (Exclusive)	81.8%	11.4%	6.8%		100.0%
Food Animal Practice (Predominant)	67.3%	13.3%	1.0%	18.4%	100.0%
Mixed Practice	75.5%	13.4%	3.4%	7.7%	100.0%
Companion Animal Practice (Predominant)	77.1%	13.1%	3.7%	6.1%	100.0%
Companion Animal Practice (Exclusive)	79.1%	16.0%	1.7%	3.2%	100.0%
Equine Practice	87.9%	4.7%	2.0%	5.4%	100.0%
Federal Government (Civil Service)	66.7%	3.7%	11.1%	18.5%	100.0%
Uniformed Services	52.1%	14.1%		33.8%	100.0%
College or University (Faculty or Staff Only)	83.9%	6.0%	3.4%	6.7%	100.0%
State/Local Government	81.3%		6.3%	12.5%	100.0%
Industry/ Commercial Organization	84.8%	3.0%	12.1%		100.0%
Not-For-Profit Organization	89.5%	5.3%		5.3%	100.0%
Currently Participating in Internship/ Residency	97.6%		2.4%		100.0%
Currently Pursuing Advanced Education	27.3%	18.2%	54.5%		100.0%
Other	67.1%	9.6%	15.1%	8.2%	100.0%
Total	**78.1%**	**13.1%**	**3.0%**	**5.8%**	**100.0%**

Table 17

Unemployment also varied by veterinary college attended, with those who attended St. George's University and other (schools, not mentioned, outside of the 28 U.S.-accredited colleges of veterinary medicine) having the highest unemployment rates.

UNEMPLOYMENT BY VETERINARY COLLEGE

	2016	2015
St. George's University	7.5%	5.1%
Cornell Veterinary College	6.2%	1.3%
University of Minnesota	5.7%	1.4%
University of Wisconsin	4.2%	3.0%
The Ohio State University	4.0%	2.4%
Tufts University	3.9%	0.0%
University of Missouri-Columbia	3.8%	2.9%
Michigan State University	3.5%	2.2%
Iowa State University	3.4%	2.4%
Western University - California	3.1%	0.0%
North Carolina State University	3.0%	1.6%
University of California-Davis	2.8%	1.2%
Louisiana State University	2.6%	0.0%
Virginia-Maryland College	2.4%	0.0%
Auburn University	2.3%	0.0%
University of Florida	1.9%	0.0%
Kansas State University	1.6%	1.1%
University of Tennessee	1.6%	0.0%
Purdue University	1.5%	0.0%
Colorado State University	1.0%	0.0%
University of Georgia	1.0%	0.0%
University of Illinois	0.9%	0.0%
University of Pennsylvania	0.9%	0.0%
Texas A&M University	0.6%	0.0%
Mississippi State University	0.0%	0.0%
Oklahoma State University	0.0%	0.0%
Oregon State University	0.0%	0.0%
Ross University	0.0%	0.0%
St. Matthew's University	0.0%	0.0%
Tuskegee University	0.0%	0.0%
Washington State University	0.0%	0.0%
Other	13.1%	7.3%
Total	**3.0%**	**1.4%**

Table 18

Factors affecting Unemployment

To identify the relationship between unemployment and the various factors presented above, a logistic regression was employed. The logistic regression predicts the probability that an observation falls into one of two categories, in this case employed or unemployed. Unemployment regression identifies the respondents as having a higher likelihood of being unemployed in veterinary medicine if the coefficient (B) is positive and significant. The increase in probability of being unemployed is defined by the Exp(B). For instance, having a first employment in companion animal exclusive medicine indicates a 11.6 times higher probability associated with unemployment. The factors that are significant are associated with unemployment, not necessarily a cause of unemployment. However, this regression applies to all respondents who were unemployed in veterinary medicine. This does not mean they are all seeking employment in veterinary medicine nor does it mean they are unemployed. It just means they are not currently employed in veterinary medicine.

Factors found to be associated with a higher probability of unemployment were first employment in companion animal (exclusive or predominant), equine, food animal or mixed animal practice, non-board certified, poor health, intern or resident, female, or reside in the northeast (Region 0).

FACTORS AFFECTING UNEMPLOYMENT IN VETERINARY MEDICINE

	B	S.E.	Wald	df	Sig.	Exp(B)
First Veterinary Employment: Companion Animal Exclusive	2.455	.511	23.103	1	.000	11.641
Board Certified =1 else 0	2.362	.680	12.067	1	.001	10.615
Health, Poor=1, Excellent=5	.422	.144	8.579	1	.003	1.524
First Veterinary Employment: Companion Animal Predominant	1.489	.582	6.535	1	.011	4.431
First Veterinary Employment: Mixed Practice	1.305	.532	6.018	1	.014	3.688
First Veterinary Employment: Intern/ Resident	2.058	.883	5.429	1	.020	7.833
Gender: Male=1, Female=2	-.773	.348	4.931	1	.026	.462
First Veterinary Employment: Equine	1.678	.770	4.748	1	.029	5.353
First Veterinary Employment: Food Animal Predominant	2.468	1.146	4.632	1	.031	11.793
Live Region 0	1.362	.692	3.875	1	.049	3.902
First Veterinary Employment: Advanced Education	-2.172	1.144	3.601	1	.058	.114
Live Region 2	1.455	.787	3.415	1	.065	4.284
Live Region 7	1.406	.778	3.265	1	.071	4.080
Live Region 1	1.232	.706	3.047	1	.081	3.429
Live Region 9	1.194	.694	2.955	1	.086	3.299
Live Region 5	1.352	.819	2.728	1	.099	3.865
Own	1.042	.659	2.500	1	.114	2.836
Live Region 4	1.194	.757	2.484	1	.115	3.300
Other Master's Degree	-1.102	.733	2.264	1	.132	.332
Married	.464	.314	2.189	1	.139	1.591
Live Region 3	.916	.699	1.715	1	.190	2.499
Live Region 8	.961	.735	1.709	1	.191	2.614
DVM Debt	.000	.000	1.650	1	.199	1.000
Divorced	.872	.697	1.567	1	.211	2.393

	B	S.E.	Wald	df	Sig.	Exp(B)
First Veterinary Employment: Food Animal Exclusive	1.147	.930	1.520	1	.218	3.148
Live Region 6	1.008	.833	1.462	1	.227	2.740
Ph.D, Ed.D.	-.455	.570	.636	1	.425	.634
M.P.H.	-.566	.713	.631	1	.427	.568
Widowed	-.851	1.131	.567	1	.452	.427
Other Degree	-.519	.710	.535	1	.465	.595
First Veterinary Employment: Industry	-.616	.866	.505	1	.477	.540
Number of years post Graduation (2015=1)	-.011	.015	.492	1	.483	.989
Rent	.446	.642	.482	1	.488	1.562
First Veterinary Employment: College/ University	.484	.707	.470	1	.493	1.623
M.S.	-.157	.448	.124	1	.725	.854
First Veterinary Employment: State/ Local Government	.415	1.197	.120	1	.729	1.514
No Additional Degree	.182	.593	.094	1	.759	1.199
Bachelor's Degree	.137	.459	.089	1	.765	1.147
First Veterinary Employment: Federal Government	-.254	.970	.068	1	.794	.776
Separated	.320	1.377	.054	1	.816	1.377
M.A.	.060	.920	.004	1	.948	1.062
First Veterinary Employment: Uniformed Services	18.789	5352.097	.000	1	.997	144568987
First Veterinary Employment: Not-for-Profit	19.417	6196.786	.000	1	.997	270790377
M.B.A.	16.929	5737.402	.000	1	.998	22505590
Specialized Professional Degree	17.195	11536.951	.000	1	.999	29343215
St George's University	-18.494	14178.460	.000	1	.999	.000
University of Minnesota	-18.396	14178.460	.000	1	.999	.000
Other University	-18.045	14178.460	.000	1	.999	.000
Louisiana State University	-17.973	14178.460	.000	1	.999	.000
The Ohio State University	-17.904	14178.460	.000	1	.999	.000
Iowa State University	-17.738	14178.460	.000	1	.999	.000
University of Missouri - Columbia	-17.713	14178.460	.000	1	.999	.000

	B	S.E.	Wald	df	Sig.	Exp(B)
Tufts University	-17.619	14178.460	.000	1	.999	.000
Cornell University	-17.567	14178.460	.000	1	.999	.000
North Carolina State University	-17.530	14178.460	.000	1	.999	.000
University of Wisconsin	-17.467	14178.460	.000	1	.999	.000
Western University	-17.329	14178.460	.000	1	.999	.000
Virginia Maryland College	-17.303	14178.460	.000	1	.999	.000
University of California - Davis	-17.192	14178.460	.000	1	.999	.000
University of Florida	-17.121	14178.460	.000	1	.999	.000
Purdue University	-16.990	14178.460	.000	1	.999	.000
University of Tennessee	-16.921	14178.460	.000	1	.999	.000
Michigan State University	-16.832	14178.460	.000	1	.999	.000
Kansas State University	-16.710	14178.460	.000	1	.999	.000
University of Illinois	-16.484	14178.460	.000	1	.999	.000
Auburn University	-16.464	14178.460	.000	1	.999	.000
University of Georgia	-16.418	14178.460	.000	1	.999	.000
Texas A&M University	-16.111	14178.460	.000	1	.999	.000
Colorado State University	-16.021	14178.460	.000	1	.999	.000
Washington State University	.649	14903.462	.000	1	1.000	1.914
Tuskegee University	.530	15732.386	.000	1	1.000	1.699
Mississippi State University	.265	15311.080	.000	1	1.000	1.304
Oregon State University	.249	15423.322	.000	1	1.000	1.283
University of Pennsylvania	-.100	14680.329	.000	1	1.000	.905
Oklahoma State University	.009	15030.787	.000	1	1.000	1.009
Ross University	-.008	14645.102	.000	1	1.000	.992
Constant	16.266	14178.460	.000	1	.999	11595008

Observed		Predicted		
		Employment Status		Percentage Correct
		Unemployed	Employed	
Employment Status	Unemployed	7	72	8.9
	Employed	5	2,613	99.8
Overall Percentage				97.1

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	515.401a	.071	.305

Table 19

Only 1.5 percent of the sample is unemployed in veterinary medicine and seeking employment or other continuing education in veterinary medicine. That is, there is a subset of respondents that is unemployed in veterinary medicine but employed outside of veterinary medicine, and not seeking employment in veterinary medicine.

UNEMPLOYED SEEKING EMPLOYMENT OR CONTINUING EDUCATION IN VETERINARY MEDICINE

	Frequency	Percent	Valid Percent	Cumulative Percent
Seeking employment in veterinary medicine	34	1.1	27	27
Seeking enrollment in an internship, residency, or other academic program	12	0.4	9.5	36.5
Not seeking employment or enrollment	80	2.6	63.5	100
Total	126	4	100	
System	3,008	96		
Total	**3,134**	**100**		

Table 20

When only those currently unemployed and seeking employment in veterinary medicine are considered, the only significant variable associated with a higher probability of being unemployed was graduation date. That is, recent graduates have a statistically higher probability of being unemployed and seeking employment in veterinary medicine.

SEEKING EMPLOYMENT AND GRADUATION YEAR

Graduation Years	Seeking Employment in Veterinary Medicine	Not Seeking Employment in Veterinary Medicine	Total
2006-2015	27	17	44
1996-2005	12	16	28
1986-1995	7	16	23
1976-1985	0	11	11
1966-1975	0	11	11
1956-1965	0	7	7
1946-1955	0	2	2
Total	**46**	**80**	**126**

Table 21

UNDEREMPLOYMENT

As noted earlier, the unemployment rate considers only those who are unemployed and seeking employment. Within veterinary medicine the unemployment rate for veterinarians would consider only those who are not employed but desire to be employed (are actively seeking employment) in the veterinary profession. But the unemployment rate doesn't measure the true number of people who are looking for work, because it does not count those who are underemployed. Because the unemployment rate is computed using the same method each year, it is an indicator of employment conditions. The point of an indicator is to measure the exact same thing consistently over time, not necessarily to put an exact measurement on a broad concept with multiple interpretations. Generally, these indicators are not meant to give accurate point estimates, but to provide an indication as to whether conditions are improving or worsening.

The AVMA Census of Veterinarians Survey was designed to measure both unemployment and underemployment. Underemployment occurs because a worker is not working as many hours as he or she would like, or the worker is not working in a position that utilizes his or her training and experience.

Underemployment has two definitions. In the context of the veterinary field, the first definition of underemployment is when a veterinarian may be keeping busy all the time but would be able to see more clients and perform more productive work with additional veterinary technicians or physical space. The second definition of underemployment, as measured in total hours, represents the number of hours that veterinarians desire to work above what they are currently working. This was measured as the desire to increase/decrease hours worked for an equivalent increase/decrease in compensation. The most important aspect of the question pertaining to hours worked was the associated increase or decrease in compensation. The survey question asked if veterinarians wish to work more for greater compensation or work less for less compensation. Additional questions sought the actual number of hours per week currently and the number of hours that would be preferred.

Summary Statistics

Underemployment was again negative in 2016 following the trend started in 2014, with more veterinarians indicating they wish to work fewer hours for less compensation than those who wish to work more hours for more compensation. In 2016, veterinarians wanted to reduce a net total 135,640 weekly hours of work, and this would require an additional 3,391 veterinary FTEs (40 hours per week equals one FTE) to eliminate the negative underemployment. This was a substantial increase over the 1,895 new veterinarians needed in 2015 and the 1,713 new veterinarians who would have been needed in 2014.

While the majority of veterinarians are content with their current number of work hours per week, 10.6 percent indicated a desire to increase the number of hours per week for increased compensation, while 19.6 percent indicated a desire to reduce the number of hours worked per week for reduced compensation.

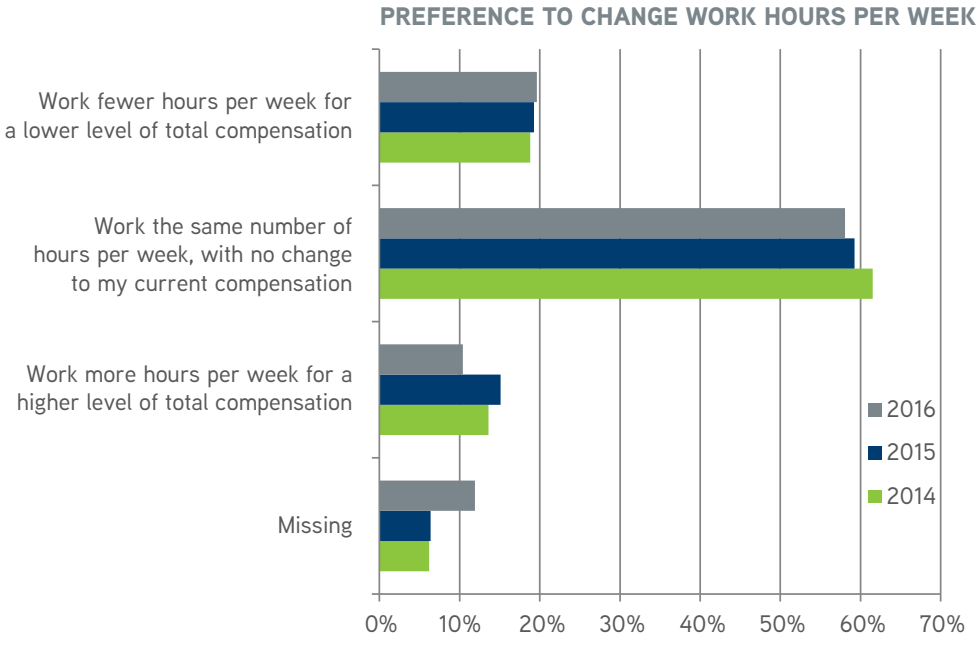


Figure 21

As with unemployment, underemployment varies by gender, region and practice type. More females want to work fewer hours than want to work additional hours, but for the first time since we have measured underemployment, the percent of men who wish to work less is also greater than the percent who wish to work more hours per week.

UNDEREMPLOYMENT BY GENDER

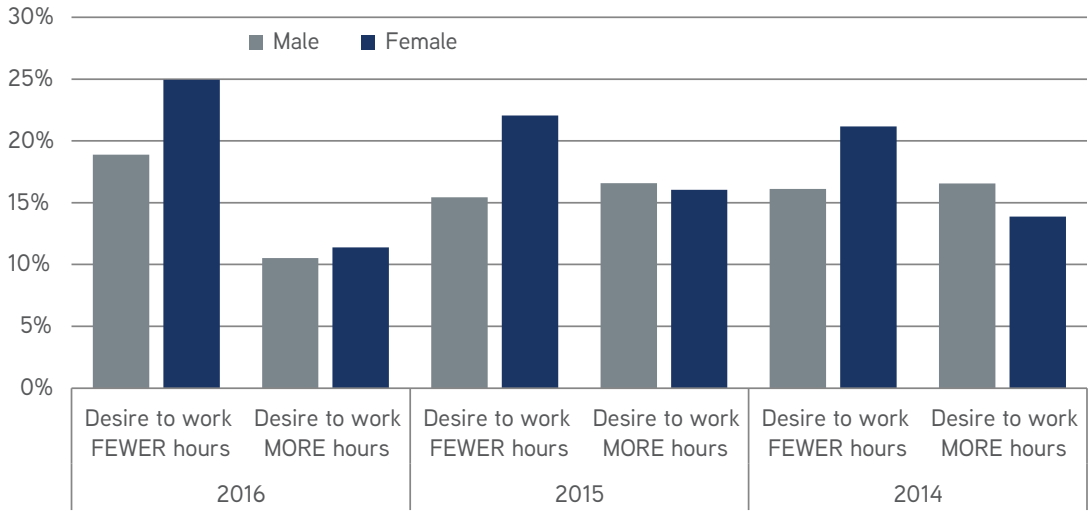


Figure 22

Geographically, most of the regions followed the national trend with more veterinarians wanting to work fewer hours than the number of veterinarians wanting to work additional hours. However, in the Northeast (Region 0), the Mid-Atlantic (Region 2), the Southeast (Region 3) and the Midwest (Region 6) there are more veterinarians who wish to work additional hours than those wishing to work fewer hours. This disparity in underemployment across regions illustrates the problem of geographical maldistribution and suggests a need for greater mobility within the profession.

UNEMPLOYMENT BY REGION

	AVMA Database	Work fewer hours	Work more hours
Region 0	4.1%	11.8%	16.2%
Region 1	8.5%	7.5%	7.3%
Region 2	9.3%	8.2%	9.6%
Region 3	14.4%	7.4%	14.2%
Region 4	10.1%	7.9%	5.0%
Region 5	8.3%	6.8%	6.6%
Region 6	8.8%	6.1%	7.3%
Region 7	12.1%	18.1%	12.6%
Region 8	7.1%	15.3%	11.3%
Region 9	13.5%	9.9%	8.9%
Outside U.S.	4.0%	1.1%	1.0%
Total	**100.0%**	**100.0%**	**100.0%**

Table 22

Underemployment by practice type also generally followed the national trend with most practice types having more veterinarians that wish to work fewer hours for less compensation than those who wish to work more hours for more compensation.

UNDEREMPLOYMENT BY FIRST VETERINARY POSITION

	AVMA Database	Work fewer hours	Work more hours
Food Animal Practice (Exclusive)	1.6%	22.0%	9.8%
Food Animal Practice (Predominant)	4.8%	20.8%	14.3%
Mixed Practice	3.8%	23.9%	8.7%
Companion Animal Practice (Predominant)	7.6%	22.9%	12.0%
Companion Animal Practice (Exclusive)	53.2%	24.1%	10.2%
Equine Practice	4.2%	23.4%	15.3%
Federal Government (Civil Service)	2.6%	10.5%	15.8%
Uniformed Services	0.6%	13.0%	10.9%
College or University (Faculty or Staff Only)	7.9%	19.1%	9.2%
State/Local Government	1.3%	9.1%	9.1%
Industry/Commercial Organization	3.8%	13.8%	13.8%
Not-For-Profit Organization		20.0%	14.3%
Currently Participating In Internship/Residency		32.1%	14.1%
Currently Pursuing Advanced Education		20.0%	40.0%
Other	8.6%	5.9%	17.6%
Total/Average	**100.0%**	**22.9%**	**10.9%**

Table 23

The number of hours respondents indicated they currently work varied widely, ranging from one hour to 100 hours, but the majority of respondents (67.4 percent) indicated their current hourly work weeks were predominately in the five-hour increments between 30 and 60 hours per week. And, as might be expected there were a higher percentage of respondents who currently work more than 40 hours per week who wish to reduce the number of hours worked per week for less compensation than there are those who wish to increase the number of hours worked per week for more compensation. The reverse was also true. Among those working fewer than 40 hours per week, there was a higher percentage who wished to work more hours per week for greater compensation than those who wish to work less for less compensation. But this differed slightly by gender.

CHANGE IN HOURS DESIRED AND CURRENT HOURS WORKING

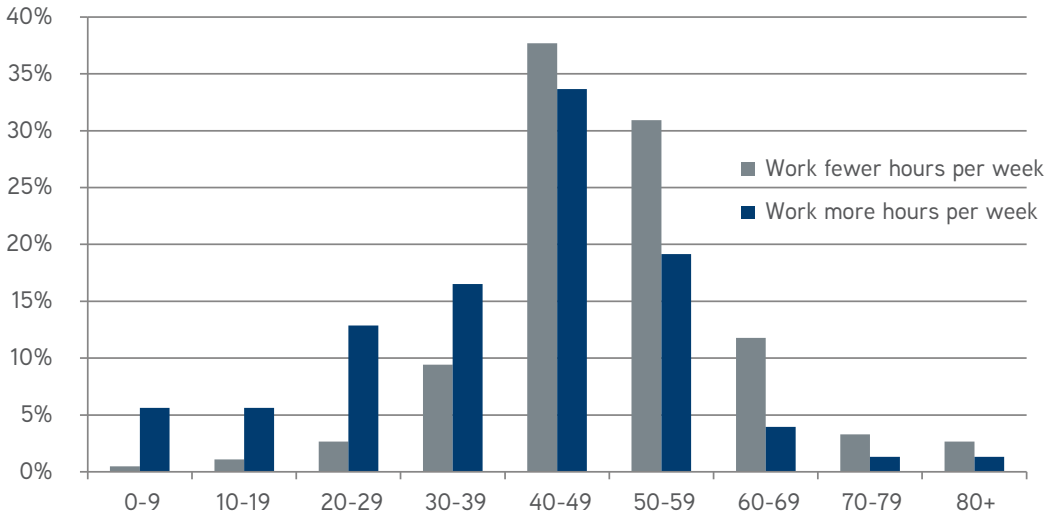


Figure 23

The difference in the preference of hours worked by gender over the last three years illustrates the constant growth in the percentage of female veterinarians who wish to work fewer hours for less compensation. And, for both men and women, the desire to work more hours fell considerably in 2016 compared to the previous two years.

The distribution of number of hours of increase or decrease to reach respondents' desired number of hours per week provides a broader view of the underemployment in the profession. In 2015, the largest percentage of those who wished to adjust the hours per week sought 10 to 19 hours more or less to work. Women had a higher percentage that desired to reduce their weekly hours of work by 10-19 hours while men had a higher percentage that sought to increase their hourly work week by 10-19 hours per week.

There is also a significant difference in the hours desired across gender, particularly within the group of veterinarians working between 40-49 hours per week. Among veterinarians working between 40 and 49 hours per week, more than 40 percent of males want to work more hours while more than 40 percent of females want to work fewer hours. Almost 40 percent of males working between 50 and 59 hours per week want to work fewer hours while almost 30 percent of females in the same category want to work fewer hours.

MALE WORK PREFERENCE

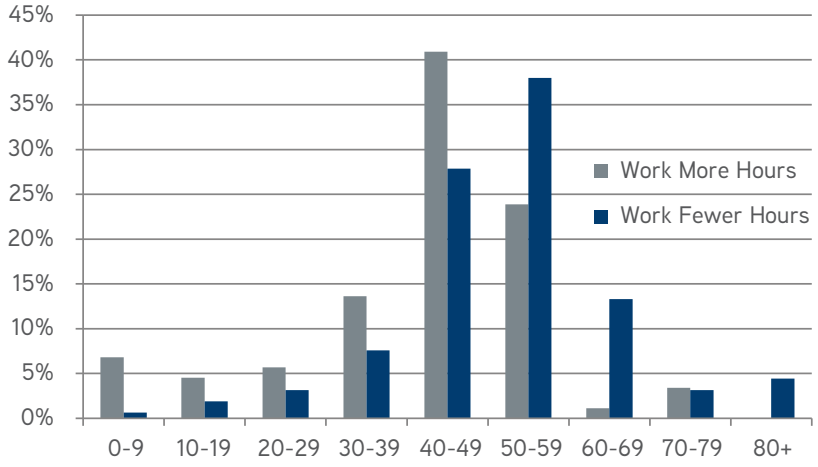


Figure 24

FEMALE WORK PREFERENCE

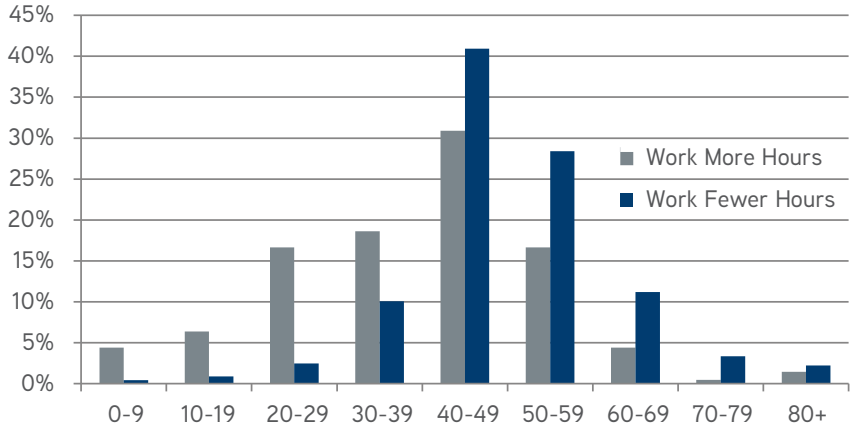


Figure 25

In 2016, the distribution of change in hours among those veterinarians who desired to change their hourly work week varied from a reduction of 49 hours per week to an increase of 50 hours per week from their current hourly work week, just as occurred in 2015. For both men and women in 2016, however, more than 30 percent desired a reduction in hours per week of 10 to 19 hours while approximately 5 percent or less desired an increase of 10 to 19 hours, a substantial decline compared to the more than 20 percent that in 2015 desired this amount of hours increased.

CHANGE IN HOURS DESIRED BY GENDER, 2016

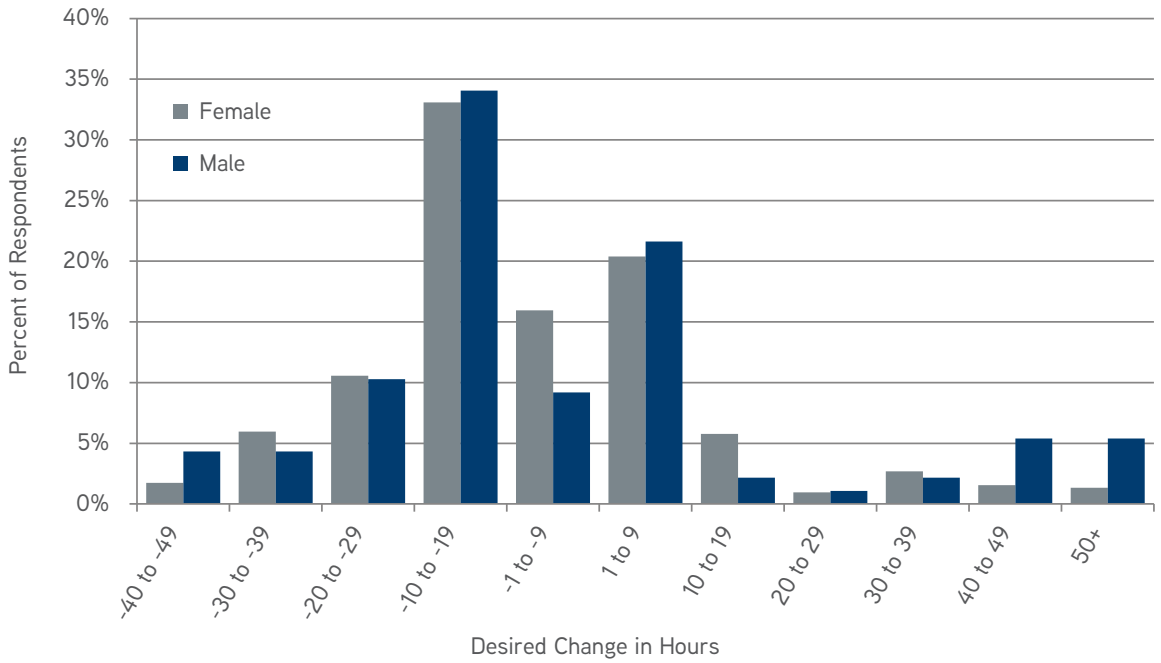


Figure 26

Of the veterinarians who desire a reduction in the number of hours they work per week with a consequence of lower compensation, the mean number of hours that they would like to work weekly, as a group, is less than 40 hours per week. This is in contrast to the group that wants to increase the hours they work to more than 50 hours a week accompanied by increased compensation.

The distribution of the desired hourly work per week reflects what each respondent claimed to be their ideal. For those who did not indicate a desire to either increase or decrease their current hours, the current hours worked was used as their desired level. For those who wished to increase or decrease their hours worked per week, the desired change was added to their current hours to obtain their desired hourly work week.

The difference between genders is observable in the distribution for both 2015 and 2016: The majority wished to work 40-49 hours per week (roughly 35 percent in 2015 and 39 percent in 2016). In 2015 the desired number of hours per week was normally distributed for women however, with roughly 30 percent wanting to work fewer hours and 30 percent wanting to work more than 40 to 49 hours per week. This changed in 2016 with 36 percent wishing to work less and 25 percent wishing to work more than the 40 to 49 hours per week.

In 2015, 46 percent of men desired a work week in excess of 40 to 49 hours while only 19 percent wanted to work fewer hours. In 2016 this wide variation declined, however, as only 38 percent indicated that the optimum hours per week exceeded 40 to 49 hours while 24 percent wished to work less than 40 to 49 hours per week.

NET HOURS DESIRED BY GENDER, 2016

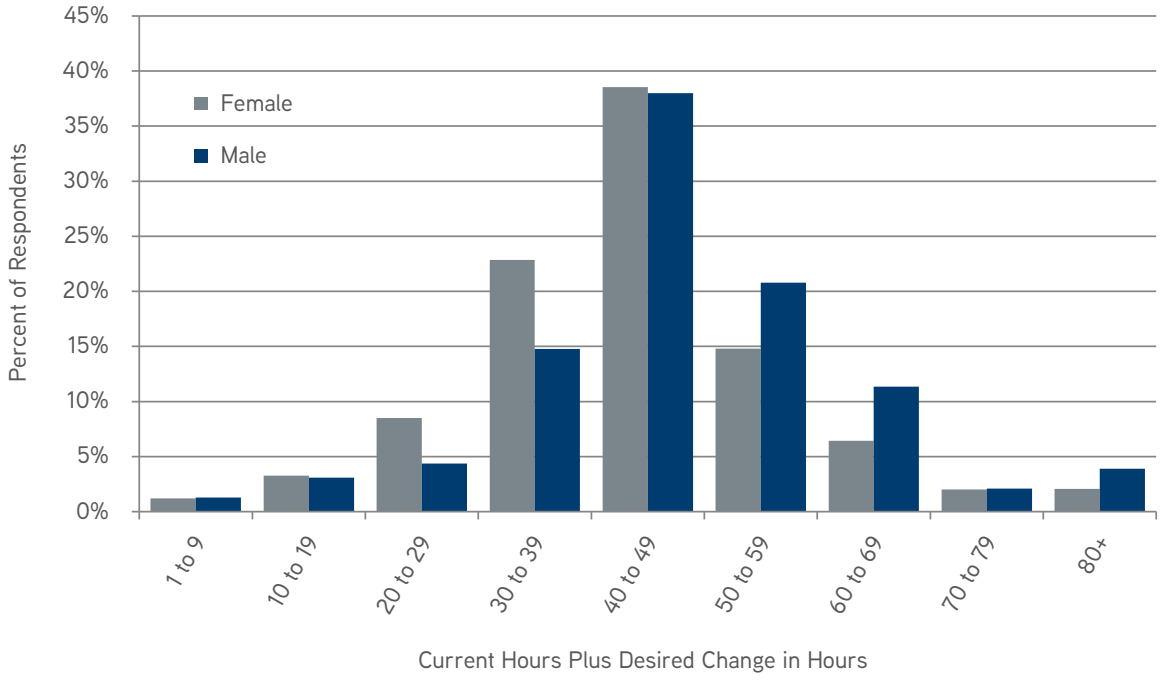


Figure 27

Taking apart the desired change in hours worked by gender and graduation period for those who wish to work more versus those who wish to work less provides greater detail for understanding the distribution of underemployment in the profession.

For nearly every age of female veterinarians, those who wish to reduce the hours per week worked for less compensation exceeded the number of those who wished to increase the number of hours worked per week for increased compensation. However, the percentage of those who wish to reduce their hourly work week has declined in the groups that graduated in 2000-2009 and 1990-1999.

FEMALE WORK PREFERENCE:
DESIRE TO WORK *FEWER* HOURS PER WEEK

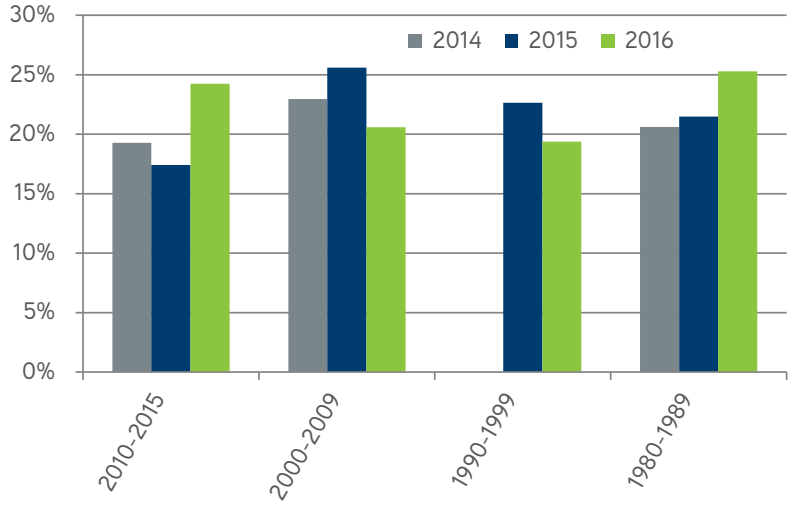


Figure 28

The percentage of female veterinarians that wish to work more hours per week for greater compensation declined across all graduation periods over the last three years. And, a smaller percentage of female veterinarians desired an increase in the hourly work week as they got further away from their graduation year.

FEMALE WORK PREFERENCE:
DESIRE TO WORK *MORE* HOURS PER WEEK

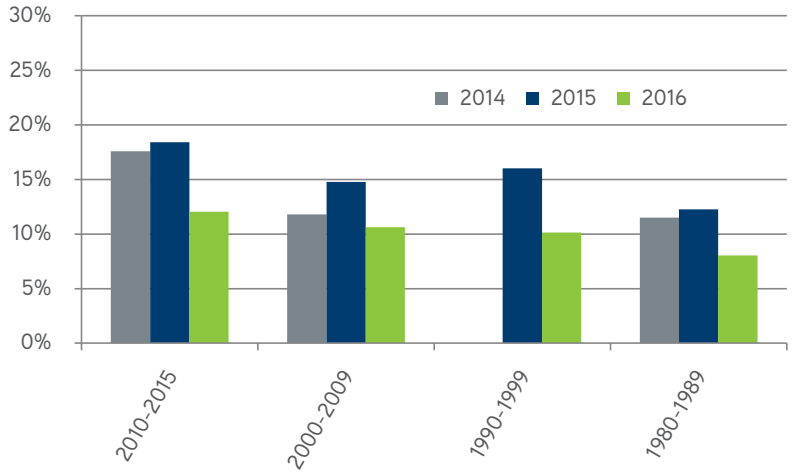


Figure 29

For the first time in three years male veterinarians in each of the graduation periods had a higher percentage of respondents that wished to work fewer hours for less compensation than wished to work more hours for more compensation. And, the pattern of those wishing to work fewer hours changed from a declining percentage of veterinarians in the older the graduation period to an increasing percentage of veterinarians that wish to work fewer hours in the older the graduation period. However, the percentage of veterinarians that wish to work more hours did decline as the graduation period became older.

MALE WORK PREFERENCE:
DESIRE TO WORK *FEWER* HOURS PER WEEK

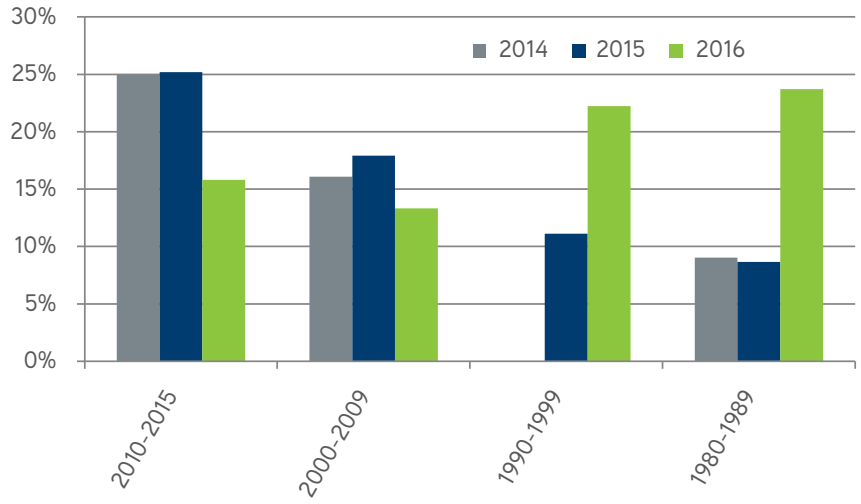


Figure 30

MALE WORK PREFERENCE:
DESIRE TO WORK *MORE* HOURS PER WEEK

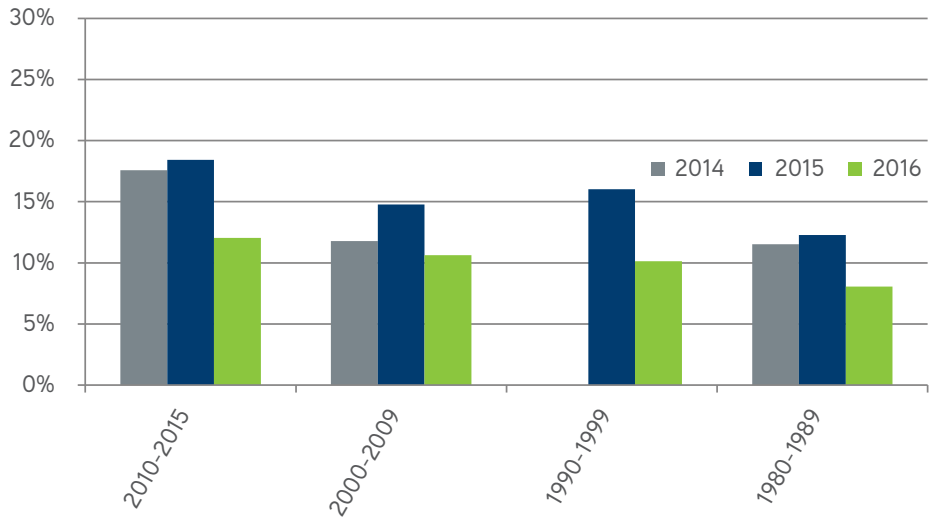


Figure 31

In summary, the veterinary profession does not have a problem with underemployment, according to the results of the 2016 Census Survey, but rather with negative underemployment. There are more veterinarians who wish to work fewer hours than those who wish to work additional hours. If the hours of all veterinarians could be adjusted to align the hours that they wish to work with the hours they actually work, 3,391 additional veterinarians would be required to fill the void. Unfortunately, this presents an unattainable solution because it would require these additional veterinarians to work in multiple practices and geographic areas simultaneously. That is, of course, unless a specific employer had numerous veterinary employees working more hours than they desired, and this is unlikely to be the case. More typically, the indivisibility of veterinary labor (or that of any professional) most typically comes in blocks of 40-50 hours. A veterinary employer who may only have 20-30 hours of negative underemployment of veterinarians in their practice would probably opt for hiring a new veterinarian, thereby creating a condition of underemployment and excess capacity. When there are multiple practices in an area that have veterinarians who wish to work less for less compensation, however, a single veterinarian may work for different practices to reach their desired level of hours and compensation.

The level of underemployment differed by practice type, with some practice types having positive net underemployment (e.g., equine, food animal exclusive, state and local government, and other veterinary sector) and other practice types having negative net underemployment. For the first time since AVMA Economics began tracking underemployment, the percent of veterinarians who wish to work less exceeded the percent who wish to work more in all private practice types, with the exception of federal and the category of other types of employment.

WORK PREFERENCE BY PRACTICE TYPE, 2016

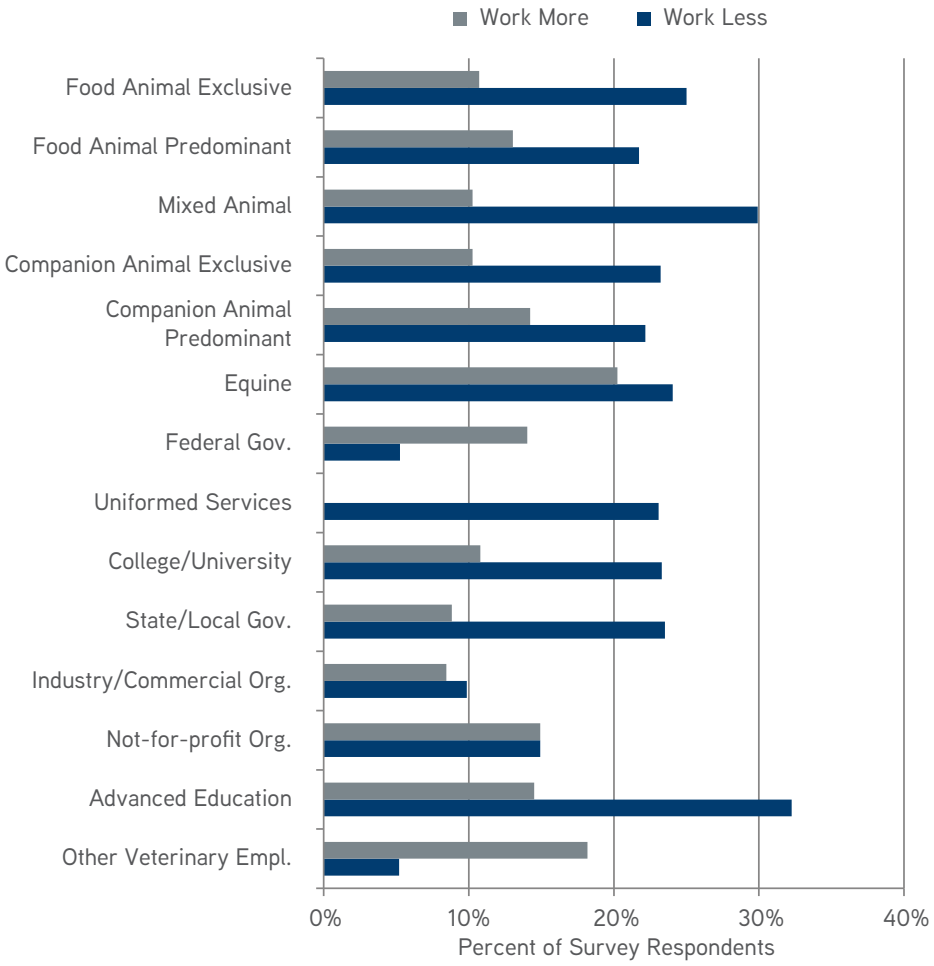


Figure 32

UNDEREMPLOYMENT BY VETERINARY COLLEGE

	2016			2015		
	Mean change in hours desired	N	Std. Deviation	Mean change in hours desired	N	Std. Deviation
Auburn University	1.57	23	21.94	1.52	54	6.35
Colorado State University	-8.89	68	15.32	-0.8	99	9.45
Cornell Veterinary College	-5.44	25	15.59	-0.82	78	9.88
Tufts University	-4.67	26	15.23	-2.42	66	7.92
Iowa State University	-4.45	30	16.39	-1.22	103	9.30
Kansas State University	-1.30	30	21.25	-2.21	68	8.39
Louisiana State University	-4.26	21	17.92	-1.35	47	7.68
Michigan State University	-3.61	36	15.69	0.12	89	8.35
Mississippi State University	4.22	16	21.10	-0.7	30	8.06
North Carolina State University	3.26	21	25.92	-1.56	70	8.57
Oklahoma State University	-8.52	26	15.06	-0.62	45	8.85
Oregon State University	-5.88	12	20.46	-1.39	33	8.69
Other (please specify):	0.54	74	28.65	0.97	106	9.96
Purdue University	-10.93	28	14.80	0.85	52	8.54
Ross University	-0.69	45	27.42	-0.32	109	7.11
St. George's University	-3.67	12	24.54	0.63	30	10.93
St. Matthew's University	1.00	2	15.56	3.36	11	15.70
Texas A&M University	-7.77	86	17.91	-0.9	79	5.76
The Ohio State University	-8.03	45	14.04	-0.07	101	8.48
Tuskegee University	0.19	13	28.56	0.08	26	8.23
University of California-Davis	-5.34	28	18.70	-1.63	96	9.34
University of Florida	-4.29	14	15.77	-3.05	40	8.20
University of Georgia	-11.43	21	9.38	-1.13	68	11.32
University of Illinois	-6.82	31	18.43	-2.6	78	7.25
University of Minnesota	0.69	21	20.26	-0.83	69	9.04
University of Missouri-Columbia	-9.91	23	19.40	-1.61	66	9.41
University of Pennsylvania	0.14	35	19.08	-0.57	75	8.38
University of Tennessee	-4.04	24	19.39	0.15	54	8.56
University of Wisconsin	-8.62	26	14.49	0.16	64	10.80
Virginia-Maryland College	-6.17	21	15.81	-1.54	80	7.64
Washington State University	-1.12	21	22.92	-1.64	66	7.00
Western University - California	3.25	12	30.37	-1.59	29	8.85
Total	**-4.42**	**916**	**19.96**	**-0.81**	**2,081**	**8.72**

Table 24

Significant at the 10-percent level, there is no difference in underemployment among colleges. Tabulations show that graduates of Mississippi State University and North Carolina State University desired the largest mean increase in hours per week, 4.22 and 3.26 respectively. Graduates of the University of Georgia and Purdue University desired the largest mean decrease in hours, 11.43 and 10.93 respectively. The work preference of all other colleges fell within that range.

Veterinarians Who Wish to Work More (Underemployment)

Within the 2016 sample, 10.4 percent (15.0 percent in 2015) of veterinarians indicated wanting to work a mean of 18.9 (11.6 in 2015) additional hours per week. The pattern of an increasing percentage of respondents who wish to work more hours decreasing with more years since graduation has been continuous through the periods of data collection. However, the decline in the percent of respondents who indicated they wish to work more hours for more compensation occurred in all graduation periods and for both genders.

WORK PREFERENCE: DESIRE TO WORK *MORE* HOURS PER WEEK

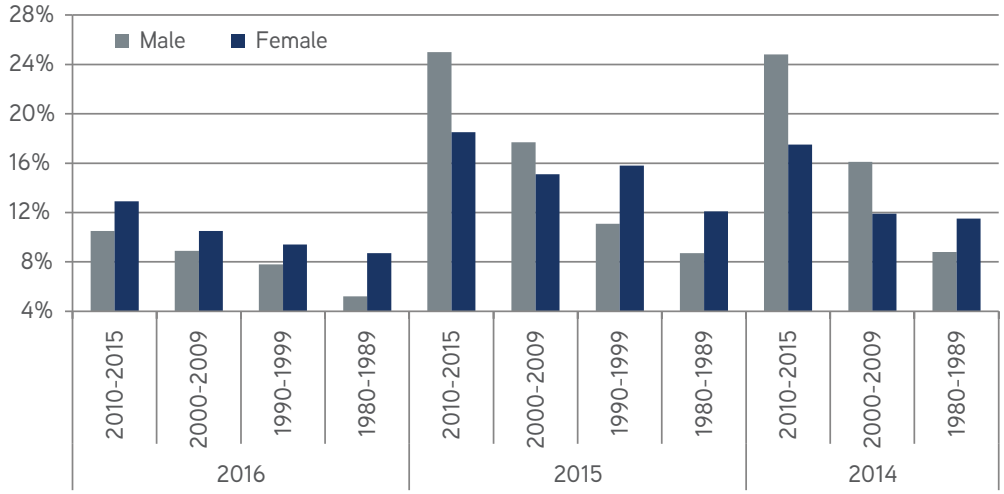


Figure 33

THE PATTERN OF AN INCREASING PERCENTAGE OF RESPONDENTS WHO WISH TO WORK MORE HOURS DECREASING WITH MORE YEARS SINCE GRADUATION HAS BEEN CONTINUOUS THROUGH THE PERIODS OF DATA COLLECTION.

Females wishing to work more comprised 7.4 percent of the sample, and the mean number of hours currently worked by this group was 37.5 in 2016 (38.4 in 2015) and the mean number of hours per week the group wished to work increased to 53.8 hours (49.6 in 2015). On the other hand, men who wish to work additional hours comprised only 3.0 percent of the sample. This group currently works 41.8 hours per week (45.0 hours in 2015) and wish to increase that to 66.7 hours per week (56.3 hours in 2015).

UNDEREMPLOYMENT BY GENDER, 2015

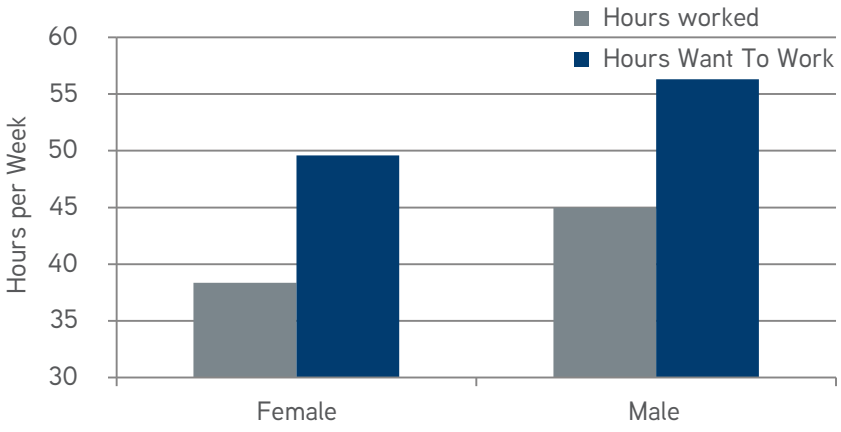


Figure 34

UNDEREMPLOYMENT BY GENDER, 2016

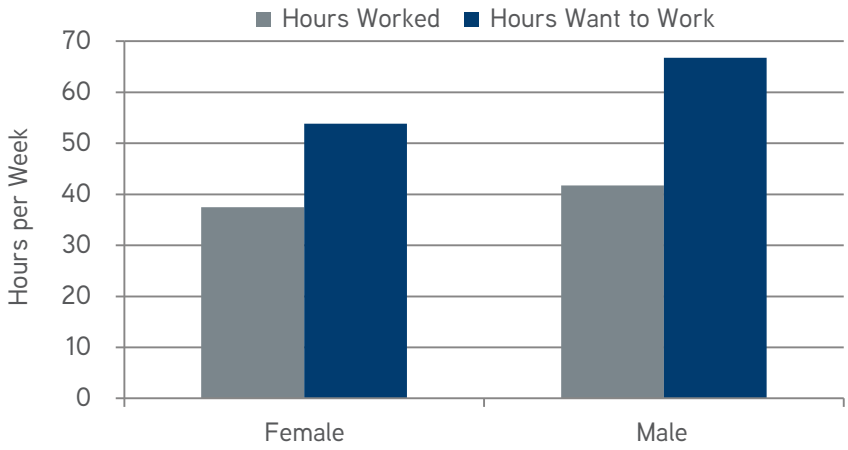


Figure 35

The level of underemployment for those who wish to work more hours for greater compensation also varies by practice type. In 2015, food animal practitioners (predominant), mixed animal and those veterinarians in advanced education who wished to work more hours reported a mean hourly work week of more than 50 hours per week and on average were looking to increase that hourly work week to more than 60 hours per week. In 2016, the veterinarians who wished to work more hours in all of the practice types had a mean hourly work of less than 50 hours, with the equine practitioners having the only mean current hourly work week above 45 hours per week (48.2 hours). For the most part, however, female veterinarians who indicated they wish to work more hours were working fewer than 40 hours per week and wish to increase their hourly work week to more than 50 hours per week.

Of those veterinarians who desired to work more hours, the group in "other employment" work the fewest hours per week currently (33.5 hours per week) and indicated a desire to move to a 42 hour work week. The low number of respondents in some of the categories and high standard deviations suggest caution in using the means to describe the situation of those considered underemployed. The values reflect the great diversity in and between the types of practices.

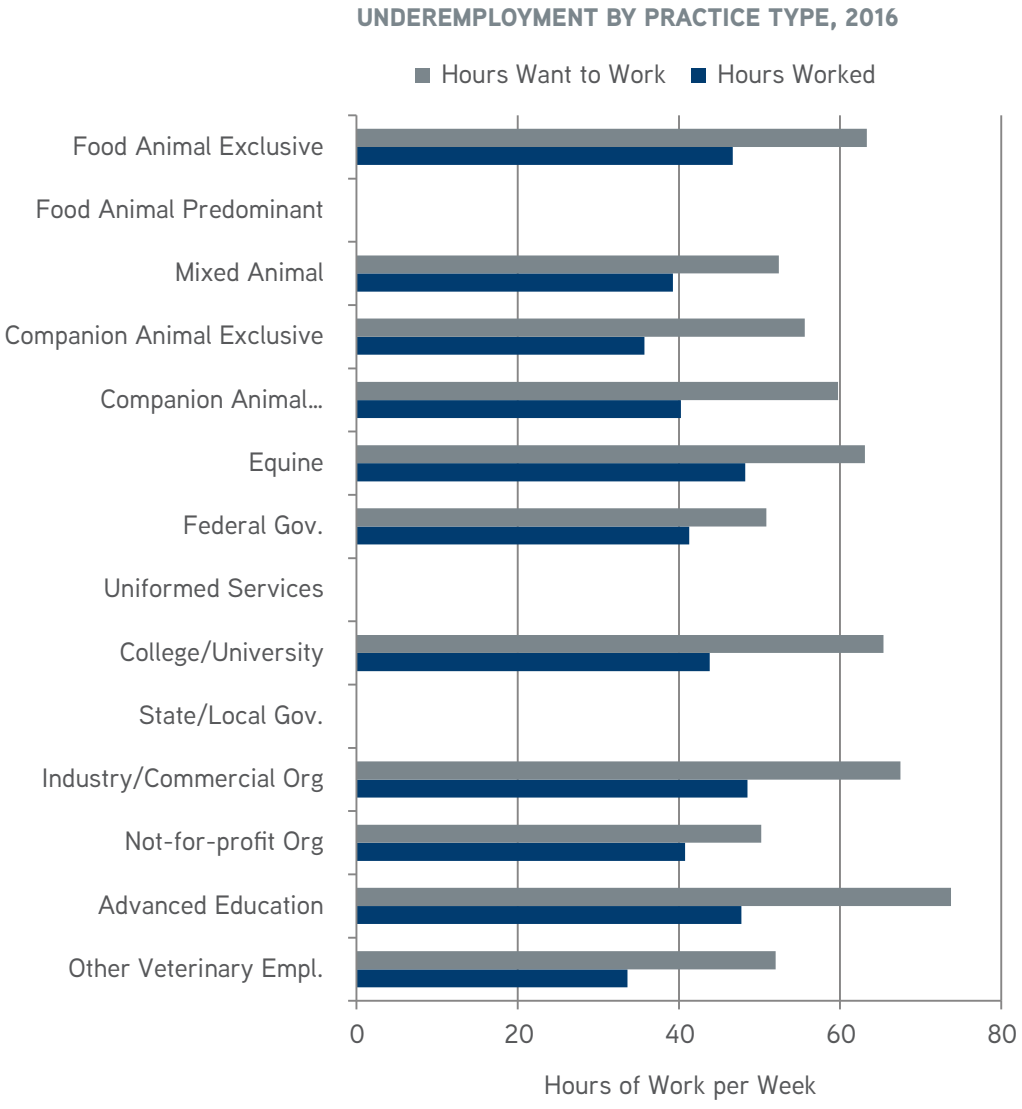


Figure 36

Across regions, veterinarians who wish to work additional hours for increased compensation are generally working a full-time, 40-hour work week, but wish to expand this to more than 50 hours per week. As with the underemployment data by practice type, the standard deviations for both the current hours worked and the additional hours veterinarians would like to work are very high and point to the large diversity in work hours within regions.

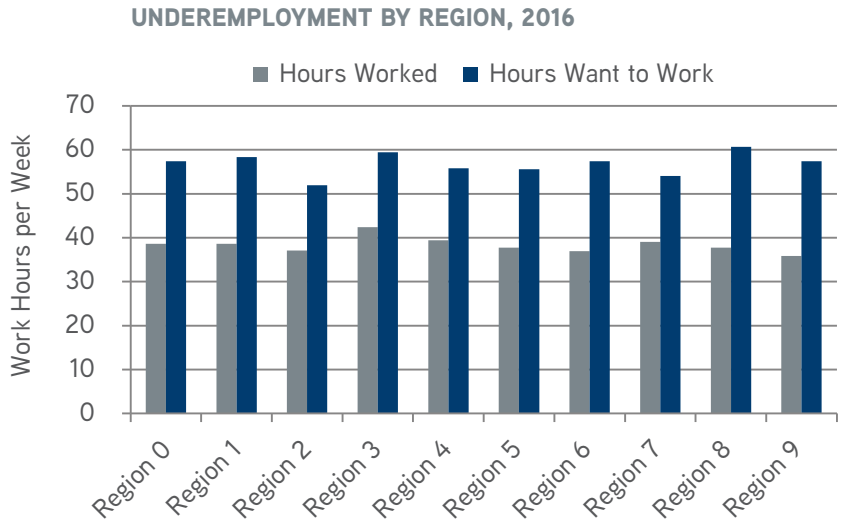


Figure 37

Veterinarians Who Wish to Work Less (Negative Underemployment)

In contrast to those who indicated a desire to work more hours for increased compensation, in 2016, 20.6 percent (18.7 percent in 2015) of the respondents indicated wanting to work an average of 14.9 hours less per week for less compensation (12.7 hours in 2015).

As with the percentage of respondents who wished to work more hours per week, the percentage of veterinarians who indicated that they would like to work fewer hours per week represented a major change from the previous two years. Those who have the greatest distance from graduation had the highest percentage of veterinarians who wished to cut back on their hourly work week.

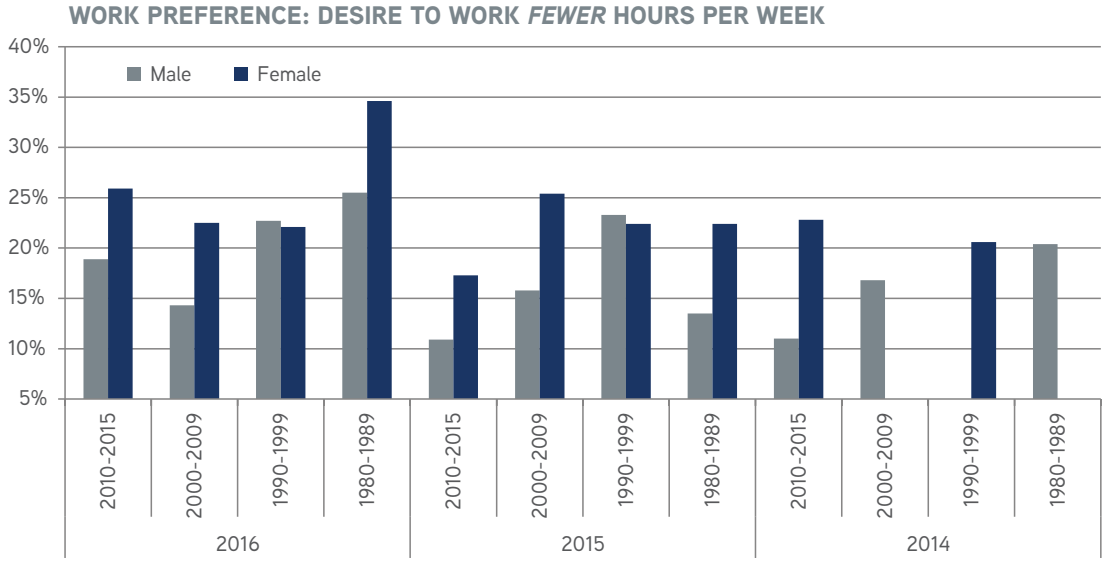


Figure 38

Females wishing to work fewer hours comprised 15.5 percent of the sample and the mean number of hours currently worked by this group was 47.6 in 2016 (48.9 in 2015) and the mean number of hours per week the group wished to work decreased to 33.1 hours (35.9 in 2015). On the other hand, men who wish to work fewer hours comprised only 5.1 percent of the sample. This group currently works 52.0 hours per week (52.2 hours in 2015) and wish to decrease that to 35.7 hours per week (37.8 hours in 2015).

NEGATIVE UNDEREMPLOYMENT BY GENDER, 2015

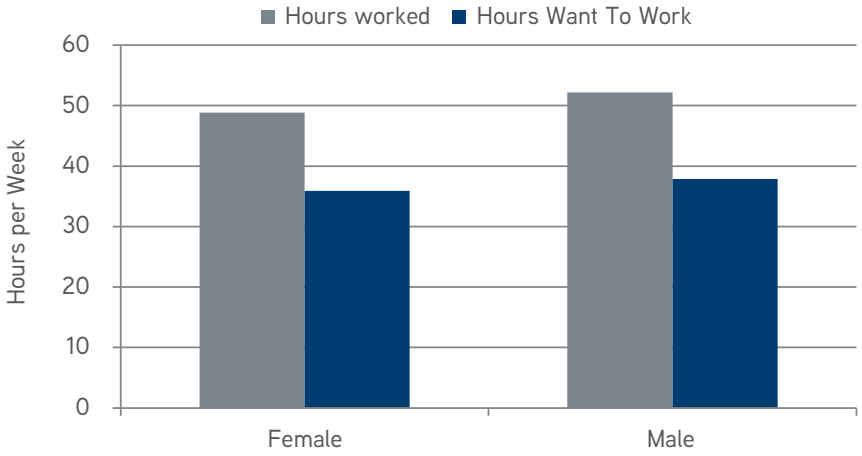


Figure 39

NEGATIVE UNDEREMPLOYMENT BY GENDER, 2016

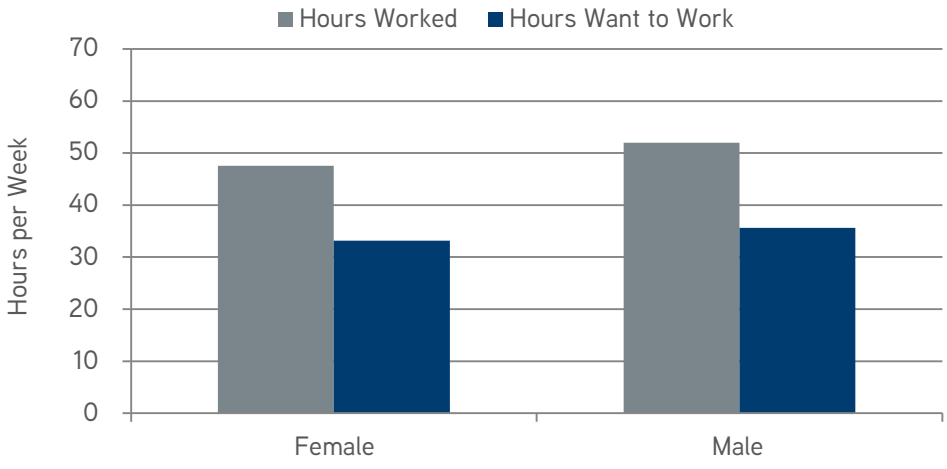


Figure 40

The group that wishes to work less is working roughly 10 hours more per week (48.6 versus 38.8) than the group that wishes to work more. And both want to change their work hours per week by 15 hours or more. However, because 465 veterinarians in the sample (20.6 percent) desire to work less (351 in 2015) and this exceeds the 239 veterinarians who desire to work more (253 in 2015), and those who want to work less desire to reduce their work week by 14.9 hours (12.86 hours in 2015) while those who want to work more want to increase their work week by 18.9 hours (12.51 hours in 2015), the total level of underemployment in the profession is negative. A negative underemployment indicates the need to add veterinarians to the workforce. Because this negative underemployment occurs in different practice types and regions of the country and may not be sufficiently large enough in any specific local area and practice type, however, adding an additional veterinarian in any specific practice or place of employment may not be feasible and thus this measure of negative underemployment cannot be used to define a level of excess demand. Indeed, this misdistribution of underemployment and negative underemployment illustrates the importance of labor indivisibility in the veterinary profession.

For the group of veterinarians who want to work fewer hours for less compensation, gender differences are less pronounced than for those who wish to work more hours. For both males and females, the average number of hours currently working is near 50 while the hours they wish to work is less than 40.

Differences in the current work week of veterinarians reporting they wish to work fewer hours for lower compensation are dramatic, with food animal predominant veterinarians and those in advanced education indicating a mean current hourly work week exceeding 60 hours and a desire to reduce this by a sufficient number of hours to move closer to the 40-45 hour work week. As in 2015, however, equine practitioners who wished to work fewer hours for less compensation wanted the greatest mean reduction in hours per week (23.3 hours) while food animal practitioners who sought fewer hours per week with a reduction in compensation sought the lowest hourly work week reduction (12 hours).

NEGATIVE UNDEREMPLOYMENT BY PRACTICE TYPE, 2016

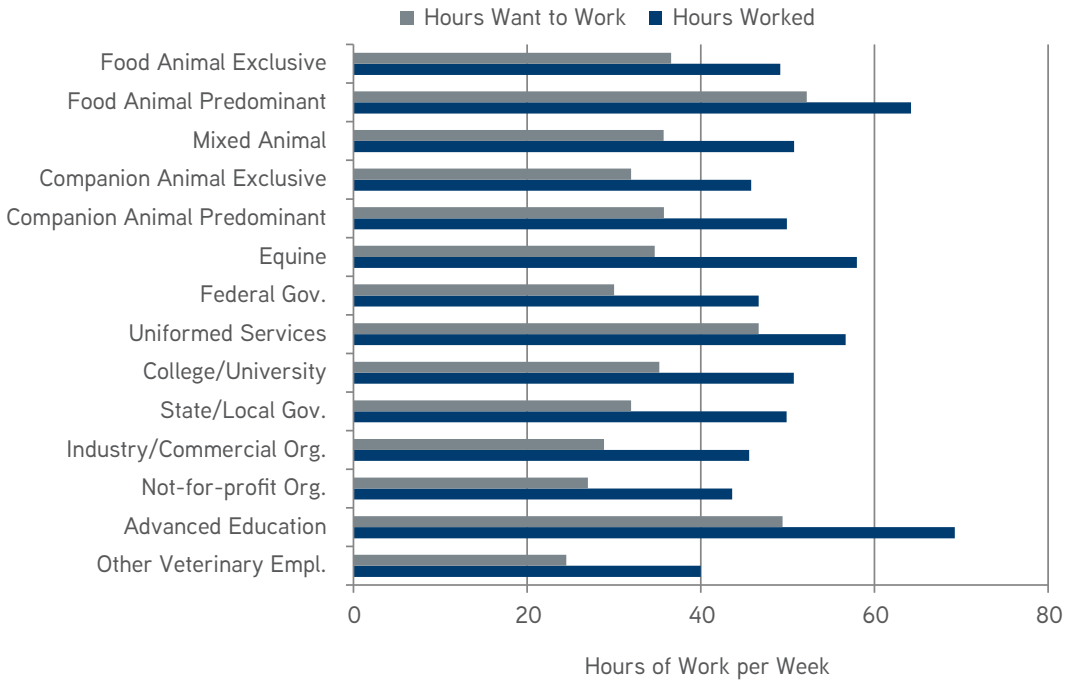


Figure 41

While there were considerable differences in underemployment by practice type, there was little difference across regions. In general, for veterinarians who indicated a desire to reduce their hourly work week for less compensation, the average current hourly work week in each region was near the 50-hour mark. These veterinarians wished to reduce their hourly work week to get under the 40-hour work week. Region 2 had the lowest mean number of hours worked per week at 45.6 hours and also the smallest mean desired reduction in hours worked of 13.2 hours. Conversely, Region 0 had the highest mean hourly work week (53.0 hours) and the largest mean desired reduction in hours worked (17.0 hours).

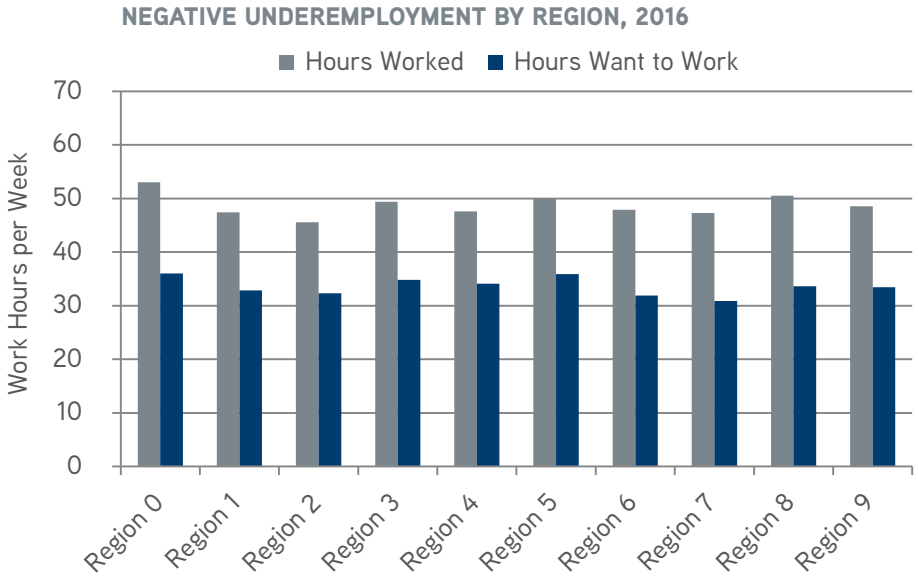


Figure 42

WHILE THERE WERE CONSIDERABLE DIFFERENCES IN UNDEREMPLOYMENT BY PRACTICE TYPE, THERE WAS LITTLE DIFFERENCE ACROSS REGIONS.

Factors correlated with underemployment

Following the methods used to identify the factors that are correlated with employment, a similar method was used to determine the factors that are correlated with underemployment. In the following estimated equation, we identify factors that affect the number of hours veterinarians work. An ordinary least squares regression was estimated and included the following variables: veterinary practice type, graduating university, workplace location, gender, internship participation, debt, board certification, marital status, mobility and health.

An ordinary least squares regression is an equation in which unknown parameters are estimated such that the difference between observed and predicted variables is minimized. The resulting model can be expressed in a formula such that controlled variations in the independent variables are used to predict the dependent variable (the variable being explained). The dependent variable in the following regression is the number of hours the respondent wants to add or subtract from his current workload. He or she is willing to take a pay cut to

FACTORS CORRELATED WITH UNDEREMPLOYMENT

Dependent Variable: Desired Change in Work Hours per Week				
	Coef.	Std. Err.	z	P>z
DVM	2.5	2.5	1.03	0.305
DVM + Ph.D.	4.7	4.5	1.05	0.291
DVM + M.S.	3.5	1.8	1.9	0.058
DVM + Specialized degree (J.D., M.D., E.D.)	-20.5	11.1	-1.84	0.065
Homeowner	0.7	1.8	0.42	0.674
Male	6.4	1.7	3.7	0
Years of Experience	-0.2	0.1	-2.05	0.04
Married	-1.5	1.7	-0.88	0.379
Want to change living location	-0.3	1.5	-0.17	0.865
Children	-1.9	1.6	-1.2	0.232
Health 1 - Poor	-0.3	10.7	-0.02	0.981
Health 2 - Fair	-3	3	-1	0.318
Health 3 - Good	0.6	2	0.28	0.776
Health 4 - Very Good	-0.7	1.8	-0.37	0.71
Health 5 - Excellent (Omitted)				
Log of Remaining Educational Debt	0	0.1	0.23	0.822
Log of Annual Income	-4.1	1.7	-2.42	0.015
Practice Owner	0.8	2.1	0.37	0.714
Specialty/Referral Practice	1.6	2.9	0.57	0.566
Consultant	2.1	10.2	0.21	0.835
Emergency	4.7	4.3	1.08	0.279
Relief	0	(omitted)		
Part-time	4.6	2.4	1.94	0.053
Region 0	-1.5	3.3	-0.45	0.651
Region 1	-5.3	2.6	-2.04	0.042
Region 2	-2.6	2.6	-1	0.317
Region 4	-3.6	2.8	-1.28	0.199
Region 5	-4.8	2.8	-1.72	0.086

Table 25

reduce hours and, of course, get an increase in compensation for working additional hours. Variables significant in explaining underemployment or negative underemployment in veterinary medicine are gender, with males wanting to work on average six additional hours per week; region, with veterinarians in Region 6 wanting to work approximately eight hours less; practice, with veterinarians in Federal government wanting to work almost 15 hours more per week and income such that for every 10 percent increase of income above the mean, veterinarians want to work .4 hours (~ 24 mins) less. In the previous year's report, factors identified as significant in explaining the variation to work fewer or more hours were income, satisfaction with employment, gender, practice type and region. With males wanting to work approximately three hours more, veterinarians in state and local government wanting to work 16 hours more, and those in mixed practice wanting to work five hours less. (See the *2016 AVMA Report on Veterinary Markets* for more details.)

Dependent Variable: Desired Change in Work Hours per Week				
	Coef.	**Std. Err.**	**z**	**P>z**
Region 6	-8.1	3	-2.69	0.007
Region 7	-5.7	2.9	-1.95	0.051
Region 8	-6	3	-1.97	0.049
Region 9	-4.7	2.7	-1.75	0.08
Food Animal Exclusive	-0.5	5.9	-0.08	0.933
Food Animal Predominant	9.1	6	1.51	0.131
Mixed Animal	-3.3	2.8	-1.17	0.242
Companion Animal Predominant	3.2	2.2	1.43	0.152
Equine	-4	3.4	-1.19	0.234
Federal Gov.	14.7	5.4	2.72	0.007
Uniformed Services	0.2	10.9	0.02	0.988
College/University	1.1	2.6	0.41	0.684
State/Local Gov.	-4.8	5.6	-0.86	0.391
Industry/Commercial Org.	1.2	5.5	0.22	0.823
Not-for-profit Org.	-1.3	5.1	-0.25	0.8
Advanced Education	-4.4	4.2	-1.04	0.297
Other Veterinary Empl.	4.6	4.7	0.97	0.333
Non-Veterinary Empl.	-6.4	14.8	-0.43	0.665
Constant	15.2	19.2	0.79	0.429
First-Stage Results:				
No. of Weeks Worked In Previous Year	-0.00026	0.003768	-0.07	0.946
No. of Hours Per Week	0.014452	0.002092	6.91	0.000
No. of Emergency Hours Per Week	-0.01161	0.003678	-3.16	0.002
Constant	-1.13107	0.191358	-5.91	0.000
Rho	0.958158	0.007701		
Lr Test Of Indep. Eqns. (Rho = 0): Chi2(1) = 139.26 Prob > Chi2 = 0.0000				

The results in Table 25 illustrate a Heckman Selection regression model representing the reduction in the number of hours that veterinarians want to work.

This statistical model has two stages. In the first stage, why some veterinarians want to change their hours, and why some do not, is analyzed. We use each individual's number of work weeks in a year (number of weeks minus number of vacation weeks), their average number of hours of work per week, and their average number of emergency work hours per week. This is done to isolate the survey respondents who want to work fewer hours because they already work more than is typically the case. The results of the estimation show that working more regular hours per week is associated with a higher probability of wanting to change the number of hours worked, while working more emergency hours is associated with a lower probability of wanting to change the number of hours worked.

In the second stage of the model, when the effect of work hours on the probability that someone wants to reduce or increase their work hours is already accounted for, coefficients reveal how each of their character traits affect their preference in the number of hours they wish to work. For example, even when considering all of the other factors listed, male veterinarians tend to want to work an average of six more hours per week, while veterinarians in Region 1 want to work 5.3 fewer hours per week. Not all of the factors listed, however, have a statistically significant effect on the desire to change hours worked.

Rho, in the aforementioned table, is the correlation coefficient that measures the independence of the two stages. If rho is statistically significant, with a p-value of less than 0.001, we can conclude that the two stages of the estimation are correlated, and this estimation procedure is valid.

To better understand the variation in underemployment, factors affecting mobility were examined. If the workforce is highly mobile then differences in unemployment rates, underemployment and incomes across regions and within regions between business areas should begin to decline. Factors thought to contribute to reducing job mobility are home ownership, marital status, number of children and preferences for type of community and size of business. These variables, or components of them, are all statistically significant in determining the factors that explain the variation in mobility.

FACTORS CONSIDERED IN EXPLAINING MOBILITY

Logistic regression	Number of Obs.	=	2,055		
	LR chi2(10)	=	271.96		
	Prob > chi2	=	0		
Log likelihood = -1287.804	Pseudo R2	=	0.0955		
	Odds Ratio	Coefficient	t-statistic	p-value	Probability
Homeowner	-1.13556	0.116655	-9.73	0	837.7%
Married	-0.40812	0.13332	-3.06	0.002	-69.0%
Separated	-0.15499	0.595906	-0.26	0.795	-18.3%
Widowed	-1.00574	0.68377	-1.47	0.141	17518.6%
Divorced	-0.42492	0.223473	-1.9	0.057	-73.9%
Children at Home	-0.29504	0.107515	-2.74	0.006	-41.9%
Prefer Smaller Community	0.665218	0.169778	3.92	0	39.9%
Prefer Larger Community	0.914956	0.139569	6.56	0	47.8%
Prefer Smaller Practice	0.614202	0.178776	3.44	0.001	38.0%
Prefer Larger Practice	-0.03268	0.126056	-0.26	0.795	-3.4%
Constant	0.971706	0.126775	7.66	0	49.3%
Omitted categories: single/never married, no children at home, not a homeowner, prefer same size community, prefer same size practice					

Table 26

MALDISTRIBUTION OF VETERINARIANS

The variation in incomes, unemployment and underemployment by region and practice type is descriptive of symptoms of maldistribution. Maldistribution suggests that the spatial distribution by practice type of the supply of veterinarians does not align with the spatial distribution by practice type of demand for veterinarians.

A location quotient can be used to evaluate maldistribution. The location quotient provides a way to quantify the regional concentration of a specific occupation in comparison to the national average. Specifically, a location quotient for veterinarians compares the number of veterinarians as a percent of all employees in a specific area to the number of veterinarians as a percent of all employees in the United States. Thus, a location quotient of one means that the concentration of veterinarians (percent of veterinarians in the workforce) in the local area is equal to the concentration of veterinarians nationally. A location quotient above one suggests the concentration of veterinarians is greater in the area than nationally, and below one suggests that the concentration of veterinarians is less in the area than nationally.

The Bureau of Labor statistics tracks veterinarian employees and has mapped by state the location quotient of these workers (veterinarian practice owners are omitted). Three states and Puerto Rico are shown to have less than the national average concentration of veterinarians while most states have between 0.8 and 1.25 of the concentration of veterinarians compared to the national average. Ten states, however, have between 1.25 and 2.5 times as many veterinarian employees per total employees in the state than occurs on the average nationally. This variation in concentration, all other factors being equal, should align with the income, unemployment and underemployment statistics. Of course, all other factors are not equal. Cost-of-living differences will interfere with income differences between the states and the median household income variation between states will affect the demand for veterinarians as will the number of pets per household and the extent of the human-animal bond of those pet-owning households. Finally, because practice owners are not included in this location quotient, the average number of veterinarians per practice will also affect the quotient.

LOCATION QUOTIENT OF AVMA VETERINARIANS BY STATE, 2015

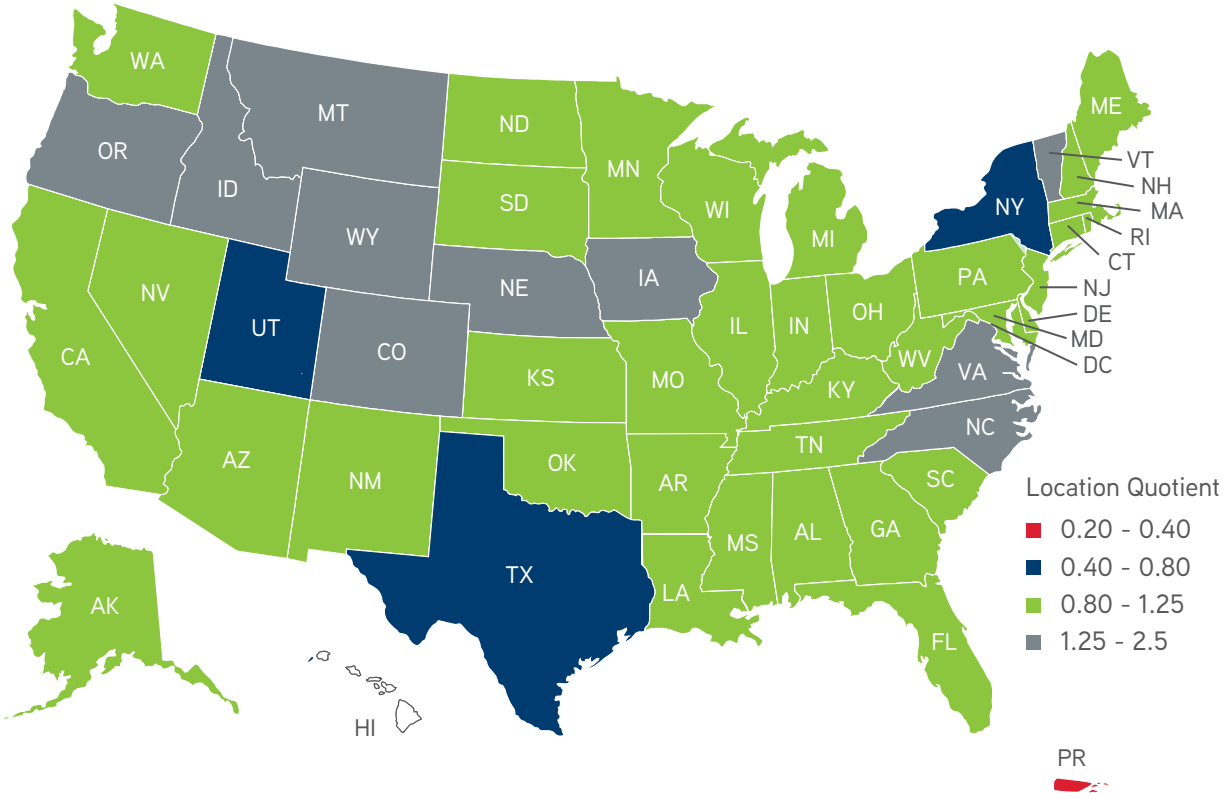


Figure 43

AVMA maintains a database of all U.S. veterinarians who have graduated from a U.S.-accredited college of veterinary medicine, and any veterinarian who graduated from a non-U.S.-accredited college and at has become an AVMA member. Using this database of roughly 107,000 active veterinarians in the U.S., a location quotient was computed for each state and is described below. Texas and Utah still have a concentration of veterinarians below the national average but are joined by five additional states including the highly populated state of California. The number of states with a higher concentration of veterinarians than the national average has grown to 14, with Idaho, North Carolina and Virginia no longer in the higher concentration category, and the states of Arkansas, Kansas, Minnesota, Missouri, Oklahoma, Wisconsin and South Dakota joining the seven states identified in the BLS location quotient as highly concentrated.

LOCATION QUOTIENT OF AVMA VETERINARIANS BY STATE, 2016

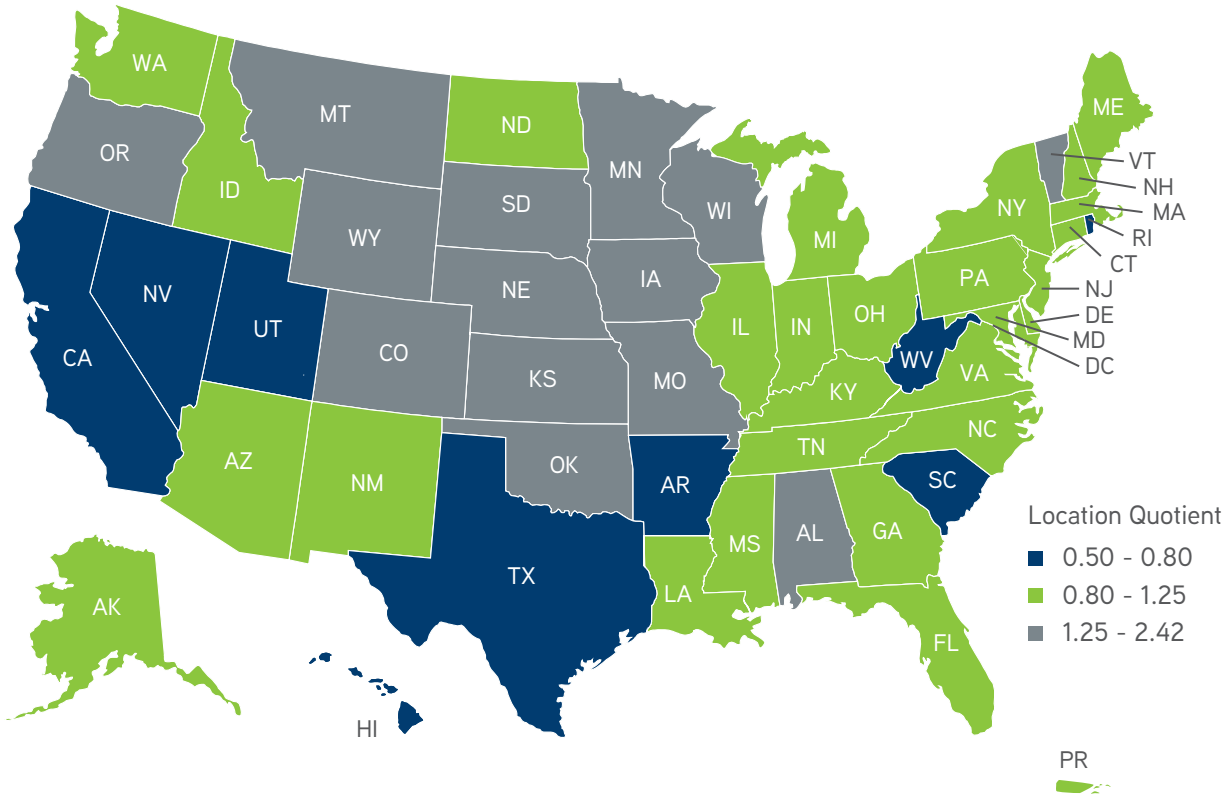


Figure 44

In 2016, roughly 4,400 applicants passed the North American Veterinary Licensing Exam and located in the United States and elsewhere. The location quotient was calculated for these new veterinarians and mapped by state. The pattern is similar to the pattern found in the map of the location quotient for all veterinarians. The concentration of these new veterinarians in Alaska, California, Florida, Maine, Michigan, North Dakota, Pennsylvania and South Carolina, however, was well below the national concentration. For states such as Californian and South Carolina, where the location quotient for the profession is less than one, that the location quotient for new graduates is also less than one suggests an increasing scarcity of veterinarians. These two states should see higher incomes relative to their costs of living, lower unemployment and more negative underemployment.

LOCATION QUOTIENT OF NEW VETERINARIANS BY STATE, 2016

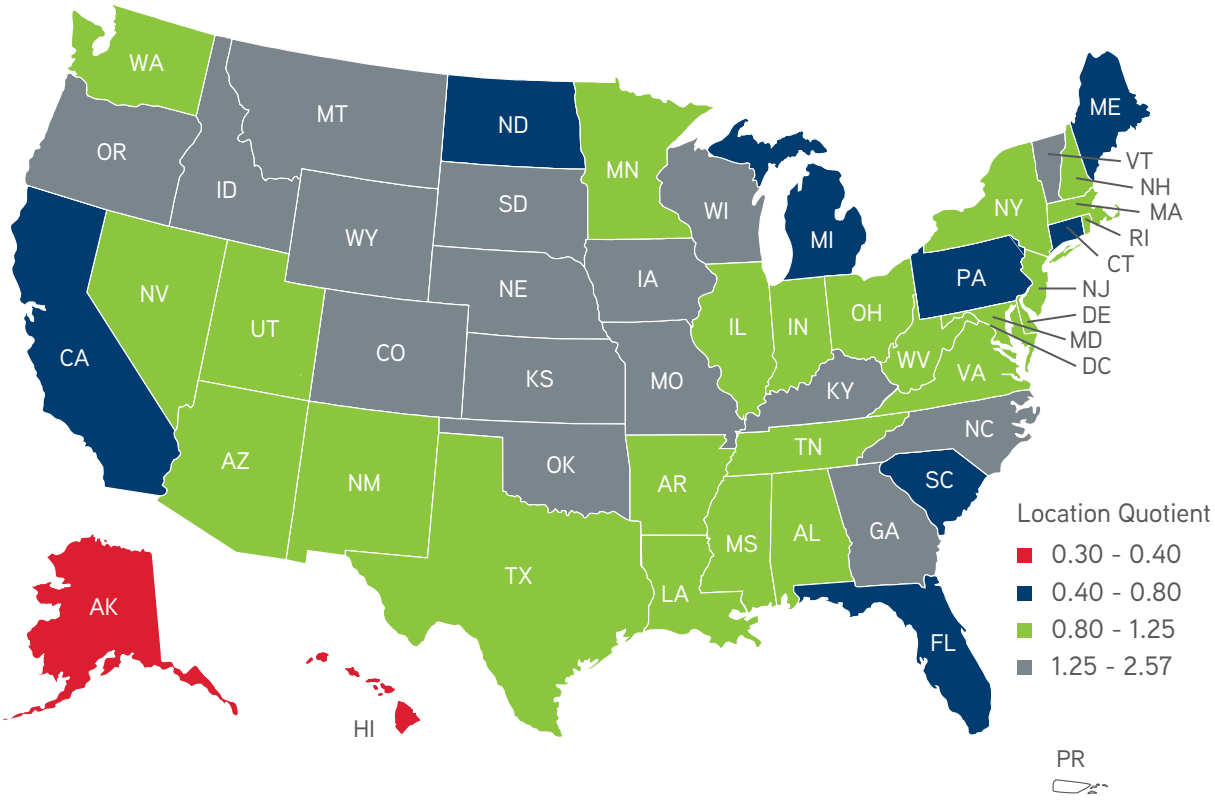


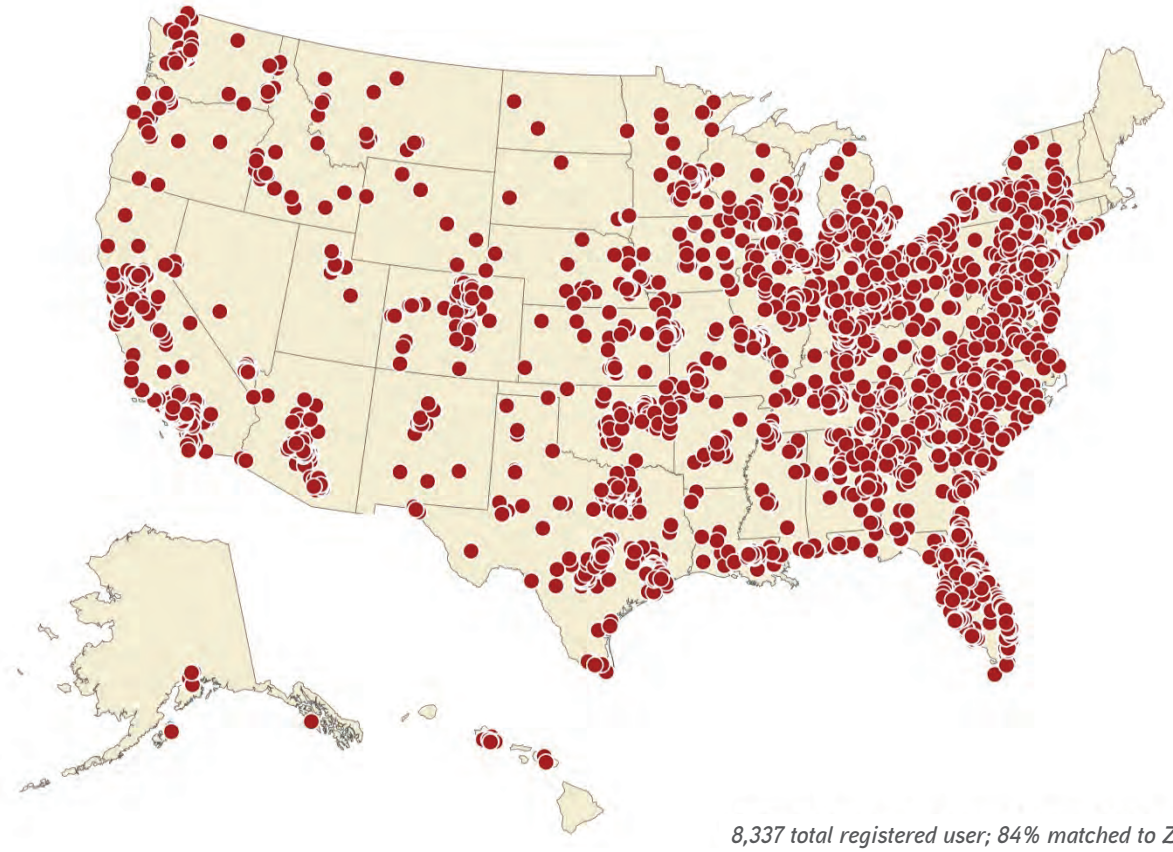
Figure 45

Distribution of Veterinary Jobs and Applicants

Using the labor quotient provides an overview of the supply and demand for veterinarians at the state level, but veterinary hospitals comprise nearly 70 percent of employment opportunities and the markets (business areas) for most of these hospitals is less than 10 miles (area where 90 percent of clients reside). Thus, the state location quotient may not be adequate in identifying the problem of maldistribution that occurs within smaller areas of states.

Using the VCC data, the location of the applicants and the employment opportunity can be mapped to identify "hot" areas for employment (small numbers of applicants per employment opportunity) and cold areas (large number of applicants per employment opportunity). The map below posts the location (one dot for one applicant) for 8,337 total numbers of registered users of VCC (applicants) who provided their ZIP code information. The distribution is strongly concentrated in the eastern United States.

VCC REGISTERED USERS, 2016

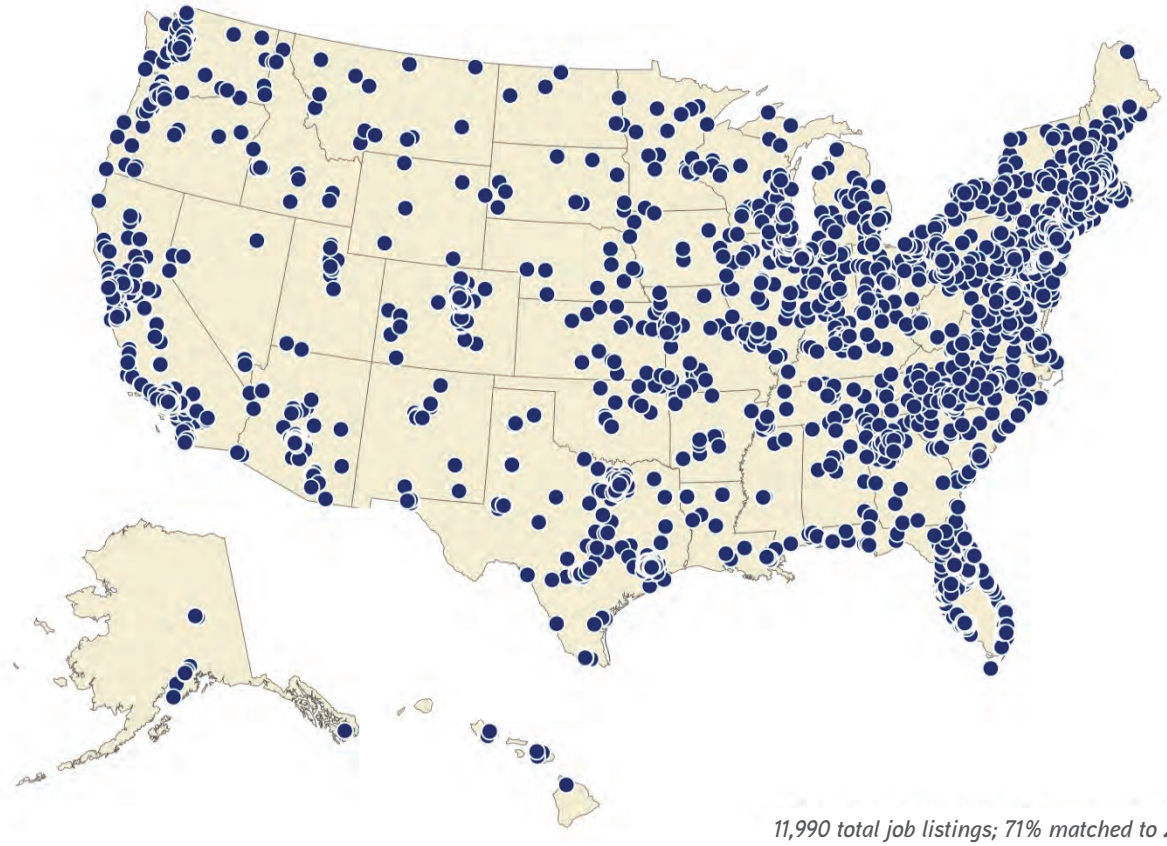


8,337 total registered user; 84% matched to ZIP code

Figure 46

The VCC job listings for 2106 appear to be similar to the distribution of registered users but appear much more concentration in the eastern third of the United States.

VCC DVM JOB LISTINGS, 2016



11,990 total job listings; 71% matched to ZIP code

Figure 47

To help focus attention on the areas that have "hot" and "cold" labor markets, a state-level S/D map can be created by the using the VCC data. The darker shaded states are areas where the number of applicants to employment opportunities is very high, with Alabama and Mississippi having 2.51-4.15 applicants per employment opportunity. The Southwest has the lowest number of applicants per employment opportunities with 0.12-0.5 applicants per employment opportunity.

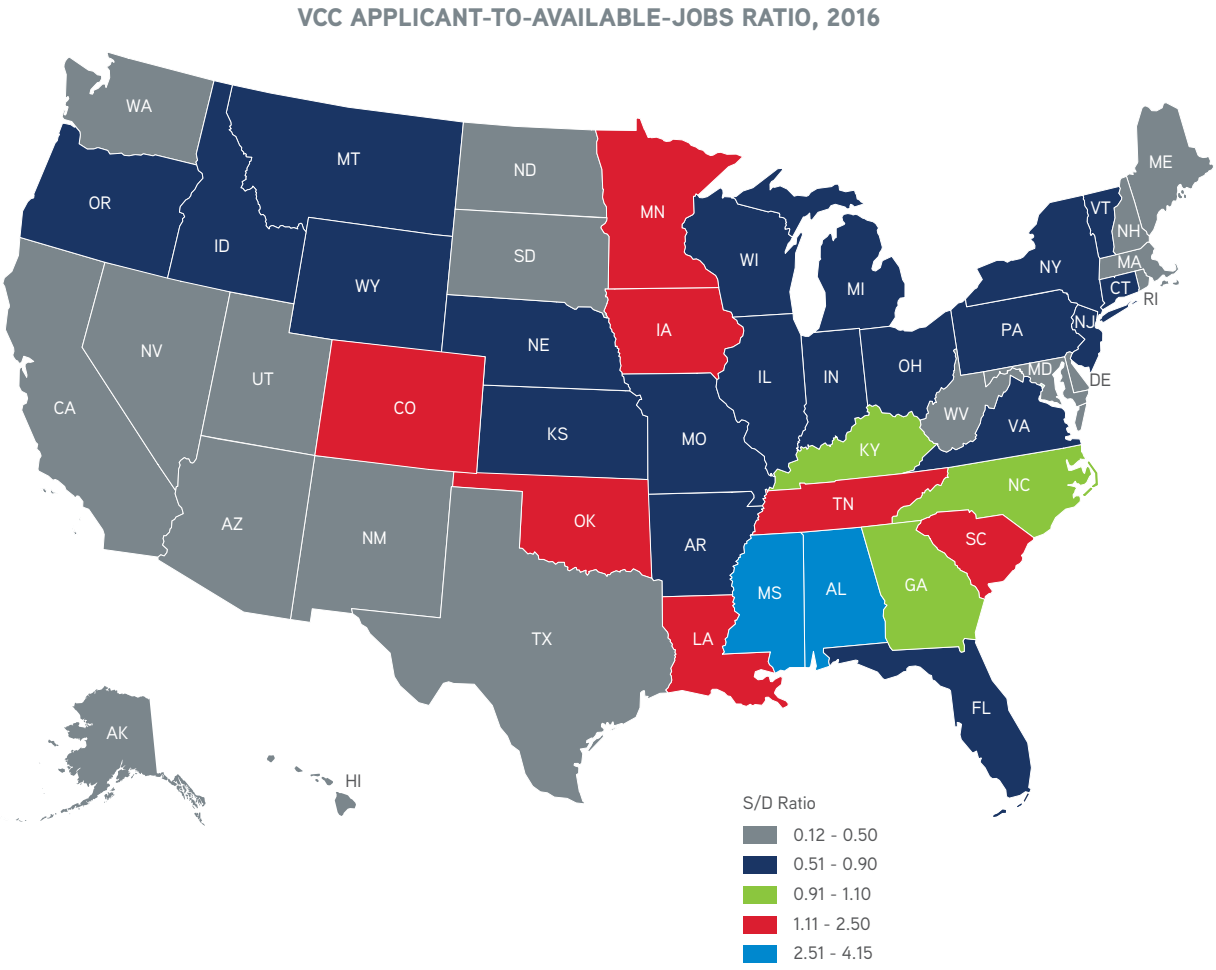


Figure 48

Using the dot map to plot the job applicants per DVM job listing provides a clearer illustration of the localized veterinary labor markets. The larger the blue circle the more applicants that exist per job listing. These large blue areas represent potential "cold" spots for veterinary labor. Competition for each available employment opportunity in these areas is stiff and this is likely to hold down income growth in these areas. The urban centers of Atlanta, Charleston, Dallas, Denver, Houston, Phoenix, Portland and Seattle have applicant-to-job ratios in excess of 10 to one.

VCC JOB APPLICANT QUANTITY PER DVM JOB LISTING, 2016

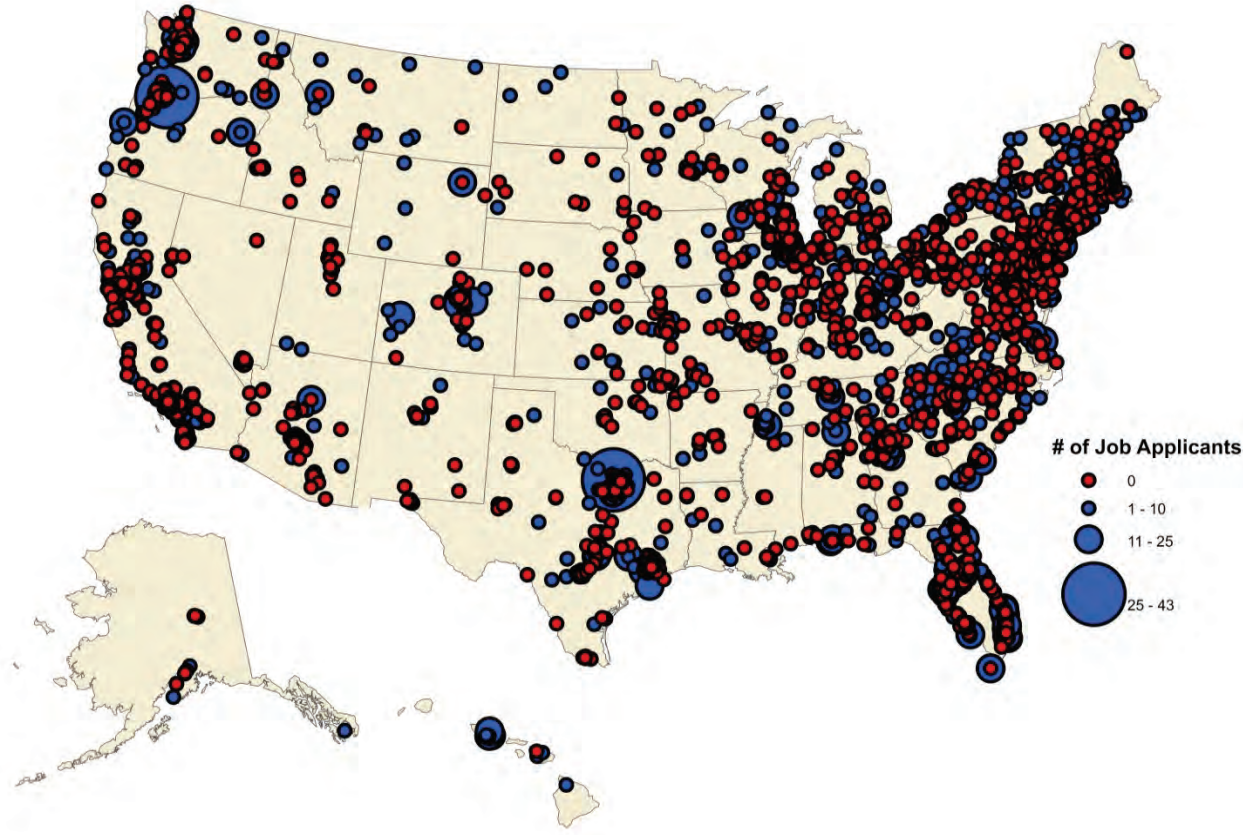


Figure 49

One contributing factor to the problem of maldistribution in the profession is community background of the veterinarians. New veterinarians seek employment in communities similar to those where they grew up. While the U.S. Census has no definition (nor statistics) for suburban communities, most people have an idea of the suburbs. However, the idea of what a suburb is varies considerably. Communities that surround urban centers is the most common perception of a suburb but some who live in communities of more than 10,000 people within proximity of an urban center, but not attached to it, may consider themselves suburban or rural.

NEW VETERINARIAN COMMUNITY

	Grew Up	Found Employment			
		Rural	Suburb	Urban	Total
2013 - 2016	Rural	757	320	140	1,217
	Suburban	1,164	3,804	842	5,810
	Urban	480	994	1,674	3,148
	Total	**2,401**	**5,118**	**2,656**	**10,175**

	Grew Up	Found Employment			
		Rural	Suburb	Urban	Total
2016	Rural	204	71	38	313
	Suburban	316	982	210	1,508
	Urban	133	258	398	789
	Total	**653**	**1,311**	**646**	**2,610**

Table 27

NEW VETERINARIANS SEEK EMPLOYMENT IN COMMUNITIES SIMILAR TO THOSE WHERE THEY GREW UP.

VETERINARIAN WELLNESS

In line with the general population, the level of incurred debt has generally followed an upward trend...

In an effort to address the growing concern over the wellness of veterinarians, the AVMA has been collecting data on self-reported wellness of veterinarians. The purpose of this collection has been to attempt to find correlations of wellbeing with employment and demographic characteristics. If, in fact, there is a problem with wellness in the veterinary profession, then it is important to know what factors are contributing to lower levels of wellness.

In addition to self-reported wellness measures, the Professional Quality of Life (ProQoL) Scale questions are included in surveys and compassion satisfaction and compassion fatigue scores calculated for each respondent. Compassion fatigue is reported as "Burnout" scores and "Secondary Traumatic Stress" scores and these two scores can be used as dependent variables in measuring the impact of factors that, conceptually, are thought to contribute to either or both burnout or secondary traumatic stress.

The structure of this section follows from the data available on the possible causes of negative wellbeing: student debt load, job, career and lifestyle satisfaction, expenditure patterns, burnout scores and self-reported health evaluations.

STUDENT DEBT LOAD

The literature on debt of practicing veterinarians, while considerable, tends to focus on debt at graduation, since this amount is fairly easy to measure and most graduates are at about the same place in their lives. Less studied is how that debt changes over time according to the experiences of practitioners who have been out of school for some time. Admittedly, the problem of large student loan debts has accelerated in recent years, but there are few studies to show, beyond qualitative and personal stories, how well DVMs are managing their educational debt. The following figures describe the debt at the start of a veterinarians' career and currently for respondents, according to when an individual graduated from veterinary school.

VETERINARY COLLEGE DEBT BY GRADUATION YEAR, 2016

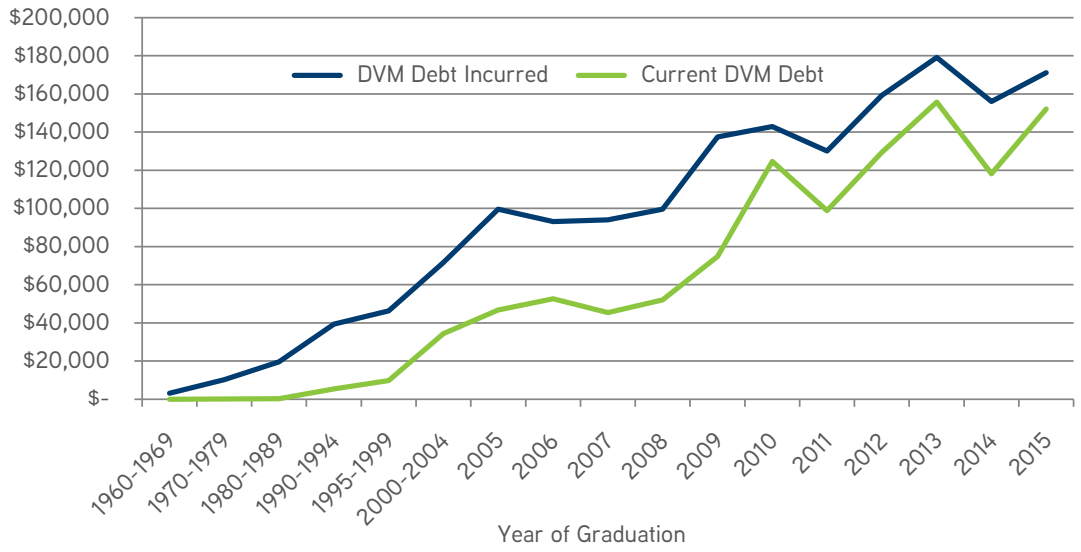


Figure 50

The first figure shows the average debt incurred for each of the sampled graduating classes, with those graduating before 2004 grouped by spans of time. In line with the general population, the level of incurred debt has generally followed an upward trend, with variations most likely due to variation in the respondent sample size in each year. Of those who incurred debt, the current amount owed is less than the original balance. Again, this balance generally rises for those who have graduated at a later date.

The second debt chart shows the dynamics of how that student loan debt has been paid off. Most veterinarians who graduated before 1990 have paid off their student loans and did so in less than 10 years. For those who graduated after 1990, the proportion of borrowers who still owe on their loans increases proportionally according to their year of graduation, with less than 20 percent of those who graduated in 2005 or latter having paid off their loans. As a comparison, those who graduated prior to 1995 and paid off their student loans did so in less than 10 years while for years beyond 1995 fewer veterinarians have been able to pay off their loans in a 10-year period. For those who graduated between 1995 and 1999 only 67 percent paid off their loans in 10 years, for those who graduated between 2000 and 2004 that drops to 41 percent and for those who graduated in 2005, less than 20 percent were able to pay off their loans in 10 years or less.

[4] J. Karl Wise, Center for Information Management, AVMA, 1992

TIME TAKEN TO REPAY STUDENT LOANS BY GRADUATION YEAR

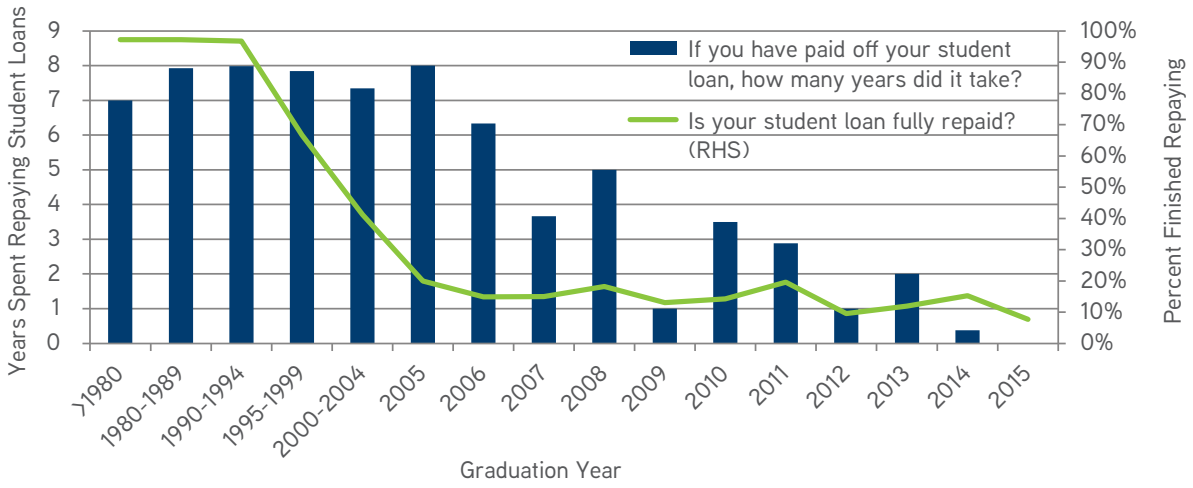
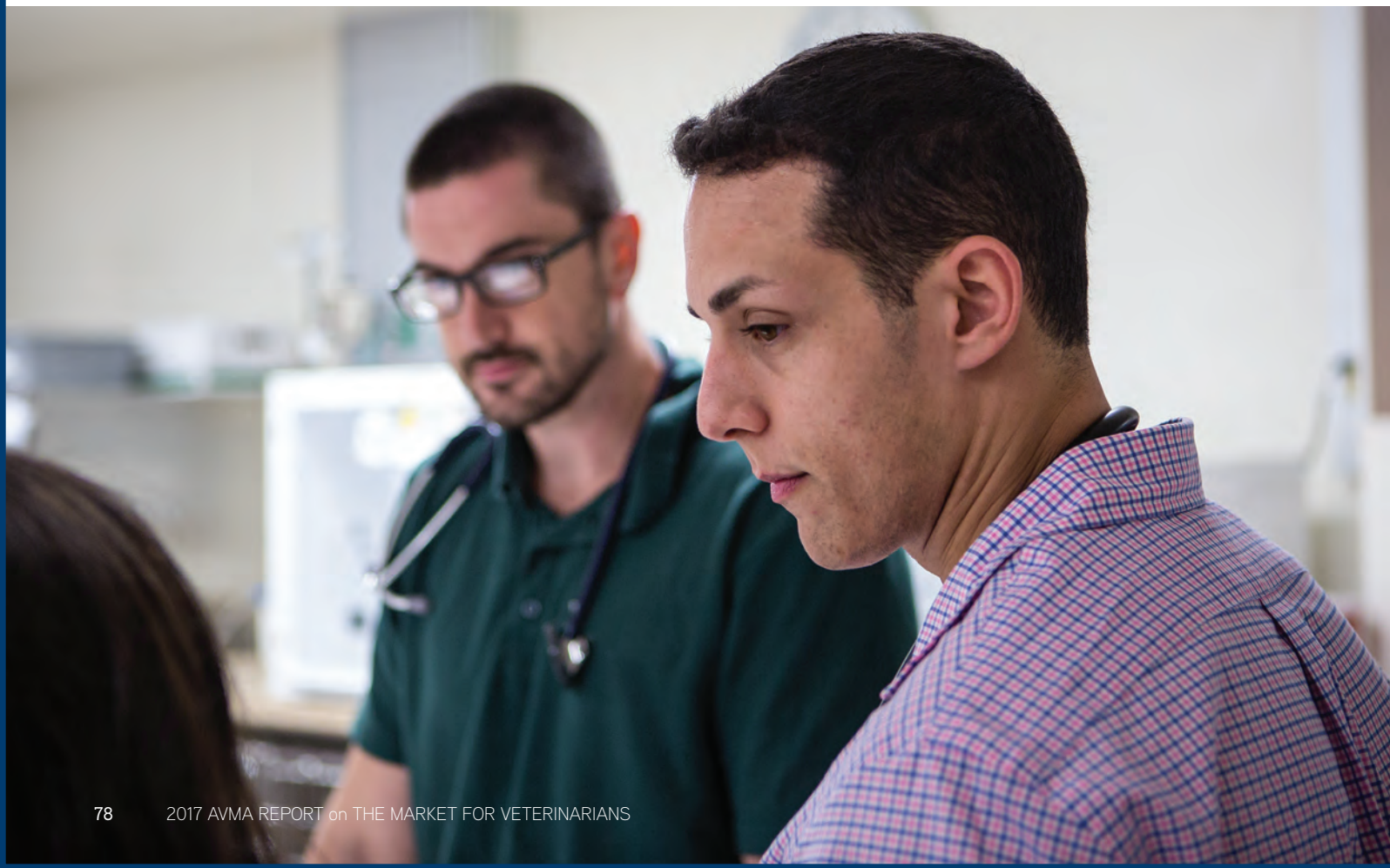


Figure 51



JOB, CAREER AND LIFESTYLE SATISFACTION

The compensation that a veterinarian receives from an employer should represent the price at which the veterinarian is willing to sell his or her labor and the price at which the employer is willing to pay for that labor. In a perfectly competitive market for veterinarians, the level of compensation conceptually represents an equilibrium point: that level of compensation where the willingness of the veterinarian to sell his or her labor is equal to the willingness of the employer to purchase the same amount of labor. The level of compensation and hours of labor provided is a negotiated amount between the labor provider and the employer. In this case, the hours of labor and total compensation pair represents a point on both the curve of the demand for veterinary labor (veterinarians) and the curve of the supply of veterinary labor. But because the veterinarian is not a homogenous product and each veterinarian can be differentiated by differences in veterinary medical skills, business acumen, client services and individual characteristics, there will be considerable variation in compensation at any point in time.

In terms of supply, the relationship is between the number of hours veterinarians are willing to provide and the compensation required to provide them. The important question to answer pertains to veterinarians' willingness to provide hours of labor at specific levels of compensation. An argument can be made that because of veterinarians' limited ability to use their DVM for other employment opportunities with similar compensation, they are forced to accept employment out of the need to repay the high cost of their education. Thus, the level of compensation does not correctly reflect their willingness to sell their labor for their current level of compensation. That is, it may be that they are taking what they can get but are not satisfied with what they are earning.

To discover veterinarians' willingness to provide the quantity of labor at the level of compensation they currently earn, answers to questions about underemployment can reveal some insight. From the AVMA Employment Survey, it is clear that there were both veterinarians working more hours and fewer hours than they wished. More specifically, some veterinarians indicated they wished to work more hours for more compensation while others indicated they wished to work fewer hours for less compensation. However, this leaves open the question, "Would you like to work fewer hours at the same level of compensation?" and "Would you be willing to work more hours for the same level of compensation?"

The addition of these two questions would close the gap in analyzing the decision process but still would not adequately address the issue of willingness to sell. To address that question specifically requires an understanding of the schedule of number of hours that each veterinarian is willing to work and the compensation at each amount of hours worked.

Unfortunately, obtaining objective information on willingness of the individual veterinarian to sell his or her labor is difficult. Instead, another approach is to measure the level of satisfaction veterinarians report for their current employment and the relationship between that satisfaction and income. If income is an important factor in determining the level of satisfaction, then the relationship between satisfaction and level of income should be both economically and statistically significant. An analysis of the respondents to both the 2015 Employment Survey and the 2015 Compensation Survey found a large and statistically significant relationship between income and job satisfaction.

From the Employment Survey, the relationship between the expressed level of satisfaction on a five-point scale where "1" was "not at all satisfied" and "7" was "very satisfied" is best defined by those whose level of compensation exceeds $100,000. Very few of these higher-income earners indicated they were not satisfied (a 1 or 2 on the five-point scale), while the majority of higher earners indicated they were at least somewhat satisfied (a 3 to 5 on the five-point scale). However, there were low earners (below $60,000) who indicated all levels of satisfaction.

From the 2016 Census of Veterinarians, a distribution of satisfaction was calculated along various income levels. The majority of respondents fell between an annual income of $50,000 and $99,999. Within this group the majority of respondents were neither satisfied nor dissatisfied with their job, giving the median rank of 4 out of 7. Within the group whose income was the highest, above $200,000, the majority of respondents were extremely satisfied with their jobs, selecting a score of 7 out of 7.

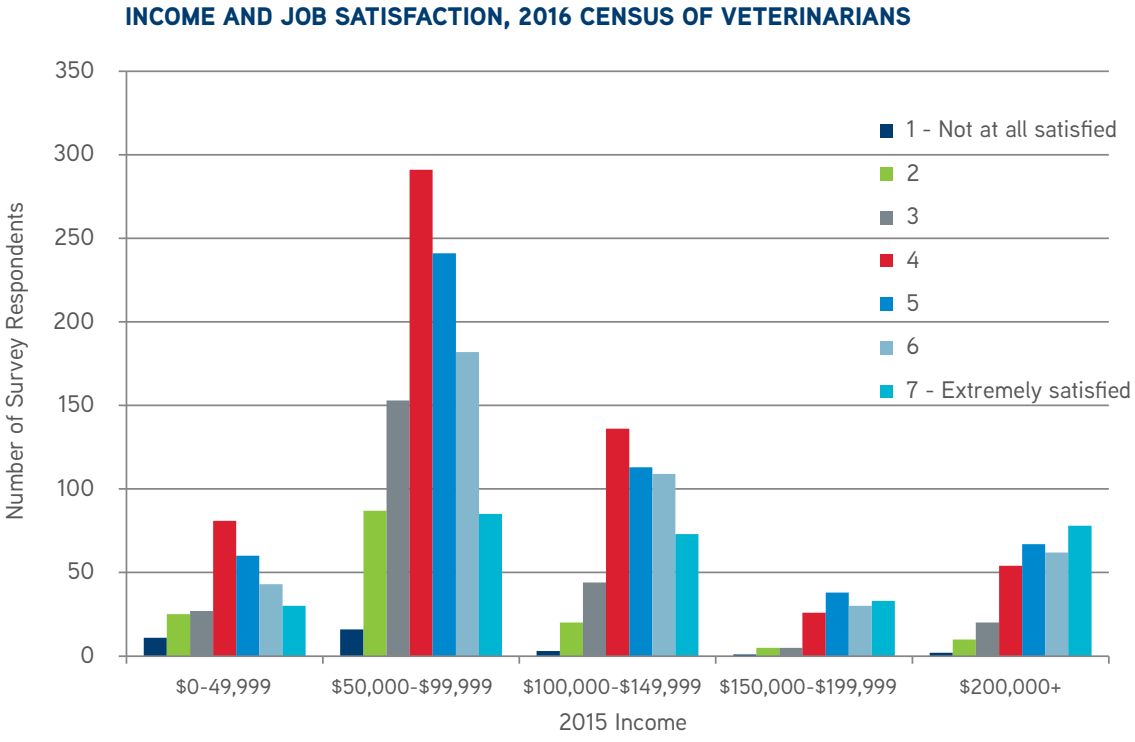


Figure 52

In line with their satisfaction with current employment, respondents indicated a similar pattern in satisfaction with compensation. Approximately 49 percent indicated satisfaction above the central measure (5-7) while 23 percent indicated a greater level of dissatisfaction (1-3) with compensation. Only 6 percent of those who were satisfied with their employment indicated a stronger dissatisfaction with their compensation.

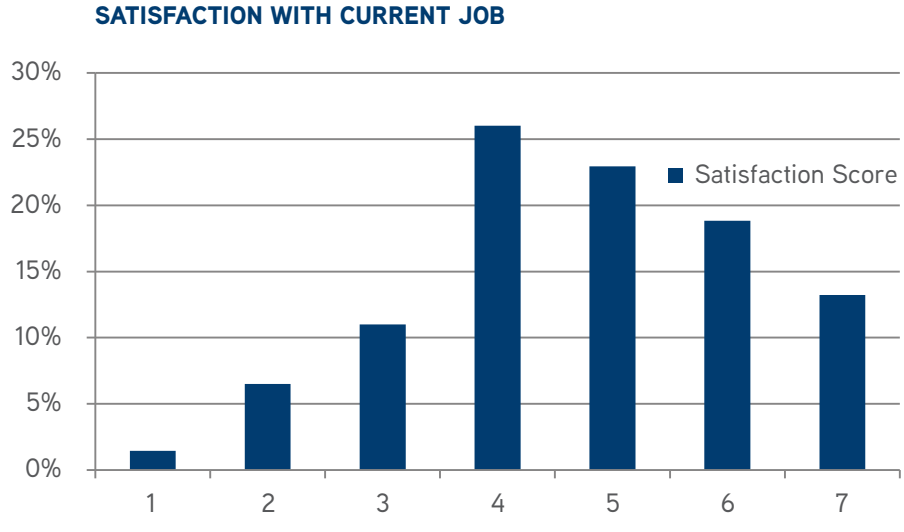


Figure 53

SATISFACTION WITH COMPENSATION

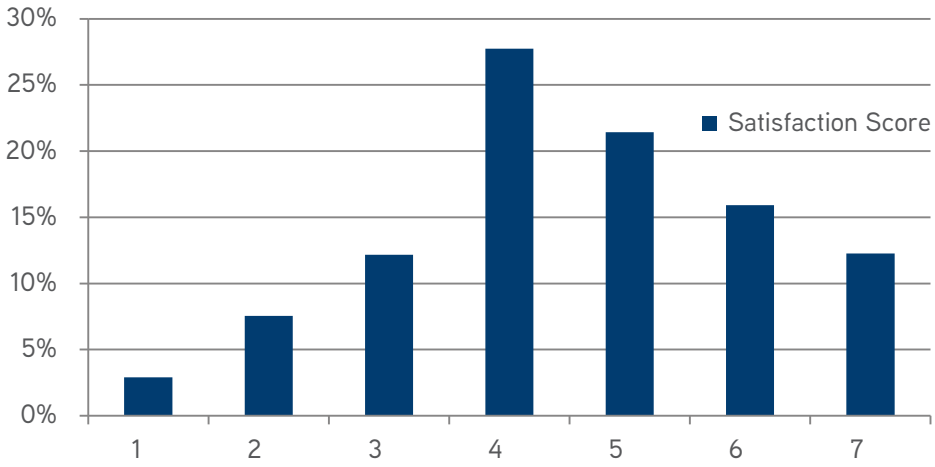


Figure 54

Veterinarians reported that they were less satisfied with their profession than with their current employment or compensation. Only 44 percent indicated satisfaction above the central point (4) while 28 percent indicated satisfaction below the central point.

SATISFACTION WITH THE VETERINARY PROFESSION

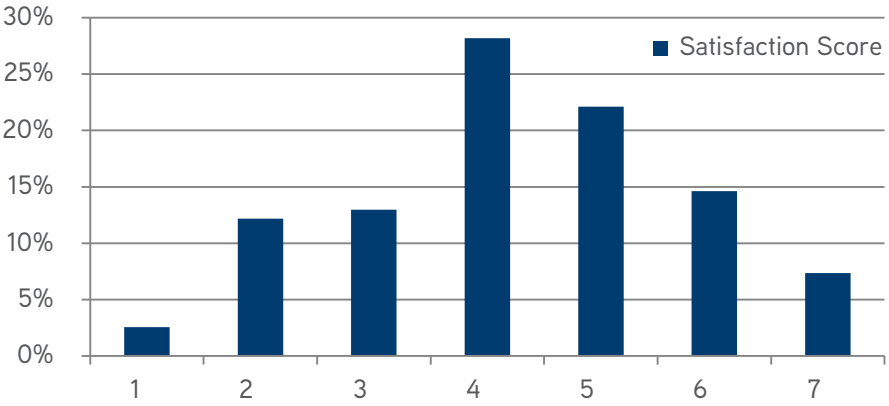


Figure 55

Following closely with the distribution of satisfaction with compensation, 53 percent of respondents indicated a level of satisfaction with their lifestyle above the central level while 21 percent indicated a level of dissatisfaction with their current lifestyle.

SATISFACTION WITH LIFESTYLE

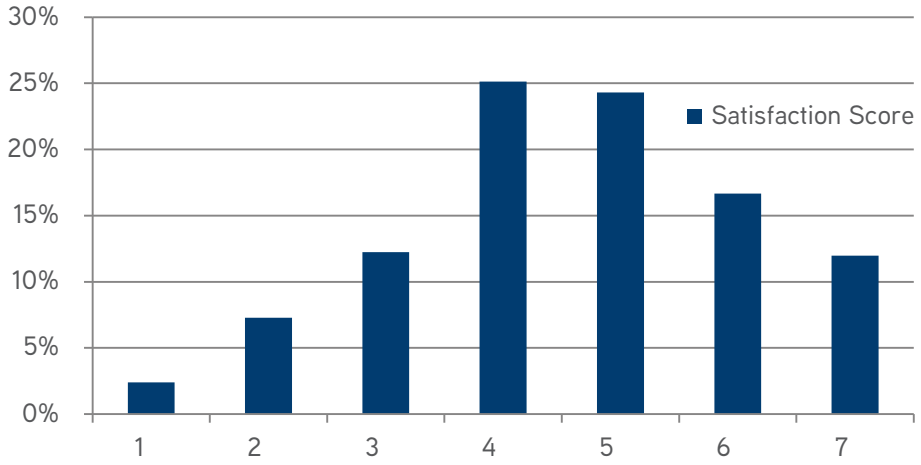


Figure 56

CORRELATIONS BETWEEN TYPES OF SATISFACTION

		How satisfied are you with your current employment?	How satisfied are you with the level of your total compensation?	How satisfied are you with the veterinary profession as a whole?	How satisfied are you with your current job?	How satisfied are you with your current lifestyle?
How satisfied are you with your current employment?	Pearson Correlation	1	.502**	.431**	.788**	.532**
	Sig. (two-tailed)		.000	.000	0.000	.000
	N	2,819	2,811	2,797	2,800	2,800
How satisfied are you with the level of your total compensation?	Pearson Correlation	.502**	1	.404**	.624**	.560**
	Sig. (two-tailed)	.000		.000	.000	.000
	N	2,811	2,812	2,796	2,799	2,799
How satisfied are you with the veterinary profession as a whole?	Pearson Correlation	.431**	.404**	1	.540**	.476**
	Sig. (two-tailed)	.000	.000		.000	.000
	N	2,797	2,796	2,799	2,792	2,792
How satisfied are you with your current job?	Pearson Correlation	.788**	.624**	.540**	1	.652**
	Sig. (two-tailed)	0.000	.000	.000		0.000
	N	2,800	2,799	2,792	2,802	2,799
How satisfied are you with your current lifestyle?	Pearson Correlation	.532**	.560**	.476**	.652**	1
	Sig. (two-tailed)	.000	.000	.000	0.000	
	N	2,800	2,799	2,792	2,799	2,802

**. Correlation is significant at the 0.01 level (two-tailed).

Table 28

The four measures of satisfaction (employment, compensation, profession, lifestyle) illustrated above appear to have similar distributions across levels of satisfaction. To determine how closely respondents replied to each question, a Pearson product-moment correlation matrix was generated for the four measures. The Pearson correlation coefficient is a measure of the linear relationship between two variables. A positive coefficient indicates a positive or direct linear relationship and a negative value indicates a negative or indirect linear relationship. The coefficient value is between 0 and negative or positive 1, the greater the coefficient, the stronger the linear relationship. The level of significance (Sig. 2 tailed) provides a probability that the value of the relationship is 0. For all of the measures the probability that there is not a linear relationship is essentially 0 (.000). A measure of 1 would indicate that the satisfaction measures are perfectly correlated. That is, every respondent who indicated they were extremely satisfied with their employment would also indicate the same level of satisfaction with the correlated measure.

The correlation between each of the measures is strong and statistically significant and this indicates that those who are satisfied with one aspect (employment, compensation, profession and lifestyle) have the same or close level of satisfaction with the other aspects. Thus, these measures of satisfaction suggest a cohort that is dissatisfied with many aspects of their life.

SATISFACTION WITH EMPLOYMENT AND MEAN INCOME

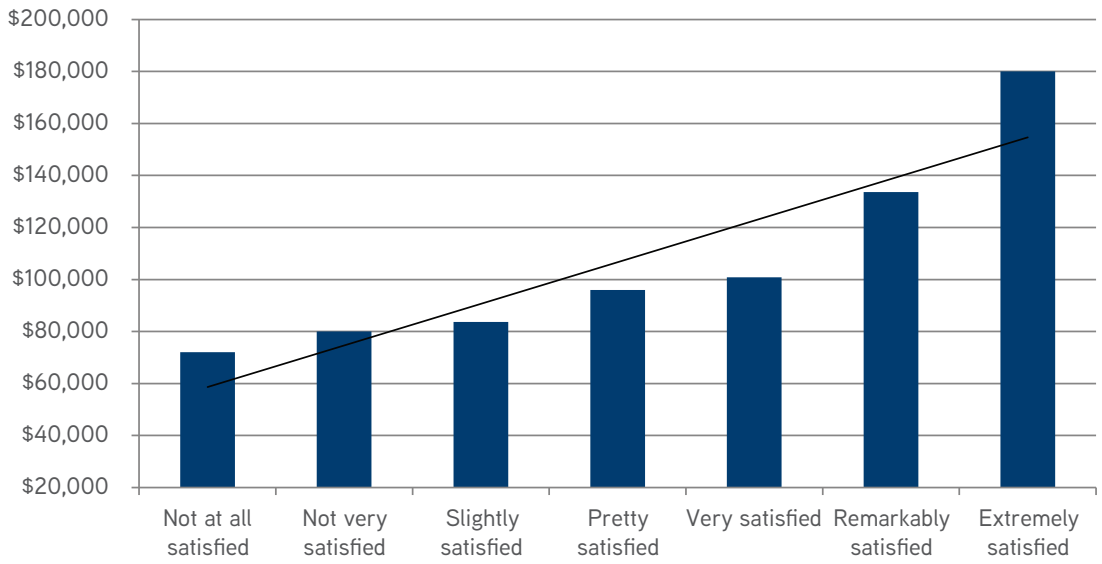


Figure 57

53%

FOLLOWING CLOSELY WITH THE DISTRIBUTION OF SATISFACTION WITH COMPENSATION, 53 PERCENT OF RESPONDENTS INDICATED A LEVEL OF SATISFACTION WITH THEIR LIFESTYLE ABOVE THE CENTRAL LEVEL

The relationship that exists between level of satisfaction with employment and mean income is statistically significant. On average the mean income at each level of satisfaction is $16,000 greater than the previous, lower level of satisfaction. The biggest difference exists between those who have reported being remarkably satisfied with their job and those reporting being extremely satisfied with their job having respective mean incomes of $134,000 and $180,000.

Of course, many factors contribute to satisfaction with employment, including actual hours worked compared to the number of hours desired, internal relationships, number of clients per day and level of debt. But there is a clear relationship between the level of income and satisfaction. This is important, especially to pre-veterinary and veterinary students and new veterinarians who may harbor the belief that compensation is unimportant as long as they are "doing what they love to do." While these data certainly suggest that this outlook may be true for some, generally this is not the case.

The results are similar in an analysis of 2015 Compensation Survey data. The survey asked the question, "How satisfied are you with your career?" Respondents could answer from 1 (not at all satisfied) to 7 (extremely satisfied). The proportion of respondents who indicate the higher levels of satisfaction (5-7) are noticeably larger in the higher-level income categories, while the proportion of those respondents indicating the lower level of satisfaction (1-3) are larger in the lower income categories.

The seven levels of responses caused a larger range of mean incomes, from a low of $72,087 from those who responded with a 1 (not at all satisfied), to a high of $180,058 from those who responded with a 7 (extremely satisfied). The linear relationship predicts a $16,013 difference between each level of satisfaction. The important point to take away from this is that the patterns of responses and levels of income are consistent across the two datasets, indicating the existence of a very real, measurable pattern: that higher levels of compensation are correlated with higher levels of satisfaction.

Most important is that, generally, veterinarians seem to be satisfied with their career choice with more than 50 percent of respondents indicating that they are at least very satisfied.

Seventy-five percent of respondents claimed to be at least a 4 (pretty satisfied) on the satisfaction scale.

The willingness of veterinarians to provide veterinary service labor, based on this simple analysis, increases as compensation increases. And this analysis suggests that a satisfaction level of 4 would generally require a level of compensation in the range of $95,000-$100,000. In addition, based on previous findings, this level of compensation should occur at the optimum level of hours worked. While the relationship between compensation and number of hours of labor available defines the supply relationship, understanding the factors that affect the willingness of veterinarians to supply labor is important to determining the number of veterinarians needed to meet the demands for veterinary services.

The challenges in estimating the demand for veterinarians are similar to those for estimating the supply. Demand is the relationship between the hours of veterinarian labor and the compensation the employer is willing to pay for those hours. The market demand is the summation of all of the individual employer relationships between hours and level of compensation. As with supply, developing this relationship would require obtaining the willingness-to-pay information from employers.

Our data contain points where the veterinarian and the employer have agreed to a level of compensation and number of hours of labor. For each of these transactions, the employer may have been willing to pay more but was not forced to because the veterinarian accepted less. Or, the veterinarian received a greater level of compensation than he or she was willing to accept in return for the hours of labor required. Under normal market circumstances, the veterinarian would not provide labor for less than the compensation he or she was willing to accept, and the employer of veterinarian labor would not pay more for the labor needed than the employer was willing to pay. An abundance of labor and few opportunities for employment would cause the level of compensation to fall. A scarcity of labor in a market with many employment opportunities would cause the level of compensation to rise for the same amount of labor. Thus, over time, the changes in the level of compensation and the number of veterinarians employed would provide insight into the changing willingness of employers to pay for, and veterinarians to sell, veterinary labor.

In the market for new veterinarians, the compensation and number of veterinarians employed contains 14 aggregate annual observations (supply and demand equilibriums), while in the market for current veterinarians there are currently only eight such equilibrium points. This quantity of points is generally insufficient to estimate the demand relationship.

PERSONAL EXPENDITURE PATTERNS

In the 2016 calendar year, a sample of 147 recent graduates completed the Personal Financial Planning Tool available on the AVMA website (https://www.avma.org/PracticeManagement/BusinessIssues/Pages/personal-financial-planning-tool.aspx). "Recent graduate" is defined as anyone who graduated between 2011 and 2015, which are the five most recent graduation years.

The expenditures of these early career veterinarians were aggregated by expense category and compared to a similar age group and national income averages for the United States. The average early career veterinarian completing the Personal Financial Planning Tool in 2016 had a mean household income of $96,563 and this falls between the eighth ($90,810) and ninth decile ($120,624) of U.S. households.

COMPARISON OF MEAN EXPENSES

	Veterinarian Household, Recent Graduate, 2016	General Population, 25-34 Years Old, 2015
Demographics		
Age	30	30
Household Size	1.5	2.7
Home Ownership Rate	28%	39%
College Education Rate	100%	74%
Gross Household Income	$96,563	$64,472
Expenses		
Federal and State Taxes	$17,874	$7,163
Student Loan Payments	$9,219	n/a*
Credit Card Debt Payments	$5,272	n/a*
Housing	$20,129	$18,305
Transportation	$3,824	$9,777
Food	$6,295	$6,636
Healthcare, Insurance and Medicare	$6,147	$4,767
Professional Development	$985	$1,123
Recreation and Leisure	$4,514	$4,039
Savings, Retirement and Social Security	$12,059	$6,753
Personal and Miscellaneous	$3,415	$3,752
Child Care**	$598	n/a*
Pet Expenses	$943	$384
Annual Expenditures	$91,274	$62,699

*These categories are not separately recorded in the BLS CE survey.

Sources: AVMA estimates and the Bureau of Labor Statistics Consumer Expenditure Survey

Table 29

There are similarities between the veterinarian and similar-aged general and similar income population households. Recreation and leisure spending is almost identical, though the similar-aged general population spends about a third more of their income on recreation and leisure. Personal and miscellaneous spending is similar for the veterinarian and similar-aged households, but the similar income households spend twice as much. All three groups spend a similar amount on housing, and the veterinarians and similar-aged households spend about the same on food while the similar income households spend 30 percent more.

While the similarities are interesting, the differences are even more so. First, notice that the average household size of 1.5 for recent graduates versus 2.7 for the similar-aged and 2.9 for the similar income households. Furthermore, the home ownership rate in the similar-aged household is 30 percent higher than that of veterinarians while the similar income households is nearly triple. Of course, the similar income households have a mean age of 47 while the veterinarians mean age is 30.

The amount of taxes paid by the similar-aged and similar income households is considerably less than for the veterinary households. This large difference reflects the difference in income, number of people in the household and the effect of the mortgage interest deduction on the tax rate.

The third large difference is in the amount spent on transportation. The similar-aged households spent almost three times more than the veterinary households while the similar income household spent nearly four times as much of a proportion.

The census data do not specifically itemize school loans or credit card debt and thus a comparison cannot be made, but recent graduates pay an average of $9,219 in student loan payments and have an average of $5,272 in credit card payments.

COMPASSION SATISFACTION AND FATIGUE

Over the last several years, the wellness of veterinarians has become a major concern within the profession. The high rate of suicides among veterinarians compared to other professions has led to a call for action.

Starting in 2015, the ProQoL tool was included in the annual survey of veterinarians (employment survey in 2015, Census of veterinarians in 2016) to begin to understand the factors that may contribute to compassion satisfaction and fatigue.

The ProQoL[2] tool is a measure of compassion satisfaction and compassion fatigue associated with helping others who have experienced suffering. Compassion satisfaction is about the pleasure you derive from your work. For example, you might feel like it is a pleasure to help others through what you do at work. You might feel positively about your colleagues or your ability to contribute to the work setting or even the greater good of society through your work with people who need care. Compassion fatigue encompasses negative feelings derived from work through scoring of burnout (exhaustion, frustration, anger, depression) and secondary traumatic stress (work-related trauma).

Responses to the ProQoL questions are scored based on the responses of thousands of individuals across a number of occupations. The ProQoL survey instrument contains a set of 30 questions and asks respondents to consider each of the questions in the context of "you and your current work situation." A five-point scale is provided (1=never, 5=very often) to reflect honestly how frequently over the last 30 days the respondent experienced each of the feelings listed. The scores have been established to describe low-, normal- and high-compassion satisfaction and fatigue as well as burnout and secondary trauma. The results from the AVMA surveys indicated that the mean ProQoL scores for compassion satisfaction were in the higher normal range, while compassion fatigue, burnout and secondary trauma were in the lower normal range. But these mean scores fail to illustrate the number of respondents who were in the high range for burnout and secondary trauma. The results of the ProQoL scores are plotted against the percent of respondents with each specific score. The distribution of compassion satisfaction scores follows a normal distribution that is skewed left. Less than a score of 22 is considered a low score for compassion satisfaction.

COMPASSION SATISFACTION SCORE DISTRIBUTION

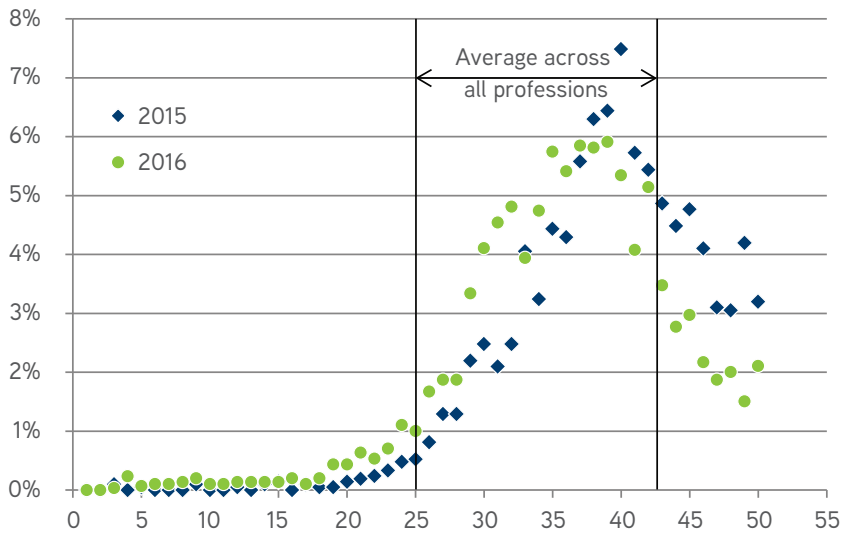


Figure 58

[2] B. Hudnall Stamm, 2009. Professional Quality of Life: Compassion Satisfaction and Fatigue Version 5 (ProQOL). /www.isu.edu/~bhstamm or www.proqol.org

Looking at what factors are associated with low compassion satisfaction, a multiple linear regression was conducted with the variables that were felt might contribute to the variation in compassion satisfaction or compassion fatigue. The result of this analysis indicated that only two factors, satisfaction with current employment and how well the veterinarian felt prepared for his or her career, were statistically significant in both 2015 and 2016. Both of these factors were positively associated with compassion satisfaction.

In 2016, industry employment, lower income and hourly compensation were found to be statistically significant in a negative association with compassion satisfaction, while being employed in academia, living in a smaller community, and increased age were positively associated with compassion satisfaction.

COMPASSION SATISFACTION SCORE

	2016		2015	
	Coefficient	P Value	Coefficient	P Value
(Constant)	16.001	0.000	18.851	0.000
Satisfaction with current employment	3.016	0.000	2.753	0.000
How well your education has prepared you to be a veterinarian	1.758	0.000	1.682	0.000
Professor (Assistant, Associate, or Full)	4.488	0.025		
Industry/commercial organizations	-4.441	0.038		
Advanced Education			-1.763	0.018
Size of community in which practice is located: 2,500 to 49,999 residents	0.655	0.035		
Compensation mode: Hourly	-1.162	0.026		
Personal Income	-9.37E-07	0.048		
Gender: Female=1/ Male=0			1.021	0.001
Age	0.054	0.000		
Hours Worked per week			0.035	0.002
Ethnicity – Asian			1.999	0.012
Marital Status: Single			-0.932	0.003
Marital Status: Divorced			1.363	0.038

Table 30

The two sources of compassion fatigue, burnout and secondary traumatic fatigue, were also measured. A score above 35 on the burnout or secondary trauma stress scale might suggest a need to seek help to deal with the factors that are causing either burnout, secondary trauma stress or both. The burnout scores from both the 2015 and 2016 surveys were normally distributed with the mean at the low end of the normal range. However, 7.2 percent of 2016 respondents had scores in excess of 35.

BURNOUT SCORE DISTRIBUTION

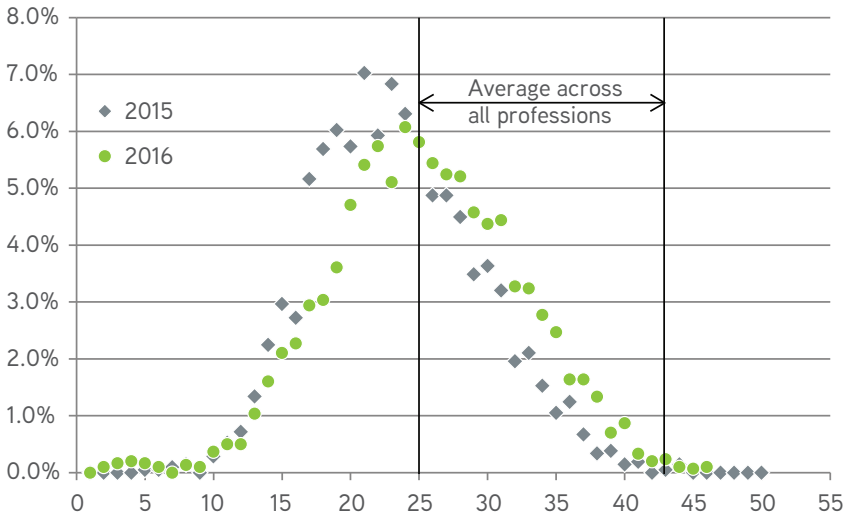


Figure 59

IN 2016, INDUSTRY EMPLOYMENT, LOWER INCOME AND HOURLY COMPENSATION WERE FOUND TO BE STATISTICALLY SIGNIFICANT IN A NEGATIVE ASSOCIATION WITH COMPASSION SATISFACTION, WHILE BEING EMPLOYED IN ACADEMIA, LIVING IN A SMALLER COMMUNITY, AND INCREASED AGE WERE POSITIVELY ASSOCIATED WITH COMPASSION SATISFACTION.

Using the same approach to examine the factors associated with burnout that was used with compassion satisfaction, three factors were found to be statistically significant in both 2015 and 2016. The less satisfied with current employment and the less prepared the respondent thought their education had prepared them for a career in veterinary medicine, the greater the burnout score. The more hours worked per week, the greater the burnout score. Again, there were several other factors that were statistically significant in their association with higher levels of burnout.

BURNOUT SCORE

	2016		2015	
Dependent Variable: Burnout Scale	**Coefficient**	**P Value**	**Coefficient**	**P Value**
(Constant)	37.044	0.000	36.151	0.000
Satisfaction with current employment	-2.707	0.000	-2.594	0.000
Food animal practice (predominant)			-3.891	0.000
Food animal practice (exclusive)			-3.329	0.000
Equine practice			-1.657	0.008
Not-for-profit organizations	-4.629	0.024		
Hours worked per week	0.08	0.000	0.054	0.000
How well your education has prepared you to be a veterinarian	-1.055	0.000	-1.188	0.000
Gender: Female=1/ Male=0	1.04	0.002		
Educational debt	4.28E-06	0.032		
Ethnicity - Black/African American	-3.385	0.038		
Ethnicity - Hispanic/Latino			-2.79	0.001
Ethnicity – Asian			-1.894	0.009
Marital status: Single			1.02	0.000
Age	-0.051	0.001		
Graduation Year			-0.382	0.038

Table 31

Secondary traumatic stress scores had a similar distribution to that of the burnout scores. However, the mean is to the left (lower) than for burnout and the percent of respondents with a score above 35 (4.1 percent) is lower than for burnout.

SECONDARY TRAUMATIC STRESS SCORE DISTRIBUTION

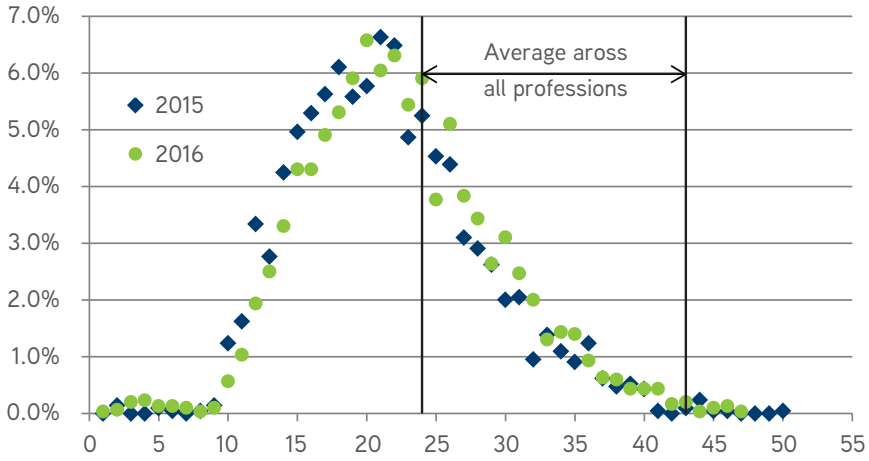


Figure 60

Again, using the same approach to examine the factors associated with secondary traumatic stress that was used with compassion satisfaction and burnout, four factors were found to be statistically significant in both 2015 and 2016. The less satisfied with current employment and the less prepared the respondent felt their education had prepared them for a career in veterinary medicine the greater the secondary traumatic stress score. Females, and the more hours worked per week were associated with greater levels of secondary traumatic stress. As with both compassion satisfaction and burnout, there were several other factors that were statistically significant in their association with higher levels of burnout.

SECONDARY TRAUMATIC STRESS SCORE

	2016		2015	
	Coefficient	P Value	Coefficient	P Value
(Constant)	26.383	0	23.237	0
Graduation year	-0.749	0		
Satisfaction with current employment	-1.349	0	-1.31	0
Hours worked per week	0.075	0	0.072	0
Gender: Female=1/ Male=0	1.461	0	1.883	0
How well your education has prepared you to be a veterinarian	-0.581	0.009	-0.695	0.001
Food animal practice (predominant)			-3.251	0.014
Food animal practice (exclusive)			-2.732	0.017
Companion animal practice (exclusive)			1.724	0
Companion animal practice (predominant)			1.278	0.015
State/local government			-3.817	0.015
Uniformed services	12.997	0.032		
Researcher	12.11	0.005		
Ethnicity - Black/African American			-3.427	0.032
Age			-0.037	0.033

Table 32

Burnout score also varies across graduation year. Those graduating within the last 10 years on average have the highest burnout scores, with a mean of 27.4. The scores decrease over the years with those graduating between 1946 and 1955 reporting a mean burnout score of 15.8.

BURNOUT SCORE AND GRADUATION YEAR

Graduation year	Mean	N	Std. Deviation
2006-2015	27.3624	1,250	6.39072
1996-2005	26.1980	702	6.90691
1986-1995	23.9641	473	6.38629
1976-1985	22.1025	283	5.75444
1966-1975	19.6647	167	5.27053
1956-1965	18.1538	65	4.91881
1946-1955	15.7778	9	6.62906
Total	25.3611	2,949	6.85675

Table 33

Those who are board certified reported a mean burnout score of 24.2 versus the mean burnout score of those not board certified, 25.6.

BURNOUT SCORE AND BOARD CERTIFICATION

	Mean	N	Std. Deviation
Not board certified	25.5946	2,526	6.78347
Board certified	24.2151	465	7.07236
Total	25.3801	2,991	6.84625

Table 34

The burnout scores between regions ranged from 23 to 28 with Region 0 having the lowest burnout score and Region 9 having the highest burnout score within the United States, at 26.8.

BURNOUT SCORE AND WORKPLACE LOCATION

Region of Workplace	Mean	N	Std. Deviation
Region 0	23.4686	542	7.87013
Region 1	26.5220	182	6.56687
Region 2	25.9470	264	6.81177
Region 3	26.2724	257	6.37161
Region 4	26.1268	205	6.60463
Region 5	26.3750	152	5.60725
Region 6	25.9337	196	6.05282
Region 7	24.5805	503	6.44537
Region 8	25.9176	364	6.29214
Region 9	26.7869	291	6.49795
Outside of US	28.0000	24	6.10773
Total	25.4570	2,980	6.78177

Table 35

Additionally, respondents with an income range exceeding $150,000 reported the lowest burnout score of 23.46 and those within the income range of $50,000-$99,999 reported a mean burnout score of 26.86, the highest within the income ranges.

BURNOUT SCORE AND INCOME RANGE

Income Range	Mean	N	Std. Deviation
$0 - $49,999	23.7752	743	7.27543
$50,000 - $99,999	26.8585	1,166	6.26795
$100,000 - $149,999	26.0843	617	6.66421
$150,000 - $199,999	23.4555	191	6.72754
$200,000 +	23.4599	274	6.66742
Total	25.4042	2,991	6.83348

Table 36

Females also had a significantly higher burnout score, 26.7 as compared to male respondents, who reported a mean score of 23.4.

BURNOUT SCORE AND GENDER

	Mean	N	Std. Deviation
Male	23.4283	1,011	6.63217
Female	26.7435	1,926	6.35836
Total	25.6023	2,937	6.64232

Table 37

Also, understandably, burnout score increases with debt levels. Respondents with less than $10,000 of DVM debt have a mean burnout score of 23.8 while respondents whose debt levels range within $200,000 and $249,999 report a mean burnout score of 29.2.

BURNOUT SCORE AND CURRENT DVM DEBT

	Mean	N	Std. Deviation
$0 - $9,999	23.8473	1,683	6.65588
$10,000 - $19,999	25.4576	59	7.23336
$20,000 - $29,999	25.7377	61	6.06053
$30,000 - $39,999	27.1452	62	6.67230
$40,000 - $49,999	26.0159	63	5.96898
$50,000 - $59,999	26.7385	65	6.64567
$60,000 - $69,999	26.8481	79	7.22902
$70,000 - $79,999	28.0000	58	6.54539
$80,000 - $89,000	26.7885	52	6.20037
$90,000 - $99,999	26.8571	63	5.51788
$100,000 - $124,999	27.1984	126	6.92592
$125,000 - $149,999	27.1261	111	6.30457
$150,000 - $174,999	27.7253	91	6.49455
$175,000 - $199,999	28.9574	94	6.59246
$200,000- $249,999	29.1754	114	6.12877
$250,000 +	28.0383	209	6.41576
Total	25.4067	2,990	6.83328

Table 38

Burnout scores vary across practice types. Veterinarians reporting employment in the Federal government had the lowest burnout score at 23.25 and those reporting employment in not-for-profit organizations reported the highest burnout score of 26.7, surpassed only by those in advanced education, including internships and residencies, who reported a mean burnout score of 27.5.

BURNOUT SCORE AND PRACTICE TYPE

	Mean	N	Std. Deviation
Food Animal Practice (Exclusive)	23.8065	31	6.16127
Food Animal Practice (Predominant)	25.2917	24	6.01071
Mixed Practice (At Least 25% Companion and 25% Food or Equine)	26.3034	145	6.20408
Companion Animal Practice (Predominant)	25.6319	288	6.57389
Companion Animal Practice (Exclusive)	26.2691	1,442	6.63103
Equine Practice	26.5169	89	6.29414
Federal Government (Civil Service)	23.2542	59	7.36158
Uniformed Services	25.7333	15	7.43031
College Or University (Faculty or Staff Only)	24.6983	242	6.34387
State/Local Government	26.1053	38	6.96241
Industry/Commercial Organizations	23.8462	78	7.23282
Not-for-profit Organizations	26.7051	78	6.40233
Advanced Education (Inclusive Of Internships And Residencies)	27.4545	66	6.82345
Other Veterinary Employment (Please Specify):	23.7935	92	6.44766
Non-Veterinary Employment (Please Specify):	23.2857	14	7.03211
Total	25.8341	2,701	6.63949

Table 39

THE OVERALL HEALTH OF RETIRED AND UNEMPLOYED VETERINARIANS IS LOWER THAN FOR EMPLOYED VETERINARIANS; HOWEVER IT WOULD BE PREMATURE TO SAY THAT ONE FACTOR CAUSES THE OTHER.

PERSONAL HEALTH ASSESSMENT

The 2016 Census Survey asked respondents to broadly evaluate their own health. Of the Survey's 2,502 respondents who reported being currently employed (2,227), 26 percent of those working full time and 23 percent of those working part time, 46 percent of both reported very good health; roughly 23 percent of both reported good health; and 5 percent of full-time veterinarians and 10 percent of veterinarians working part time reported fair to poor health. These contrast with the health of 87 currently unemployed and 152 retired veterinarians (16 percent and 20 percent) who report being in excellent health; 43 percent of both were in very good health, 28 percent and 23 percent were in good health; and 12 percent and 15 percent were in fair health or poor health. The overall health of retired and unemployed veterinarians is lower than for employed veterinarians; however it would be premature to say that one factor causes the other.

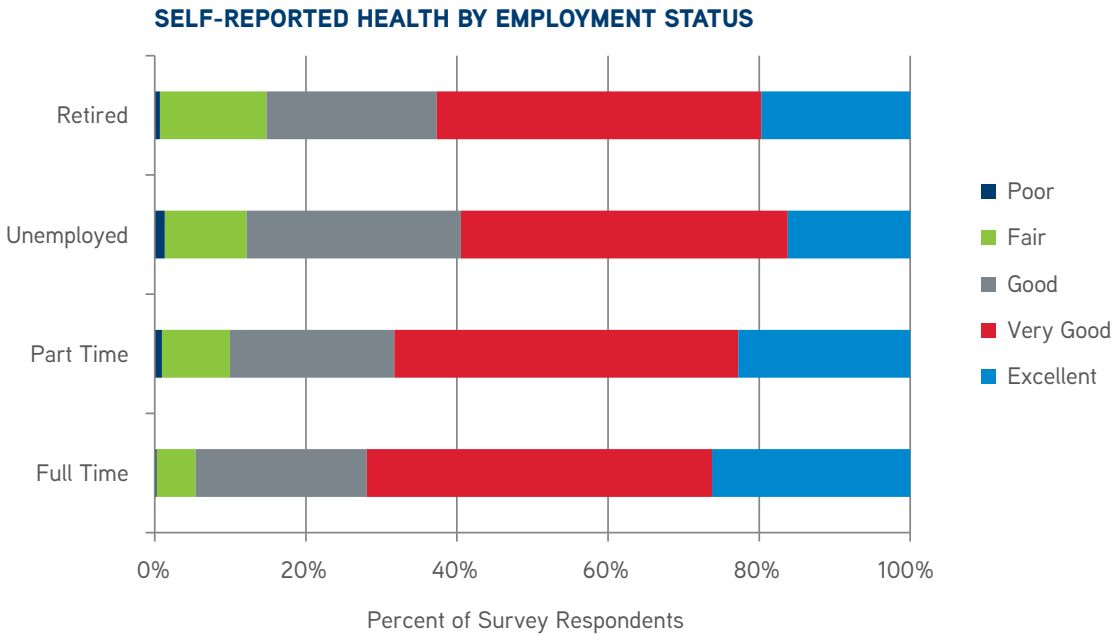


Figure 61

The self-reported health scores also varied by practice type with food animal exclusive veterinarians indicating the largest percentage in excellent health but food animal predominant reporting the largest percentage good to poor health.

Veterinarians in not-for-profit organizations had the lowest percent of respondents indicating excellent health and state and local government veterinarians had the highest percentage of respondents indicating fair or poor health.

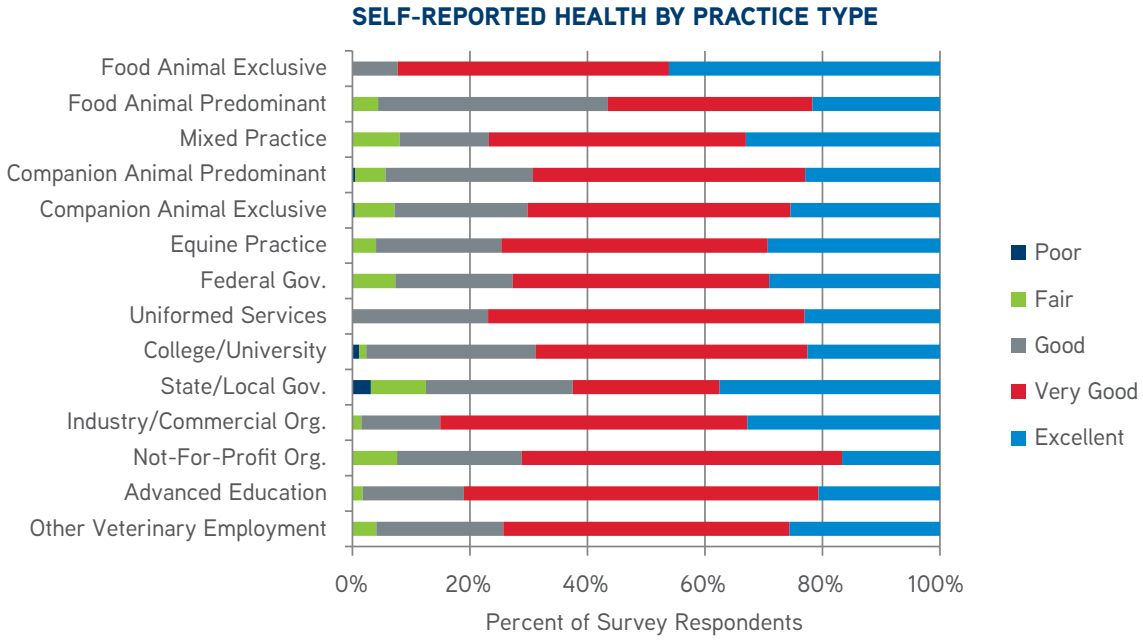


Figure 62

There was little difference in the self-reported health rating by gender with both the mean value and the distribution being very similar.

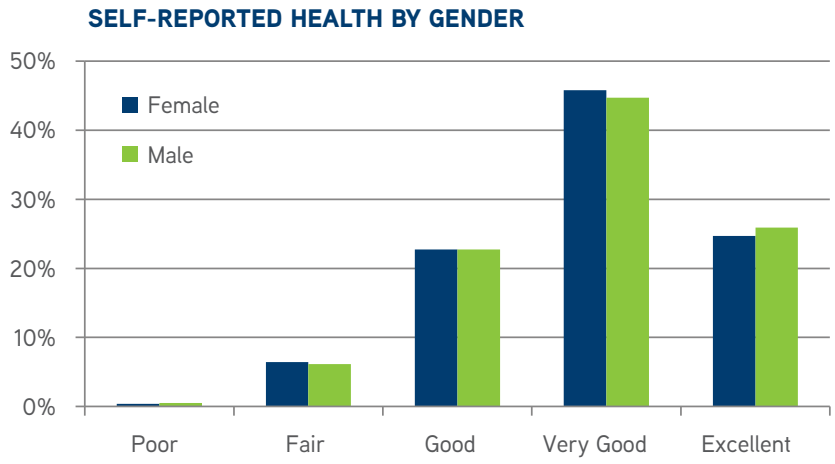


Figure 63

Self-reported health scores also varied little by year of graduation although those who graduated in earlier years had higher percentages of respondents indicating they were in excellent health, just 23 percent of new graduates report excellent health while roughly 34 percent of graduates from 1980 to 1989 reported excellent health.

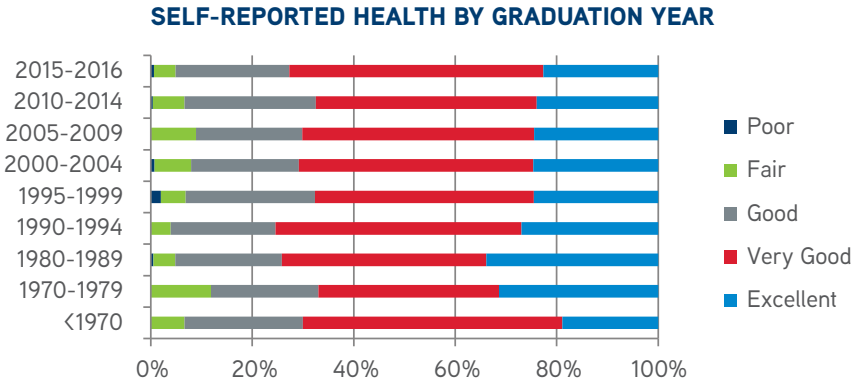


Figure 64

By region, the self-reported health appears to be little different with the Mountain West (Region 8) and the Mid-Atlantic (Region 2) having a slight edge of those reported very good to excellent health.

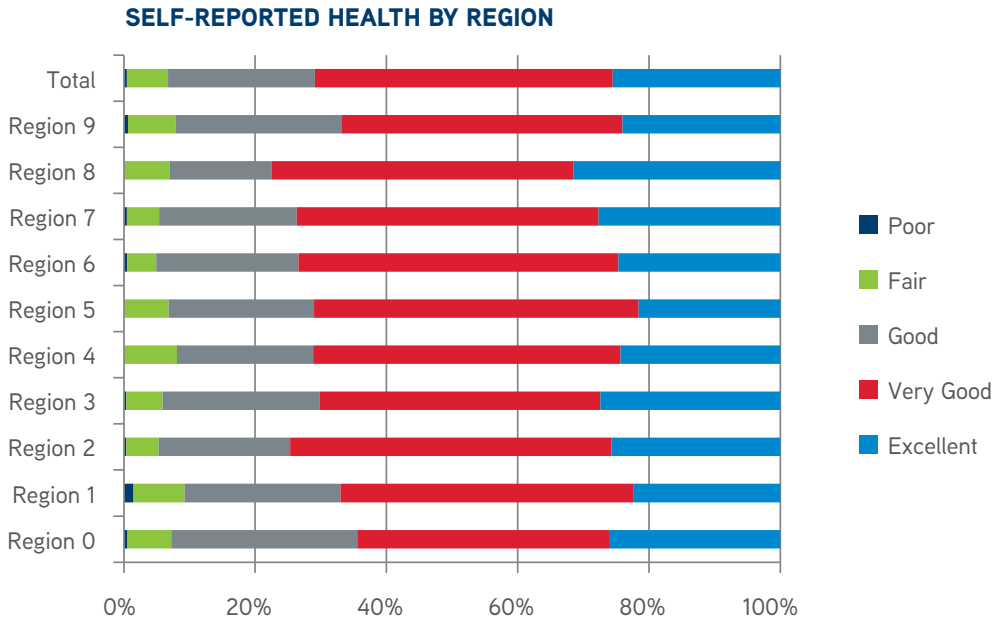


Figure 65

VETERINARY MARKET KEY PERFORMANCE INDICATOR: NET PRESENT VALUE

The difference between the returns and the total investment over the lifetime of veterinary work is the net value of the DVM degree.

The discussion of the veterinary incomes, unemployment, underemployment, applicant-to-jobs ratio and wellness provides an indication of the internal function of the market for veterinarians. The change to each of these measures over time provides an overview of how the market is evolving and the direction the market is headed. But these measures only provide a view of how well the market is functioning internally, not how well the market is performing within the vertically related veterinary markets.

The output of the market for veterinarians is the capacity to provide veterinary services. The performance of this market is the efficiency with which veterinary resources are used to produce veterinary services that are valued by society at or above the cost of producing them, and, one of the main costs is veterinary compensation. An efficient market would enable veterinarians to receive a normal economic return on the cost of becoming a veterinarian. A normal economic return is a percent return on the investment for comparable investments.

Given money to invest, the decision on where to invest is based on how much money can be made by investing in alternative opportunities. The opportunity that provides the greatest return for every dollar invested might be the best investment choice.

Money spent on the DVM degree is an investment and the return is the increased future earnings. Taking a closer look, the DVM degree investment includes three components;

1) actual cost of the education including tuition and fees, books, supplies and equipment needed for the education and any other expenses that were required to obtain the degree;
2) the interest on any money borrowed to pay these education expenses; and
3) income not earned while in veterinary school, an "opportunity cost" that is considered part of the investment.

The value of the investment in veterinary education is the sum of all costs to obtain the DVM: the actual costs to attend veterinary college, the interest on any money borrowed, and the income foregone while in veterinary college and not working.

The returns as noted earlier are the lifelong earnings received as a result of the DVM degree. This is not the total income received as a veterinarian, but the income received that is above what may have been earned with a bachelor's degree. This is the value-added earnings that can be attributed to the DVM degree.

The difference between the returns and the total investment over the lifetime of veterinary work is the net value of the DVM degree. Or, taking the returns as a percent of the total investment provides a measure of the returns on investment.

Because most people prefer current rewards over future rewards, however, the value of an earnings dollar declines each year. This conversion of dollars received or spent in the future to a current value is known as discounting and reflects the social time preference of money. Another way to look at discounting is to ask, "How much would I have to offer to pay you a year from now to not pay you $100 today." If you replied $110, then you have indicated that next year's dollar has to be discounted by 10 percent to be equal to the value of a dollar today.

When both returns and investment are discounted, the net value of the DVM degree becomes the net present value (NPV) of the DVM degree and provides an indication of the value of increased earnings resulting from obtaining the DVM degree in today's dollars. The average NPV of the DVM (VMD) degree for the 2016 graduates was roughly $250,000, but this varies greatly by location, practice type, hours worked, specialization and other factors.

Of course there are also non-measurable benefits and costs that can be attributed to the DVM degree such as the benefits of daily interaction with animals, the satisfaction of helping animals and animal owners, or the costs of client conflicts. So the NPV only represents the measurable value of the DVM degree and not the total value.

Knowing the NPV of the DVM degree enables a comparison of alternative careers and career paths just as one compares alternative investment opportunities. This measure can be used with the perceived non-measurable benefits and costs to make more informed career choices and track the performance of the veterinary profession over time.

The NPV of the DVM is calculated by estimating the income received from the veterinary career less the compensation that may have been received without the DVM degree and the costs of obtaining the DVM degree. Consider the following measures for the 2016 graduating class from the 28 U.S. veterinary colleges:

- Mean total debt (debt plus the servicing costs) of a 2016 graduating veterinarian $253,778;
- Mean lifetime income of 2016 graduates was estimated at $5,114,294;
- NPV for men is estimated at -$43,038;
- NPV for women estimated at $308,892;

The NPV hit a low in 2014 for women and 2015 for men. The difference in the NPV for men and women is due to the higher debt and lower incomes of women at graduation and the higher opportunity costs of pursuing a veterinary education for men as compared to women.

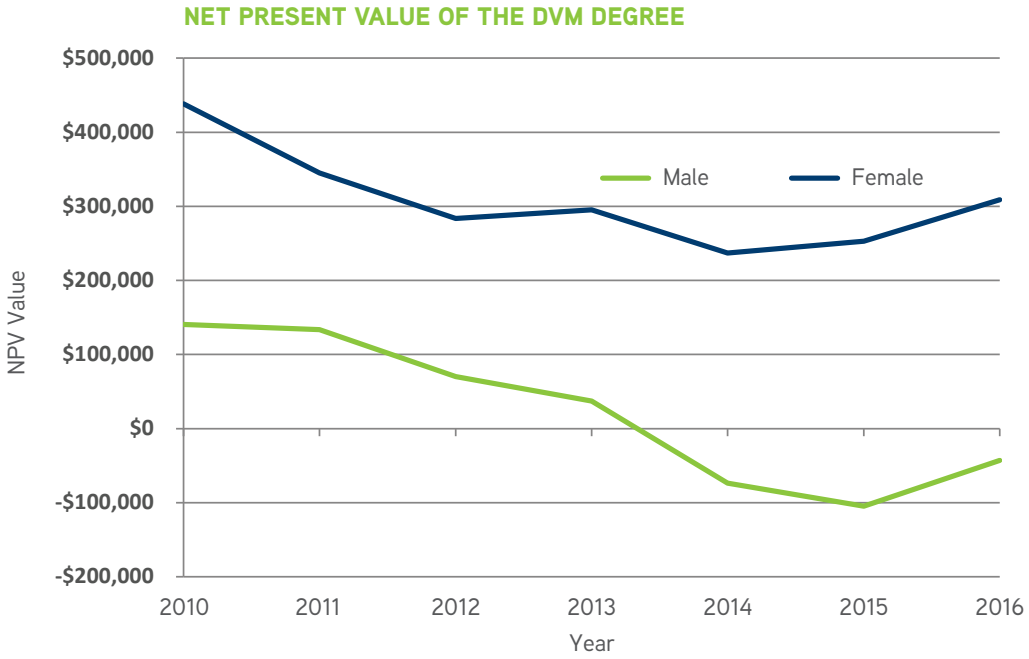

NET PRESENT VALUE OF THE DVM DEGREE
$500,000
$400,000
$300,000
$200,000
$100,000
$0
-$100,000
-$200,000
NPV Value
Male
Female
2010
2011
2012
2013
2014
2015
2016
Year

Figure 66

The opportunity costs refer to the lifetime income earning potential had veterinarians pursued an alternative career prior to entering veterinary college. The lifetime mean earnings of a typical bachelor's degree recipient are used to estimate this opportunity cost. And this alternative earning profile begins at graduation and thus a veterinarian gave up four years of alternative earning potential while in veterinary school and this must be overcome before there is a positive gain in earnings with the DVM versus the B.S. only.

The difference in the NPV of the DVM for women and men is mostly a result of the higher opportunity costs for men compared to women. With only a B.S., women earn only 72 percent of what men earn over their career, but earn more than 92 percent of what men earn at the beginning of their career as a veterinarian. And the difference between the starting salary of a DVM and B.S. has increased for women but declined for men over the last six years.

The drop in the difference of DVM and B.S. degrees for men from $21,353 to $18,277 indicates that the opportunity cost of men to gain a DVM is increasing, making the economic decision to obtain a DVM more difficult. On the one hand, for women, the opportunity cost of obtaining the DVM is declining as the difference between the DVM and B.S. starting salary has increased from $24,882 to $26,176[4].

These differences in opportunity costs may contribute to the growing concentration of women in the veterinary profession. For men, the negative NPV yields no return on the DVM, while for women the positive NPV indicates a positive return on investment.

STARTING SALARIES BY GENDER AND DEGREE

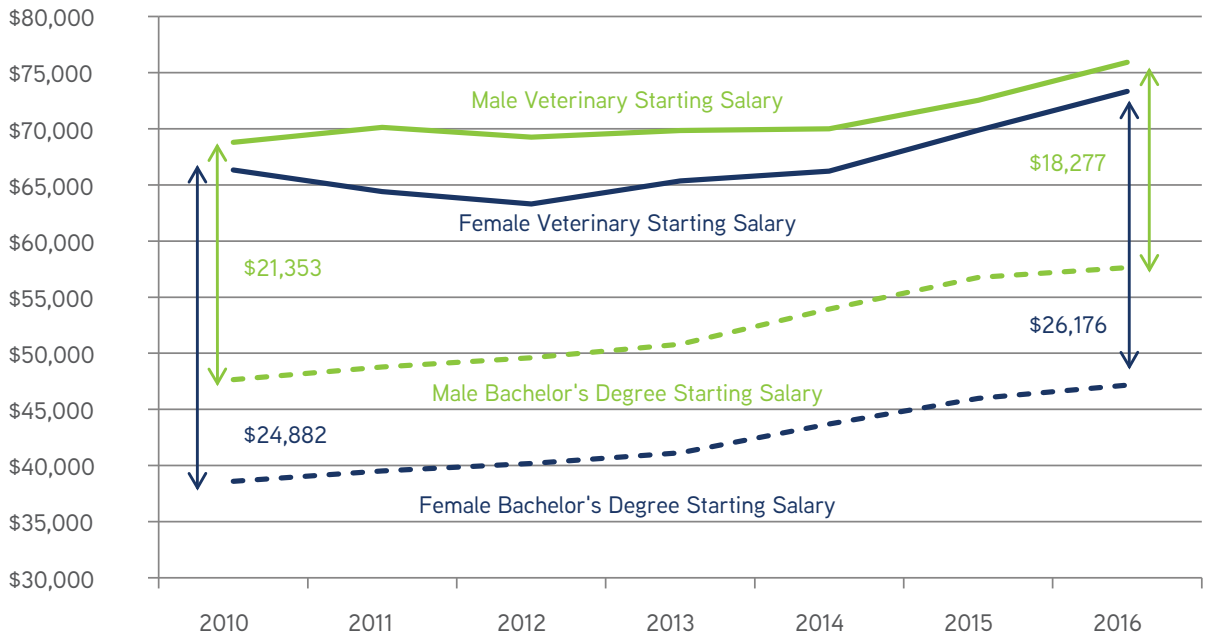


Figure 67

[4] Salary Trends Through Salary Survey: A Historical Perspective on Starting Salaries for New College Graduates
Salary Trends Through Salary Survey: A Historical Perspective on Starting Salaries for New College Graduates. (2017). Naceweb.org. Retrieved 5 January 2017, from https://www.naceweb.org/job-market/compensation/salary-trends-through-salary-survey-a-historical-perspective-on-starting-salaries-for-new-college-graduates/#appendix

OWNERS VS. ASSOCIATES NPV

For many veterinarians, owning a practice is a primary career objective. But what exactly are the financial incentives, and how much is it worth, on average? Using the 2002-2015 compensation data from AVMA surveys that include roughly 15,000 private practice veterinarians, some 6,000 of whom are practice owners and some 9,000 associates, the effect of practice ownership on NPV of the DVM can be estimated.

NUMBER OF OBSERVATIONS USED IN ANALYSIS

		Number of Owners	Number of Associates
Companion Animal	Male	1,511	1,799
	Female	956	2,782
Food Animal	Male	1,133	824
	Female	243	379
Mixed Animal	Male	955	1,043
	Female	344	859
Equine	Male	576	610
	Female	270	717
Total		**5,988**	**9,013**

Data are from 2002-2015 AVMA surveys.

Table 40

Difference in Annual Income

The difference in the mean income between practice owners and associates could be due to factors other than practice ownership. In this dataset the difference in the mean income of all owners to all associates is approximately $20,000; owners earn almost 25 percent more than associates. But there are many factors that are different between owners and associates. For example, owners tend to be older and have more experience. The survey data indicate that owners average six years older and have seven more years of experience, and owners work more than 45 hours per week, compared to 43 for associates. In addition, though the sample has only slightly more men than women, 46 percent of men are owners compared to 26 percent of women. Each of these factors, and others, have an impact on veterinary income and thus might explain at least a part of the difference in income between practice owners and associates.

To separate the effect of the various potential factors from strictly the effect of practice ownership on incomes, four separate regression models were estimated. The other factors that affect income were discussed previously and listed in the experienced veterinary salary calculator.

EFFECT OF OWNERSHIP ON ANNUAL INCOME BY GENDER AND PRACTICE TYPE

		Effect	Coefficient	Std Err	t-statistic	p-value
Companion Animal	Male	4.80%	0.047	0.018	2.66	0.008
	Female	3.50%	0.035	0.019	1.86	0.062
Food Animal	Male	9.50%	0.091	0.023	3.93	0
	Female	n/a	0.056	0.041	1.38	0.169
Mixed Animal	Male	10.80%	0.102	0.024	4.32	0
	Female	n/a	-0.016	0.032	-0.5	0.62
Equine	Male	n/a	0.001	0.032	0.04	0.966
	Female	-6.50%	-0.067	0.039	-1.7	0.089

Note: Estimates in this table are based on a statistical analysis that controls for relevant correlates.

Data are from 2002-2015 AVMA surveys. Incomes are deflated to be in real 2015 dollars.

Table 41

As the table indicates, when controlling for relevant factors, most owners do indeed still earn more than associates. The income difference between owners and associates, however, varies across gender and practice type. Male practice owners earn a higher premium for ownership compared to women. And by practice type, male equine practice owners do not appear to make statistically significant different income from associates, and using an 8.9 percent significance level, female equine veterinarian's incomes are actually penalized for practice ownership compared to associates.

These estimates of the income premium to practice ownership are based on the sample collected and may change from year to year. For example, a drought could greatly affect the compensation for food animal veterinarians in a specific year. However, the length of the dataset, spanning 14 years, should minimize any sector-specific, year-to-year variation in income.

Lastly, these estimates may be overestimating the effect of practice ownership, due to what is termed "omitted variable bias." An extensive literature in the field of Labor Economics details this potential for omitted variable bias. The omitted variable here is something like business acumen. Veterinarians with a high degree of business acumen may earn a higher income, and the effect of this factor on income may not be captured by any other factor other than practice ownership; veterinarians with high levels of business acumen may be more likely to own a veterinary practice. The AVMA surveys have no measure of business savviness, and had it been included in the statistical models, may have reduced the effect of practice ownership on incomes.

Difference in Lifetime Income

Using the regression equations that produced the salary calculator, along with the 2016 reported starting salaries of new veterinary graduates, age-earnings profiles are produced by gender, practice type, and ownership status. These are estimates, based on what veterinarians earn with different levels of experience, which is calculated as the year the survey was administered, minus the veterinarian's year of graduation, minus the number of years spent out of the labor force. If we assume a 40-year-long career with an age at graduation of 27, and retirement at 67, with practice owners owning a practice immediately upon graduation, we can estimate the additional lifetime income received from practice ownership in the table below. Accounting for the time-value of money as occurred in the NPV calculation with the same 4 percent per year discount rate, the present value of that additional lifetime income is computed. This present value is the value of the increased income from practice ownership in today's dollar value.

EFFECT OF OWNERSHIP ON LIFETIME INCOME BY GENDER AND PRACTICE TYPE

		Additional Lifetime Income	Present Value of Additional Lifetime Income
Companion Animal	Male	$202,675	$98,427
	Female	$148,474	$72,588
Food Animal	Male	$370,869	$184,071
	Female	$0	$0
Mixed Animal	Male	$396,905	$193,352
	Female	$0	$0
Equine	Male	$0	$0
	Female	-$184,142	-$87,731
Note: Estimates in this table are based on a statistical analysis that controls for relevant correlates.			
Data are from 2002-2015 AVMA surveys. Incomes are deflated to be in real 2015 dollars.			
Discount rate used is 4 percent per year.			

Table 42

Or, we can present these same findings in a yearly format by examining the age-earnings profiles of veterinarians, as shown in the figures below. The following four charts display the expected annual income for veterinarians in real 2015 U.S. Dollars.

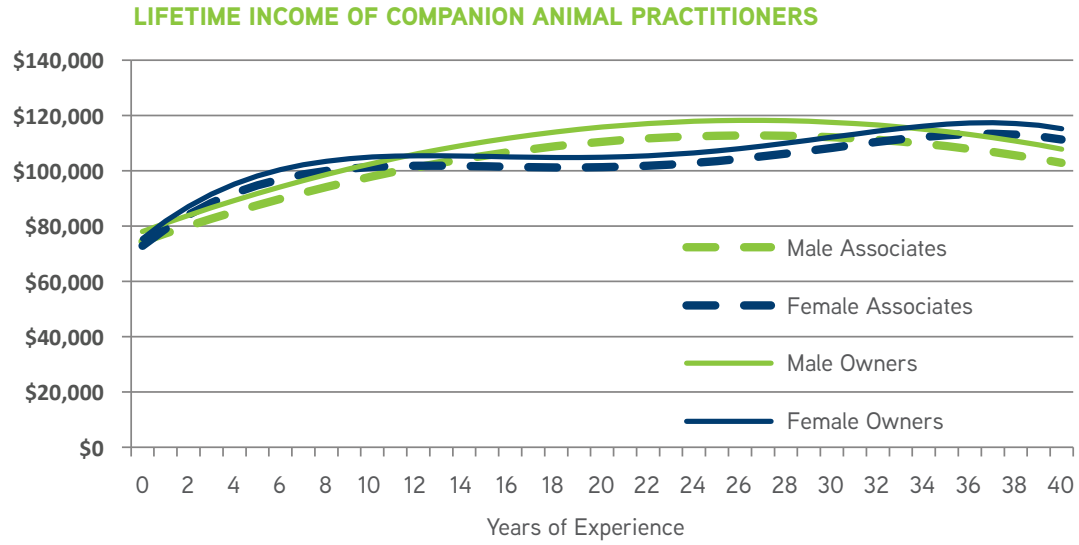


Figure 68

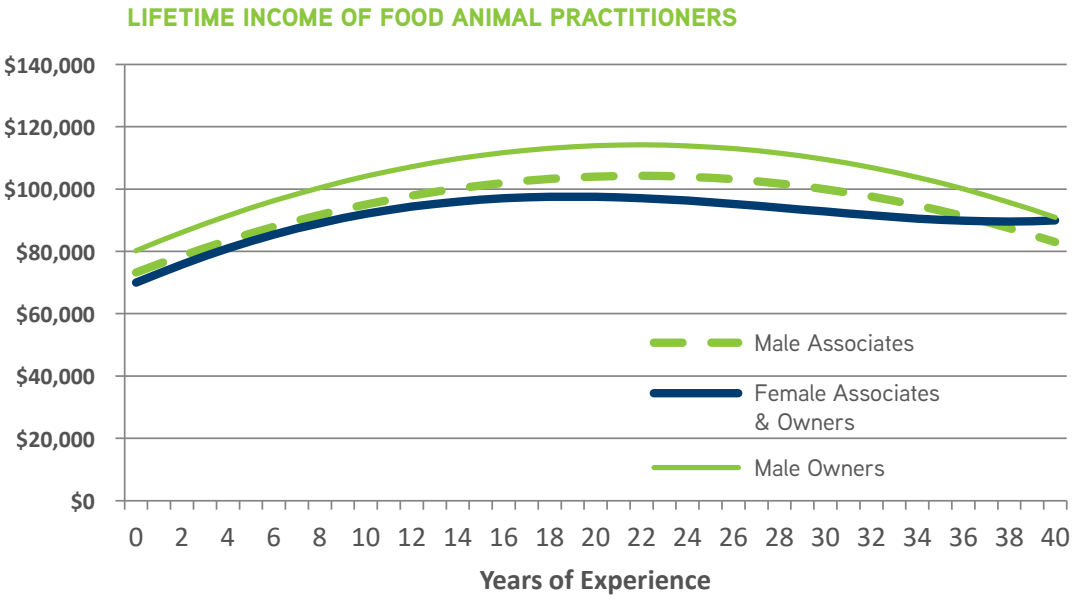


Figure 69

LIFETIME INCOME OF MIXED ANIMAL PRACTITIONERS

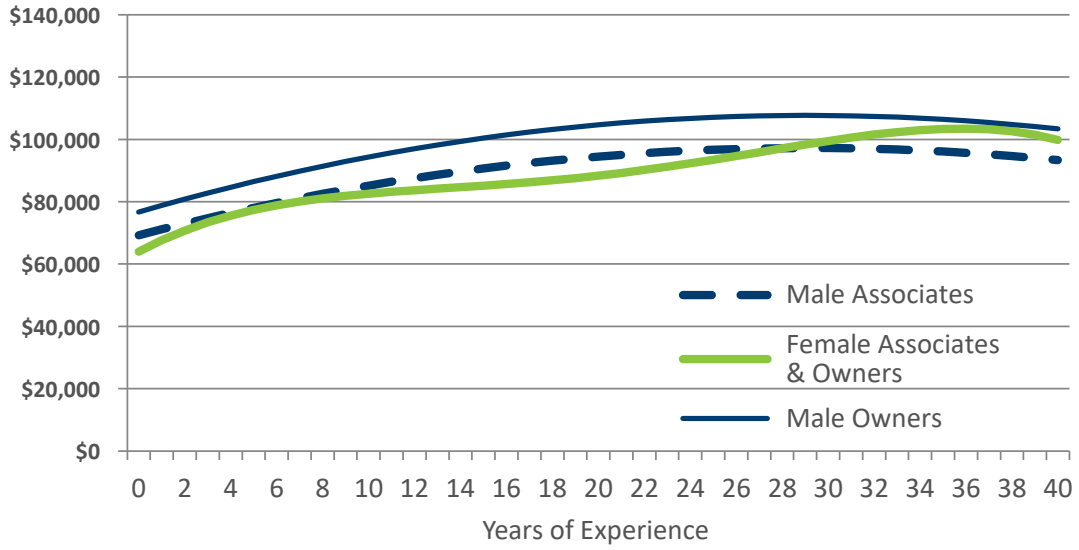


Figure 70

LIFETIME INCOME OF EQUINE PRACTITIONERS

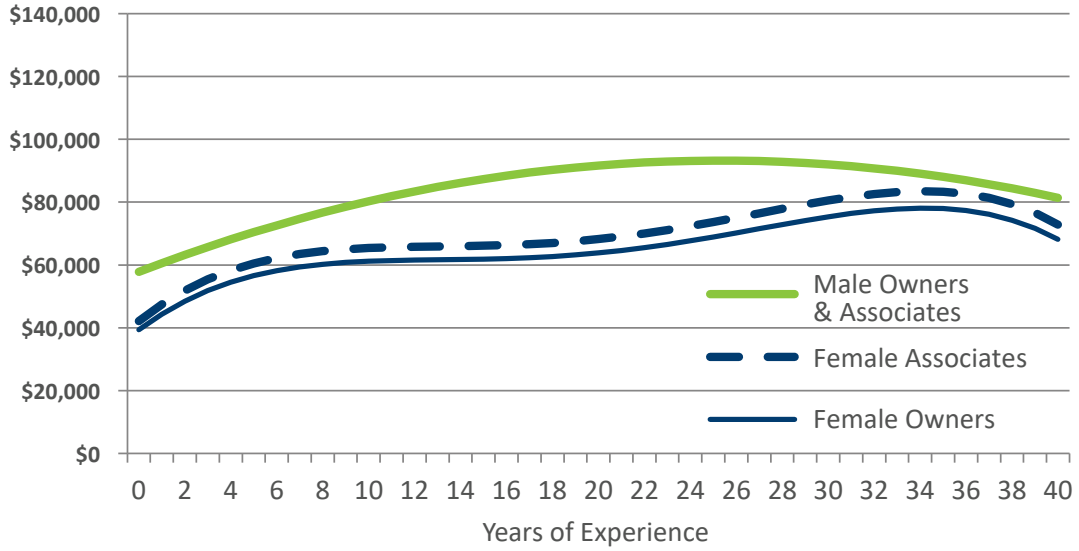


Figure 71

This analysis describes the difference in income between owners and associates, all other factors held constant. However, this analysis doesn't account for the potential wealth aspect or non-measurable benefits of practice ownership. In many businesses, an integral goal of the business plan, "asset rich and cash poor," is achieved by drawing the income that is necessary to meet lifestyle expectations and putting the other earnings back into the business to grow wealth for retirement.

There are other non-measurable benefits to being a practice owner such as increased work schedule flexibility. Studies like Goldin (2014) illustrate the relationship between flexibility and compensation: Careers that offer greater flexibility are more evenly compensated among genders, whereas careers with less flexible work schedules – where business depends on the relationship between a professional and his or her clients (like that of a veterinarian) – tend to have larger gender-wage gaps. If, as Goldin asserts, women tend to more highly value flexibility in their time, then it would make sense that they would become practice owners. Being a practice owner would increase their overall income to offset the effect of their desire for flexibility.

DISCUSSION

This report has provided information on the market for veterinary labor, nationally, regionally and by practice type. Key indicators of the health of the market are unemployment rate, underemployment rate, income, wellness and satisfaction, and net present value. But these key indicators for a given year only provide a snapshot in time and provide neither a rear view mirror to see where you have been nor a windshield to see where you are going. This can only occur through the continued collection of the data and annual reporting of each indicator in a time series. In addition, knowing what has happened, what is happening and what may happen is not useful without knowing how to change course. Forecasting a course change, to date, requires the econometric analysis of the factors that affect each of these indicators. The importance of the econometric analysis is not just to determine the factors that affect the indicators but the relative importance of these factors. This knowledge allows a focus on the most important factor that drives change to produce the best results for the markets.

Over the last three years the key indicators have been reported and each year, across the board, the indicators generally point to an improving market for veterinary labor. Unemployment remains well below national levels, underemployment is negative, indicating an overall need for additional veterinarians in the workforce, the applicant-to-job ratio has fallen below 1 for the first time in eight years, incomes continue to rise and wellness is generally good throughout the profession.

The market still has considerable maldistribution problems, however, both between larger areas like regions and states and within states and metropolitan centers. Underemployment differs by gender and as the profession increasingly becomes largely female this difference in desired hourly work week may have implications for the number of veterinarians needed to provide the level of services demanded and the price of those services.

While wellness is generally good for the profession, there is clearly a percentage of the profession that is dissatisfied with their employment, compensation, the profession and their lifestyle, and we have identified the individuals' perception of their college preparation and their satisfaction with their current employment (the culture of the practice) as being statistically significant in explaining burnout. As we have noted previously, using the ProQoL tool to measure compassion satisfaction and compassion fatigue may not be the correct tool to measure wellness in the profession, especially to get at problems of drug abuse, suicide ideation, or other severe mental health issues. But clearly all of our measures point to a problem with a segment of the profession, and identifying the appropriate professionals to develop the best tools for measurement and determining the factors that are causing the wellness problems should be a priority for the profession.

The NPV of a DVM has been on a downward trend since 2010. This indicator provides a window into the value society places on veterinarians versus the investment required to become a veterinarian, and currently for males the investment cost exceeds the social value. Men's opportunity cost to attend veterinary college is very high in comparison to women's as men's earning potential with a bachelor's degree is much higher than for women. If the earnings from a STEM bachelor's degree were considered instead of an average across all bachelor's degrees (general) the opportunity cost would be considerably higher and the NPV more negative. This represents a market failure to produce veterinarians at a cost society is willing to pay and points to a problem embedded in the cost of education as well as in the value assigned to veterinary services.

The cost of education has changed rapidly over the last two decades as society has made a fundamental shift away from support of college education to foster a more enlightened populace, and embracing the idea that college grads earn more and thus should pay for their own college. This change will take time to work through the markets to shift support of the veterinarian supply chain from the taxpayer to the animal owner.

The value of veterinary services creates the demand for veterinarians. This is the main factor in determining veterinary salaries. The focus on medical care rather than preventative care may have influenced the animal owner's perception of value. This will be discussed in the following report on the market for veterinary services.

The market for veterinarians continues to improve and must be considered robust. As the economy has improved and household incomes have risen, so too has the demand for veterinary services and hence the demand for veterinarians. During this economic expansion veterinarians are likely to be busy, some of them extremely busy as the large negative underemployment number would suggest. Unfortunately, this may lead some to forget the lessons of the last recession and remove any urgency at improving value or reducing education costs. This is exactly the wrong message to draw from industry observation, and these problems should be addressed when resources are available – not when resources become scarce.

References

Goldin Claudia. (2014) "Grand Gender Convergence: Its Last Chapter" American Economic Review 104(4):1091-1119.

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The AVMA & AAVMC Report on the Market for Veterinary Education:

The market for veterinary education is the beginning of the pipeline to the market for veterinary services. This report examines the characteristics of veterinary college applicants, the supply of and demand for veterinary education, and the performance of the market in providing new veterinarians.

The AVMA Report on the Market for Veterinarians:

This report explores the demographics and employment of the veterinary profession: where veterinarians are located, what type of work they do, how much they are compensated, and how they are managing their educational debt. The report also measures unemployment and underemployment and identifies the contributing factors, and explores the performance of the market based on the value of the DVM degree.

The AVMA Report on the Market for Veterinary Services:

All demand for veterinarians and veterinary education begins with the demand for veterinary services. This report provides the latest information on the price of veterinary services, price and income elasticity, and the financial performance of veterinary practices. Our forecasts of capacity utilization and excess capacity for regions and types of practices provide an indication of the performance of this market.

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2017 AVMA Report on

THE MARKET FOR VETERINARY SERVICES

AVMA Veterinary Economics

2017 AVMA Report on

THE MARKET FOR VETERINARY SERVICES

Veterinary Economics Division
American Veterinary Medical Association
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CONTENTS

LIST OF TABLES

LIST OF FIGURES

SUMMARY

Among the veterinary markets assessed in this and the previous reports on the veterinary markets produced in 2017 by the American Veterinary Medical Association (AVMA) Veterinary Economics Division (VED), the market for veterinary services is seen as one marked by a high degree of complexity. To help veterinarians conceive strategies to meet new business challenges, economic trends need to be identified, drawing from a diverse set of data and other information – an effort undertaken by the AVMA VED to close "gaps" in knowledge to enable practitioners to more effectively direct their businesses. Practice management research is critical to developing a greater understanding of the dynamics that shape the veterinary services market; ongoing research will be important to gain deeper insight into factors underlying potential opportunities for veterinary practices to more deeply penetrate the share of the necessary pet health care needs of animal-owning households.

Federal government statistics show that over the past decade, the size of the market for veterinary services has grown consistently, reaching approximately $38 billion in total output in 2015. This expansion could be attributable to a number of factors: more pets and other domestic animals; new or expanded animal welfare regulations; and an increased tendency of pet owners to place value on their pets – or the strengthening of the human-animal bond. Of overriding importance is consumers' willingness to pay for services – a propensity that is somewhat dependent on household income. Hence, an improved U.S. economy as is expected, and the resultant increase in household incomes should build demand for veterinary services.

Pet owners' willingness to purchase veterinary services is but one contribution of the veterinary profession to nation-wide economic activity. Expenditures at veterinary hospitals constitute the direct impact of veterinary services on the total revenue of the economy. But the capacity to deliver these services is predicated on a vast array of "inputs" to the system: Veterinarians need education/training, supplies, equipment, pharmaceuticals, facilities and staff. These factors represent activity generated by other businesses, which also contribute to the overall economy. The market for veterinary services alone, however, comprises a $33 billion industry made up of tens of thousands of firms, according to an industry model whose data are derived from the U.S. Bureau of Economic Analysis, Bureau of Census, and Bureau of Labor Statistics.

DETERMINING DEMAND

At five-year intervals the AVMA conducts its Pet Ownership and Demographics Survey (PDS), counting the number of pets in the nation. The latest study took place in 2017, and analysis of the results will be summarized in the *2018 AVMA Report on the Market for Veterinary Services*. The purpose of the PDS is "to serve the veterinary medical profession and all other individuals who need to make decisions about the health care and product marketing demands associated with the companion animal industry and ... to update and expand our knowledge about the companion animal population in the United States regarding demographic characteristics and use of veterinary medical services." Specific PDS objectives are "to determine populations of dogs, cats, birds, horses and other pets owned by U.S. households; household demographic characteristics associated with pet ownership; and frequency of times that pets were seen by a veterinarian and annual veterinary medical expenditures." (Wise, 1992)

The PDS has provided a national estimate of the number of pets of all types, frequency of visits to the veterinarian and the expenditure on veterinary services or products and market size – insufficient data to measure demand. The yearly expenditure reported by a household is a distinct number reflecting the total amount paid to veterinarians in the year surveyed, but demand is a set of quantities purchased or, equally important, not purchased at each price by pet owners. To measure demand for veterinary services, the AVMA VED collaborated with the National Center for Food and Agricultural Policy in late 2015 to field a metropolitan market demand study of single multi-county market areas, establishing a survey mechanism to help understand the relationship between the demand for veterinary services and certain market demographics. An interesting finding of the pilot concerned routine check-ups. While the 2012 PDS noted that about 20 percent of dog owners had not visited a veterinarian in the past 12 months, when given more choices as to where the canine pet might have received a routine check-up in the past 12 months, 80 percent of canine owner respondents to the pilot indicated having obtained a routine check-up in the last 12 months. Another 13 percent, however, indicated they had received a routine check-up at an alternative to a traditional veterinary hospital or clinic. What this says about unaccounted for demand looks to be a topic of further pursuit to better understand competitive dynamics and to construct valid responses.

Also in 2015 the AVMA worked with the American Association of Bovine Practitioners (AABP) to survey the latter's membership in order to better understand some of the unique aspects of the veterinary markets that affect bovine veterinarians. AABP members work on a diverse group of animals, with the bovine categories clearly dominating revenue: 30 percent of the respondents indicated that 76 percent-100 percent of their revenue is from veterinary products and services associated with dairy animals and 5 percent of respondents reported that more than three-quarters of their revenue comes from cow-calf products and services. Small ruminant, swine, equine and, in particular, companion animals, however, also comprise a share of the revenue of AABP-member-owned veterinary practices. Nearly three-quarters of practices reported service call fees amounted to less than 10 percent of their gross revenue, while 11.5 percent of practice indicated that reproductive services drew 41 percent-50 percent of practice revenue.

In 2016 the AVMA entered into collaboration with the American Association of Equine Practitioners (AAEP) to conduct a survey of U.S. equine veterinarians, an effort that also sought to understand the unique problems facing this segment of the profession. Equine veterinary practice makes up less than 5 percent of all veterinary practice types in the veterinary medical profession. Veterinarians identifying as working with equids, whether in an exclusively or predominantly equine practice, or in a mixed animal practice, are a minority in the field. Ownership trends in the equine industry, and thus economics in the equine veterinary industry, were by and large negative in the years following the recession of 2008. AVMA data indicate that the pet horse population in the nation declined by a third between 2006 and 2012, and that the population of horses on farms that reported at least $1,000 in annual sales dropped by 10 percent. Additionally, there was a 6.7 percent reduction in the annual income of equine veterinarians during that same period.

While both sectors of the profession have distinct characteristics, and market conditions, associated specifically with their sector, reports from both practice segments tell of a threat posed by parallel service providers, who focus on the more routine tasks of animal care. Such non-veterinarian providers of veterinary services are claimed by more than 60 percent of the AABP respondents to have taken business from them, while more than 84.7 percent of the AAEP respondents have lost business to parallel service providers.

INHALANTS AND INSURANCE

Another way to peer into the veterinary services market is through examining animal health product supply data – from which a profile of the current market can be drawn, and insight into macro trends within the companion animal market gained. Data also serve as a leading indicator of industry changes. Product market analysis can, for example, be used to gauge changes in specific practice profit centers. For instance, sales of inhalant anesthetics can afford a useful indicator of surgical and dental activity. Inhalants are used specifically for advanced procedures requiring patient anesthesia, consumed in unit increments, and administered on an as-needed basis across the operational year. Use by practice type provides an indication of where surgical and dental procedures are being most performed and how that market share changes over time. By studying the share of inhalants as an average of the number of practices in each practice type, low-cost providers can be observed using twice as much inhalant, and emergency/specialty practices 2.5 times as much as small animal primary care practices.

A statistic tossed about in the industry says that pet owners with pet health insurance visit veterinary clinics more frequently and spend more money than do pet owners without pet health insurance. Multiple factors specific to the animal, consumer and veterinarian, however, influence the services purchased. The only way to determine the independent effect of insurance on consumer behavior is to control for the individual characteristics that could affect purchases of both veterinary care and pet health insurance. In 2014 AVMA partnered with Mississippi State University to start the process of evaluating the effect of pet health insurance on the demand for veterinary services. Findings arising from the collaboration did convey that pet owners with insurance spend more on the pet, not only on veterinary care, but also on other expenses such as entertainment, food and boarding. More information will be released as the study advances, and the full set of control variables is determined.

The *2017 AVMA Report on the Market for Veterinary Services* turns attention to the public practice of veterinary medicine, which includes public health services such as monitoring and managing food safety and zoonotic diseases, recognizing that the threat posed by the latter is not only a public health concern for the nation – but also for the world.

INTRODUCTION

The most important of the three veterinary markets for the veterinary profession is the market for veterinary services. The demand for veterinary services, animal owners' willingness to purchase animal health products and services from veterinary practices, guides the demand for veterinarians and applicants to veterinary colleges. As the demand for veterinary services rises relative to the supply of veterinary services, the price of these services will increase, leading to an increase in the demand for veterinarians and the income of veterinarians. The increasing income of veterinarians relative to the costs of the education required to become a veterinarian will increase the demand for veterinary education and thus veterinary college applicants.

The concept of excess capacity was new to the veterinary profession in the 2013 AVMA Workforce Study. Excess capacity is a measure of the demand for veterinary services relative to the supply of veterinary services at a specific price. When excess capacity is increasing, the supply of veterinary services is growing faster than the demand for those services, prices of services should fall, veterinary incomes decline and the demand for veterinary college seats decline.

A number of factors affect excess capacity, including growth in the number of households with animals, number of animals per household, change in the human-animal bond, changes in the prices of veterinary products and services in relation to the change in the price levels of other items in a household's market basket, and the change in incomes of animal-owning households.

Since 2013, the number of households with pets has increased, the human-animal bond has been strengthening, and median U.S. household incomes have grown. These factors would suggest that excess capacity has been declining and that the demand for veterinary goods and services, the demand for veterinarians and the demand for veterinary college applicants should be increasing.

In the *2017 AVMA Report on the Market for Veterinarians*, the number of jobs available through the AVMA Veterinary Career Center (VCC) exceeded the number of applicants in the fall of 2016 for the first time since before the recession. Veterinary incomes and starting salaries increased even in the face of a rising supply of new veterinarians. More than 3,000 veterinary full-time equivalents (FTE) were required in 2016 to meet the demand associated with the large negative underemployment (hours per week veterinarians desire to work less with less compensation greater than the hours per week that veterinarians desire to work more for more compensation).

As a veterinary key performance indicator (KPI), excess capacity should be measured annually using a consistent, analytical process so that the value can be compared across the years as a measure of the economic health of the profession. Excess capacity, however, is a physical measure and does not provide ample information about the financial health of the profession. A decline in excess capacity may be a positive indicator unless it is achieved through a reduction in the profitability of the profession. The 2013 AVMA Workforce Study included several assumptions because data were not available. As these assumptions are replaced with data, the baseline value of excess capacity computed for 2012 may change. Going forward, as new data are collected, the impact of this new data to the baseline estimate of excess capacity will be provided. In the meantime, consider the current estimate of 12.7 percent excess capacity in the veterinary services market. Is that considered high? And can it be compared to other markets?

The Federal Reserve Board measures and tracks capacity utilization in manufacturing, mining and utilities sectors. Excess capacity is the complement of capacity utilization. The Federal Reserve Board estimates that manufacturing excess capacity was 36.5 percent at the bottom of the last recession, returned to a low of 24.2 percent in February of 2012 and remains near that mark, at 24.1 percent, as of June 2017 (Federal Reserve Board 2017). In previous economic expansionary periods, however, excess capacity dropped to less than 15 percent in manufacturing and thus there is still considerable excess capacity in manufacturing today. While the measure of manufacturing excess capacity provides an example of the effect of the national economy on the manufacturing sector, this measure refers to physical capacity rather than labor capacity, although the two may be linked.

Currently the AVMA Economics Division knows of no measures of excess labor capacity in other service industries, so no accurate comparison can be made. Additionally, the problem becomes even more complicated because measuring labor for veterinary services can suffer from substitution bias. For example, the primary functions of a veterinarian include making diagnoses, and prescribing treatment and medications. A veterinary technician works alongside the veterinarian and often performs functions such as creating radiographic images, collecting and performing diagnostic tests on blood samples, and explaining follow-up care and compliance. A veterinarian might often take over these or other duties. In doing so, this is not wasted time, but it may be more efficient and economical for

the veterinarian to perform the medical and diagnostic functions for which they are highly trained and delegate routine tasks to a veterinary technician, hence the substitution bias.

All indicators in the three veterinary markets continue to indicate that the general U.S. economic recovery is creating positive results for the profession. Unfortunately, this turnaround could rob the profession of the inducement for innovation in veterinary practices necessary to provide a larger share of the health care requirements of the animals in the practice business area.

This report focuses on the market for veterinary services. In the three vertically related veterinary markets, the market for veterinary services is a combination of the need for veterinary medical services or other skills and training that veterinarians have to offer, and the ability of the profession to provide these services by educating, training and certifying veterinary medical professionals. The demand for veterinary services comes from a variety of sources, among consumers and the general public.

REGIONS OF THE UNITED STATES

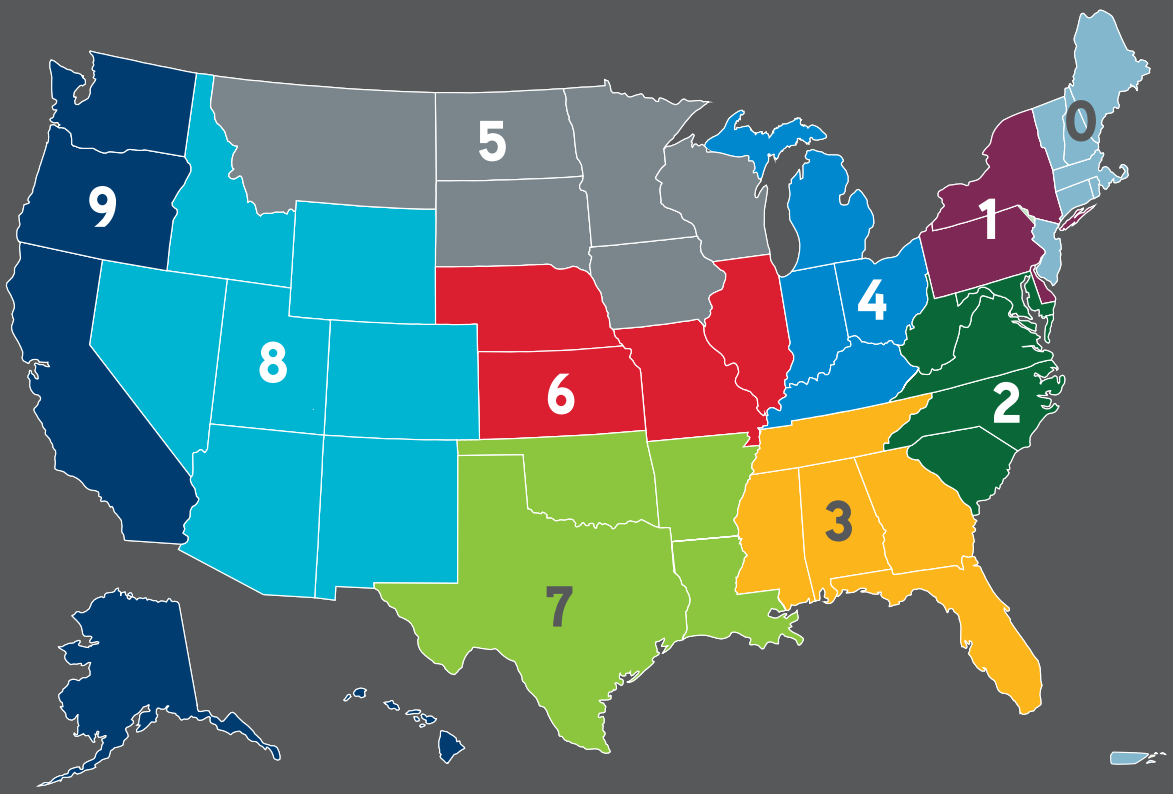


Figure 1

DEMAND FOR PRIVATE PRACTICE VETERINARY SERVICES

The demand for private practice veterinary services is one of the most complex and least understood parts of the veterinary markets.

The demand for private practice veterinary services is one of the most complex and least understood parts of the veterinary markets. Data and information are needed to identify trends, understand the underlying factors yielding these trends, and create strategies for veterinarians to adapt to their ever-changing business environments. The AVMA VED is shifting the conversation by filling in as many of the knowledge gaps as possible. The AVMA VED intends to use this avenue to publish not only information on the veterinary industry, but also financial ratios and practice information so that veterinarians in private practice know how to gauge and track their own progress.

A key missing component in the market for veterinary services is practice management research. While the AVMA VED has developed an extensive research program to better understand the animal health care decisions made by animal owners, no organized research offers insight into the supply of veterinary products and services. More explicitly, research is needed to better determine what factors or strategies are successful for veterinary practices to gain a larger share of the animal-owning households' animal health care needs.

OUTPUT OF THE VETERINARY INDUSTRY

The market for veterinary services has consistently increased in size over the past decade, according to statistics from the United States Bureau of Economic Analysis, reaching approximately $38 billion of total output in 2015 (Figure 2). This expansion might be attributable to multiple factors, including an increase in the number of pets and other domestic animals; regulations enacted by state and federal governments to enhance animal welfare, prevent animal abuse, and ensure that all animals receive the care that they deserve; and the evolution in the value placed on pets by their owners. Most importantly for the veterinary profession, because a consumer's willingness to pay for services is at least partially dependent on household income, a projected improvement in the economic condition of the U.S. economy – and an increase in household incomes derived from a recovery – is expected to further increase the demand for veterinary services.

VETERINARY INDUSTRY OUTPUT, 1998-2015

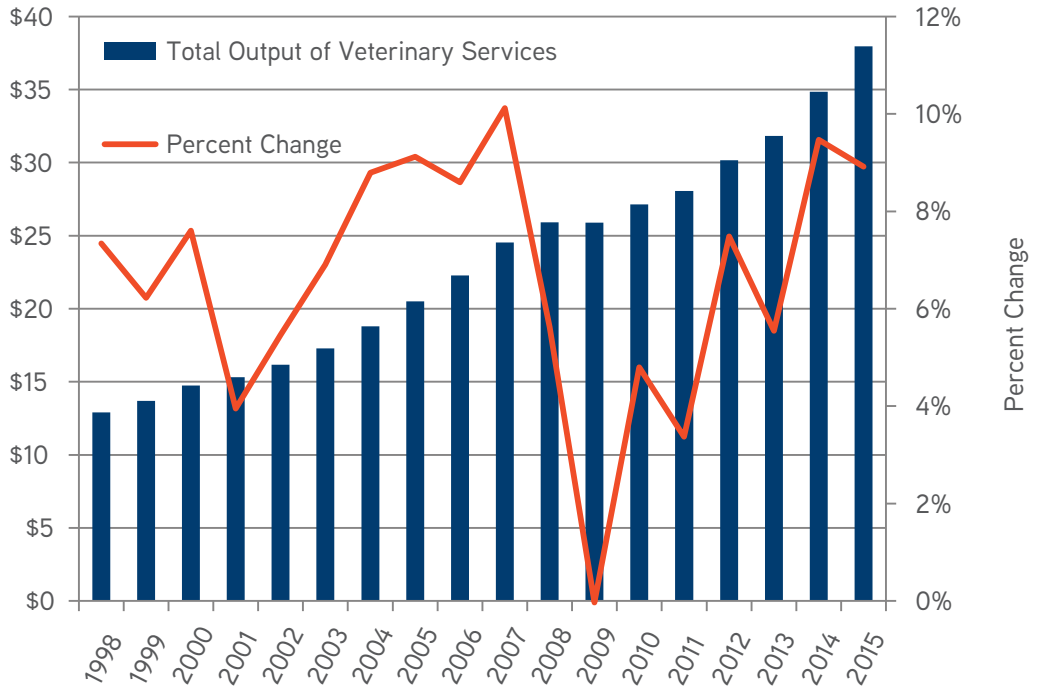


Figure 2

The number of establishments was obtained from the Barnes Reports on U.S. Industry & Market Outlook – Veterinary Services Industry. The veterinary service sector (541940) as defined by the North American Industry Classification System (NAICS) and used in the Barnes Reports comprises entities that sell veterinary services to animal owners as well as establishments that supply testing services to veterinary practitioners. The Barnes reports provide an estimated number of establishments, employees, and the total value of output at state and national levels for the current year and offer a prediction of these variables for the next two years. In addition to the state and the national data, the reports present the same variables for the U.S. metropolitan areas. The industry is divided by subgroups relative to the size of establishment. In 2015, for example, the veterinary services industry encompassed 37,840 establishments composed of 9,306 establishments employing between one and four people; 8,736 establishments with a capacity of five to nine people; 8,832 establishments with 10 to 19 employees each; 3,376 establishments in the category of having 20 to 49 employees; 293 establishments with a total employee group of 50 to 99 workers; 10 establishments with more than 500 employees each; and 7,229 single-operator establishments. The following table presents the estimated and projected number of establishments, employees, and the value of industry sales from 2014 to 2018 as reported in the 2013 edition of the Barnes Report.

The next table shows the state total employment as estimated by Barnes Reports and as reported in the 2013 data from IMPLAN. IMPLAN (Impact Analysis for Planning) is an economic input-output model designed for economic impact analysis. Originally developed by the USDA Forest Service and now maintained by the Minnesota IMPLAN Group, it measures the economic and social impacts of a change in an industry to the larger economy.

The difference in the total employment between the two sets of data might lay in the definition of the industry. In fact, the IMPLAN sector 459 (veterinary services) does not match the same definition as NAICS 54194. For instance, pet stores are included in retail stores (sector 400 – 401) in IMPLAN, not in sector 459.

The different veterinary practice types have a unique set of expenditures (production function) that was defined based on practice-owner responses to the AVMA Compensation Survey. Using the U.S. national input-output modeling system, the total employment, income, output and taxes paid is estimated for each practice type.

EFFECT ON EMPLOYMENT, INCOME AND OUTPUT BY PRACTICE TYPE				
	Total Employment (thousands)	Total Income ($millions)	Total Output ($millions)	Tax on Production & Imports ($millions)
Food Animal Practice	45	1,507	3,057	57
Small Animal Practice	205	6,780	13,755	255
Equine Practice	36	1,205	2,445	45
Mixed Practice	136	4,520	9,170	170
Other Practice Types	32	1,055	2,140	40
Total Veterinary Services	**455**	**15,066**	**30,566**	**567**

Table 1

The following table gives an estimate of the number of employees in the veterinary industry per state.

VETERINARY INDUSTRY EMPLOYMENT BY STATE, 2015			
Alabama	5,000	Montana	1,655
Alaska	759	Nebraska	2,558
Arizona	7,059	Nevada	2,960
Arkansas	2,463	New Hampshire	2,007
California	34,970	New Jersey	8,247
Colorado	7,950	New Mexico	1,941
Connecticut	4,351	New York	16,180
Delaware	1,083	North Carolina	11,913
D. of Columbia	398	North Dakota	756
Florida	22,005	Ohio	13,395
Georgia	10,564	Oklahoma	4,299
Hawaii	1,046	Oregon	6,065
Idaho	1,967	Pennsylvania	13,237
Illinois	13,021	Rhode Island	807
Indiana	7,056	South Carolina	4,913
Iowa	3,668	South Dakota	998
Kansas	4,262	Tennessee	7,254
Kentucky	4,779	Texas	25,826
Louisiana	4,820	Utah	2,384
Maine	1,750	Vermont	1,017
Maryland	7,049	Virginia	11,475
Massachusetts	9,519	Washington	8,939
Michigan	9,520	West Virginia	1,706
Minnesota	6,254	Wisconsin	6,935
Mississippi	2,525	Wyoming	856
Missouri	6,506	**U.S.A.**	**338,667**

Table 2

While the total economic impact of the veterinary services sector is small (roughly 0.35 percent) as a share of GDP, the importance of this sector is much greater for smaller rural and suburban communities. In addition, the model is not able to calculate the amount of output that would not have been produced as a result of losses from prevented disease events, had these incidents not been addressed by veterinary services. The very nature of veterinary services to manage animal diseases provides a benefit to society that is not measured in the GDP statistics.

Had money been spent to manage disease outbreaks, that money would have been drawn from the consumption of other products and services. Whether this transfer of expenditures would increase or decrease GDP depends on the economic activity that is associated with managing disease outbreaks versus the economic activity associated with the products and services that must be reduced to provide resources for managing disease outbreaks.

NUMBER OF PRIVATE PRACTICE VETERINARIANS BY STATE, 2013

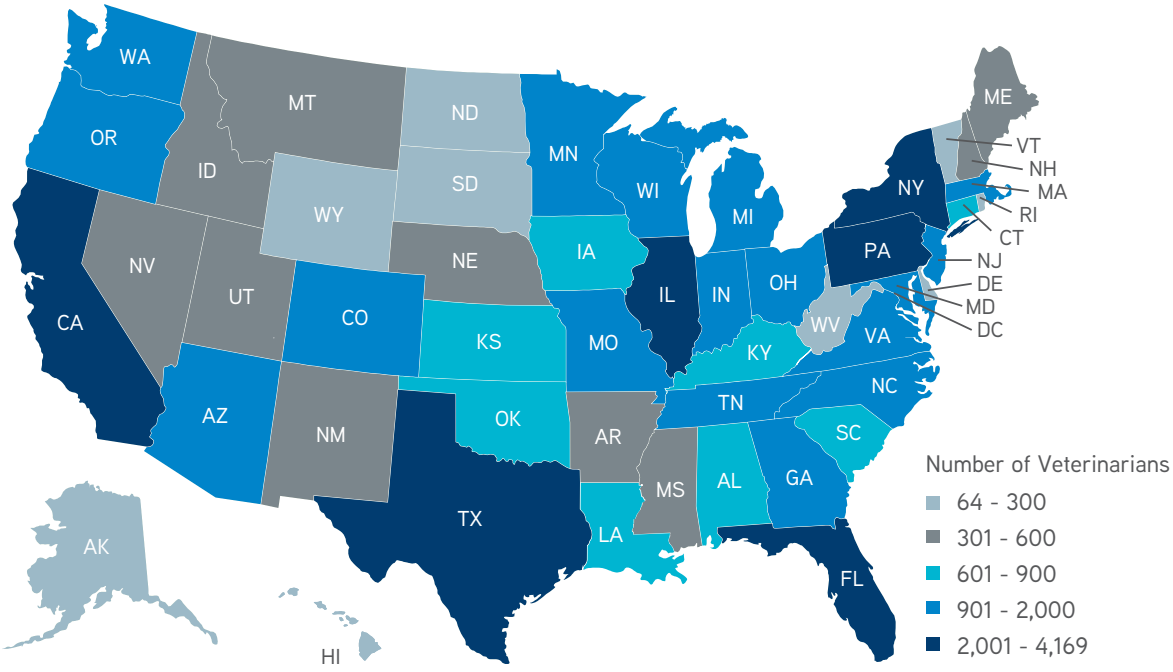


Figure 3

The distribution of veterinarians across states aligns with the distribution of veterinary practices, as those states with the largest (or smallest) number of veterinarians also have the largest (or smallest) number of veterinary practices. This suggests that the distribution of size of veterinary practices likely does not vary much between states.

NUMBER OF VETERINARY ESTABLISHMENTS BY STATE, 2015

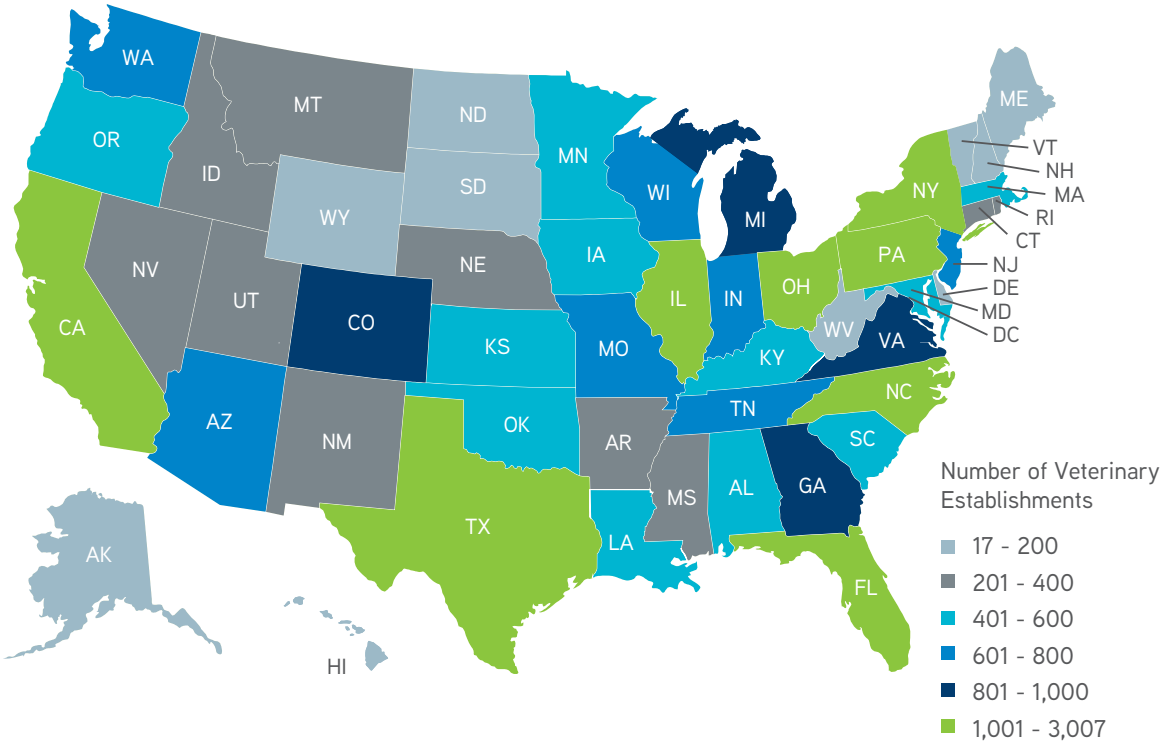


Figure 4

The distribution of practices by size indicates that the 10-year growth of practices has occurred in all categories across firm size. During the 10-year period from 2002-2013 veterinary practices within firms that have one to four employees have grown by nearly 2,000 practices, while at the other end of the size spectrum establishments that have more than 500 employees have increased by more than 1,000 practices. The increasing number of establishments that exist within firms of more than 500 employees is an indication that the number of practices that are a part of a large consolidation has increased at a rate above all other firm sizes.

VETERINARY ESTABLISHMENTS (NUMBER OF EMPLOYEES), 2002-2013

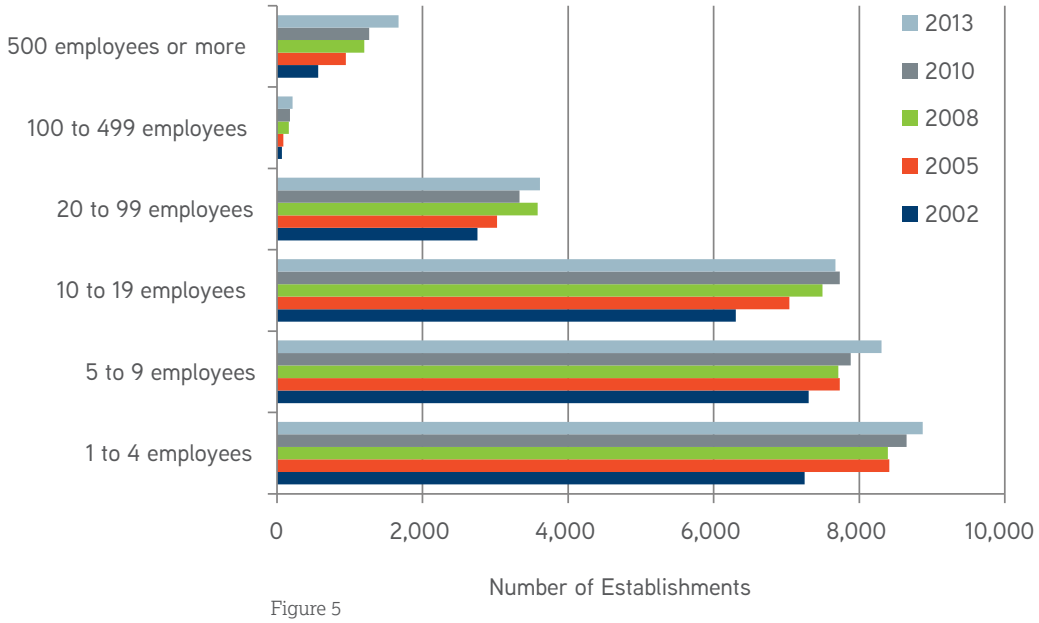


Figure 5

The growth in the number of firms that have multiple establishments — a sufficient multiple to obtain more than 500 employee — had no change over the 10-year period and remained at 16 firms throughout the period. The number of firms with multiple establishments to have 100 to 499 employees increased by 50 percent over the same period, however, rising from more than 50 to 76 firms.

VETERINARY FIRMS BY NUMBER OF EMPLOYEES, 2002-2013

Figure 6

The number and size of firms determines the structure of the industry. Increasing size of practices and declining numbers of practices suggests an increasing concentration or consolidation in the industry. A better measure of concentration, however, is the percent of the industry's output that is produced by the largest firms. More specifically, a common concentration index considers the share of the total market that is controlled by the four largest firms. But, a more specifically defined measure of concentration is the Herfindahl-Hirschman Index (HHI). The HHI is a commonly accepted measure of market concentration that is determined by taking the square of the market share of each firm competing in a market, and then summing the resulting numbers, and can range from close to zero to 10,000. If there was only one firm in the market (even if it had 10,000 establishments/practices) it would have a market share of 100 percent and the square of that would be 10,000, the most concentrated market possible – a monopoly.

The current concentration in private veterinary practice shows that approximately 20 percent of establishments account for 50 percent of industry output. But this includes all private practice types and does not consider firms. The number of firms in the industry is unknown but the largest of firms has about 1,000 practices while the smallest firm is a single-practice firm. There are many firms with one to five practices and most of these are owned by practicing veterinarians.

ECONOMIC IMPACT OF THE VETERINARY INDUSTRY

The market for veterinary services is a $33 billion industry made up of tens of thousands of firms, according to the IMPLAN model. Using IMPLAN data and software, this section looks at the composition of these firms, as well as their employment and output. Data for the IMPLAN software is captured from the U.S. Bureau of Economic Analysis, Bureau of Census, and Bureau of Labor Statistics (BLS). These data are used to summarize 536 sectors of the U.S. economy, both the outputs and the purchases of each of these sectors by geographic area.

The input-output account matrix provides information on the importance of the relationship between different industries within the economy. The relationship is typically presented in a form of multipliers showing the share of the rest of the industries from a one-dollar investment made by an industry, for example, the veterinary services industry. These multipliers enable the tracking of the effect of a change in the production of the veterinary services industry on the output of all industries that contribute to the production of the output of the veterinary services industry.

The willingness of pet owners to spend for veterinary services is but one contribution of the veterinary profession to the market as a whole — that is, to the economy-wide economic activity. Money spent at veterinary hospitals constitutes the direct impact of veterinary services on the economy (total revenue). To provide these services, however, veterinarians require supplies, equipment, pharmaceuticals, facilities and staff. These "inputs" to veterinary services are produced by other businesses, and the activity generated by these businesses to produce the inputs are known as the "indirect" impacts to the general economy.

Establishments according to the IMPLAN definition are not necessarily veterinary practices. This estimate includes establishments that may not necessarily be clinics, but rather could be animal control centers, animal shelters, veterinary-focused pharmaceutical companies, veterinary testing laboratories, and independent veterinary contractors, many of whom are relief veterinarians.

IMPLAN data provide, for every industry, the total number of employees, the industry labor income, the total proprietor income, and the total value of output. The employment, labor income and output associated with the industry of interest are called "direct effects." The multipliers enable determination of the "indirect" and "induced" effects. These terms refer to the changes that occur in other industries due to the change in the veterinary services industry. For instance, a change in the demand for veterinary services will cause the pharmaceutical industry to revise its production plan to meet the new demand in the veterinary industry. The changes in the pharmaceutical industry are captured in the indirect effects.

Finally, all of the people employed in the direct and indirect businesses spend money earned from these businesses. These expenditures for goods and services require additional labor. The sum of all of the goods and services purchased as a result of the expenditures of employees of veterinary hospitals, as well as those of businesses supplying inputs to the hospitals, produce what is termed an "induced" impact on the economy. The sum of the direct (veterinary hospital revenue), indirect (expenditures in related businesses) and induced (household expenditures from employees) impacts comprise the total economy-wide impact of veterinary practices.

For the veterinary services sector in the U. S. economy, the indirect and induced impacts of its services are $13.4 billion and $18.8 billion, respectively. Combining the direct, indirect and induced impacts, the total value of economic activity generated in the U.S. economy as a result of veterinary services in 2014 was $63.1 billion for an economic multiplier of roughly 2.1. To achieve this economy-wide impact required 729,089 employees in veterinary medicine and the supporting sectors, which, combined with the veterinary and veterinary-related businesses, provided federal, state and local taxes of $10.3 billion.

THE AVMA PET OWNERSHIP AND DEMOGRAPHIC STUDY

The number of pets has historically been determined every five years by the AVMA Pet Ownership and Demographic Survey (PDS). The first PDS was fielded in 1982 and the most recent PDS occurred in 2012. The PDS was again fielded this year (2017) and results from analysis of the data are being developed at the time of this writing and will be summarized in the *2018 AVMA Report on the Market for Veterinary Services*. The purpose of the PDS is "to serve the veterinary medical profession and all other individuals who need to make decisions about the health care and product marketing demands associated with the companion animal industry and ... to update and expand our knowledge about the companion animal population in the United States regarding demographic characteristics and use of veterinary medical services."

The specific objectives of the PDS are "to determine:

- populations of dogs, cats, birds, horses and other pets owned by U.S. households;
- household demographic characteristics associated with pet ownership; and
- frequency of times that pets were seen by a veterinarian and annual veterinary medical expenditures." (Wise, 1992)

Since the 1992 PDS, the national survey received roughly 50,000 respondents (47,000-60,000) and provided a national estimate of the number of pets of all types, frequency of visits to the veterinarian and the expenditure on veterinary services or products, and market size. Unfortunately, this information does not provide the data required to measure demand. The annual expenditure provided by a household is a single number of the total amount paid to veterinarians in the surveyed year, while demand is a set of quantities purchased or not purchased at each price by pet owners. And total market size is the number of customers (per year) including the pet owners who did not patronize a veterinarian during the year surveyed.

THE 2015 PILOT STUDY

At the end of 2015, in cooperation with the AVMA VED the National Center for Food and Agricultural Policy, an independent consulting group specializing in demand analysis, conducted a metropolitan market demand study to devise an accurate, low-cost household survey of single multi-county market areas for measuring the demand for veterinary services. This pilot study sought to determine a process for integrating smaller, metropolitan market-specific areas with the five-year PDS. These metropolitan market surveys would help to understand the difference in the relationship between the demands for veterinary services that may occur as a result of differing market demographics. A second objective is to provide a method for computing the annual changes to the national estimates of numbers of pets, number of veterinary visits by each pet, and the effect of price and income on the demand for specific veterinary services — and from whom the veterinary services were purchased.

One of the noteworthy findings in the 2015 pilot study is associated with the question on routine check-ups in the past 12 months. The 2012 PDS noted that approximately 20 percent of dog owners had not visited a veterinarian in the past 12 months. When provided more choices of where the canine pet might have received a routine check-up in the past 12 months, however, 80 percent of responding canine owners noted they had obtained a routine check-up in the last 12 months, in-line with the PDS estimate. However, another 13 percent indicated that they had received a routine check-up at an alternative to a traditional veterinary hospital or clinic. This calls into question the oft-quoted percent of pets not receiving annual care. This research, however, occurred in a small local market and thus might not extrapolate to the larger United States.

ROUTINE CHECK-UP FREQUENCY AND PROVIDER			
PDS versus Pilot Survey Q9	2012 PDS	Random Sample	Veterinary Clients
Exam, vaccinations obtained from vet in previous year?	81%		
Routine check-up (somewhere) in past 12 months?		92%	97%
Not this year		8%	3%
Not from a veterinarian	19%		
Pilot Q10a-h Where did you take Dog for routine check-ups (exam, vaccinations, etc)?			
Veterinary clinic or hospital		80%	82%
Shelter or humane society		1%	
City- or county-sponsored public clinic		1%	
Pet shop		1%	
Pet-focused retail store		4%	
Mobile facility or van		6%	11%
Other: vet who does house calls			4%

Table 3

The majority (83 percent) of dogs visit a veterinary practice one or two times a year with slightly more than half visiting only one time per year for a routine check-up. An interesting question to be asked of veterinarians is what is the total number of routine visits required per year to fulfill the health care guidelines set by the practice.

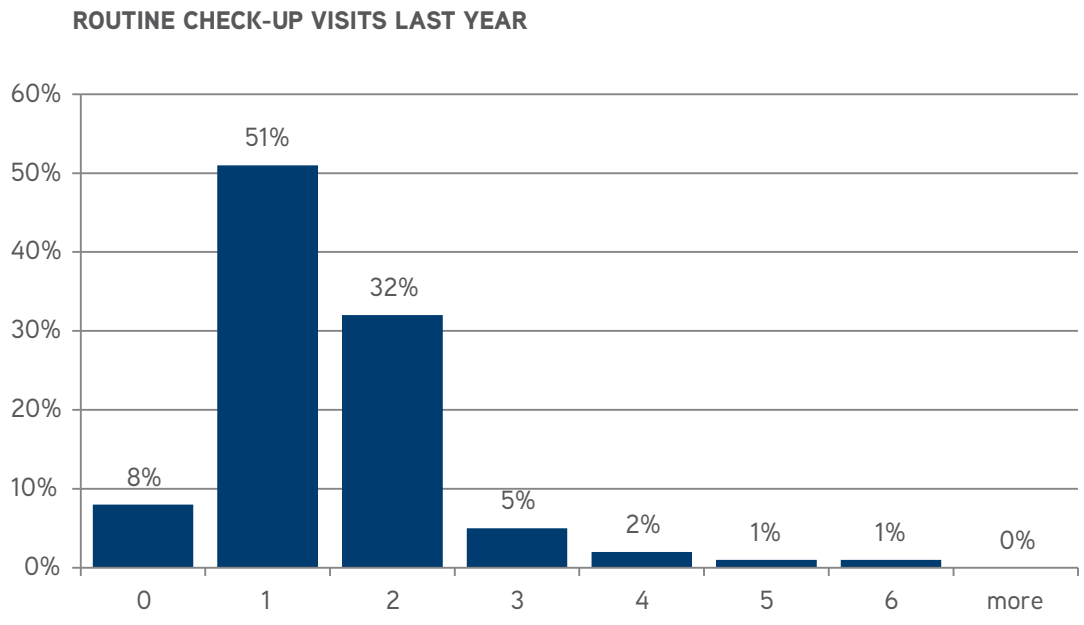


Figure 7

The respondents also reported the amount they spent for a routine check-up, and that information is provided in the figure below, separated by where the routine check-up was obtained. The variation in price paid per visit is large, running from zero to $500.

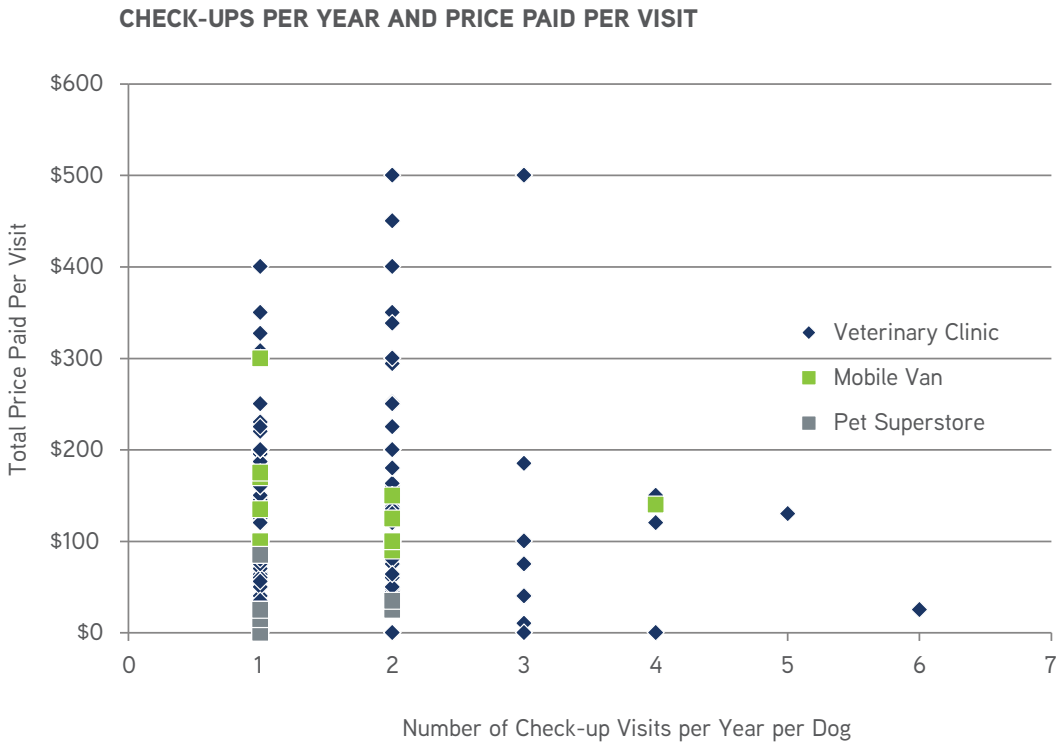


Figure 8

The number of visits and the price per visit can be organized in an accumulative distribution to produce a demand schedule, indicating how many routine dog check-ups could be provided at each price. Approximately 100 routine check-up visits would be purchased at a price of $200 per visit and 200 routine check-ups would be purchased at $100 per visit. In this specific market the demand for routine check-ups is inelastic (a large increase in price has little impact on quantity demanded) from $500 to $200 but becomes elastic (a change in price has a larger impact on the quantity demanded) after the price reaches $200.

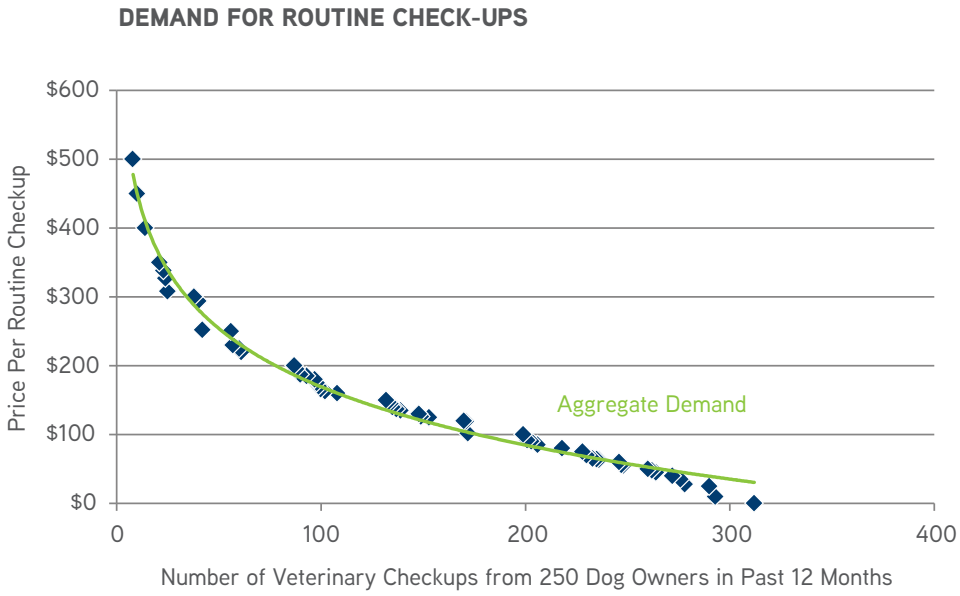


Figure 9

Plotting the amount of revenue (price of each routine check-up multiplied by the number of check-ups) that can be earned at each price illustrates the optimum price with which to maximize revenue. At $120 per routine check-up, the total revenue is maximized (not necessarily profit). An important question is whether the revenue-maximizing price is the same around the country or if it is unique to every market.

The importance of this finding is the demonstration that some price increases can improve financial performance while others will cause a decline in financial performance. But again, the factors internal to each practice, the culture and income of the clients and the type and size of pets could influence the revenue-maximizing price. In this example current prices for a routine check-up under $120 can be increased to improve financial performance of the practice while current prices above $120 that are increased will lead to a decline in financial performance.

This study should only be used as an example to indicate that consistently raising price may have negative impacts on practice financial performance. As price increases, the number of clients opting to purchase the service may decline. Initially, a decline in clients will not be sufficient to offset the increase in price and total revenue will increase. At some point, however, an additional increase in price will reduce the demand sufficiently to reduce total revenue.

MARKET REVENUE FROM ROUTINE CHECK-UPS OF 250 DOG OWNERS, 2015 PILOT SURVEY

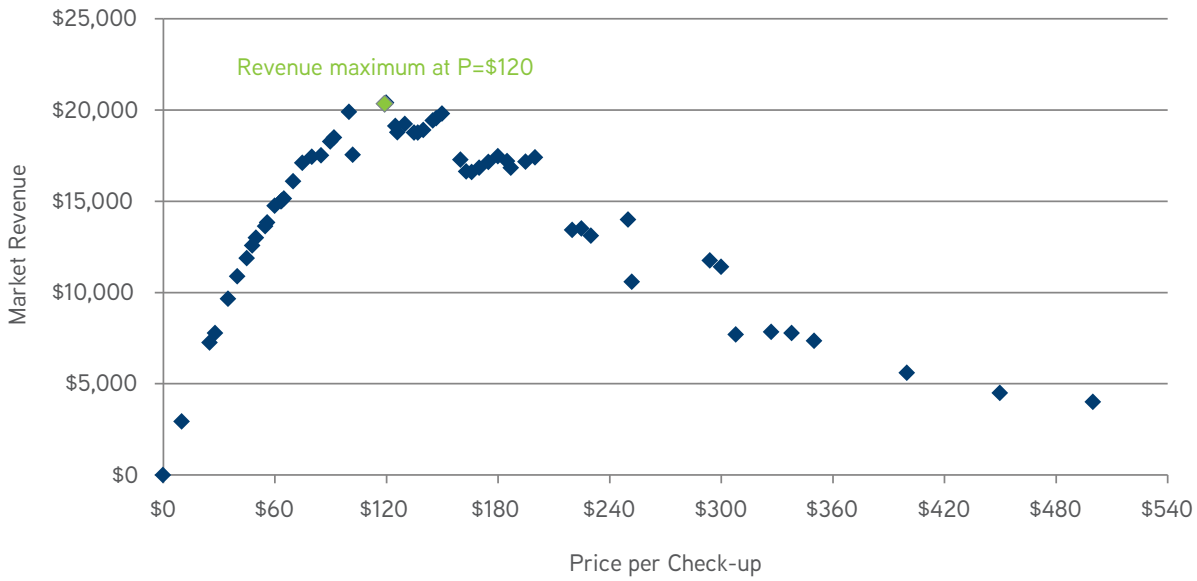
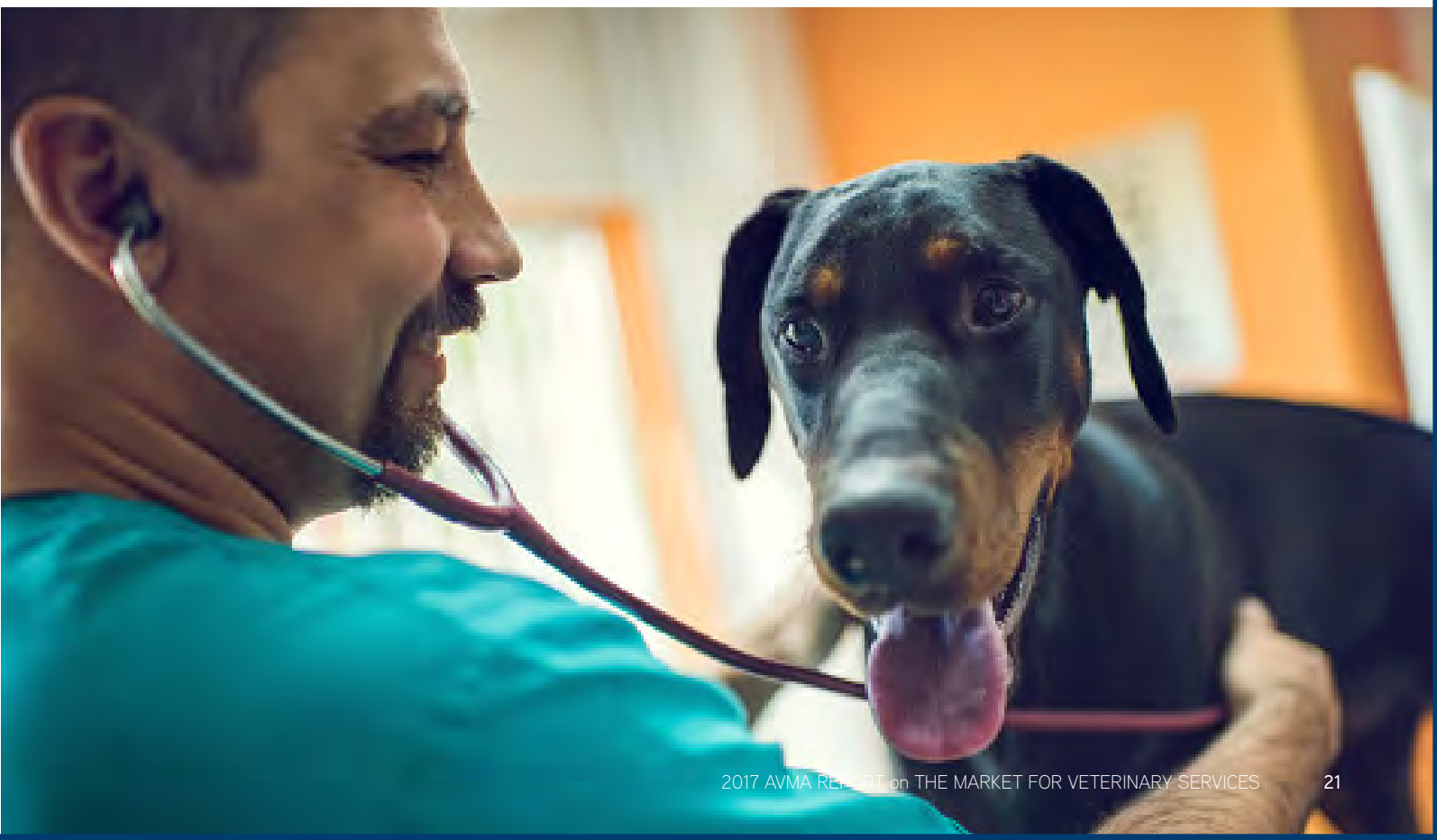


Figure 10

Determining the revenue-maximizing price for various services and the factors that create any variation in this price between locations will provide important information to veterinary practices about the impacts of price on the demand for veterinary services. Findings from the analysis of this 2017 Pet Ownership and Demographic Survey data were presented at the 2017 AVMA Economic Summit, and are scheduled to be published in early 2018.



THE 2017 PET OWNERSHIP AND DEMOGRAPHIC SURVEY (2017 PDS)

The 2017 PDS addresses some previously identified problems with the pet population estimates, and the more serious estimation problems about the veterinary care spending data. The potential challenges for these types of surveys include:

- ensuring that pet owners' demographic data are current;
- ensuring that the number of completed surveys exceeds 50,000;
- ensuring correct weights for more accurate pet population and pet ownership rate estimates;
- eliminating pet-owner bias in determining dog and cat body condition (underweight to obese);
- counting pet-months to more accurately estimate spending per pet, per year;
- counting pets with permanent IDs (tattoos or microchips);
- counting pets covered by "wellness plans" and pet health insurance;
- counting dogs that are primarily service or working dogs as opposed to "pets;"
- counting dogs and cats fixed by their current owner or before;
- identifying dog, cat, and horse owners spending more than $1,000 to treat a single health issue; and
- designing survey modules specific to dogs, cats, horses and other pets.

The Iowa State Survey Research Lab developed a sample frame that was able to ensure that the demographic information for households was obtained in 2017. This is an improvement over past surveys where the demographic data was secured at the time of enrollment in national survey pools.

The sample frame for the 2017 PDS was also expanded (more than triple past surveys) to ensure that the desired number of responses (completed surveys) was reached. This level of responses ensures a very small confidence interval around the estimate of the percent of households with pets, number of pets per household and level of expenditures on veterinary products and services.

PDS PRODUCTION, SAMPLE FRAMES, MODES AND SIZES

Edition	Survey By:	Sample Source	Mode	Sample Size	Completed Surveys
1983	Charles Research Group	NFO Research	paper	20,000	13,506
1988	Charles Research Group	NFO Research	paper	40,000	29,535
1992	CIM (AVMA)	NFO Research	paper	80,000	55,143
1997	CIM (AVMA)	NFO Research	paper	80,000	59,998
2002	CIM (AVMA)	NFO Research	paper	80,000	54,240
2007	Irwin Broh & Associates	TNS Custom Research	paper	80,000	47,842
2012	Irwin Broh & Associates	TNS Custom Research, Lightspeed MySurvey, ResearchNow, Federated	online	222,244	50,347
2017	National Center for Food and Agricultural Policy and Iowa State University	Survey Sampling International	online, mobile-friendly	TBA	41,622

Table 4

The 2017 PDS will also provide a more accurate picture of the body weight and condition of pets. Pet owners are thought to be biased in reporting their pets' weight: With obesity the new norm for pets, owners often make the mistake of accepting their animal's weight as normal even when the animal is overweight. In the 2012 PDS, 85 percent of the survey respondents thought their pet was the ideal weight, and only 13 percent thought their animal was overweight or obese, while the remaining 2 percent thought their animal was underweight.

In 2015, the Association for Pet Obesity Prevention (APOP) conducted a survey of veterinarians to gauge what veterinarians see in their practices regarding the body condition of pets. The APOP survey was designed exclusively for veterinarians concerned about the trends in weight gain for pets. The survey was conducted by having veterinarians visit the APOP website, log-in, and self-report the percent of their patients in each weight category. These veterinarians reported the same assessment as owners did in identifying pets that were underweight, but the similarities ended there. Veterinarians report only 44 percent of pets as having an ideal body weight, and 54 percent as being overweight — a full 41 percentage higher than the pet owners rate!

Both types of perceptions about body classification are important to ascertain and comprehend. The problem is that pet owners will almost always tend to under-report obesity. On the other hand, while veterinarians are highly trained to spot obesity in animals, the sample was created in a biased way — whereby only veterinarians who are interested in the subject would take the time to seek out and then complete the survey. So the survey may be over-represented by veterinarians who operate in areas where obesity may be a larger problem. These two types of biases will be inhibited in the future PDS and MMD surveys by using pictures of body shape, without associated wording (underweight, ideal, overweight, obese, etc.) in order to help guide survey respondents to provide more accurate answers.

CLASSIFICATION OF CANINE BODY CONDITION

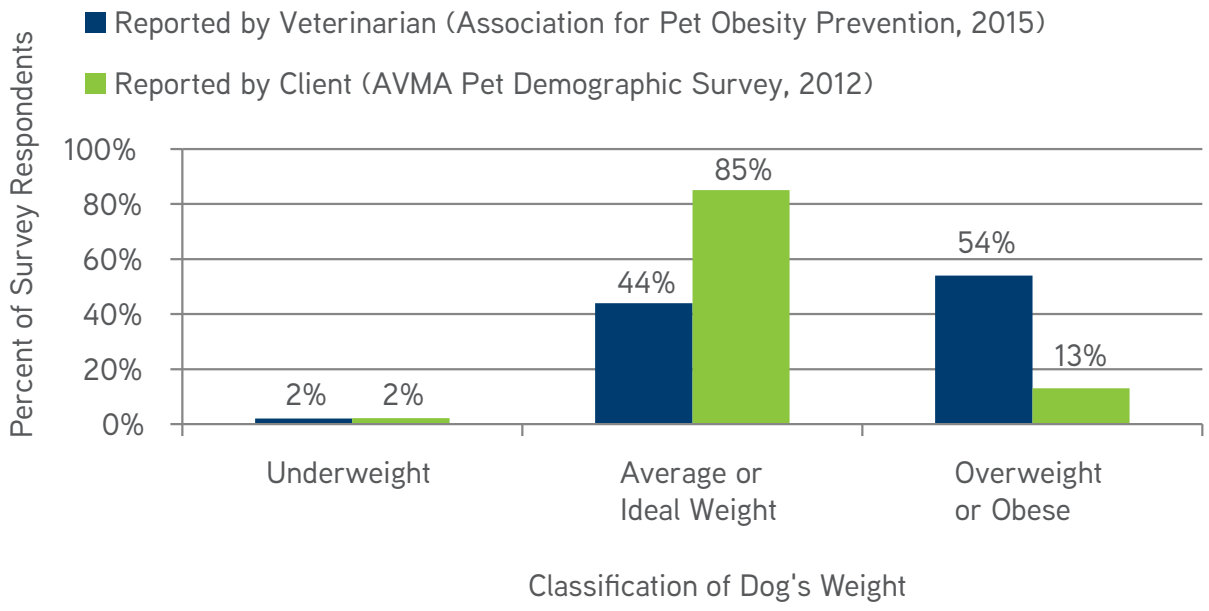


Figure 11

The new questions for the 2017 PDS will enable the calculation of price and income elasticities with a high level of accuracy. Previous studies have collected data on procedures purchased from veterinarians and the total amount paid for veterinary services in a year as well as in the last visit, but these values fail to give accurate enough information to be able to derive demand estimates.

The PDS will be annually updated using the Metro Market Demand Studies. Every year the AVMA will survey up to eight metropolitan markets to conduct more specific research about pet owners, test new questions, and annually update the PDS with statistics extrapolated from the metro areas to the nation as a whole. Additional results from the 2017 PDS will be shared in the *2018 AVMA Report on the Market for Veterinary Services*.

COMPARING U.S. PET POPULATION STATISTICS

Much has been made of the difference between the estimates detailed in the AVMA's U.S. Pet Ownership and Demographics Sourcebook (PDS) and those made in the American Pet Products Association's (APPA) National Pet Ownership Survey (NPOS). These differences may be the result of differences in sampling methodology and/or statistical definitions used in the surveys. The differences are classified into four categories and discussed in this section.

AVMA analysts have access to only the raw PDS survey data, and can calculate statistics as needed. Without access to the raw data from the APPA survey, however, it is difficult to attribute exact magnitudes to each of the differences listed below. Furthermore, because of copyright restrictions, it is not possible to publish re-creations of data from either of the sources, so instead the argument below must rely on proportional and percentage comparisons, rather than absolute comparisons.

When talking about pet populations, these figures are arrived at with a common formula. Noteably, the APPA NPOS "objective is to monitor consumer habits on an ongoing basis to identify short- and long-term trends, as well as new opportunities, in pet ownership and pet product and service consumption." (pg. xvi) The AVMA PDS objective is to create "...the largest, most statistically accurate and complete survey of the pet owning public and pet population demographics."

Margin of Error

All statistics are subject to variability, so the first potential difference in survey results is simple statistical noise. That is, there is a difference in means between two samples simply because each sample is comprised of independent observations. The greater the sample size, the more likely the means are to be equal. Standard deviations are typically reported with statistical publications so that the reader is able to evaluate the probability that the mean value is the correct value. The NPOS does not provide any standard deviations in the tables, except for binomial probabilities, but the standard deviations from the AVMA data are used to approximate those in the NPOS. Table 5 provides the comparable statistics from the AVMA PDS and the APPA NPOS.

MEAN NUMBER OF PETS PER HOUSEHOLD		
	AVMA, 2011	APPA, 2010-2012
Sample Sizes		
Total	**50,347**	**25,109**
Dogs	20,604	527
Cats	16,401	461
Birds	1,762	299
Mean Number of Pets per Household		
Dogs	1.52	1.47
Cats	1.97	2.11
Birds	2.15	2.98
Standard Deviation of Mean Number of Pets per Household		
Dogs	1.17	1.43
Cats	2.15	2.42
Birds	4.40	4.88
Margin of Error, 95% confidence*, Mean Number of Pets per Household		
Dogs	0.02	0.12
Cats	0.03	0.22
Birds	0.21	0.55
Confidence Intervals around Mean Number of Pets per Household*		
Dogs	(1.50,1.53)	(1.35,1.59)
Cats	(1.94,2.00)	(1.89,2.33)
Birds	(1.95,2.36)	(2.43,3.53)

Table 5

As shown in Tables 5 and 6, means and confidence intervals can be compared across the surveys. The confidence intervals for the two survey samples overlap for dogs and cats but not for birds. This estimated result indicates that there is no statistical difference between the mean number of dogs and cats per household. Note that the confidence interval for dogs and cats from the PDS fits inside the confidence interval for the NPOS. Thus, it is likely that both the sample size difference and statistical noise could explain the small difference in means between the NPOS and PDS for the number of dogs and cats per households. However, for birds there is no overlap between the mean estimates and the opposing confidence intervals and thus sample size and statistical noise are unlikely to be able to explain the differences in these mean numbers of animals per household.

For the percent of households that have pets the statistical difference between the PDS and NPOS is a different story. The NPOS sample is half the size of the PDS and the confidence intervals do not overlap. This indicates that neither the sample size nor the statistical noise can explain the differences and other factors must be considered.

DO YOU OWN A PET?		
	AVMA, 2011	APPA, 2010-2012
Sample Sizes		
Total	50,347	25,109
Do You Own a Pet? (Percent answering "Yes")		
Dogs	36.28%	46.70%
Cats	31.08%	37.30%
Birds	3.21%	5.70%
Standard Deviation of Do You Own a Pet		
Dogs	48%	50%
Cats	46%	48%
Birds	18%	23%
Margin of Error, 95% confidence*, of Do You Own a Pet		
Dogs	0.42%	0.62%
Cats	0.40%	0.60%
Birds	0.15%	0.29%
Confidence Intervals of Do You Own a Pet		
Dogs	(35.86%, 36.70%)	(46.08%, 47.32%)
Cats	(30.67%, 31.48%)	(36.70%, 37.90%)
Birds	(3.06%, 3.36%)	(5.41%, 5.99%)

Table 6

STANDARD DEVIATIONS ARE TYPICALLY REPORTED WITH STATISTICAL PUBLICATIONS SO THAT THE READER IS ABLE TO EVALUATE THE PROBABILITY THAT THE MEAN VALUE IS THE CORRECT VALUE.

TIMING

One such other factor to consider is illustrated by the length of time to which that the question about pet ownership refers. The APPA publishes its questionnaires in full. The first, or screener, questionnaire asks in the beginning, "If you do not currently have a pet in your household but had one in your household in the past two years, please respond to the following questions as if you currently had that/those pets in your household." (APPA pg. 59).

The 2013-2014 APPA survey was conducted online in 2012 (pg. xvi), whereas previous versions were administered in July through the mail. This section of the report compares the 2012 AVMA PDS, which describes pet ownership trends in the calendar year 2011, with the 2013-2014 APPA NPOS, which was conducted in 2012 and describes pet ownership trends from 2010-2012. This then is a comparison of the pet populations quoted in the APPA's NPOS publication as two-year averages with the statistics quoted in the AVMA's PDS pet populations on a single day, December 31st. Specifically, the 2012 Pet Ownership and Demographic Sourcebook states, on page 174:

"In this publication, there were two measurements used when extrapolating findings to the entire U.S. population. For statistics that involve pet and owner populations, households that owned animals on December 31 were used in calculations. However, to determine expenditures and utilization of services for the entire year, households that owned pets anytime during the year were used in calculations."

WITHIN SAMPLE DIFFERENCES OF PET POPULATIONS, 2011 PDS

		Dog	Cat	Bird	Horse
Respondents with at least one animal	Anytime in 2011	20,604	16,401	1,762	774
	December 31, 2011	18,266	15,646	1,616	708
	Difference	12.8%	4.8%	9.0%	9.3%
Total count of animals from survey respondents	Anytime in 2011	31,661	35,216	4,271	2,132
	December 31, 2011	29,147	32,306	3,796	1,898
	Difference	8.6%	9.0%	12.5%	12.3%

Table 7

This is a statistical relic of the way that the sampling is conducted: All households that owned a pet are counted in the first number (the total for the year), but the second number (December 31st), will always, inevitably be less because households lose animals throughout the year, and not all of them replace those animals before the end of the year. Even if a household did replace a deceased or lost pet, the statistics would be different because that household would report owning two animals during the year, but only one at the end of the year.

A lot can be different on December 31st compared to the rest of the year. Pets are given away to family members and shelters, and some pets die. Some bitches give birth to a litter, only to have some puppies of that litter given away. Students go off to college and leave their pets at home. There are many reasons why animals that may have been present in an individual's household at any point in a year are subsequently not present in the household at the end of the year. Comparing AVMA's estimates, in 2011 there were 74.1 million households who owned pets at any time that year, but as of December 31, 2011, that number dropped to 66.5 million, a 10.3 percent intra-year decline.

Whatever the case may be, a population of any kind changes over time, and a population count should be conducted in such a time as the population does not have enough time to change in a statistically relevant way during the period of time captured in the snapshot. For example, a respondent in the survey claimed to have had 25 dogs throughout the year, but as of December 31, 2011, had exactly 15 dogs. Losing 10 of one's dogs in a year to death is possible, but not likely. More likely, it could indicate that this person was a foster parent to shelter animals, and found homes for 10 dogs in the course of 2011.

Although only one question within the survey was asked to determine the difference between the number of pets owned during a two-year period (NPOS) and a one-year period (PDS), the large difference in the number of pets estimated during a year and for a single day suggests that a two-year estimate would produce a larger number of pets per household than would a one-year estimate.

POPULATION REPRESENTATION OF SAMPLE

The PDS and APPA are somewhat comparable in total sample size. The 2012 PDS had a sample size of 222,244, receiving 50,347 responses. The NPOS was sent to 50,000 individuals and received 25,109 responses (pg xvi). When responses number in the tens of thousands, these levels of responses are perfectly comparable to one another. To be analogous, however, the sample must represent the population with respect to the demographic characteristics that affect pet ownership. Even if the sample is selected to represent the population, the responses are unlikely to perfectly match the population characteristics and will need to be reweighted by the important demographic factors.

The NPOS survey study authors contend, "The panel of pet owners is representative of all pet owners in the U.S." However, this is not possible to know apriori, as one of the objectives of doing the survey is to identify the factors that influence pet ownership. More specifically, one objective of the survey is to estimate the relationship between various demographic characteristics and pet ownership. It could be the case that the sample was selected to be representative of the U.S. population in measured variables, but it's impossible to know about the variables being measured, in this case, pet ownership statistics.

Second, those sample returns are only for the statistics measuring pet populations. A follow-up survey sent out to NPOS respondents asked detailed questions about pets in eight categories: dog, cat, freshwater fish, saltwater fish, bird, small animal, reptile and equine. These follow-up surveys had similarly high response rates, from approximately 50 percent to 80 percent. However, the problem is that the total number of returns for all eight categories was 2,739. Contrast this to the AVMA survey which had 19,211 responses from dog owners, 16,409 responses from cat owners, and 1,762 responses from bird owners. In total, this is a more than ten-fold difference in useable responses.

BACKYARD POULTRY AND THE PET BIRD POPULATION

Of course, not all pets are dogs and cats. The resurgence of backyard poultry represents a popular movement in the United States. The AVMA PDS tracks "Poultry (pets) in a separate category from "Birds," and though households with birds in the PDS outnumber households with poultry by about three to one, the total number of poultry outnumbers birds by about 50 percent. The NPOS survey, however, does not have a category for poultry. That some poultry owners in the NPOS survey classified their animals as "Birds" (and the rest as "Other") is plausible, though it is impossible to know how many without having the raw data. Thus, the use of only the generic "bird" as a pet category may inflate the number of bird-owning households.

Indeed, the PDS indicates that 439 respondents, or just under 0.9 percent of survey respondents, reported owning poultry on December 31, 2011 (or 494, 1 percent at any time in 2011). The average number of poultry for these 439 households is 12.3, with a standard deviation of 13.6. The NPOS does not report on the statistics for the "Other" category, so it is unknown how they compare. Because backyard poultry flocks are large relative to the average number of caged birds per household, this would drive up the average number of animals per household.

One more key piece here is that the species of birds kept by respondents to the NPOS are known, as these are listed in the publication; 93 percent of the survey respondents selected of the common household species listed, and 7 percent selected "Other species of bird," which would seem to put a cap on the maximum number of poultry owners. The NPOS, however, has a two-stage sampling process. The respondents may have taken the screener survey first, where the proportion of pet-owning households is counted, and then some were offered a detailed follow-up survey. The follow-up survey asked about the species of bird. Some of the respondents with backyard poultry may have continued on with the survey and answered questions appropriately (accounting for at least part of that 7 percent of other birds), while others may have been discouraged by the questions, recognizing that the questions were designed for caged or house birds. The conflation of poultry flock size with household bird pets inflates the number of birds per household.

When counting households with animals, the APPA survey requests, "Please indicate from the list below the type(s) of animal(s) you own." "Bird" and "Other Animal" are listed among the options. On the other hand, the AVMA survey asks, "Which of the following pets did your household own at any time in 2011?," with "Birds" and "Poultry (pets)" both listed among the options. A 2014 study in *Poultry Science* indicated that 57 percent of backyard poultry owners consider their flocks to be pets (Elkhoraibi, et al. 2014). Together this suggests that the APPA survey may be picking up both poultry flocks considered pets as well as poultry flocks considered revenue-generating or food-generating property. This difference in definition between "own" and "pet" inflates the number of bird-owning households.

For argument's sake, let's suppose all 7 percent of those in the "Other" category had backyard poultry, at the PDS average of 12.3 birds per flock. Then to arrive at the overall average of 2.98 birds per household would require the other 93 percent of respondents to own an average of 2.32 birds per household, which is inside the 95 percent confidence interval obtained from the PDS.

Lacking the APPA's NPOS raw data, these differences can't be quantified without making assumptions. So, let's assume the distribution of poultry owners in the APPA survey is the same as in the AVMA survey, in order to estimate the number of non-poultry, pet birds. The PDS found 3.7 million households with birds and 1.02 million households with poultry (pets) while the NPOS found 6.9 million households with birds. The PDS also estimated 2.3 birds per household and 12.3 poultry per household, while the NPOS estimated 2.98 birds per household. Within the estimates of households with birds and number of birds per household, the PDS estimated 20.9 million birds in households while the NPOS estimated 20.6 million, a negligible difference.

BIRDS AND BACKYARD POULTRY ESTIMATES		
	AVMA, 2011	APPA, 2010-2012
Number of Households with Birds		
Birds	3,700,000	6,900,000
Poultry (Pets)	1,020,000	n/a
Total Households	4,720,000	6,900,000
Number of Animals per Household if Birds are Present		
Birds	2.3	2.98
Poultry (Pets)	12.3	n/a
Average Birds per Household	4.5	2.98
Total Estimated Bird Population		
Birds	8,300,000	20,600,000
Poultry (Pets)	12,591,000	n/a
Total Bird Population	20,891,000	20,600,000

Table 8

SAMPLE STRATIFICATION AND POST-SURVEY WEIGHTING

Statistics in the APPA's NPOS are not weighted according to the population, but rather according to the sample. There is simply a statement that says, "Ipsos has also developed a special panel balancing system for outgoing sample…This provides a more balanced returned sample and lessens or eliminates the need to weight the data." (pg. xvi). What the study authors describe is a system of sample stratification based on demographic variables. Survey samples are often created in this way. The problem, however, is that the approach assumes that the response variable (pet ownership) is not correlated with the factors on which the stratification is conducted. There is no indication that the survey results were checked or reweighted when the national statistics were created.

Contrast this with the 2012 Pet Ownership and Demographic Sourcebook: "The sample was selected with respect to the following characteristics: U.S. Census region, income, household size, age of head of household, family versus non-family, and population density (Table A-7). For 2012, the respondent data was weighted by the following six characteristics to correctly represent the demographic composition of the U.S." (pg. 177).

Without the complete raw data, it is impossible to say exactly how much weighting is affecting the difference in the results. However, one indication was seen in the 2016 AVMA Metro Market Demand Survey. In that survey, even with an appropriately stratified sample, failure to weight statistics based on demographic characteristics would result in estimates of canine ownership between 13 and 34 percent (or about 6-17 *percentage points*) higher than the true proportion.

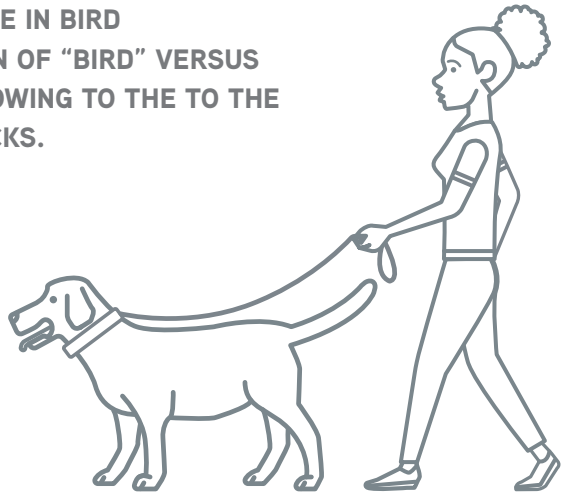
2016 AVMA METRO MARKET DEMAND SURVEY, PERCENT OF HOUSEHOLDS OWNING DOGS

	Philadelphia CSA	Los Angeles CSA
Raw, Unweighted	51%	58%
Weighted	45%	41%
Difference	13%	34%

Table 9

The difference in estimates between the APPA's NPOS and AVMA's PDS surveys can probably be attributed to three primary sources: definition of population (due to timing of the survey), post-survey weighting of final statistics, and the two-stage screener-module surveying procedure. The vast majority of the difference in bird populations may be due to the definition of "bird" versus "poultry" and "own" versus "pet," owing to the presence of backyard poultry flocks.

THE VAST MAJORITY OF THE DIFFERENCE IN BIRD POPULATIONS IS DUE TO THE DEFINITION OF "BIRD" VERSUS "POULTRY" AND "OWN" VERSUS "PET," OWING TO THE TO THE PRESENCE OF BACKYARD POULTRY FLOCKS.



PROFESSIONAL SEGMENTS

An increase in the demand for meat or dairy products affects the market for bovine veterinary services.

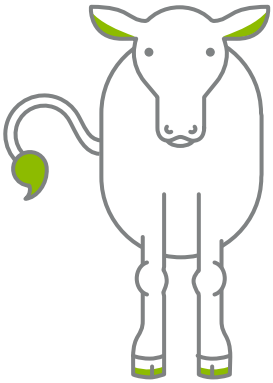
BOVINE VETERINARY SERVICES

In 2015 the AVMA worked with the American Association of Bovine Practitioners (AABP) to survey the latter's membership in order to better understand some of the unique aspects of the veterinary markets that affect bovine veterinarians. Data were collected from 455 AABP veterinarians on topics as diverse as employment, hours worked, income, ownership, educational debt, and practice revenue. This section of the report focuses on the statistics from bovine veterinary practice owners. The full report can be obtained from the AABP or the AVMA.

The bovine practice financial performance depends on the overall condition of the national economy and, more specifically, the economic conditions in the animal protein production sector. An increase in the demand for meat or dairy products affects the market for bovine veterinary services. A downturn in the economy leads to a contraction in household demand for animal protein, reducing food animal production and the demand from animal producers for all inputs, including veterinary services. The result is lower financial performance of bovine veterinary practices. Also found is that bovine veterinary practices, as with the other veterinary practice types, are highly affected by the general economy's performance. An improvement in the national economy might not be beneficial in all regions or for all practices, however, and some regions might benefit more than others.

Bovine Practice Characteristics

According to the survey, the most common practice setup for bovine veterinarians is to provide ambulatory services only, at 61 percent of the respondents. The next most common type is to provide both ambulatory and haul-in services, at 30 percent of the sample.



DISTRIBUTION OF VETERINARIANS BY TYPE OF BOVINE PRACTICE

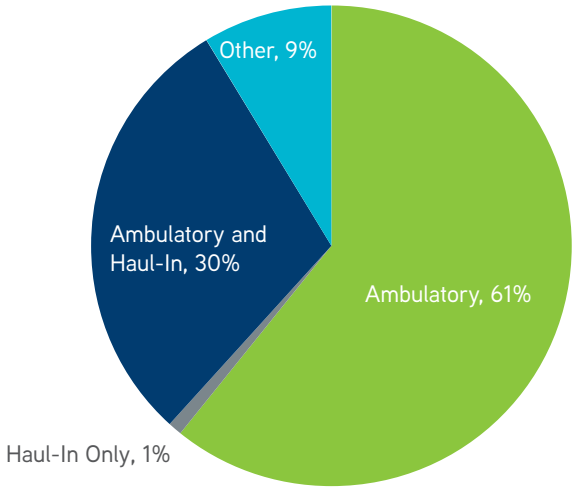


Figure 12

Given that more than 90 percent of the sample AABP members' practices offer ambulatory services, a natural follow-up question focuses on the amount of time spent on an average call. The following figure shows that a majority of respondents, 62 percent, spend an average of one hour or less on a typical call. However, 22 percent of respondents reported spending more than an hour and a half on an average call. The longer call times may be reflective of seeing more animals per visit, of spending more time in transit, or providing more services per animal on each visit.

AVERAGE TIME SPENT DURING A TYPICAL CALL

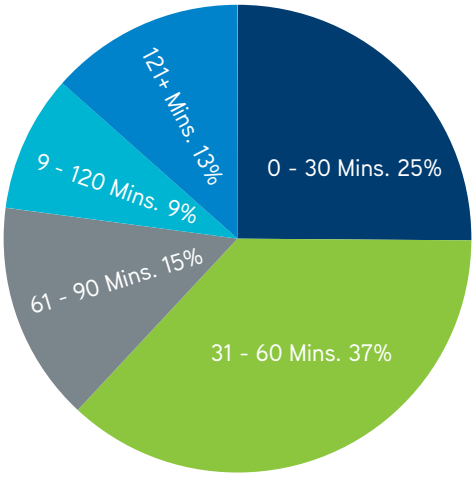
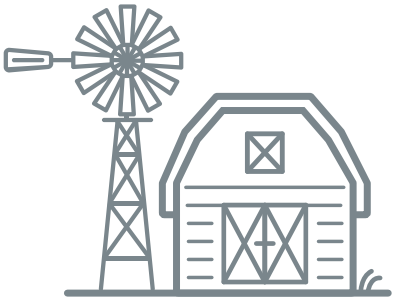


Figure 13



THE LONGER CALL TIMES MAY BE REFLECTIVE OF SEEING MORE ANIMALS PER VISIT, OF SPENDING MORE TIME IN TRANSIT, OR PROVIDING MORE SERVICES PER ANIMAL ON EACH VISIT.

Because of the variety of methods used to bill clients based on time and distance, the more insightful question would be to ask what percent of time is actually spent providing services, rather than, for example, driving, or performing administrative tasks.

Nearly half of respondents, 47 percent, say that they spend from 75 to 100 percent of their time performing billable work for clients, and 75 percent of respondents spend at least half of their time performing billable work.

DISTRIBUTION OF RESPONDENTS BY PERCENT OF TIME SPENT ON PROVIDING BILLABLE SERVICES

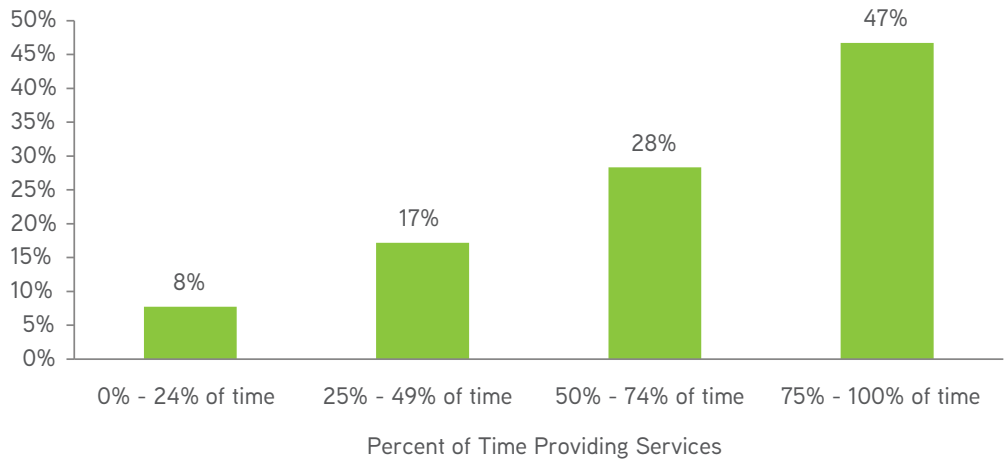


Figure 14

Members of AABP serve a diverse group of animals. The following table displays the percent of revenue associated with each of the following types of animals. The bovine categories clearly dominate revenue in the table below, as 30 percent of the respondents indicated that 76 percent-100 percent of their revenue is from veterinary products and services associated with dairy animals and 5 percent of respondents obtain 76 percent-100 percent of revenue from cow-calf products and services. Small ruminant, swine, equine and, in particular, companion animals, however, also comprise a share of the revenue of AABP member-owned veterinary practices.

PERCENTAGE OF PRACTICE REVENUE BY TYPE OF ANIMAL						
	0%	1% - 10%	11% - 25%	26% - 50%	51% - 75%	76% - 100%
Dairy	15%	21%	8%	12%	15%	30%
Cow-calf	9%	40%	21%	16%	9%	5%
Feedlot	44%	40%	11%	4%	1%	1%
Stocker	41%	42%	10%	5%	2%	0%
Small Ruminant	15%	72%	8%	4%	1%	0%
Swine	37%	55%	5%	2%	1%	0%
Equine	21%	51%	17%	7%	3%	1%
Companion Animal	23%	19%	14%	20%	18%	6%

Table 10

Bovine practice owners were asked to indicate the percent of revenue that was obtained by category of services. Some 74.3 percent of practices noted that service call fees, the charge for taking a trip to an animal owner's farm, amounts to less than 10 percent of the gross revenue of the practice. On the other hand, 11.5 percent of practices indicated that 41 percent-50 percent of the practices' revenue was obtained through the provision of reproductive services.

Results from the AVMA's 2012 Biennial Economic Survey indicated that in 2011 food animal exclusive and food animal predominant practices (though not necessarily AABP member practices) derived a mean of about 24 percent of their revenue from the sale of prescription drugs. The current AABP survey indicates this number may have dropped, as 70 percent of respondents claimed to derive 20 percent or less of their revenue from all product sales, not just prescription medications, with a mean of 17 percent.

PERCENTAGE OF REVENUE BY TYPE OF ACTIVITY										
	< 10%	11% - 20%	21% - 30%	31%- 40%	41% - 50%	51% - 60%	61% - 70%	71% - 80%	81% - 90%	91% - 100%
Call Fees	74.3%	20.7%	2.3%	0.7%	1.0%	0.7%	0.3%	-	-	-
Reproduction services	24.8%	18.3%	19.2%	13.3%	11.5%	5.3%	3.4%	1.9%	2.5%	-
Individual sick animal	51.6%	29.6%	12.1%	4.8%	1.0%	0.6%	0.3%	-	-	-
Surgery	65.6%	23.8%	7.4%	2.0%	1.0%	0.3%	-	-	-	-
Technician-generated	94.3%	4.6%	1.1%	-	-	-	-	-	-	-
Protocol development consultation	94.8%	3.3%	0.7%	-	0.7%	-	-	-	0.7%	-
Consultation, other	33.9%	54.3%	4.3%	-	1.6%	0.8%	0.4%	0.8%	0.8%	3.2%
Sale of products	45.4%	25.0%	15.1%	6.7%	3.9%	1.8%	1.1%	0.7%	0.4%	-
Radiology	92.2%	5.9%	2.0%	-	-	-	-	-	-	-
Preventive medicine	59.9%	17.4%	12.6%	4.8%	2.4%	0.7%	1.0%	1.0%	0.3%	-
Embryo transfer	70.2%	6.4%	6.4%	2.1%	2.1%	4.3%	-	2.1%	2.1%	4.3%
Laboratory, diagnostics	94.0%	4.7%	0.9%	0.4%	-	-	-	-	-	-
Other revenues	61.5%	7.7%	1.9%	-	3.9%	1.9%	-	-	1.9%	21.2%

Table 11

PARALLEL SERVICE PROVIDERS

Like many types of veterinarians, bovine veterinarians are interested in learning about competition from non-veterinary service providers. In particular, bovine veterinarians have communicated that they are particularly concerned that their role in providing animal services is being reduced to the provision of medical emergencies.

There are many types of non-veterinarian providers of services, such as pharmaceuticals, parasiticides, antibiotics, reproductive services, ultrasound imaging and nutritional services that were once deemed the sole market of veterinarians. These non-veterinarian providers of veterinary services are referred to as parallel providers. Because of the potential effects of parallel veterinary service providers on not only the revenues of practices and incomes of veterinarians, but the very existence of bovine practices in some rural areas, bovine veterinarians were asked to identify the potential competitors who have adversely affected their practices. More than 60 percent of the respondents claim that parallel providers have taken business from them.

Particularly with very large cattle operations, producers may find it worthwhile to hire a full-time employee to administer many of the vaccines and services that have generally been reserved for veterinarians. Bovine veterinarians, in turn, have been increasingly relegated to a smaller role in the health care of bovines and other types of animals.

Only 15.3 percent of the respondents said they have never been affected by any of the parallel service providers listed in Figure 15. The primary types of parallel services provider that affects bovine veterinarians consists of route trucks that deliver supplies to farms (52 percent) and non-licensed veterinary service providers (50 percent). Consultant veterinarians who visit farms once a year are also listed as potential threats to bovine veterinary practices.

PARALLEL VETERINARY SERVICE PROVIDERS AND THEIR IMPACT ON BOVINE VETERINARIANS' PRACTICES

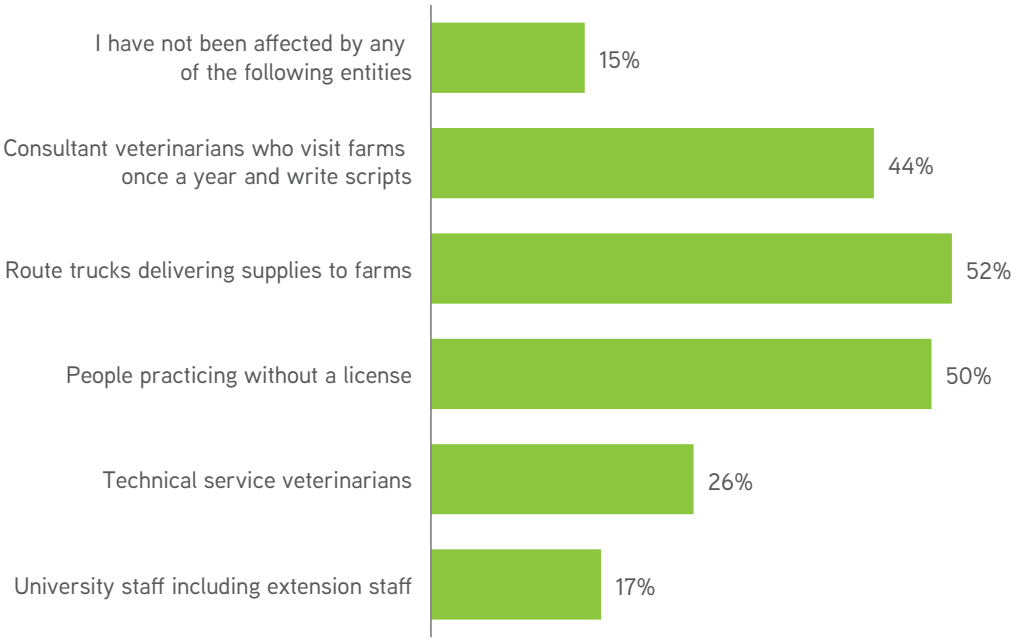


Figure 15

Of those respondents who said they are being affected by parallel providers, the majority (50.4 percent) claim that they are losing between 11 and 50 clients each year because of the competition.

MORE THAN 60 PERCENT OF THE RESPONDENTS CLAIM THAT PARALLEL PROVIDERS HAVE TAKEN BUSINESS FROM THEM.

NUMBER OF CLIENTS LOST BECAUSE OF NON-VETERINARIAN ANIMAL SERVICE PROVIDERS

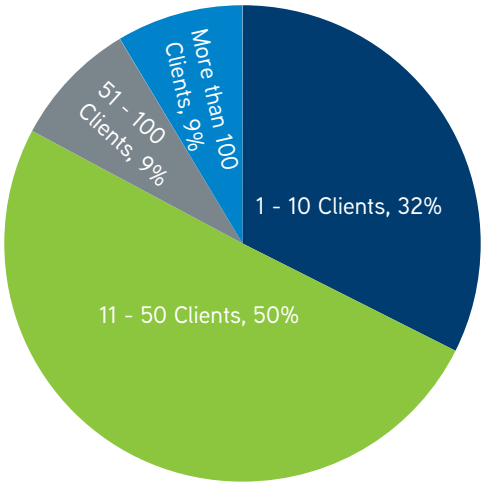


Figure 16

Respondents were also asked to estimate how many head of animals they are not servicing as a result of parallel providers of veterinary services. For instance, 40 percent of those being affected indicated that each year they are not seeing between 100 and 500 head of dairy cows as a result of activities of parallel providers (Figure 17). Between 15 and 20 percent lose approximately the same number of cow-calf pairs each year.

NUMBER OF ANIMALS NOT SEEING BECAUSE OF NON-VETERINARIAN ANIMAL SERVICE PROVIDERS

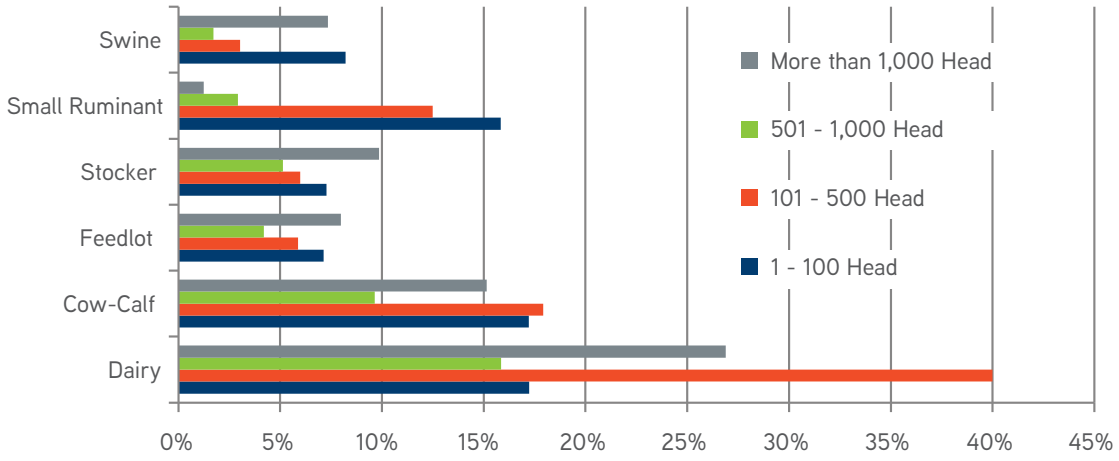


Figure 17

The bovine veterinarians were asked about the gross revenues of the practice to determine whether bovine veterinary practices have expanded or contracted over the last five years. Of those who responded, 55.3 percent said that their practice revenue has stayed constant during the last five years, 14.9 percent report that their revenue has declined, while 29.8 percent expressed that revenue had increased.

CHANGE IN PRACTICE REVENUE DURING THE LAST FIVE YEARS

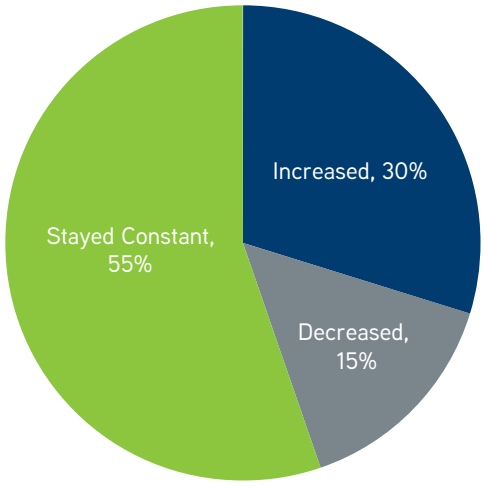


Figure 18

TODAY, ROUGHLY 440,000 FARMS PRODUCE 85 PERCENT OF ALL U.S. AGRICULTURAL OUTPUT AND THIS IS DOWN FROM NEARLY 6 MILLION FARMS IN THE 1930s.

Of those who have experienced an increase in their gross revenue, 47.2 percent said the increase in revenue was between 1 percent and 10 percent (Figure 19). Roughly one-fifth have seen an increase of 20 percent or more during the last five years.

RATE OF INCREASE IN LOST PRACTICE GROSS REVENUE IN PREVIOUS FIVE YEARS

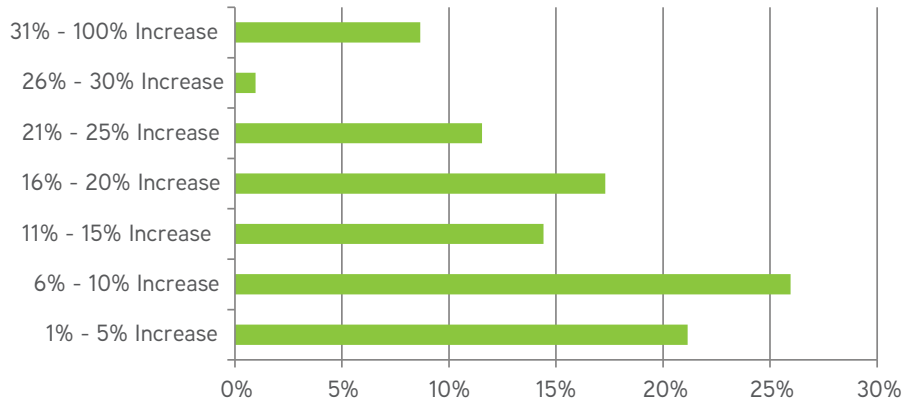


Figure 19

Besides parallel services providers, another factor that might affect food animal and rural veterinary salaries is one that is known to have an adverse impact on local businesses and economies throughout rural America. Today, roughly 440,000 farms produce 85 percent of all U.S. agricultural output and this is down from nearly 6 million farms in the 1930s. This increasing concentration in agricultural production has enabled large farms to buy inputs in bulk at lower prices from central markets (pecuniary economies) rather than local markets, a change that has trimmed rural communities' of population and supporting businesses.

The fewer and larger food animal producers are often of a sufficient size to have employees who perform reproductive services, vaccinations, deworming and parasite control and other services that smaller operations once purchased exclusively from the local veterinarian. While these large operations continue to need emergency veterinary medical services, there is often an insufficient quantity of these services demanded to enable a veterinary business to locate in a small community and be economically viable. Many of the small farms belong to retirement or lifestyle owners who have not engaged in production agriculture as a profession and typically need more services per animal to assist with their production activities than do the professional producers. To this extent, the demand for veterinary services may be tied to the average herd size in a business area and the hypothesis is that the larger the herd size, the fewer the services per animal.

Table 12 displays the results of a regression analysis that sheds light on the effect of herd size on the income of bovine veterinarians. This estimated equation includes standard variables that are known to be correlated with veterinarian incomes, including variables on demographics and work characteristics. The estimated equation also includes variables of particular interest to bovine veterinarians, such as the number of minutes spent per call, the number of non-veterinarian service providers in the area, and the estimate of herd size elicited from the survey respondents.

The variables of interest are those measuring the number of animals: population of dairy cows, population of cow-calves, population of stockers, population in feedlots, and population of small ruminants. At the 10 percent level of significance, each of these variables, except the population of small ruminants, is statistically significantly associated with bovine veterinarians' income. Larger herds of dairy cows, cow-calves and feedlot animals tend to increase veterinary compensation, while larger herds of stockers tend to decrease compensation.

These findings fail to lend evidence to the hypothesis that larger herd sizes are associated with fewer veterinary services provided per animal. Larger numbers of animals in the business area are associated with increases in income, with the exception of stocker cattle. The data did not allow for a determination of variations in services per animal with changing herd sizes. Also, recall that a veterinarian's average call time may be higher than that of another because the number of services per animal is higher, the number of animals treated is greater, or the distance travelled is further. This regression shows that there is no discernable relationship between the average number of minutes per call and income.

Also important in this income regression are the number of years of experience and gender. AABP district, board certification, number of minutes spent on a call, and the number of competing non-veterinary service providers had no statistically significant impact on income. Male bovine veterinarians tend to make about 77 percent more than female bovine veterinarians. Also, consistent with trends in other professions, income generally increases with the number of years of experience, up to a maximum at 28 years of experience, and then slowly declines after that point.

EFFECT OF HERD SIZE ON BOVINE VETERINARIANS' INCOME				
Variable	% Change*	Parameter Estimate	Std. Error	Pr > |t|
Intercept		9.55034	0.68641	0.00010
Number of years since DVM (1)	2.80360%	0.02765	0.01174	0.02030
Quadratic term of (1)	-0.04920%	-0.00049	0.00023	0.03500
Log (# of Hours per week)		0.32464	0.16236	0.04810
Respondent is board Certified (YES = 1)		-0.30248	0.26139	0.24980
Gender (Male = 1, Female = 0)	77.05670%	0.57130	0.14406	0.00010
Log (# of minutes per call)		0.04859	0.06436	0.45200
Log (# of non-vet service providers)		0.00636	0.03712	0.86420
Population of dairy cows in the area	0.00010%	0.00000	0.00000	0.05470
Population of cow-calf in the area	0.00040%	0.00000	0.00000	0.01700
Population of stocker in the area	-0.00100%	-0.00001	0.00001	0.05360
Population of feedlot in the area	0.00000%	0.00000	0.00000	0.01830
Population of small ruminants in the area		-0.00001	0.00001	0.11100
District 2		-0.10556	0.18998	0.57960
District 3		-0.38251	0.23419	0.10530
District 4		-0.18083	0.18760	0.33730
District 5		-0.08718	0.15278	0.56940
District 6		-0.05544	0.18407	0.76380
District 7		-0.24673	0.21570	0.25520
District 8		0.00551	0.21988	0.98000
District 9		-0.16703	0.20476	0.41650
District 10		0.28167	0.23393	0.23120
District 11		-0.06135	0.19009	0.74750

Table 12

**percent change was calculated for parameters that are statistically significant at 10 percent significance level.*

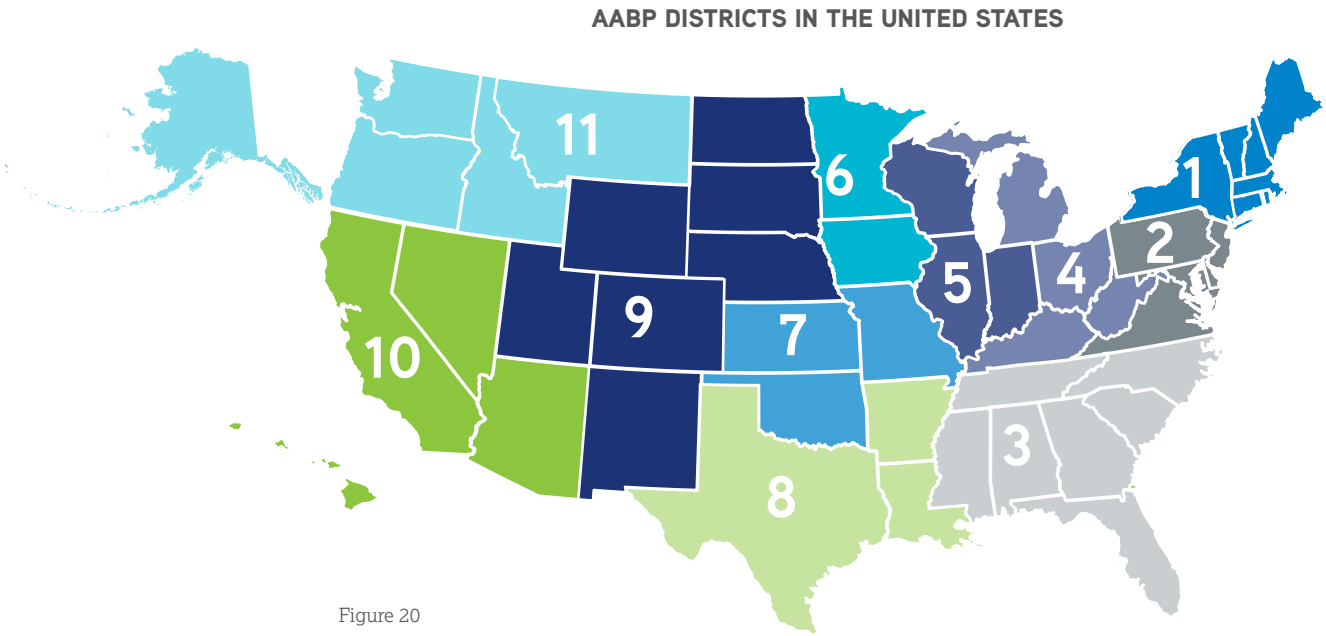


Figure 20

EQUINE VETERINARY SERVICES

The market for equine veterinary services is highly specialized, with veterinarians typically undergoing years of post-graduate training. In 2016 the AVMA VED collaborated with the American Association of Equine Practitioners (AAEP) to conduct a focused survey of U.S. equine veterinarians. The purpose of this survey was many-fold, but was partially to understand the unique problems facing equine veterinary practices.

Equine veterinary practice accounts for less than 5 percent of all veterinary practice types in the veterinary medical field. Veterinarians identifying as working with equids, whether in an exclusively or predominantly equine practice, or in a mixed animal practice, are a minority in the profession. Trends in the equine industry, and thus in the equine veterinary industry, were mostly negative in the years following the recession of 2008. Based upon AVMA data, the U.S. horse pet population is estimated to have declined by 33 percent between 2006 and 2012, and the horse population on farms that reported at least $1,000 in annual sales decreased by 10 percent. Additionally, equine veterinarians saw a 6.7 percent reduction in annual income during that same period. In contrast, companion animal exclusive veterinarians, gained a 22.7 percent increase in annual income during the same period. Gathering data about the current state of the equine veterinary industry through the AVMA-AAEP 2016 Survey of Equine Practitioners will allow stakeholders to make informed and more directed efforts to strengthen the profession.

This study of the economics of equine practitioners is a joint effort of the AAEP and the AVMA to gain an understanding of common and unique attributes of equine practices and practitioners compared to the general veterinary profession and to identify challenges facing the profession so that these issues can be addressed with maximal effect.

The forthcoming *American Association of Equine Practitioners Economic Report 2017*, includes information on demographics, the market for veterinary education, the market for veterinarians, the market for veterinary services, a portrait of equine veterinary practice, and an analysis of the impact of equine practices on economic activity in the United States.

EQUINE PRACTICE CHARACTERISTICS

Among AAEP respondents, a large share of respondents (36.5 percent) provides ambulatory or mobile services only (Figure 20). Ambulatory with a haul-in facility compromise 35.4 percent of the distribution. On the opposite end of the spectrum, respondents primarily working in a haul-in facility were only 1.3 percent, and 1.7 percent were in a full-service specialty/referral hospital.

DISTRIBUTION OF AAEP RESPONDENTS' 2015 PRIMARY PRACTICE BUSINESS MODELS

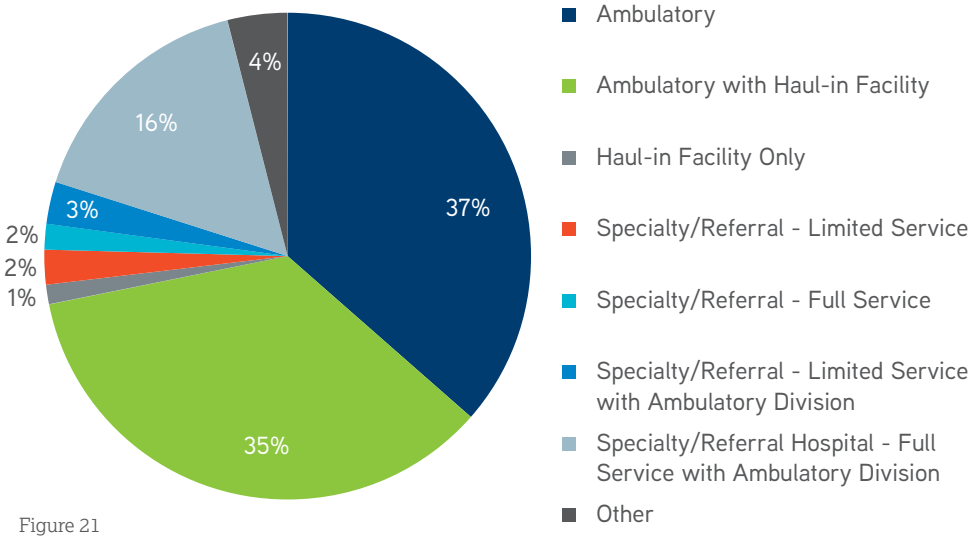


Figure 21

As with the bovine practitioners, the equine practitioners have various methods of billing with the preponderance of AAEP respondents (91.9 percent) charging a farm call or trip fee and 89.4 percent of respondents charging an emergency fee.

The method of billing for ambulatory calls varies across equine sector. Charging ambulatory visits by zones is the most common form for ambulatory billing among AAEP respondents in the hunter/jumper (76.5 percent), companion (62.5 percent), and general equine practice (68.3 percent). According to the AAEP group, only a small percentage charge one-way or round-trip for ambulatory calls. Just more than 31 percent of western performance respondents and 44.4 percent of ranch/working sector respondents charge based on mileage.

DISTRIBUTION OF AAEP RESPONDENTS' BILLING OF AMBULATORY FARM CALLS BY EQUINE SECTOR

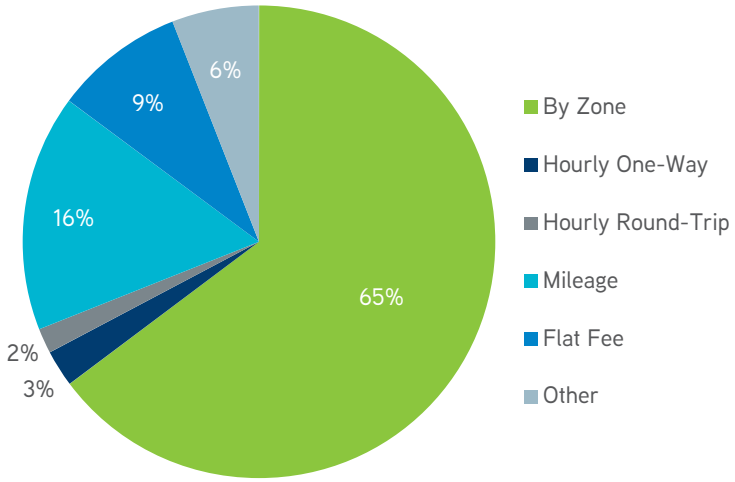


Figure 22

AAEP respondents primary practice service area covered anywhere from a zero-mile radius to a 2,500-mile radius. Nearly a third of respondents' service area was between a 21- and 40-mile radius, and 38.6 percent between 41- and 60-mile radiuses (Figure 23). Overall, the majority of AAEP respondents service area was estimated at between 0 and 60 miles, with the remainder, 22.6 percent, with a service area covering over 61 miles. Respondents in the Thoroughbred sector on average serve the largest area, 179 miles, followed directly by respondents in the ranch and working horse industry, with a 137-miles radius (Table 5.13). Respondents in the companion sector have an average service area of 45 miles. Respondents in a full-service specialty/referral hospital on average have the smallest radius among the AAEP group of 52 miles (Table 13). Respondents in some other type of business model have a service area on average of 177 miles. The majority of the respondents in this other category identified themselves as racetrack veterinarians or working in integrative therapy.

DISTRIBUTION OF AAEP RESPONDENTS' PRIMARY PRACTICE SERVICE AREA RADIUS

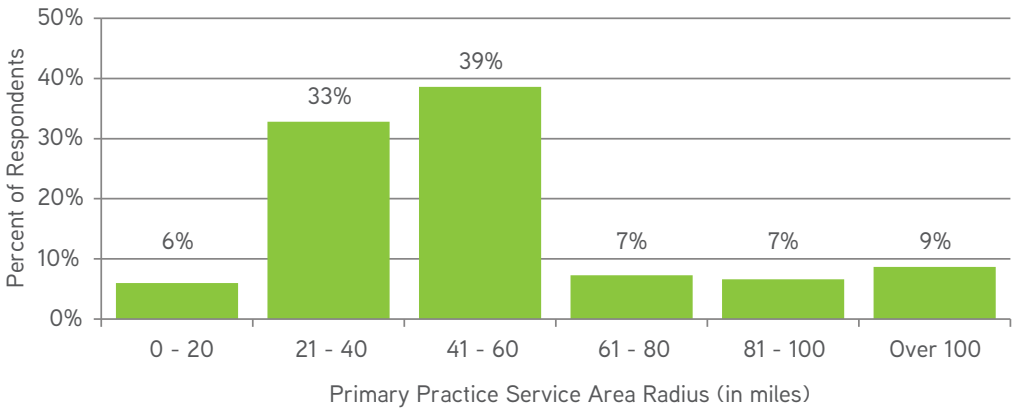


Figure 23

The ambulatory equine practitioner spends considerable time on the road, with 47 percent of AAEP respondents indicating mileage of 25,001-50,000 miles a year, followed by 29 percent travelling between 12,501 and 25,000 miles a year. Of AAEP respondents in the Standardbred industry, 71.4 percent travel between 25,001 to 50,000 miles a year, and the majority (more than 75 percent) of respondents in any equine sector travel fewer than 50,000 miles a year. Respondents' miles travelled per year by business model show that 63.6 percent of respondents in a limited-service specialty/referral hospital and 71.4 percent in a haul-in facility travel up to 12,500 miles a year. More than 30 percent of AAEP respondents in another type of business model travel more than 50,000 miles per year. These respondents reported being a racetrack veterinarian or in integrative therapies.

MEAN OF AAEP RESPONDENTS PRIMARY PRACTICE SERVICE AREA RADIUS (IN MILES) BY BUSINESS MODEL

	Obs.	Mean	Std. Dev.	Min	Max
Ambulatory	193	76	188	1	2,500
Ambulatory with haul-in facility	184	58	45	10	400
Haul-in facility only	7	66	65	0	180
Specialty/referral hospital - Limited service	10	87	101	5	300
Specialty/referral hospital - Full service	9	52	25	15	100
Specialty/referral hospital - Limited service with ambulatory division	15	99	109	30	400
Specialty/referral hospital - Full service with ambulatory division	82	56	45	20	300
Other	19	177	306	1	1,000

Table 13

PARALLEL SERVICE PROVIDERS

Just like the bovine practitioners, equine veterinarians face competition from parallel service providers who focus on the more routine tasks of animal care. There are many types of non-veterinarian provided services such as dentistry, podiatry, sports medicine, integrative therapies, reproduction, and pharmaceutical services that were once deemed the sole market of veterinarians. These non-veterinarian providers of veterinary services are referred to as "parallel providers." The AVMA investigated the potential effect of parallel veterinary service providers on both practice revenue and the income of veterinarians for equine practices.

Equine veterinarians were asked to identify the potential competitors who have adversely affected their practices. More than 84.7 percent of the AAEP respondents have lost business to parallel service providers. Nearly a quarter (23.1 percent) of equine practices provide seasonal services in other locations or other states, and 86.4 percent of this group have had parallel providers move in on their business, whereas 13.6 percent of seasonal service providers have not seen decreased revenue from parallel providers.

The primary type of parallel services that AAEP respondents think reduces their practice revenue stream consists of dentistry at 62.5 percent, with internet pharmacies coming in at 55 percent; 11.1 percent indicated that services were impacted by university staff at university hospitals or at satellite locations.

IMPACT OF PARALLEL VETERINARY SERVICE PROVIDERS ON EQUINE PRACTICES

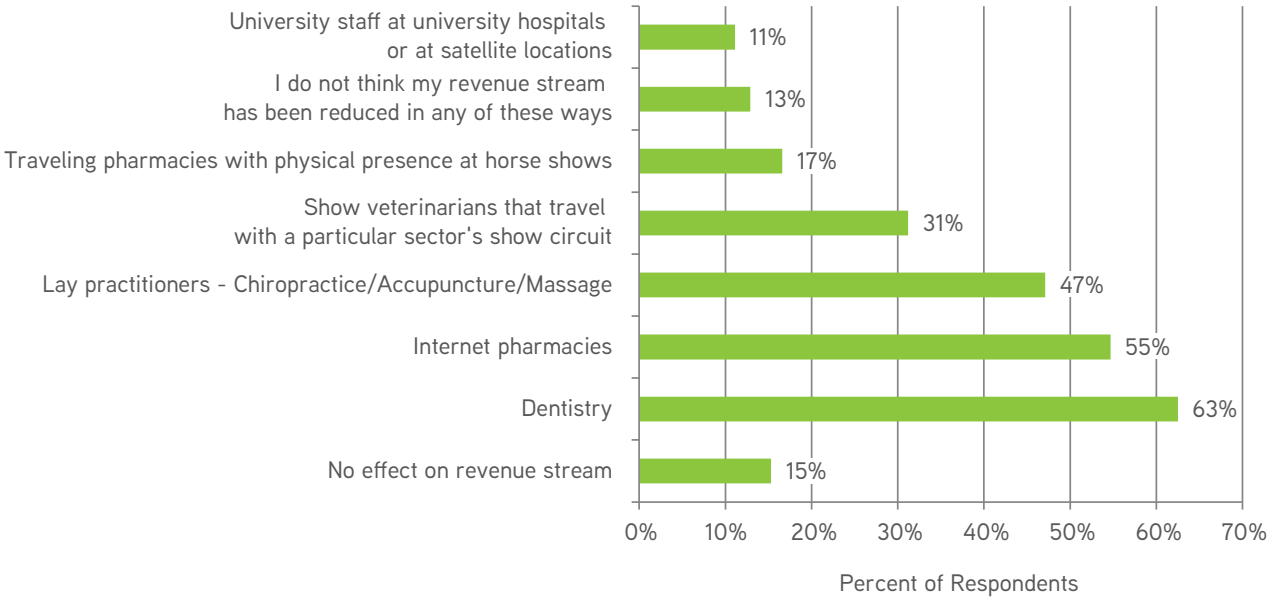


Figure 24

AAEP respondents face competition not only from parallel service providers, but also from other veterinarians within their service area. AAEP respondents reporting one to 10 other equine veterinarians in their service area comprised 26.5 percent, followed by 23.6 percent for both 11 to 20 veterinarians and 21 to 30 veterinarians. Only 1 percent of respondents did not perceive any competing veterinarians.

DISTRIBUTION OF THE NUMBER OF COMPETING EQUINE VETERINARIANS IN RESPONDENT'S SERVICE AREA

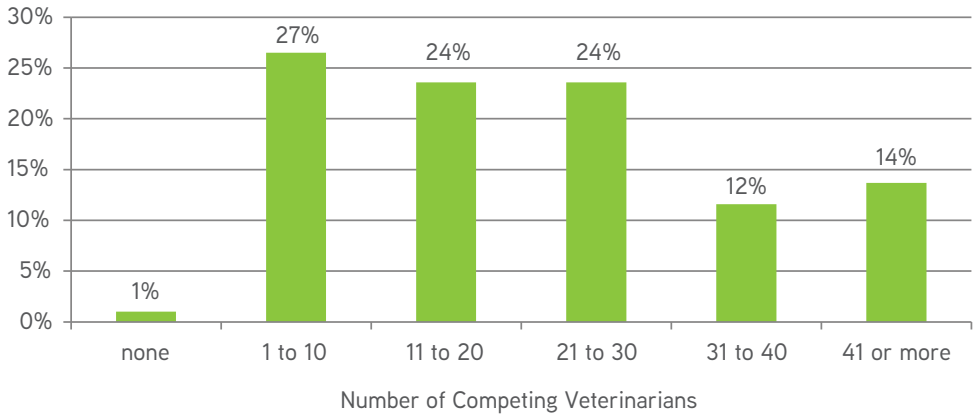


Figure 25

LABORATORY ANIMAL VETERINARY SERVICES

In the past 100 years, the laboratory animal veterinary (LAV) specialty has grown considerably. Today more than 2,000 laboratory animal veterinarians are practicing nationwide. Their ultimate goal is to ensure that animal health and welfare are maintained in scientific environments. The demand for laboratory animal veterinarians depends on the number of veterinary schools producing candidates for the specialty certification and on the number of biomedical research institutions, the largest consumer of laboratory animal veterinary services, needing these professionals.

In the market for veterinary services, demand for veterinary services comes from both private and public sources. A recent in-depth study was recently conducted between the AVMA, the American College of Laboratory Animal Medicine (ACLAM) and the American Society of Laboratory Animal Practitioners (ASLAP). Laboratory animal veterinarians are a highly specialized group. The lab animal practitioner and other public practice veterinarians are a difficult practice type to analyze in the market for veterinary services because they do not conduct financial transactions. Whereas a common approach among private practice veterinarians is to compensate based on production, or a combination of a base salary with a production component, public practice veterinarians do not have production metrics as readily and frequently available to gauge the demand for their services. Rather, the demand for public practice veterinary services can more easily be measured with other metrics. In this case, the balance between supply and demand in the upstream market for veterinary services will determine the quantity and income of veterinarians. As such, one way to measure the demand for their services is through income. To this end, the salaries of laboratory animal veterinarians are examined as an indicator of the health of their specialized market for veterinary services.

LABORATORY ANIMAL VETERINARIAN MEAN SALARY TREND

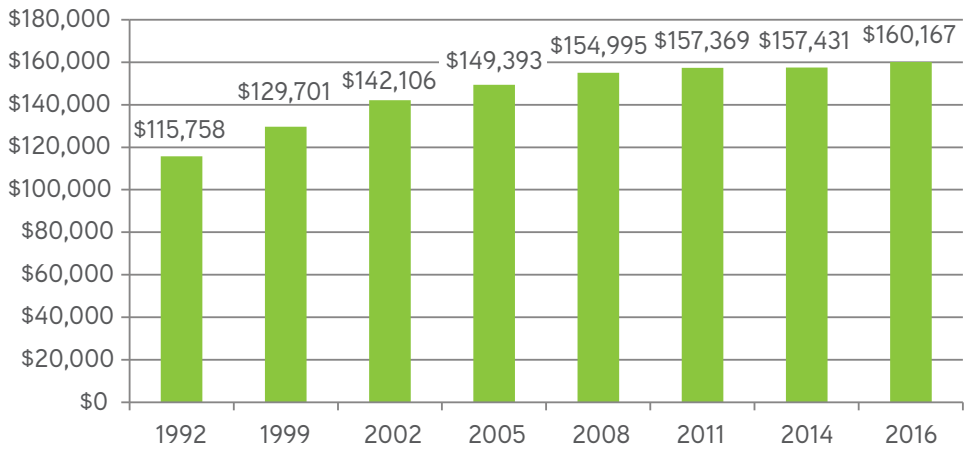


Figure 26

Laboratory animal veterinarians are among the best paid veterinarians in the United States due to the high demand for their services. The average annual professional income of laboratory animal veterinarians is well above the average income of most veterinary practitioners. This high income relative to other practice types provides a continued economic incentive to pull students and practitioners toward the LAV specialty until the demand and supply of laboratory animal veterinary services reaches equilibrium and the income of lab animal practitioners returns to a level in line with other practice types. With the continuous entry of new consumers into the market for LAV services, demand will shift up along the supply curve creating an upward trend for price. Each new business that requires research animals generates additional demand for LAVs that must be filled. The income for laboratory animal veterinarians has been consistently higher than all other veterinary professionals, indicating that the growth in the demand for LAV services has exceeded the growth in supply of LAVs, especially compared to all other segments of the veterinary profession.

The trend in professional income was determined based on the information collected from the historical salary surveys of laboratory animal veterinarians (2014 Report) and the 2015

ACLAM/ASLAP Compensation Survey. The salary survey of laboratory animal veterinarians is conducted every three years by a subcommittee representing both ACLAM and ASLAP and aims to assess the annual professional income of laboratory animal veterinarians working in the United States. For the purpose of comparison, for the *ACLAM/ASLAP Economic Report 2017* (available through the AVMA) the nominal incomes were converted into real dollar incomes, with 2010 used as the base year.

Lab animal veterinarians are employed in many areas of the public sector (including industry/corporations), and the difference in salary is displayed in Table 14. Those in industry have the highest mean salary, followed by self-employed consultants.

LABORATORY ANIMAL VETERINARIAN SALARY BY TYPE OF EMPLOYER, 2015

	Mean	Std. Dev.	1st Quartile	Median	3rd Quartile
Academia	$158,179	$60,815	$110,000	$150,000	$195,000
Industry	$203,884	$85,323	$141,500	$180,000	$260,000
Government - Civil Service	$151,525	$34,435	$122,000	$158,000	$176,000
Government - Uniformed Service	$140,460	$25,034	$120,000	$144,650	$165,000
Not-For-Profit Organization	$165,312	$68,390	$120,500	$146,000	$203,500
Self-Employed Consultant	$189,871	$81,217	$114,487	$215,000	$260,000
Other Employment	$150,092	$44,590	$117,000	$152,000	$170,000

Table 14

Experience plays a major role in salaries, with those who have practiced as LAVs for 30 or more years attaining an income of nearly $200,000, on average, per annum.

LABORATORY ANIMAL VETERINARIAN SALARY BY YEARS OF EXPERIENCE, 2015

	Mean	Std. Dev.	1st Quartile	Median	3rd Quartile
1 - 9 years	$113,297	$30,578	$98,000	$112,000	$126,000
10 - 19 years	$135,957	$38,071	$107,000	$130,000	$160,000
20 - 29 years	$181,786	$73,428	$128,000	$170,096	$210,000
30 - 39 years	$198,121	$60,009	$163,000	$190,000	$228,638
40 - 49 years	$209,175	$51,658	$171,000	$210,000	$227,000
50 years and over	$216,800	$94,906	$188,000	$230,000	$230,000

Table 15

Lab animal veterinarians have consistently enjoyed the highest level of salaries of any of the practice types studied. This high salary is indicative not only of their relatively high level of training, but also of their relative scarcity compared to veterinarians of other practice types.

LABORATORY ANIMAL VETERINARIANS ARE AMONG THE BEST PAID VETERINARIANS IN THE UNITED STATES DUE TO THE HIGH DEMAND FOR THEIR SERVICES.

VETERINARY PRODUCTS DEMAND AS A LEADING ECONOMIC FACTOR

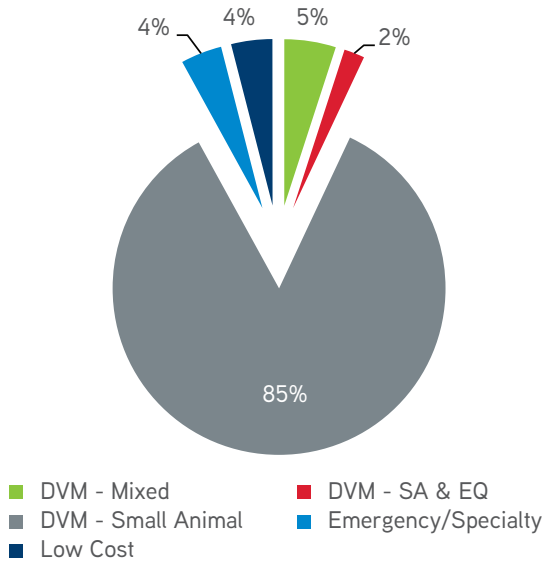
Approximately 30 percent of the revenue in veterinary practices is from the sales of pharmaceutical products.

Approximately 30 percent of the revenue in veterinary practices is from the sales of pharmaceutical products. At the 2016 AVMA Economic Summit an overview of the veterinary product markets was presented by Dr. Travis Meredith of Animalytix, a public clearinghouse for sales-aggregated industry market share information. Animalytix has a comprehensive database of nearly $60 billion in animal health product sales of vaccines, pharmaceuticals, nutraceuticals and veterinary supplies from more than 500 manufacturers. The database of animal health products has been developed through a partnership between Animalytix and leading animal health distribution companies and selected manufacturers. The animal health product market can be analyzed geographically for more than 8,500 brands on a weekly or monthly basis.

The animal health product supply data may be used to provide a profile of the current market, insight into macro trends within the companion animal market, and as a leading Indicator of industry changes, representing both opportunities and challenges.

The concentration in the market for veterinary services can be measured with the product supply data. A veterinary consumption index (VCI) is developed using a constant "market basket" of items to measure the market share of various types of veterinary practices, such as small animal, mixed animal, emergency/specialty and low-cost. Based on the VCI, 85 percent of the market for veterinary services is estimated to be associated with companion animal medicine.

ANIMALYTIX VETERINARY CONSUMPTION INDEX



What's In The Basket
Needles
Sutures
Syringes
White Goods
Fluids
Human Labeled Pharmaceuticals (Generics)
Euthanasia Products
Others

What's Not in the Basket
Canine Vaccines
Feline Vaccines
Flea & Tick Products
Heartworm Preventative Products
Other pharmaceuticals influenced by regional or seasonal epidemiology.

Figure 27

The VCI can also be used to evaluate the concentration (size and quantity) of veterinary practices in the market. Animalytix has identified 28,641 unique locations for delivery of animal health products. The largest practices (largest purchases of products) represent 5.9 percent of the total but 25 percent (Tier 1 or first quartile) of all product purchases. The second quartile contains 13.2 percent of all practices and thus, less than 20 percent of the practices account for 50 percent of the product market. The smallest group, Tier 4, comprises nearly 60 percent of practices and only 25 percent of the product market.

THE ROLE OF ENTITY SIZE AND THE IMPACT ON MARKET DISPARITY

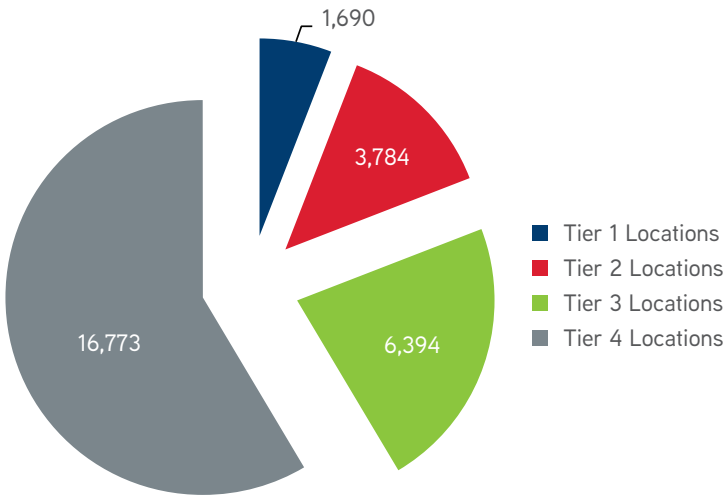


Figure 28

The VCI can also be used to identify variations in performance between markets. Measuring the percent change in the volume of sales for specific metropolitan markets provides an indication of the change in demand for veterinary services. This is an important measure and can help guide the Metro Market Demand surveys to determine what metro market to examine to understand how the national market is affected, and the factors that affect it, by the difference in demographics between geographic areas.

VCI DYNAMICS BETWEEN MAJOR MARKETS

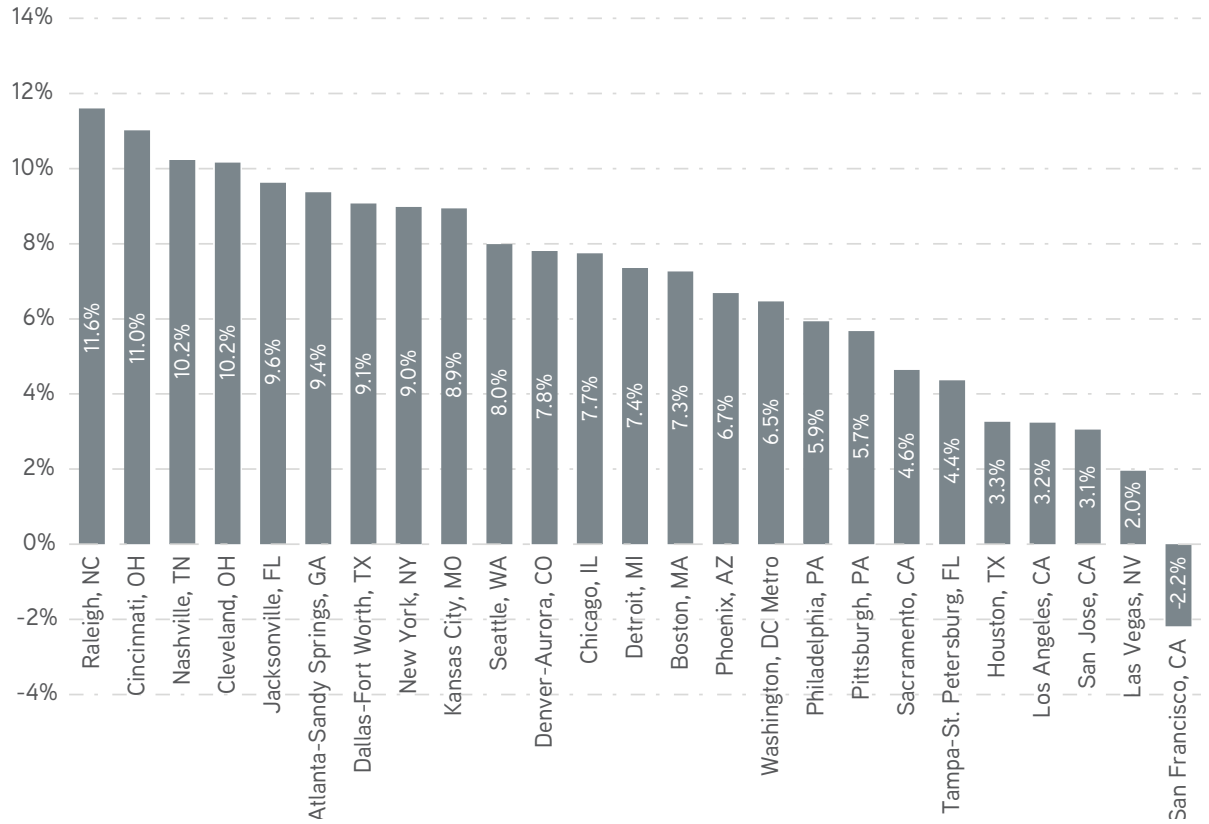
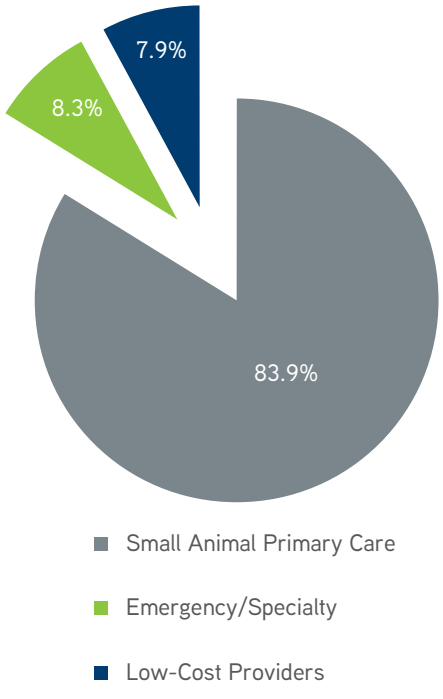


Figure 29

The analysis of the product market can also be used to evaluate changes in specific practice profit centers. For instance, inhalant anesthetics can provide a useful indicator for surgical and dental activity. Inhalants are used specifically for advanced procedures requiring patient anesthesia, are consumed in unit increments and are utilized on an as-needed basis across the operational year. Use by practice type provides an indication of where surgeries and dentals are being most performed and how that market share is changing over time. By examining the share of inhalants as an average of the number of practices in each practice type, low-cost providers can be seen to be using twice as much inhalant, and emergency/specialty practices 2.5 times as much inhalant as small animal primary care practices.

INHALANT ANESTHETIC CONSUMPTION AS A LEADING INDICATOR FOR SURGERY SUITE ACTIVITY & PER-LOCATION INHALANT CONSUMPTION DYNAMICS, 2013-2016

INHALANT ANESTHETIC CONSUMPTION AS A LEADING INDICATOR FOR SURGERY SUITE ACTIVITY



PER-LOCATION INHALANT CONSUMPTION DYNAMICS, 2013-2016

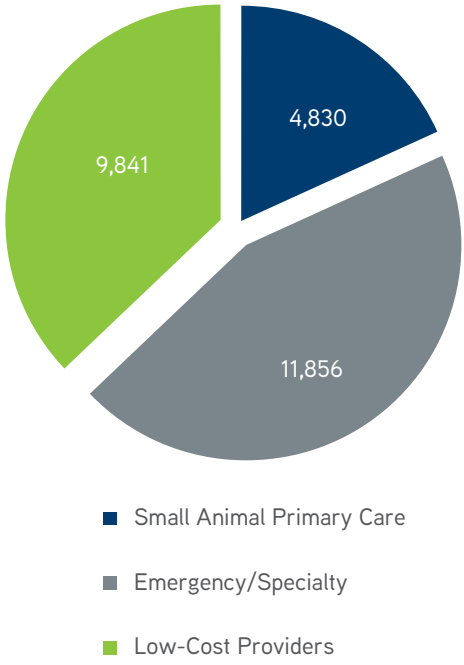


Figure 30

The product information is extremely valuable and will provide an insight into the veterinary services market, geographically, by profit center and for various animal health challenges. Coupled with the MMDs and the PDS, the profession can begin to build a more comprehensive picture of the market for veterinary services and better evaluate the factors that are the most important drivers of change.

MEASURING THE PERCENT CHANGE IN THE VOLUME OF SALES FOR SPECIFIC METROPOLITAN MARKETS PROVIDES AN INDICATION OF THE CHANGE IN DEMAND FOR VETERINARY SERVICES.

PET HEALTH INSURANCE AND VETERINARY EXPENDITURES

Higher income for a household is strongly correlated with an increased probability of visiting a veterinary clinic.

A persistent question in the veterinary profession is whether pet health insurance (PHI) increases the demand for veterinary services from individual pet owners. Unfortunately, there is no published statistically valid literature that addresses this question. There have been studies that have noted an association between higher levels of pet owner expenditures and pet health insurance, but these analyses fail to control for confounding factors. A higher income individual is probably more likely to have pet health insurance compared to a lower income individual, for example, and those higher income individuals are likely to spend more on veterinary care than are low-income individuals. And, pet owners with greater human-animal bond will spend more on animal health care. Thus, the cohort of pet owners who have pet health insurance may be those with a higher propensity to purchase pet health care services.

If the social sciences were conducted exclusively in laboratories in conditions under which human behavior could be perfectly controlled, then economists wouldn't need statistical methods beyond calculating means to measure human behavior. Think about the perfect experiment to determine the effect that pet health insurance has on consumer behavior. In that experiment economists would randomly find an individual pet owner without pet health insurance, and carefully observe her purchases of veterinary services over the course of a year. At the end of the year the analysts would go back to the beginning of the year and instead provide this person with pet health insurance, observing and noting any differences in her behavior regarding the purchase of veterinary services.

Unfortunately social scientists cannot control for all possible factors in a laboratory, so they use statistical techniques as the next best method. These statistical techniques, typically some version of ordinary least squares multiple regression analysis, associate and quantify characteristics of individuals. For example, previous research has shown that pet owners who consider their pets to be members of the family are less price sensitive than those who consider their pet to be property. Similarly, higher income for a household is strongly correlated with an increased probability of visiting a veterinary clinic.

A statistic that has been repeated many times, and is easy to demonstrate, is that pet owners with pet health insurance visit veterinary clinics more often and spend more money and visit veterinary practices more times in a year than do pet owners who do not have pet health insurance. But many factors specific to the animal, consumer and veterinarian affect the services purchased by an individual. The only way to determine the independent effect of insurance on consumer behavior is to control for the individual characteristics that could affect purchases of both veterinary care and pet health insurance. Some notable examples of these factors are household income and measurements of attitude, such as how the survey respondent values preventative care. Two alternatives exist, the first of which is to collect a large enough set of observations of pet health care decisions by owners with and without pet health insurance. To get close to comparing the same pet owner's decisions with and without pet insurance the data would compare similar pet types, ages and health as well as pet owners' socio-economic characteristics.

AVMA partnered with Mississippi State University (AVMA-MSU study) in 2014 to begin the process of evaluating the effect of pet health insurance on the demand for veterinary services. The AVMA-MSU study did indeed find that pet owners with insurance spend more on the pet, not only on veterinary care, but also on other expenses such as entertainment, food and boarding. This comparison of means is displayed in the following chart.

AVERAGE EXPENDITURES WITH AND WITHOUT PET HEALTH INSURANCE

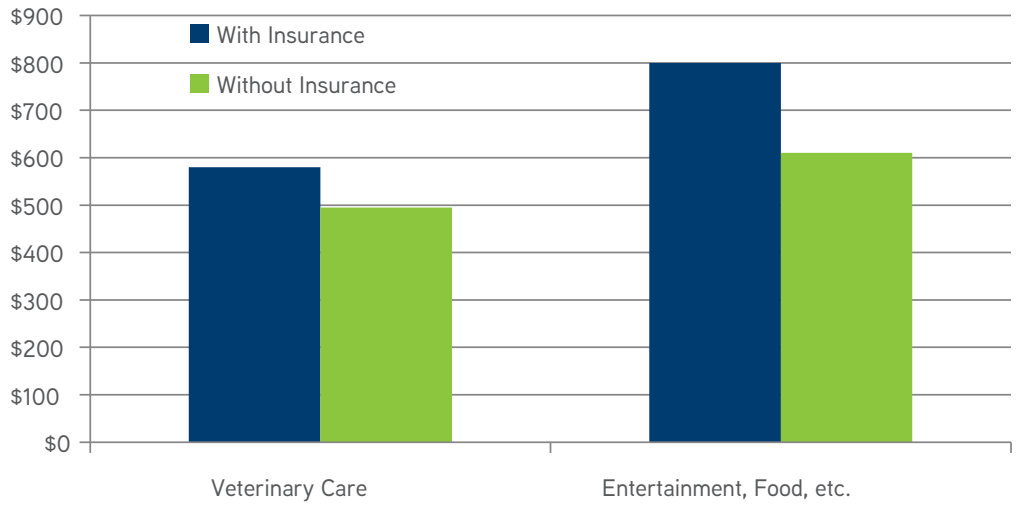


Figure 31

Pet health insurance protects owners against rare, potentially catastrophic events where the life of the pet may be in jeopardy. For a specific person over a specific time period, these events are relatively rare. Furthermore, pet health insurance is not widespread in the United States, with a market penetration of only about 3 percent of pet owners. Because of these two facts, even a large survey of random pet owners would only pick up a few responses from individuals who recently made use of their pet health insurance policy.

One interesting aspect of pet health insurance is that veterinarians have reported that, given a possible set of choices, pet owners with PHI tend to choose the more expensive options. In order to mimic this set of choices, the AVMA-MSU survey asked respondents to choose between a hypothetical set of alternatives with different costs and recovery options associated with each. From the four choices, the survey respondents with insurance were much more likely to pick more expensive treatment options than were those respondents without insurance. Furthermore, the choice of euthanasia (at a cost of $100) was reduced from 31 percent to 3 percent through the election of the emergency survey and thus not only were current expenditures increased but future expenditures would also increase through the increase in the lifespan of the pet.

CLIENT WILLINGNESS TO SPEND WITH AND WITHOUT PET HEALTH INSURANCE

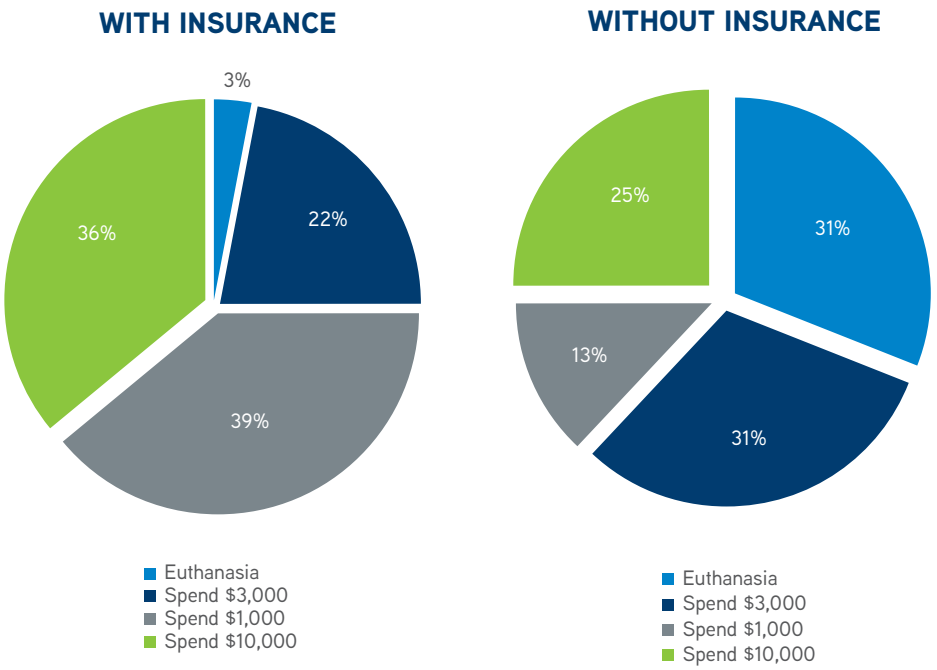


Figure 32

These results were based on a preliminary set of data, not the full set of survey respondents. Additional information will be released as the study develops, and the full set of control variables is determined.

PUBLIC HEALTH VETERINARY EXPENDITURES

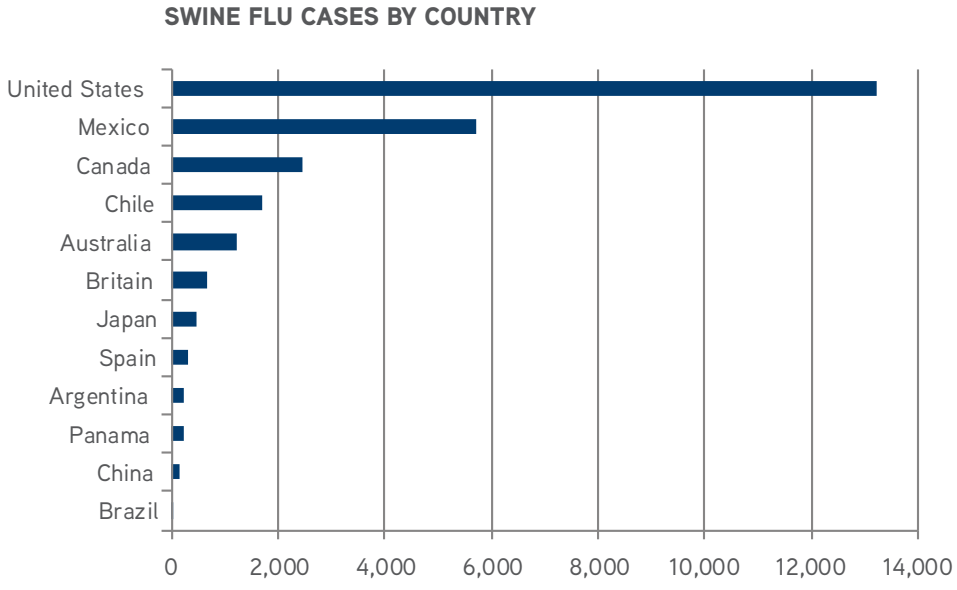
A growing body of literature suggests that animal diseases are burdens to households, regions, countries, and society in general.

The public practice of veterinary medicine includes public health services such as monitoring and managing food safety and zoonotic diseases. A growing body of literature suggests that animal diseases are burdens to households, regions, countries, and society in general. The world population has doubled since 1960 and continues to grow, with nearly 1 billion people added every 13 years. Food insecurity and malnutrition remain persistent world problems.

ZOONOTIC DISEASES

The potential havoc wreaked by zoonotic diseases is an ever-present problem facing public health in the United States and the world at large. Consider that 60 percent of all infectious diseases are zoonotic (Taylor et al. 2001) and 15 of the 35 leading communicable causes of death are zoonotic in nature. Zoonotic diseases adversely affect human health both through negative consequences to livestock and direct effects on human health.

The primary commodities feeding into the global production of food are crops and livestock. Four livestock and livestock products are ranked by value among the top 10 commodities produced in the world. Animal diseases reduce both the quality and quantity of these four livestock products, reducing the availability of protein for the human diet.



Source: World Health Organization

Figure 33

Because the monitoring and managing of zoonotic diseases is a public veterinary service, the determination as to the number of veterinarians required is a decision for state and federal governments. To ensure that there is an adequate quantity of these public veterinary services provided, governments need the best information on the trade-offs between the costs of prevention and the costs of treatment. More specifically, what are the avoided costs of zoonotic disease outbreaks versus the expenditures required to ensure that avoidance? And, this estimate of benefits (cost avoidance) to costs of adequate monitoring and management should be made for all potential zoonotic disease outbreaks rather than for each individual potential outbreak as many of the potential zoonotic diseases have similar geographical origins.

AVMA VED is cooperating with the Paul G. Allen School for Global Animal Health and the School of Economic Sciences at Washington State University on research intended to develop a process for measuring the costs of zoonotic diseases and determining a level of monitoring and management that would maximize the benefit/cost ratio, and in so doing, calculate the optimum quantity of veterinary services (number of veterinarians) that should be purchased by state and federal governments.

To make this estimate of the expected costs of a zoonotic disease outbreak, two primary classes of components are needed: the probability of an outbreak and a projection of its extent, as well as a calculation of the associated costs and benefits of such an outbreak. For the first component, the epidemiology literature abounds with estimated models of disease outbreak, which include both the probabilities of such events occurring, and the extent of harm to humans and animals expected.

For the second component, a growing field of literature looks at estimating the economic effects of zoonotic disease events. Important in these estimations are the separation between direct costs and indirect costs and benefits. The direct costs arise from the tangible activities related to animal quarantine, surveillance, vaccination, indemnification, euthanasia, and cleaning and disposal, as well as the costs associated with human health. The indirect costs and benefits arise from the effects of price shocks on consumers and producers.

TOP MARKETS FOR U.S. BEEF ($ MILLIONS)				
	Japan	Mexico	South Korea	Canada
2003	$1,182	$623	$754	$309
2004	$31	$393	$2	$105
2005	$50	$584	$3	$194
2006	$105	$786	$4	$415
2007	$294	$737	$124	$576
2008	$439	$895	$291	$683
2009	$495	$770	$215	$622
2010	$662	$669	$504	$731
2011	$873	$791	$661	$1,039
2012	$1,000	$647	$548	$1,189
2013	$1,283	$739	$567	$1,197
2014	$1,419	$943	$824	$1,052
2015	$1,080	$852	$778	$925

Table 16

**BSE was confirmed in a U.S. cattle sample in late December 2003. Before BSE, the countries in this table accounted for more than 90 percent of U.S. beef exports. Sources: World Agricultural Supply and Demand Estimates, National Agricultural Statistics Service and Economic Research Services.*

Just as there are two sides to every coin, even negative events like zoonotic disease outbreaks are associated with economic benefits for some market participants. For example, in the Avian Influenza (AI) outbreak of 2014 in the United States, the market saw the death and destruction of large numbers of animals. The destruction was so large that it affected the market price for eggs and poultry protein. Despite increased security and costs associated with AI testing, the majority of poultry producers were unaffected directly by AI, but instead indirectly benefited through the spike in prices that ensued. This price spike above the long-term market price, then, was actually a boon for the majority of poultry producers. This is not to say that AI was a positive event for all involved, but benefits were realized — they were just distributed unevenly among producers.

A second class of benefits for some producers may come in the form of international trade barriers. In the event of the erection of a trade barrier in response to a zoonotic disease event, some producers stand to gain while others stand to lose. The cases of mad cow disease and foot and mouth disease are good examples of where a handful of countries enacted trade embargoes to bar imports from countries experiencing infections. This effectively increased the domestic price of beef in the countries which enacted the trade embargoes and, in turn, benefited those countries' domestic beef producers at the expense of the rest of the world's producers.

Of course, every transaction has two sides, and if the domestic price of an animal protein is higher, the implication is that consumers must also be paying a higher price, which is counted as a cost. Contrary to expectation, the increase in consumer costs does not necessarily outweigh the increase in producer benefits. Instead, the relative distribution of benefits is determined by the relative price elasticities for consumers and producers. Whether price changes are net positive or negative additionally depends on the availability of substitutes: When consumer preferences between two animal protein sources are more equal, a price shock in one would cause substitution to the unaffected protein source.

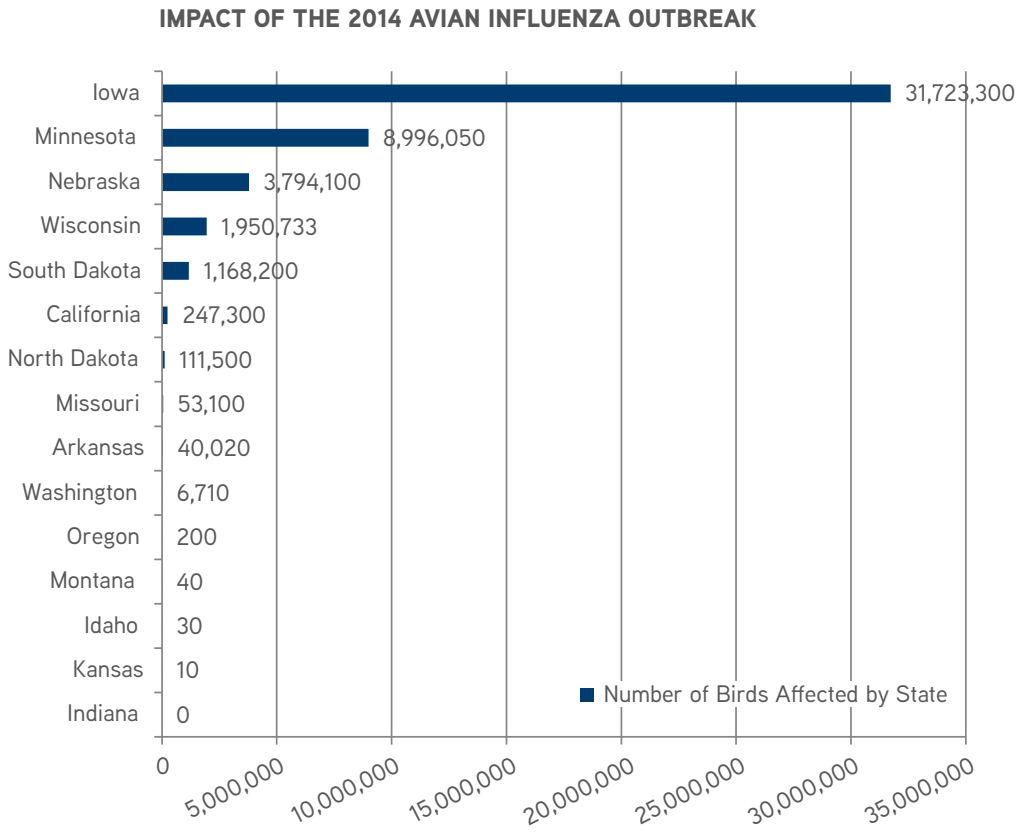
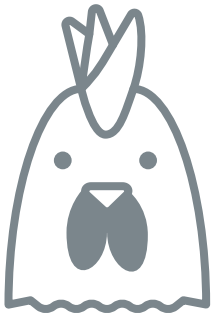


Figure 34

To begin the development of a standard process for measuring benefits and costs, the research began by analyzing the recent avian influenza outbreak. For this specific zoonotic outbreak no documented human health event or costs to individuals occurred. Approximately $879 million, however, was spent on the outbreak and subsequent planning activities (Johnson et al 2016), of which $200 million was spent on indemnity payments and $610 million on response activities on premises. In addition to these costs, poultry producers lost more than $1 billion and consumers paid higher prices for poultry products.



COST OF THE 2014 AVIAN INFLUENZA OUTBREAK	
	($Millions)
Welfare to Producers	$1,000
Indemnity Payments	$200
Response Activities	$610
Other Costs	$69

Table 17

THE HUMAN-ANIMAL BOND

The Human-Animal Bond Research Institute (HABRI) released a study in December 2015 (Clower and Neaves, 2015) detailing its researchers' first best guess at the economic value of companion animals to human health. The report focused on two aspects of human health benefits: the benefits related to reducing the number of physician office visits, and the savings related to obesity treatments. The estimated total savings in the United States for human health care from companion animals was estimated to be $11.8 billion, of which $11.4 billion was from savings related to physician office visits and $0.4 billion was from savings related to obesity treatments.

Beginning in 2016 the AVMA has, in collaboration with the University of Colorado-Boulder, began reviewing all relevant and available original studies about measuring the effect of the human-animal bond. Researchers identified 373 relevant studies using the HABRI central database, and narrowed the field to 151 actual academic studies that were original studies (not reviews, magazine articles, or news stories), written in English and accessible through library resources.

The researchers identified seven broad areas of health that have been studied in papers within the HABRI central database. These seven areas are: walking/physical activity, zoonoses, cardiovascular health, injuries among the elderly (a negative benefit of the human-animal bond), stress, depression, and general psychological wellbeing. As depicted in the Figure 35, the first two categories, walking/physical activity and zoonoses make up nearly half of the studies, with cardiovascular health trailing in third place.

HUMAN-ANIMAL BOND RESEARCH STUDY TOPICS

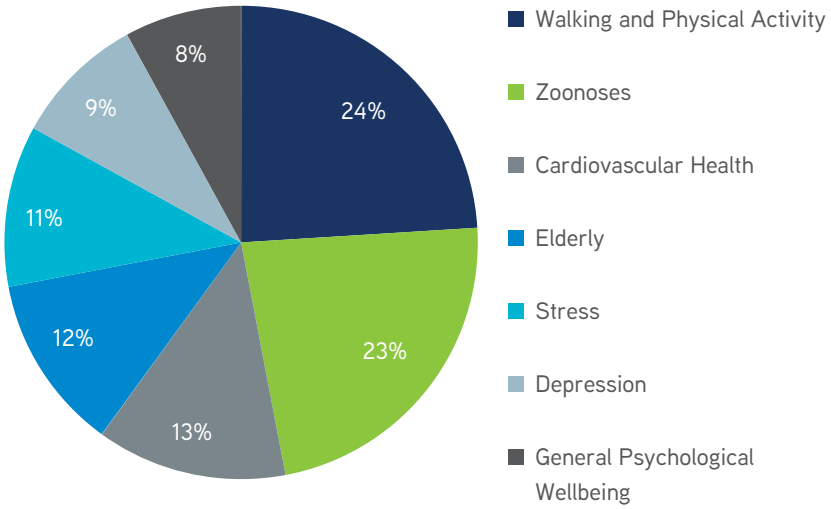


Figure 35

The results were inconsistent across studies. While 72 percent of studies reported a health benefit to the human-animal bond, the remaining 28 percent reported no measurable effect, or a negative effect. These negative effects were primarily contained in the elderly category where the negative effects of companion animals occur through the injury of elderly pet owners.

A number of sampling issues were evident across the studies, in which most samples consisted of a small, select group of individuals — for example, only cardiovascular patients already receiving treatment at a particular hospital. Furthermore, because of the experimental designs and expense involved in monitoring health outcomes, most studies involved small samples, but the studies that involved larger samples were generally less rigorous because they were cross-sectional and therefore only measured correlation, not causation.

STUDIES BY CATEGORY		
	Positive Benefits	Lack of or Negative Benefits
General Physical Health	25	21
Cardiovascular Health	28	5
Psychosocial Health	22	13
Physical Activity	33	1
Other	0	3
Total	**108**	**43**

Table 18

The next step in this research will be to estimate the benefits of animal ownership across each of the seven topic areas by using the best studies from each. Alternately, a simulation study could be performed to study the potential distribution of benefits, given that there is no way to compare or control for factors across these studies, as a simulation could give more insight than would a simpler approach.

VETERINARY PRACTICES

Close to three-quarters of the U.S. active veterinarian workforce are employed by private practices.

Estimates of veterinary practices in the United States vary between just over 28,000 and nearly 32,000 depending on the source of information. The process to determine the actual number of veterinary practices by AVMA's VED is still evolving and will consider the data from the AVMA's veterinary database, various industry estimates such as that presented above by Animalytix, the U.S. Census of Services, the American Consumer Survey, the Bureau of Labor statistics on veterinary employees, and the general accounts tabulated within the NAICS Veterinary Services segment for the national accounting of GDP (IMPLAN). This calculation process estimates that there were 31,830 businesses that provided veterinary medical services in 2016 and employed (including owner-operators) 75,754 veterinarians.

More important than the number of practices and veterinarians who work in them, is the financial performance of these practices and the factors that are important in determining how well they are performing. For this, there is no national data. One of the major challenges in obtaining national data from across veterinary practices to develop a performance KPI has been the absence of a standard chart of accounts (COA) for veterinary practices. Each practice aggregates the individual product and services into costs and revenue categories; practices, too, might manage assets as part of the practice or as a separate business. Practices also differ in whether they use book value or fair market value in inventory and asset valuation, and reflect considerable variation in the distribution of revenue across enterprises (e.g., imaging, wellness, surgery, boarding, grooming).

At the AVMA's 2016 Veterinary Economic Summit, the president of VetPartners noted the effort underway through the Economic Advisory Research Council to develop a profession-wide standard COA, and this was accomplished by the spring of 2017 with collaboration from the AVMA, the American Animal Hospital Association (AAHA), Veterinary Management Groups (VMG), VetPartners, the Veterinary Hospital Managers Association and accounting firm Katz, Sapper and Miller (KSM). The new AAHA/VMG COA can be found at https://www.aaha.org/professional/resources/chart_of_accounts.aspx

While there are groups of practices such as VMG practices, National Veterinary Associates, Banfield veterinary hospitals, and others that have collected specific performance data on veterinary practices, either the data are not publically available, not complete, or both. And, it is difficult to determine whether the data are comparable as the veterinary practices use a number of different charts of accounts to aggregate their costs and revenues.

VETERINARY PRACTICE STATISTICS AND KEY PERFORMANCE INDICATORS

Close to three-quarters of the U.S. active veterinarian workforce are employed by private practices. In private practice, as opposed to government or industry positions, a primary measure of the productivity of a veterinarian is total personal gross revenue.

GROSS REVENUE OF FULL-TIME PRIVATE PRACTICE VETERINARIANS, 2015

	Mean	Std. Dev.	1st Quartile	Median	3rd Quartile
Total Personal Gross Revenue	$453,894	$703,004	$150,000	$400,000	$573,000
Percent from Professional Services	66%	29%	60%	75%	85%
Percent from Product Sales	21%	17%	5%	20%	30%

Table 19

Employers often incentivize veterinarians to work not only for monetary compensation, but other benefits as well. These benefits are detailed in the following table and include medical benefits such as health, dental and disability insurance; leave benefits for sickness, vacation and holidays, and benefits specific to veterinarians such as discounted pet care, association dues, and professional license fees. In general, veterinarians working in the public sector are more likely to be provided benefits related to medical and sick leave, but less likely to be provided benefits unique to veterinarians. In both the public and private sectors, 8 percent of veterinarians report that they receive no employer-provided benefits.

EMPLOYER-PROVIDED BENEFITS, 2016

	Private	Public
Medical/hospitalization plan	58%	82%
Dental plan	31%	66%
Disability Insurance	30%	52%
Life insurance	27%	56%
Liability insurance	56%	35%
Paid sick leave	37%	64%
Paid vacation leave	60%	76%
Paid legal holidays	38%	66%
Continuing education leave	58%	53%
Continuing education expenses	77%	61%
Licenses	76%	51%
Association dues	71%	50%
Tax-deferred retirement plan	42%	56%
Employer contribution/match	43%	53%
Informal profit-sharing plan	3%	4%
Personal use of vehicle	14%	8%
Discounted pet care	75%	31%
Other	4%	5%
No benefits provided	8%	8%

Table 20

COMMUNITY SIZE OF PRIVATE PRACTICE VETERINARIANS, 2016

Veterinarians reside and practice in communities with many different designations from rural/urban to non-metro and metropolitan. By community size, the largest group of veterinarians are those who reside in communities of 2,500 to 49,999 residents (39 percent), with the next largest group residing in communities of 50,000 to 499,999 residents (36 percent).

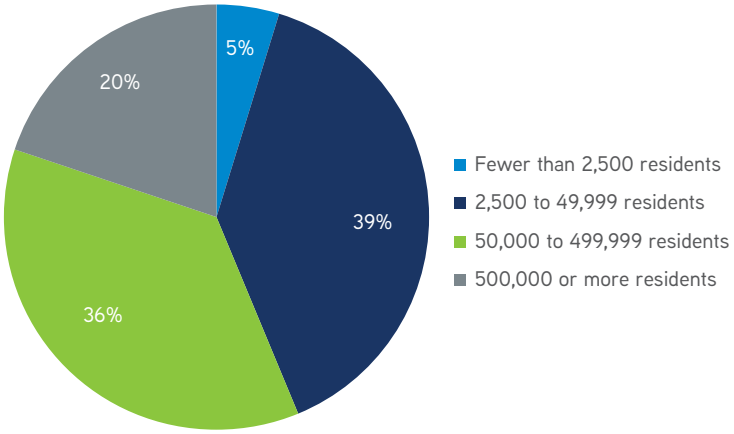


Figure 36

ROLE OF ASSOCIATES IN PRACTICES, 2016

Among veterinary practices, the majority of associate veterinarians practice general medicine (80 percent), while 10 percent are primarily involved in providing specialty care.

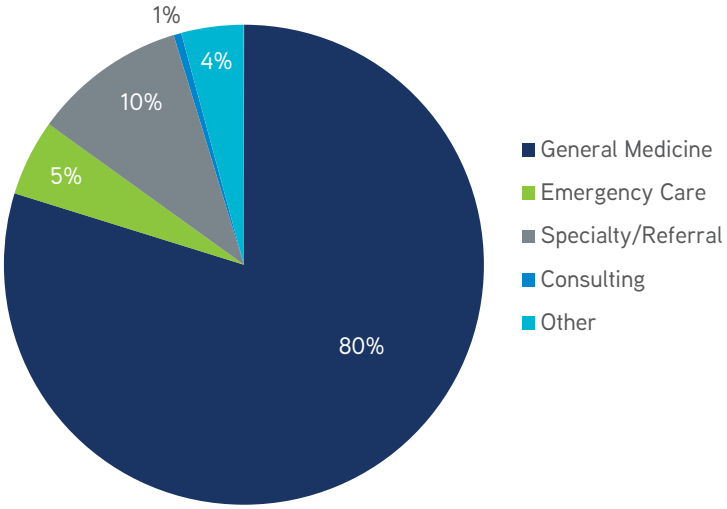


Figure 37

Roughly 25 Percent of veterinarians indicate that they are practice owners, with another 17 percent indicating that they are looking to purchase a practice.

PRACTICE OWNERSHIP STATISTICS, 2016	
Total Survey Respondents	2,541
Public Practice	33%
Private Practice	67%
Private Practice, Owner	25%
Private Practice, Looking to Purchase a Practice	17%
Private Practice, No Plans to Become an Owner	58%

Table 21

While 56 percent of veterinarians are female, only 19 percent of females want to purchase a practice while 34 percent of male veterinarians wish to purchase a practice.

ASSOCIATES WANTING TO BUY A PRACTICE, 2016		
	Male	Female
Want to Buy a Practice	34%	19%
Do Not Want to Buy a Practice	66%	81%
Region of Associates Wanting to Buy a Practice		
Region 0	1.2%	4.9%
Region 1	1.6%	6.1%
Region 2	4.5%	5.7%
Region 3	3.6%	6.9%
Region 4	2.4%	10.9%
Region 5	2.4%	5.3%
Region 6	4.9%	5.3%
Region 7	3.2%	7.7%
Region 8	3.2%	4.9%
Region 9	3.6%	11.7%

Table 22

About 22 percent of associate veterinarians in private practice are looking to purchase a veterinary practice in the future. Survey respondents were planning purchases from between 0 and 120 months in the future, with a median of 24 months and a mean of 33 months. The most frequent response was 36 months.

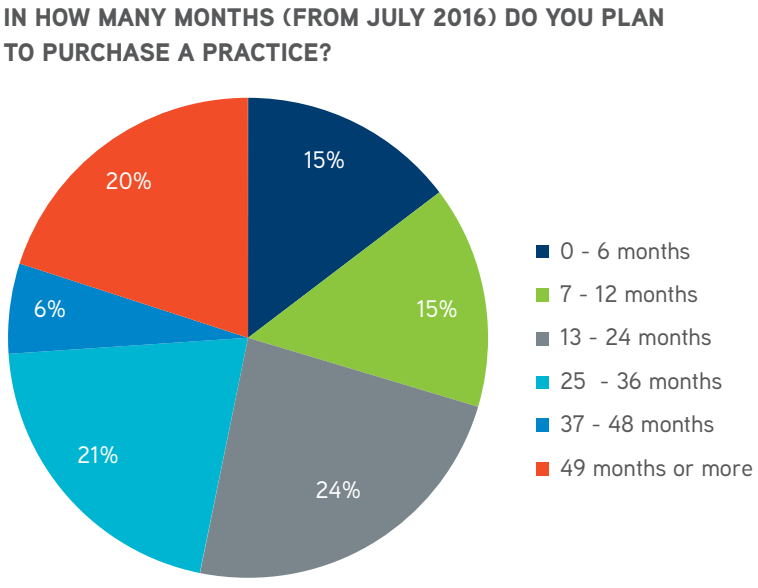


Figure 38

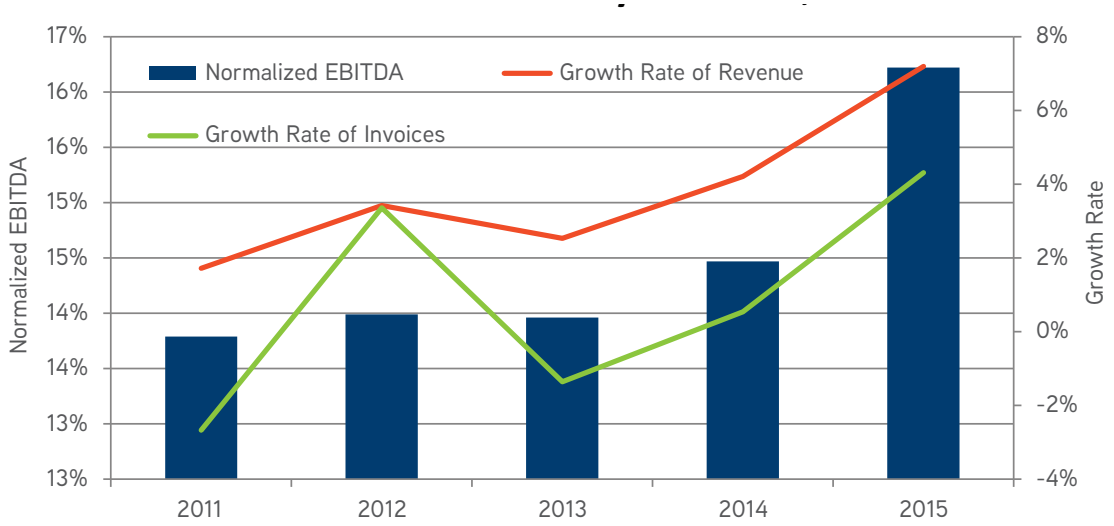
VETERINARY MANAGEMENT GROUPS

The continued recovery from the recession is being felt in veterinary practices, as seen in the mean earnings before interest, taxes, depreciation and amortization (EBITDA) of the Veterinary Management Group (VMG) practices. Terry O'Neil, of Katz, Sapper and Miller, which provides analytics for the Veterinary Management Groups, provided an overview of the financial performance of the more than 400 veterinary practices that provide practice financial data to KSM.

The KSM data are one of the few sets of practice financial data that are available to provide a picture of the changing financial health of veterinary practices from year to year. Because of the great diversity in veterinary practices both from the demographics of the communities they serve and the profit centers on which each practice focuses, however, these 411 practices are insufficient to provide national financial guidelines that may be applicable to every practice. Developing these industry standard KPIs for the various-sized markets and the product and service focus of each practice is important to help guide the practices in strategies to improve financial performance.

Nevertheless, the VMG practices indicate that revenue and EBITDA were continuing their upward trend through 2015. Average revenue growth has been increasing for the past few years and saw a large pickup in 2015 compared to 2014. This was accompanied by a large increase in the number of invoices per FTE veterinarian and EBITDA increasing to levels higher than that seen in the recent past.

REVENUE TRENDS IN VETERINARY PRACTICES, 2011-2015

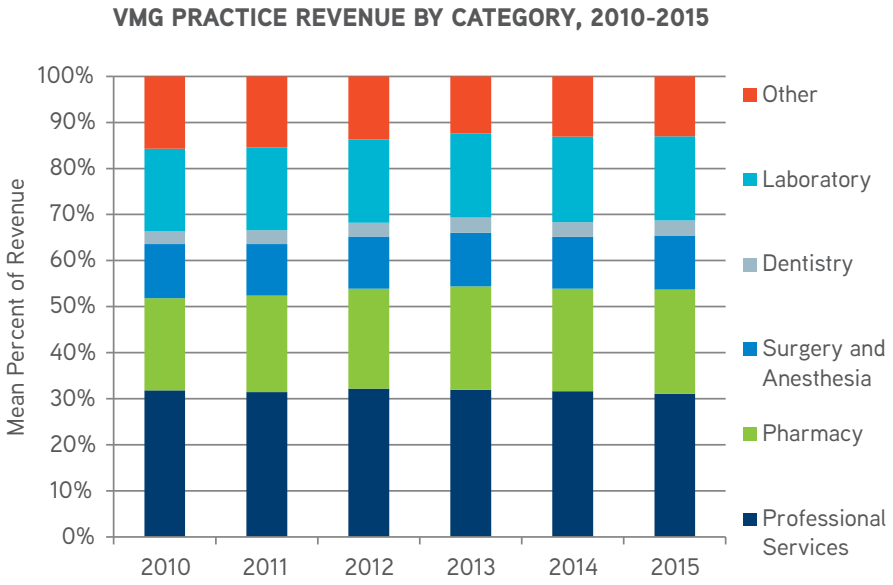


Source: Katz, Sapper and Miller and the Veterinary Management Groups

Figure 39

AVERAGE REVENUE GROWTH HAS BEEN INCREASING FOR THE PAST FEW YEARS AND SAW A LARGE PICKUP IN 2015 COMPARED TO 2014.

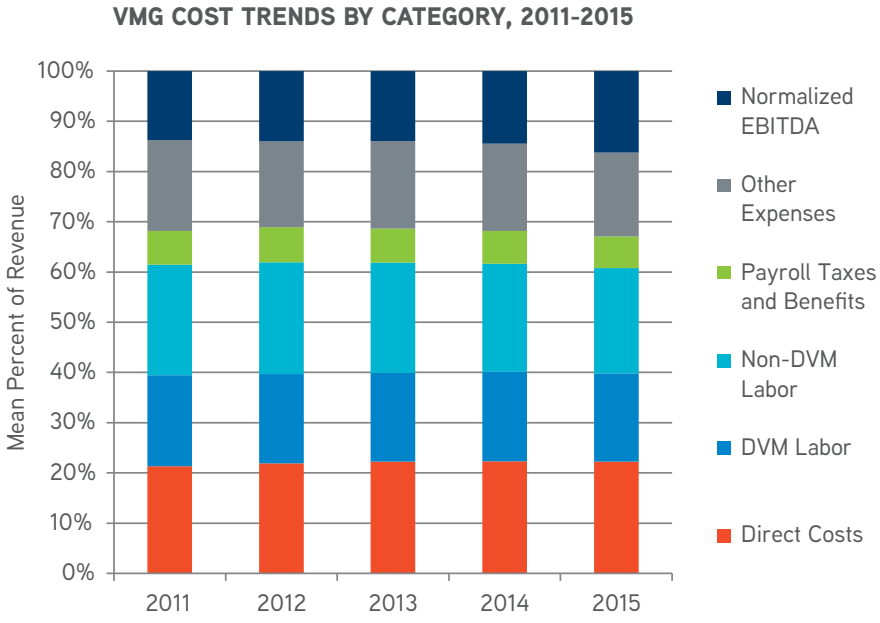
At the same time that EBITDA has been increasing, the professional services percent of total revenue has been falling, meaning that revenue from pharmacy, laboratory, product sales, and other sources have been increasing as a percent of revenue.



Source: Katz, Sapper and Miller and the Veterinary Management Groups

Figure 40

These statistics indicate that the most profitable practices tend to be those that have best controlled their costs by maintaining the lowest cost of acquiring new clients–at below $25 per new client–and keeping labor costs below 40 percent of total revenue.



Source: Katz, Sapper and Miller and the Veterinary Management Groups

Figure 41

The cost of DVM labor is lower for the most profitable practices. This may indicate that top-performing practices are better able to leverage their use of veterinary technicians. However, non-DVM labor as a percent of revenue is also lower for the highest-performing practices. And also the ratio of support staff to DVMs is almost identical in both groups. Overall, it appears that the top-performing practices save overall on labor costs.

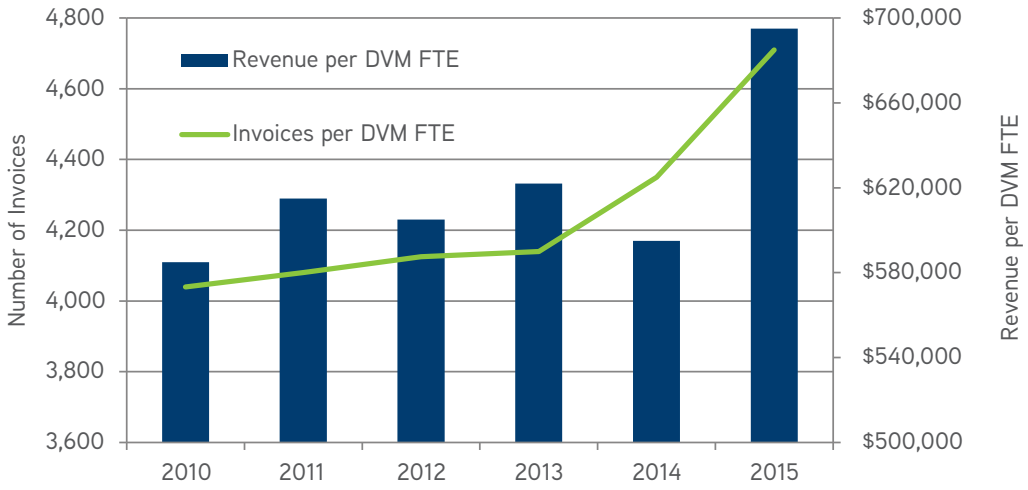
Overall cost KPIs for practices in 2015 indicated direct costs of 22 percent of revenue, while labor and benefits made up 45 percent of revenue, with an average EBITDA of 16 percent.

While the number of invoices per DVM FTE has increased, the average client transaction remained in the $150 range. Growth in revenue may have been a result of higher prices, an expanded bucket of services, or most likely both.

VMG PRACTICE EXPENSE BY KPI, 2015	
Revenue	Percent
Direct Costs 22%	
Labor and Benefits	
Owner and Non-Owner DVM	18%
Non-DVM Staff	21%
Payroll Taxes and Benefits	6%
Total Labor and Benefits	45%
Gross Profit 33%	
General and Administrative	
Advertising	1%
Administrative and Fee Collection Costs	5%
Rent	6%
Facility and Equipment Costs	4%
Other Employee Costs	1%
Total General and Administrative	77%
EBITDA 16%	

Table 23

REVENUE GROWTH PER DVM FTE, 2010-2015



Source: Katz, Sapper and Miller and the Veterinary Management Groups

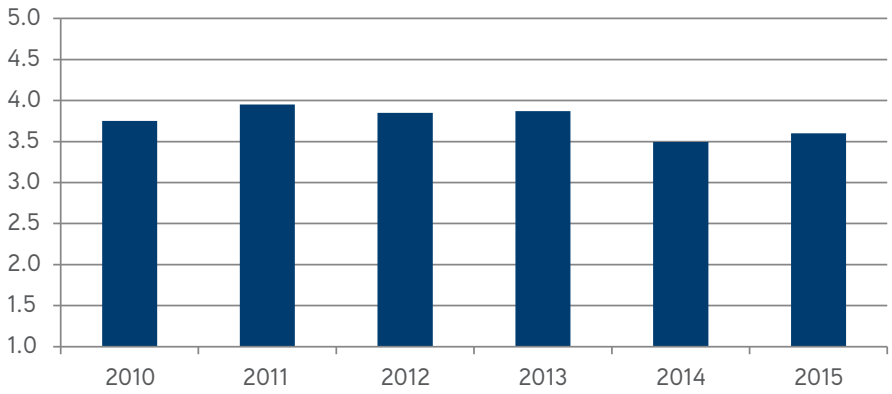
Figure 42

There is no clear trend in recent years for revenue per DVM FTE, though the level has increased to nearly $700,000 in the most recent year for which data were collected. This lack of trend may be an artifact of the way it is calculated, owing to the fact that the VMG definition of FTE is standardized for all practices and may not have exactly the same definition as it does when used colloquially. One thing that stands out is that the number of invoices per DVM FTE has been much higher for the highest performing practices, that is, until the last year of available data, when the average from the dataset caught up to those in the highest quintile.

One way to increase profitability may be to look at non-medical services as profit centers. Statistics show a strong positive relationship between EBITDA and the percent of sales due to boarding and grooming. Indeed, while this may mean that designating physical space for these activities is hard on the rest of the clinic, clients may come to appreciate the one-stop-shop approach where they can get all of their animal's needs met in a single visit. And if not in a single visit, the approach brings in clients who can be reminded about check-ups and a practice's standards of care. Repeated interaction in multiple aspects of an animal's life can be a good way to build relationships with clients.

Lastly with regard to the VMG data, the support staff leverage ratio bounces around a bit but appears to reach middle ground slightly above 3.5 support staff per veterinarian. This ratio is lower compared to other practice statistics, but that is most likely accounted for by the differing composition of practices in each sample.

SUPPORT STAFF LEVERAGE RATIO



Source: Katz, Sapper and Miller and the Veterinary Management Groups

Figure 43

PRACTICE MANAGEMENT CONTINUING EDUCATION

Recent survey results, such as in the AVMA and AABP studies, reveal that at the time of graduation most veterinarians desire additional education to help prepare them to be better business managers. Specifically, 27 percent of the AABP survey respondents expressed that they desire more lessons in business finance, 21 percent in human resources management, and 17 percent in managerial business analysis.

DESIRE FOR ADDITIONAL PRACTICE MANAGEMENT EDUCATION AT TIME OF GRADUATION

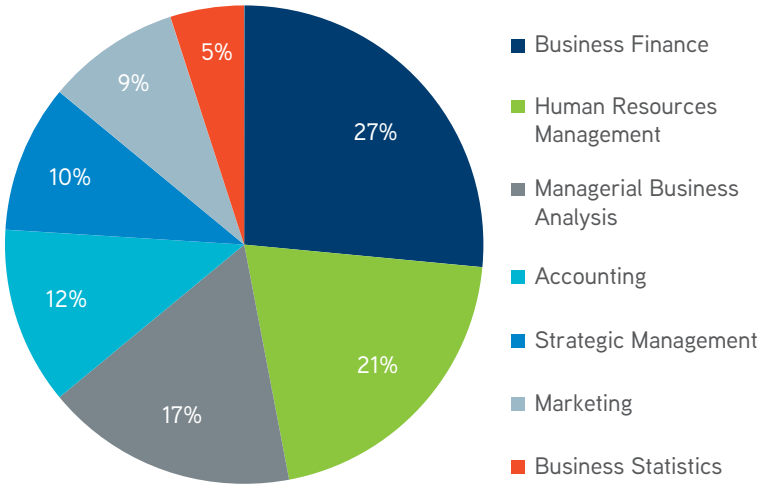
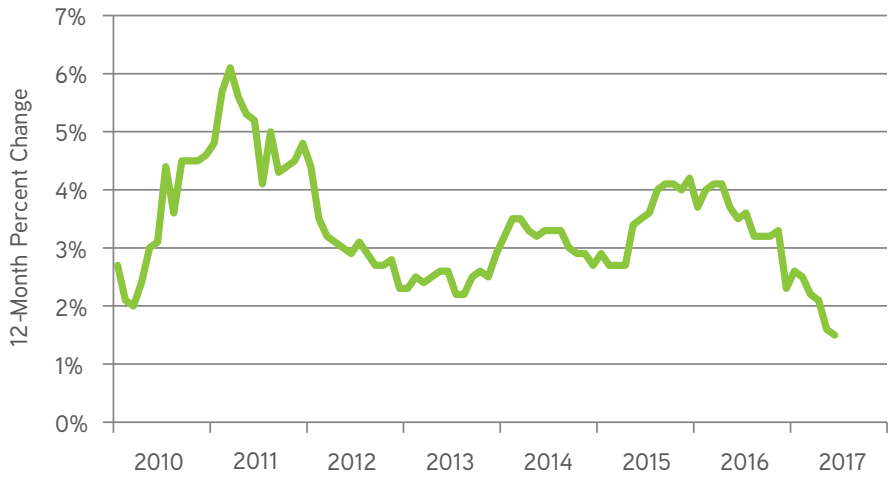


Figure 44

DISCUSSION

The cost of veterinary care to consumers is rising much faster than inflation, though this trend has shown signs of slowing in recent years.

VETERINARY SERVICES PRICE INDEX, MONTHLY, 2007-2017



Source: U.S. Department of Labor, Bureau of Labor Statistics

Figure 45

This increase in prices has correlated with a long-term decline in the proportion of pets visiting a veterinarian for yearly check-ups.

VETERINARY SERVICES PRICING AND PATRONAGE TRENDS, 1985-2016

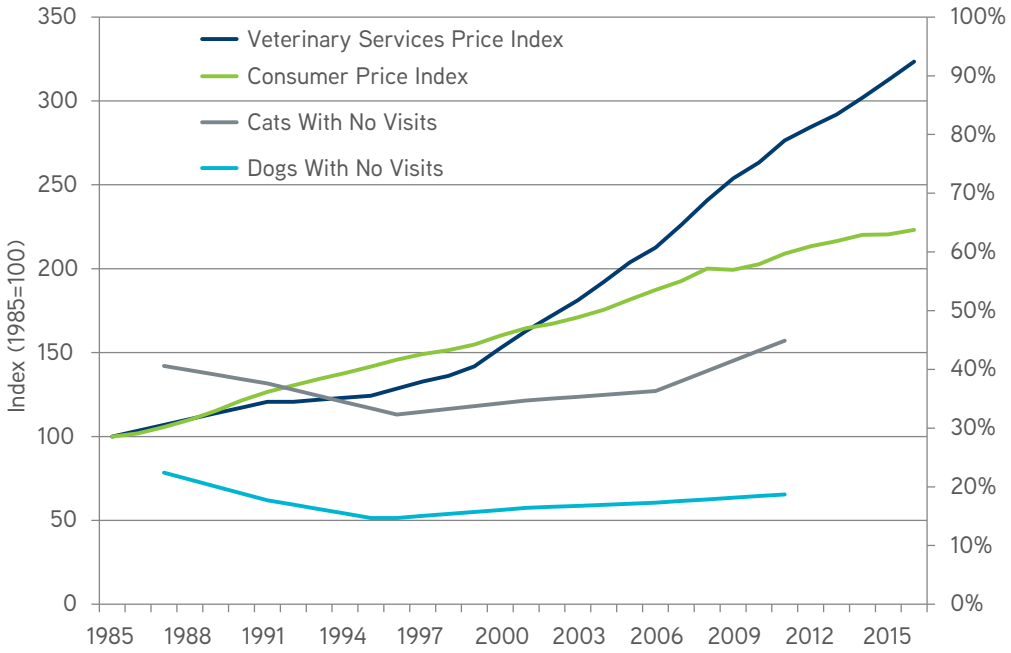


Figure 46

In more recent years, this trend has continued, with a continuing decline in the number of pets visiting veterinarians, and an increase in the cost per visit, or amount of each invoice from veterinary clinics.

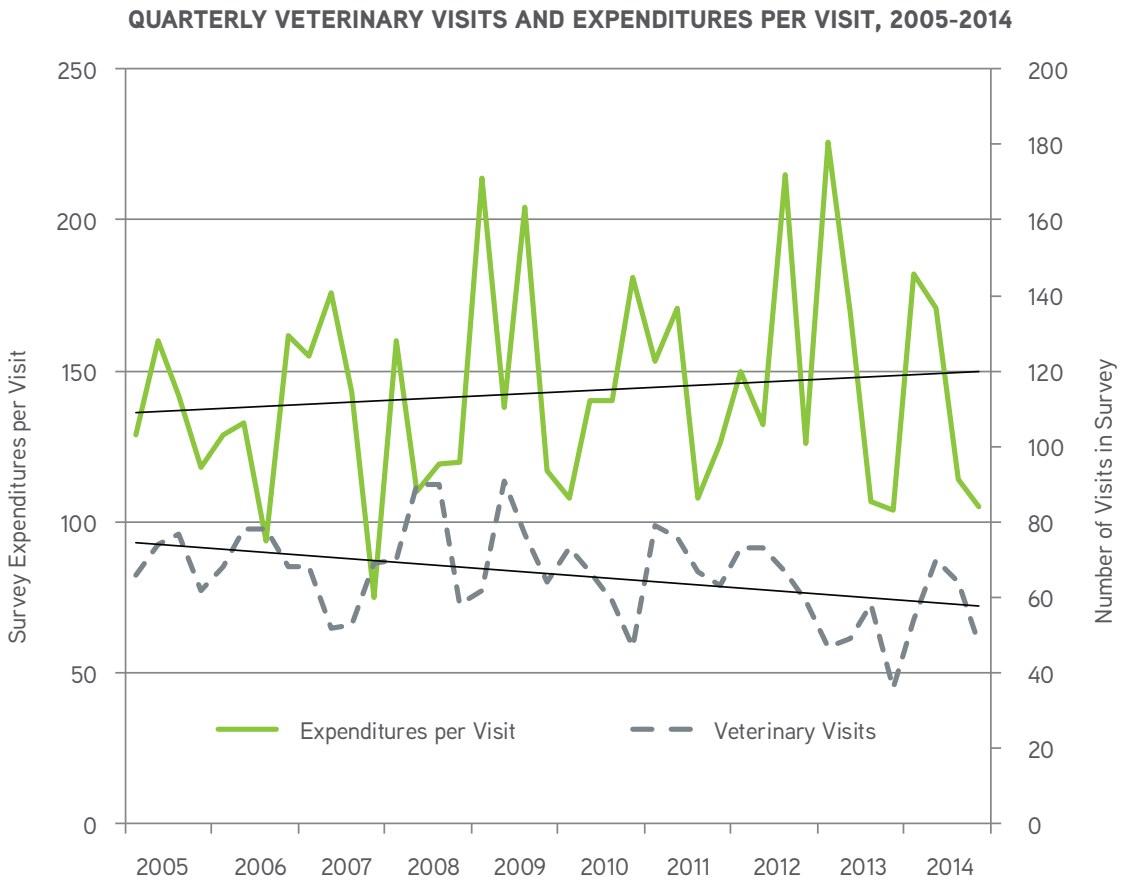


Figure 47

This long-term trend of price increases should concern veterinarians who rely on consumers of veterinary services to provide a customer base. To an extent, veterinary care beyond a bare minimum is often viewed as a luxury service. This means that as prices increase, it will be the case that a smaller and smaller proportion of the U.S. population will purchase veterinary care, and among those who do purchase veterinary care, a greater number could elect cheaper options for purchasing veterinary services. Because of the possible implications to the bottom line of veterinary clinics and the potential effect on public health (e.g., lack of vaccinations), it is important to understand why the cost of veterinary care is rising.

A recent study by researchers from the National Bureau of Economic Research, titled, "Is American Pet Health Care (Also) Uniquely Inefficient?" concluded that the rising cost of human healthcare is mirrored by the rising cost of pet healthcare, indicating the increases are likely caused by the same problem, but which is not associated with the widespread use of health insurance.

So what is the common factor driving up the price of pet and human healthcare? First, let's break down the costs of running a veterinary practice into two categories: operating expenses and profits. The common practice in the veterinary industry is to measure profit using EBITDA.

Then, further break down operating expenses into two categories: cost of labor and direct costs. The cost of labor refers to both DVM labor and support staff, while direct costs involve fixed costs and variable costs. Fixed costs are those that do not change according to the number of clients seen or procedures performed, such as the cost of a building (mortgage or rent), utilities, and the costs of durable

DISCUSSION

equipment and instruments. Variable costs, on the other hand, are those that increase or decrease with each transaction, for example, disposable medical supplies such as gloves, sutures and syringes, and the cost of prescription medication.

Now consider that the cost of labor and pharmaceuticals make up approximately 70 percent of practice expenses. Because these costs are increasing, so too must the cost of care.

Why is the cost of labor increasing? Much of it is driven by the labor market: the market for veterinarians.

Expenditures per visit are increasing while the number of visits per household is decreasing. So, while EBITDA is increasing, this ratio indicates that a smaller and smaller share of households is contributing a larger and larger percent to the profitability of veterinary practices.

VETERINARY PHARMACEUTICAL PRICE INDEX, 1999-2016

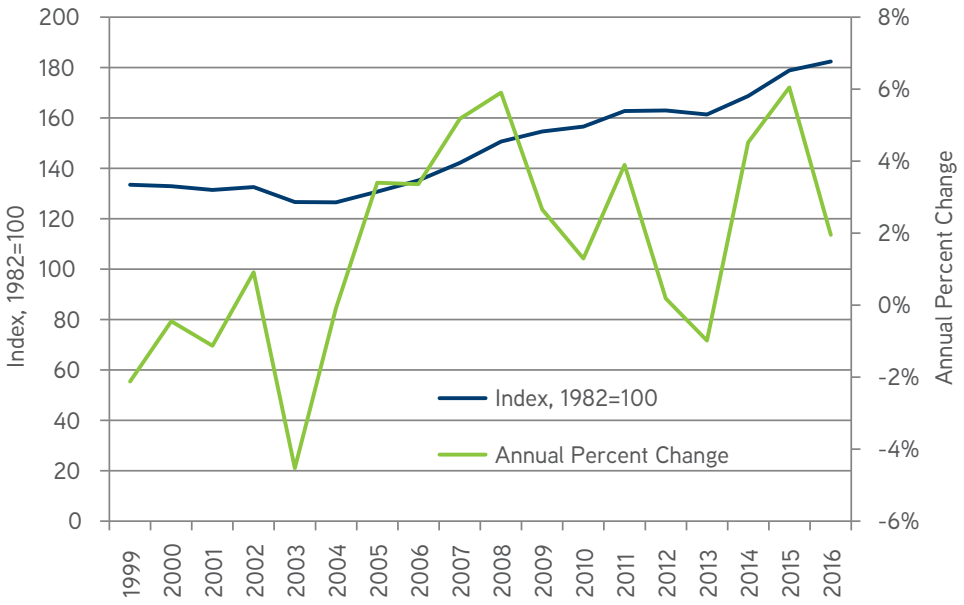


Figure 48

Veterinarians are working and earning more income overall, but are also working longer hours. In recent years, this pattern has pushed down the hourly pay of veterinarians. For new graduates, starting salaries continue to increase, though the actual effect on their wage rate per hour is unknown. A small part of these price increases are due to inflation. The vast majority of the increases, however, are most likely linked back to the market for veterinary education, in which the cost to obtain a veterinary medical degree has jumped in recent years.

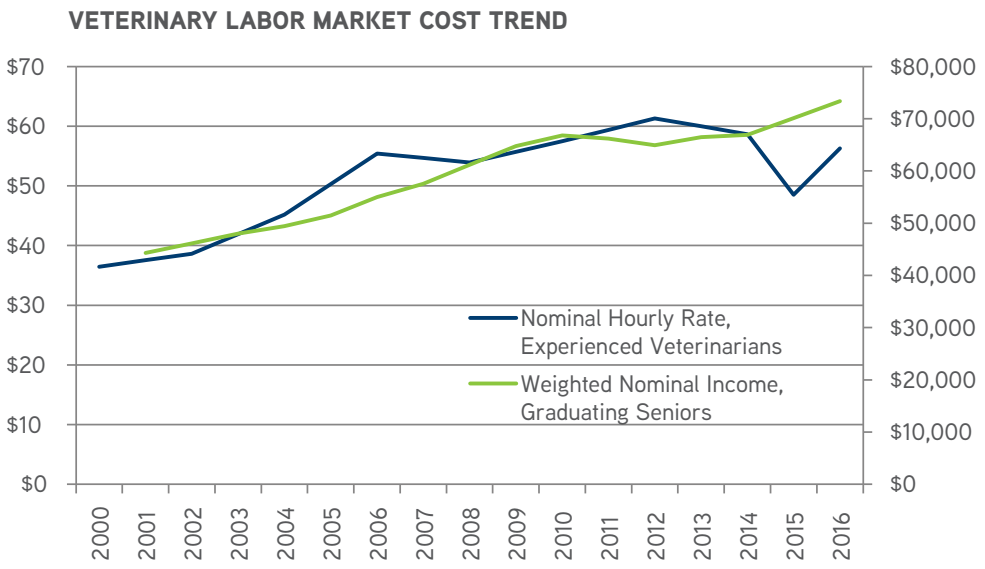


Figure 49

Consider that if the cost of veterinary care to the consumer is rising at some rate of percent per year, and is composed of 40 percent labor and 30 percent pharmaceuticals, what must be happening to the other 30 percent of costs? According to the VMG data, EBITDA levels are increasing, at least for the segment of hospitals organized into VMG groups.

The conclusion: The cost of veterinary care is rising because of the increase in the costs of both labor and supplies, but profit margins are also rising.

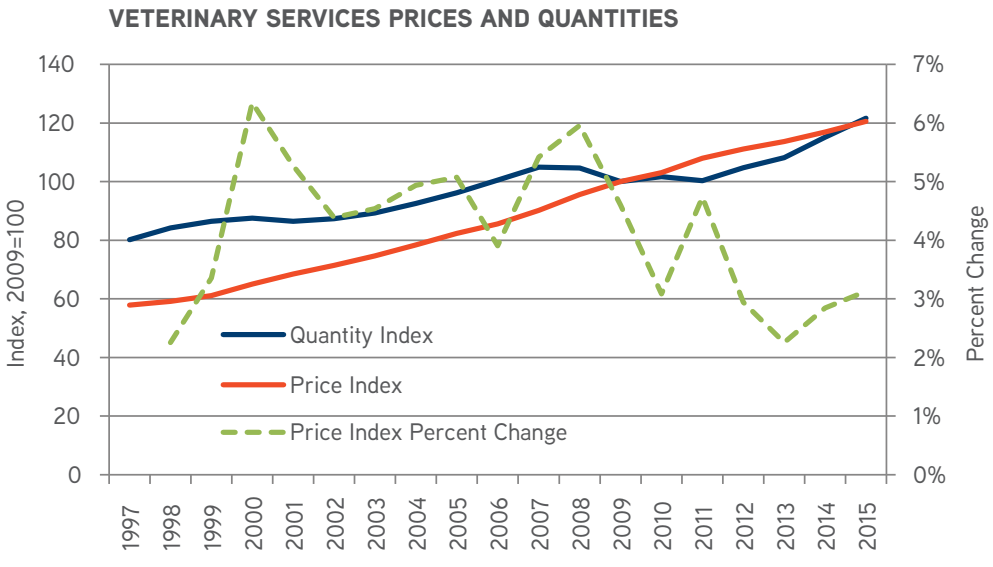


Figure 50

Recent data show that increases to prices paid by consumers of veterinary services have continued at a slower pace in the past few years, and have correlated with a sharp increase in the quantity of veterinary services provided. Hopefully, this trend will continue, and a decoupling of prices will emerge between the markets for human medical services and that of veterinary services.

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