AVMA 2017

ECONOMIC REPORT SERIES

Produced in partnership with the American Association of Bovine Practitioners

AVMA® | *Veterinary Economics*

American Association
of Bovine Practitioners

ECONOMIC REPORT 2016

Michael R. Dicks
AVMA Director of Veterinary Economics

Frederic B. Ouedraogo
AVMA Veterinary Economics Division
Economic Analyst

Ross Knippenberg
AVMA Veterinary Economics Division
Economic Analyst

Barbara Dutton
AVMA Veterinary Economics Division
Economics Writer/Content Coordinator

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EXECUTIVE SUMMARY

Bovine veterinary practice is one of the major practice types in the veterinary medical field. Veterinarians who identify as specializing in beef and dairy health are often involved in the health of myriad other food and companion animals.

This study of the economics of bovine veterinary practitioners was conducted as a joint effort of the American Association of Bovine Practitioners (AABP) and the American Veterinary Medical Association (AVMA). The purpose of the effort was to gain an understanding of common and unique attributes of bovine practices and practitioners when compared to the general veterinary profession and other veterinary practice types. The report is comprised of a number of major parts: the demographics of the bovine practitioners, the market for bovine veterinary medical services, unemployment and underemployment, income and debt, bovine veterinary practices, and the impact of the bovine practices on the economic activity in the United States.

Demographics of the Bovine Practitioners

The first section provides the descriptive statistics of bovine veterinary practitioners. The demographic characteristics include gender, age, ethnicity, education, motivating factors to become a bovine veterinarian, expectations before entering the profession, satisfaction as a bovine veterinarian, and compensation.

A gender shift in the veterinary profession has been occurring for several decades, switching to a majority of women in 2009[1]. The reasons for this shift are unknown, but the trend is not without speculation. Hypotheses for this shift range from the reluctance of men to embrace a career in a female-dominated profession, to income-driven reasons. The income-driven hypothesis would suggest that the rates of increase in salary in professions where females constitute the majority of labor are lower than in male-dominated professions. If this is the case, the bovine veterinary profession would have one of the higher rates of salary increases among sub-sectors of the veterinary medical profession as the ratio of men to women in the bovine veterinary profession is still greater than 3:1. Our analysis indicates that in contrast to

[1] In 2009, the American Veterinary Medical Association reported that females outnumbered males in the veterinary profession for the first time: 44,802 to 43,196.

the trend in the general U.S veterinary profession (37 percent of males and 63 percent of females) the bovine veterinary profession is made up of only 31 percent of females and 69 percent of males.

Nevertheless, it is important to mention that bovine practices are being increasingly populated by females. A joint distribution between gender and categories of age shows that men made up 82 percent of the bovine practitioners in the age category 40 years or more, but represent only 51 percent of those practitioners less than 40 years of age.

The age structure enables us to answer the question about whether or not the bovine veterinary profession is sustainable in its current form. That is, are veterinary professionals being consistently trained so that new veterinarians are taking over at a rate sufficient to offset those entering retirement, being injured, or leaving for other reasons? Our analysis indicates that veterinarians less than 40 years of age represent 33 percent of the AABP members. At the national level, and regardless of the specialty branches, all veterinarians in the same age category represent 39 percent of the population. While bovine practitioners have a smaller replacement rate than the profession in general, the replacement rate would appear sufficient to sustain the current number of bovine practices.

The ethnicity of bovine practitioners is consistent with the U.S veterinary demographics. Caucasians make up 95 percent of the AABP membership. The issue of lack of diversity has been a topic in veterinary colleges and in the veterinary profession generally. There is no potential for change unless people from underrepresented groups show an interest in a veterinary career and receive a seat at a veterinary medical college. Two underrepresented groups, Asians and Hispanics, are increasing as a share of the profession. A successful career for these ethnicities may help to provide a positive inducement to other groups to pursue bovine practice.

Respondents to our AABP surveys predominantly have been graduates of U.S. veterinary medical colleges, but a small number have graduated from foreign AVMA accredited schools. The surveys were not restrictive regarding the year of graduation and include respondents that graduated from 1950 to 2015. All of the 28 accredited veterinary medical colleges with current veterinary practitioner alumni were represented. The highest frequencies of responses were from Iowa State University (11 percent), Kansas State University (7.7 percent), and The Ohio State University (7.3 percent).

Internships are optional for new graduates who wish to strengthen their practical abilities before joining practices. Our data indicate that only 11 percent of AABP members participated or are currently participating in an internship. From an economic perspective, this might be an indication that the job market in the profession is more robust or there is no payoff to completing an internship as compared to the general veterinary workforce, where 23.7 percent pursue an internship. While internship participants are generally satisfied with the internship experience there was wide-spread agreement that the internship did not meet the expectation related to learning to manage a veterinary business.

The gender distribution by specialty is considerably different from the distribution in general within the bovine practice. Specialties such as animal welfare, lab animal medicine, pathology, surgeons, theriogenology, and toxicology have a limited number of women. The only areas where women are highly represented are clinical pharmacology, internal and preventive medicine.

Mean income for private practice veterinarians in the United Sates was between $80,000 and $120,000 in 2015 (2016 AVMA Report on the Market for Veterinarians). Food animal exclusive practitioners have consistently had the highest mean income for all private practitioners while food animal predominant practitioners had lower mean incomes than for all private practitioners. The mean salary for food animal exclusive veterinarians in 2015 roughly $130,000, while mean salary for food animal predominant was $90,000. Data from the AABP survey indicate that the mean income for AABP members is $119,965 and the mean income for men and women are respectively $136,543 and $84,217.

Bovine Veterinary Practices

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.

In this report, the Gross Regional Product was used as a proxy to assess the general condition of the regional economy. We find that the bovine veterinary practices, as with the other veterinary practice types, are highly affected by the general economy's performance. However, an improvement in the national economy might not be beneficial in all regions or for all practices, and some regions might benefit more than others.

Economic Impacts of the Bovine Veterinary Profession

Economic Impact Analysis (EIA) aims to provide a comprehensive assessment of the economic impacts of bovine practitioners on the local economy. The analysis is regional, using the 11 districts defined by the AABP.

The objective of the EIA is to determine the economy-wide impacts of bovine veterinarian activities at the district and national level. We present the direct, indirect, induced, and total effects of veterinary practices on the eonomies of each of the AABP districts. The results are summarized below:

- Bovine veterinary profession generates a total of 20,636 direct jobs, supports 3,848 indirect and 6,013 induced jobs leading to a total effect of 30,497 jobs nation-wide.
- Bovine veterinary profession invests $729,809,504 in the U.S economy in the form of employee compensation and proprietor income.
- The contribution of bovine veterinarians in terms of value added is estimated at $1,642,370,571, from which $741,628,418 is directly related to the professional veterinary activities and $390,287,434 is attributable to the intermediate input suppliers.
- Bovine veterinary profession contributes to approximately $1,495,681,349 of the U.S. GDP.
- Bovine veterinary practices add $127,690,495 worth of tax revenue to the local government, with $1,907,949 pf the taxes from employee compensation, $89,640,200 from tax on production and imports, $32,734,174 from households, and $3,408,172 from corporations.
- The total contribution of the bovine veterinary profession to federal tax revenue is estimated at $254,618,918.

INTRODUCTION

Bovine veterinary practice is one of the major practice types in the veterinary medical profession. Veterinarians who identify as specializing in beef and dairy health are often involved in the health of myriad other food and companion animals, live in rural settings, operate mobile hospitals and see many patients per client visit.

This study of the economics of bovine practitioners was conducted as a joint effort of the AABP and the AVMA. The purpose of this report is to assist in an understanding of common and unique attributes of bovine and other veterinary practice types.

In the lifetime of an organization, it is common for members to evaluate the organization's goals, seek new strategies to fulfill new or uncompleted tasks, and adopt new strategies and policies to achieve goals identified. To do this, an organization will conduct an analysis of internal resources, the factors affecting these resources, and the environment in which the organization operates. The environment refers to the general conditions of the local, regional and national economy or the markets thereof, in this case, the bovine veterinary profession. Characteristics of the market include the structure of the profession (number and size of practices), the level of competition that might exist (within the profession and between veterinary and non-veterinary service providers), and the institutional rules that govern the interactions between organizations or individuals within the trading territories.

To examine the economics of the bovine sector of veterinary medicine, AABP and AVMA launched two surveys of bovine practitioners in 2015: the employment and the compensation surveys. These surveys were sent to all members of AABP and similar surveys were distributed to a random, stratified sample of all U.S. veterinarians. The summaries and comparisons of these surveys are presented in the first section of this report. The objective of these surveys is to better understand the conditions and problems facing the bovine veterinary profession and the factors that affect both, and how these problems differ from the general veterinary profession.

The success of the bovine veterinary profession depends largely on the general conditions of the agricultural economy. Bovine practices, as with any other private practice type in the veterinary profession,

provide services to animal owners. The demand for these services is related to the number of animals in the business area, the health needs of these animals, and the willingness and ability of the animal owners to pay for the available wellness and medical services of the bovine veterinary practitioners. The willingness and ability to pay for veterinary services is related to the income level of households. Thus, a change in household income affects the demand for animal protein which in turn affects bovine practices as a change in the demand for services. A short economic downturn might not have significant impacts on a bovine producer's income, but will likely be detrimental if the downturn persists, as was the case during the most recent recession. Bovine veterinary practices differ from their companion and equine counterparts in that the changing market value of an animal may influence the decision of the animal's owner in selecting a treatment option. As the demand for animal protein increases, the value of the animal increases and thus an animal owner's willingness to select specific treatment options might increase.

Like other sectors of private practice within the veterinary profession, the bovine veterinary practice is facing competition that could adversely affect the revenue of AABP members and perhaps eventually change the structure of bovine practices. For instance, non-veterinary practitioners are providing veterinary medical goods and services to food animal producers. These competitors provide diagnostics and other services such as reproductive services (e.g., artificial insemination, embryo transfer, and pregnancy checks), imaging (e.g., ultrasound for carcass characteristics), nutritional consultation and other nonmedical animal services. Because these non-veterinary practitioners generally have lower overhead and are more available to provide specific services at lower cost, some food animal producers rely on their services at the expense of traditional veterinary service providers. This study investigates the magnitude of the incidence of these parallel services and their impact on bovine or food animal veterinarian practices.

The need for veterinary services in rural areas might be greater than what can be provided by available veterinary services. This should not be taken to imply that there is a shortage of veterinarians, but rather, that in many cases the density of available animals and animal owners who have the ability and willingness to purchase veterinary services is not large enough to enable a veterinary practice to be financially viable under the business models currently employed. A federal program, the Veterinary Medicine Loan Repayment Program, has been used to lower the cost of providing veterinary services by paying the educational loans of veterinarians to work in these underserved areas. As the concentration of food animals continues to increase, following the trend of the last century, more rural areas may become

underserved. As such, the determination of the effect of herd size on the demand for veterinary services is an important component of this study.

The role of bovine veterinarians is an important part of the general economy in many communities. To better understand how the profession is weaved into the economy, we conducted an economy-wide impact analysis (EIA). To conduct the EIA, an input-output analysis was performed using IMPLAN software. The input-output analysis is a specific type of economic analysis that identifies the share of inputs purchased from all other industries by bovine veterinary practices, the share of total output from bovine veterinary practices that is consumed by other industries, and the economic activity created as a result of the expenditures from those working in and providing services to this profession. The impact analysis considers how the activities within an economy would differ, with and without, bovine veterinary practices.

The report is divided as follows: Section I provides an overview of the data sources and demographics of the bovine veterinary medical profession, Section II describes the market for beef and dairy cattle, Section III provides an overview of employment, unemployment and underemployment in the profession, Section IV provides information on the income and debt of AABP members, Section V presents information on bovine veterinary practices, and Section VI concerns the economic impact analysis of bovine veterinary practices.

AABP: BACKGROUND AND MISSION STATEMENT

The American Association of Bovine Practitioners is an allied organization of the American Veterinary Medical Association. AABP is composed of veterinarians interested in bovine medicine. It was founded in 1965 as a not-for-profit organization and has grown to a membership of approximately 6,000 veterinarians. Most of the members are from the United States, but approximately 500 Canadian members and 200 members from other countries have joined the organization, with the common objective of serving society as leaders in cattle health, welfare and productivity.

The objectives of the organization are to improve the public stature and increase the knowledge of veterinarians in the field of dairy and beef cattle practice, to elevate standards of bovine practice and attract attention to the relationship between bovine practice and the public interest, to promote understanding and good will among its members, and to play the role of mediator between bovine veterinarians and members from other organizations.

SECTION I. DATA SOURCES AND DEMOGRAPHICS

1.1 Data Sources

Data used in this report were obtained from numerous sources including the AABP/AVMA 2015 employment and compensation surveys and the AVMA's Association Management System (APTIFY) database. The AVMA/AABP Employment Survey was conducted in March 2015. The initial sample of 2,907 AABP members was created using the AABP membership list. After controling for members who lost their membership status, the final sample was 2,716 members. From those AABP members retained for the survey, a classification distinction was made between practitioners and non-practitioners. Only the 2,138 practitioners who were selected to receive the survey were considered. The survey was sent to veterinarians in the final sample, with a reminder to respond to surveysent every week until March 17, 2015 when the survey was offically closed. In total, 455 complete responses were collected, giving a response rate of 21.3 percent.

The primary purpose of the *Employment Survey* was to measure unemployment and underemployment as well as the factors that affect each of these. The survey also measures satisfaction with career, profession needs and constraints, respondents' opinions about the future of the profession, and self-reported competency in specific areas of practices both current and prior to graduation.

The survey also asked specific qestions to determine the impact of non-veterinarian competitors on bovine practices. With the development of online-based businesses, animal owners are now able to order prescriptions via the Internet and receive them in the mail. This may be a more efficient method for some animal owners to receive pharmaceuticals and other products as it reduces handling costs and waiting time. This competition, however, adversely affects the revenue of traditional practitioners who rely on onsite consultation. University staff, technical service non-veterinarians, people practicing without a license, route trucks delivering supplies to farms, and consultant veterinarians who visit farms once a year and write prescriptions are also potential competitors of bovine veterinarians. Additionally, the AVMA *Employment Survey* considers the issue of veterinary education debt and the effect of that debt on employment, underemployment, health and job satisfication.

Retirement projections can be significant to strategic planning efforts in the veterinary profession. by asking respondents at what age they plan to retire, decision makers can determine how many veterinarians will be exiting the profession in any given period, and calculate the number of veterinarians anticipated necessary to replace retired veterinarians without jeopardizing the ability of the profession to meet the demand for services. Those already retired were asked why they retired, as well as to identify reasons why practitioners might retire earlier or delay retirement. Reasons other than health-related issues might signal that actions are called for to prevent a shortage of talent.

To provide a general measure of unemployment for the profession, the survey asked respondents if they had been unemployed at any time in the last year, and for how long. To estimate underemployment (working less than desired) the survey sought to determine how many hours are spent at work each week and whether the respondent would like to work additional hours (for greater compensation) or work fewer hours (for less compensation).

The AVMA *Employment Survey* also sought responses about the business environment, work conditions, the average number of animals treated per visit per year, the average number of billable hours per year and the percentage of time spent attending to patients, the number of unique clients served each year, the percentage of revenue from specific tasks within the practice, and the practice description .

A second survey, the AVMA *Compensation Survey*, was conducted in June of 2015 to collect information on salary and benefits as well as practice finance. As with the *Employment Survey*, the *Compensation Survey* was emailed to all AABP members. The response rate for the *Compensation Survey* (11 percent) was lower than than for the *Employment Survey*. Respondents who self identified as practice owners were directed to the specific private practice owners' section to answer questions pertaining to the general characteristics of the practice, the employment status of the respondents, the methods of compensation, the size of the community in which their practice is located, and some financial statements of their practice.

The Aptify software provides a comprehensive database of all AVMA members as well as all veterinarians that have attended an AVMA-accredited veterinary college or have passed AVMA Educational Commission for Foreign Veterinary Graduates certification. A record for each veterinarian exists to categorize each by

practice type and the state where they are employed. This classification enables the computation of the number of practitioners in each of the 11 AABP districts in the United States.

1.2 Demographics of Respondents

The demogrpahics of the bovine practitoners differs from the general veterinary propulation in age, veterinary college attended, gender, practice type where employed, and geographic location.

1.2.1 Year of Graduation and Age

The distribution of sample respondents by year of graduation shows that all generations of veterinarians are included, from those who graduated before 1950 to most recent graduates. The majority (64.2 percent) of AABP sample respondents graduated before 2001 and the remaining (35.8 percent) graduated between 2001 and 2015. This distribution is consistent with the general AVMA membership that shows that 63.03 percent of the members graduated prior to 2001. However, nearly 51 percent of the AABP members graduated prior to 1990 while less than 38 percent of the general membership graduated prior to 1990. Thus, in the near future the replacement rate for bovine practitioners may need to be accelerated to maintain the level of services now being provided, everything else being equal.

Table 1.1: Distribution of AABP Sample Respondents and AVMA Members by Year of Graduation

Year of Graduation	AVMA Membership	AABP Sample
[1941 -- 1950]	0.04%	0.00%
[1951 -- 1960]	0.16%	1.73%
[1961 -- 1970]	1.42%	6.49%
[1971 -- 1980]	12.51%	17.73%
[1981 -- 1990]	23.58%	24.87%
[1991 -- 2000]	25.34%	13.41%
[2001 -- 2010]	29.99%	17.62%
[2011 -- 2015]	6.98%	18.16%

The distribution of bovine practitioners by age (Figure 1.1) shows a sharp contrast to the general veterinary population. The distribution is skewed in favor of veterinarians of age 51 and over for the AABP sample, whereas for the general population, the majority of veterinarians (76 percent) are under 40 years old.

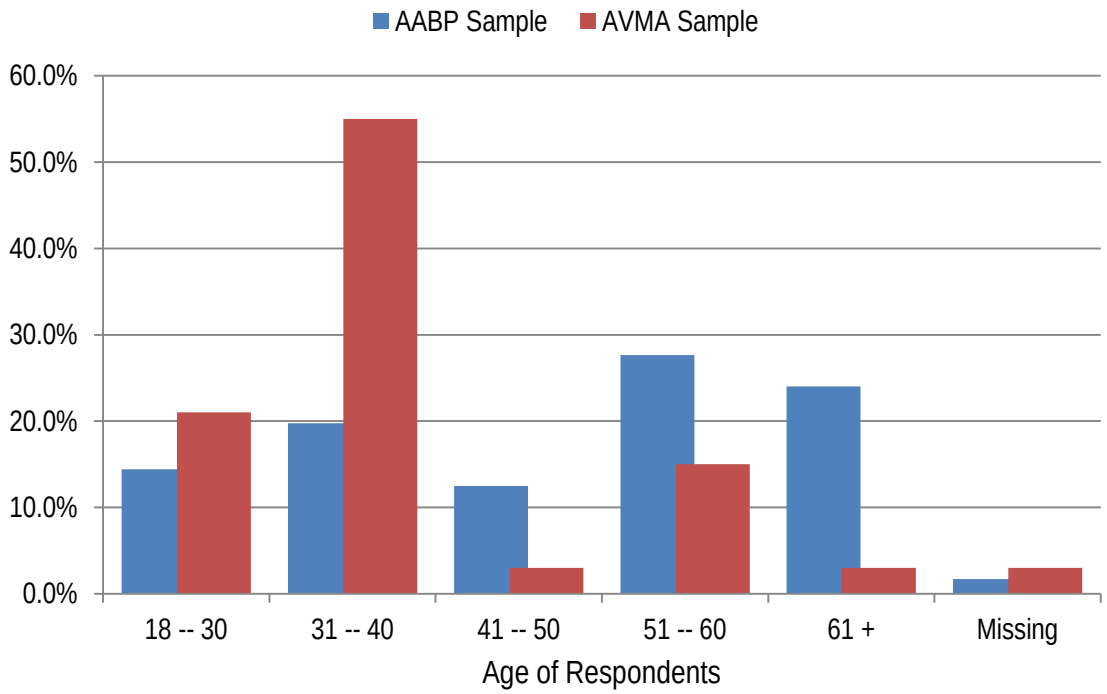


Figure 1.1: AABP Sample Respondents vs AVMA Membership by Group of Age

1.2.2 Veterinary Medical College Attended

The distribution of respondents by veterinary medical college attended is shown in Table 1.2. The majority of respondents (94.7 percent) graduated from a U.S. veterinary medical college and the remaining number graduated from an AVMA-accredited school outside of the United States. The largest share of bovine practitioners (from the sample respondents) graduated from Iowa State University (11.0 percent), Kansas State University (7.7 percent), and The Ohio State University (7.3 percent).

Table 1.2: AABP and AVMA Sample Respondents vs AVMA Membership by Veterinary College

VM College	AABP Sample	AVMA Sample	AVMA Membership
Auburn University	3.43%	3.03%	4.99%
Tuskegee University	1.18%	1.38%	1.74%
University of California-Davis	4.60%	4.94%	4.80%
Colorado State University	4.60%	5.85%	5.92%
University of Florida	0.21%	2.71%	2.83%
University of Georgia	1.93%	3.19%	4.10%
University of Illinois	4.28%	4.25%	4.37%
Iowa State University	11.03%	5.32%	4.95%
Kansas State University	7.71%	4.04%	4.84%
Louisiana State University	0.43%	3.24%	2.75%
Cummings SVM at Tufts University	0.75%	3.51%	2.29%
Michigan State University	5.67%	4.15%	5.10%
University of Minnesota	6.96%	3.72%	3.50%
Mississippi State University	1.39%	2.18%	1.65%
Purdue University	2.78%	3.08%	3.25%
Cornell Veterinary College	6.64%	3.83%	4.31%
Oklahoma State University	1.71%	2.18%	3.13%
University of Pennsylvania	2.89%	4.78%	5.16%
Texas A&M University	2.78%	4.36%	6.42%
Washington State University	3.21%	3.19%	3.31%
University of Missouri-Columbia	4.18%	3.19%	3.19%
The Ohio State University	7.28%	5.48%	6.56%
Oregon State University	0.64%	1.59%	1.18%
University of Tennessee	0.64%	2.60%	2.13%
Virginia-Maryland Regional College	1.82%	4.31%	2.62%
North Carolina State University	1.28%	3.93%	2.13%
University of Wisconsin	4.39%	4.25%	2.16%
Western University - California	0.21%	1.65%	0.59%
Ross University	0.86%	0.00%	.
St. George's University	0.32%	0.00%	.
Other	4.18%	0.05%	.

1.2.3 Gender

Overall, 69.0 percent of respondents were male and 31.0 percent were female (Figure 1.2). This distribution is representative of the AABP membership. The general AVMA membership shows the opposite distribution with more female veterinarians than male.

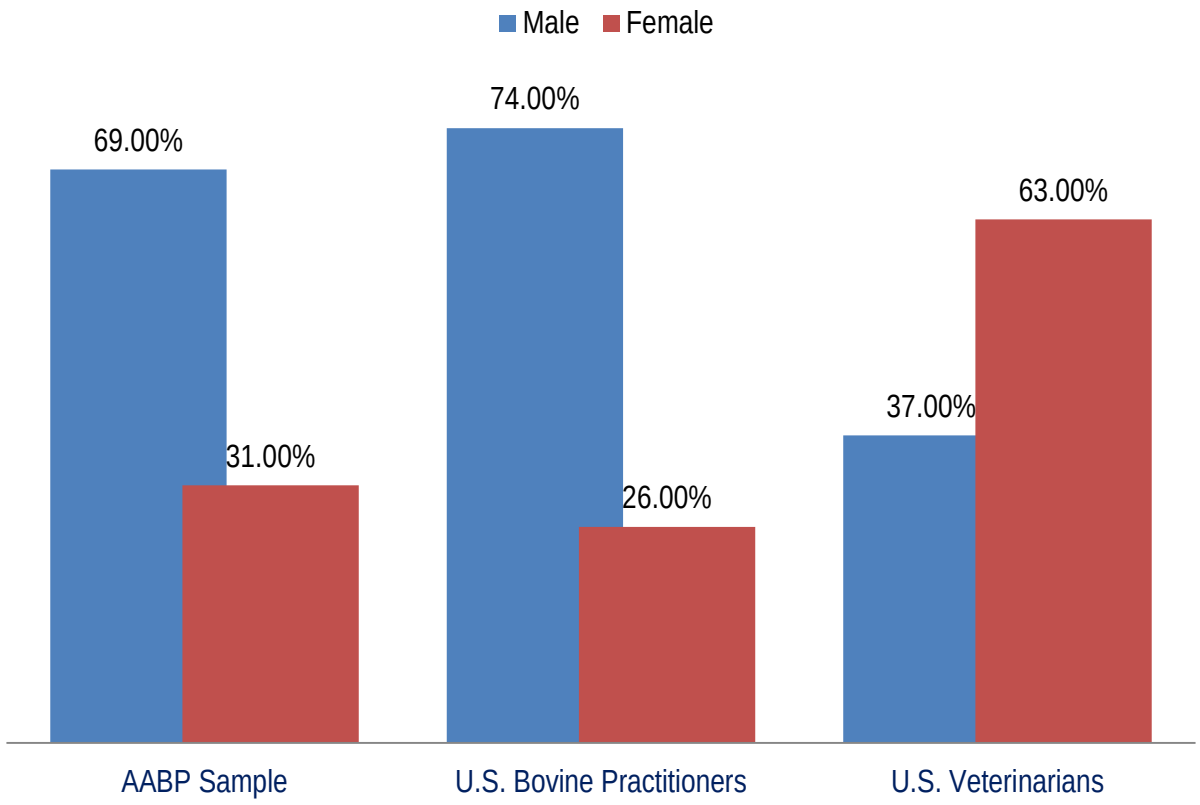


Figure 1.2: AABP Sample Respondents vs AVMA Membership by Gender

The joint distribution by age and gender of respondents is provided in Figure 1.3. For the category of age "More than 60 years," females represent less than 8 percent of the sample. Women dominate in the "less than 30 years" age group, comprising more than 58.9 percent of the sample. This is an indication that the veterinary profession is being ever more populated by women. This trend is also evident in the entire veterinary profession, where women outnumbered men for the first time in 2009.

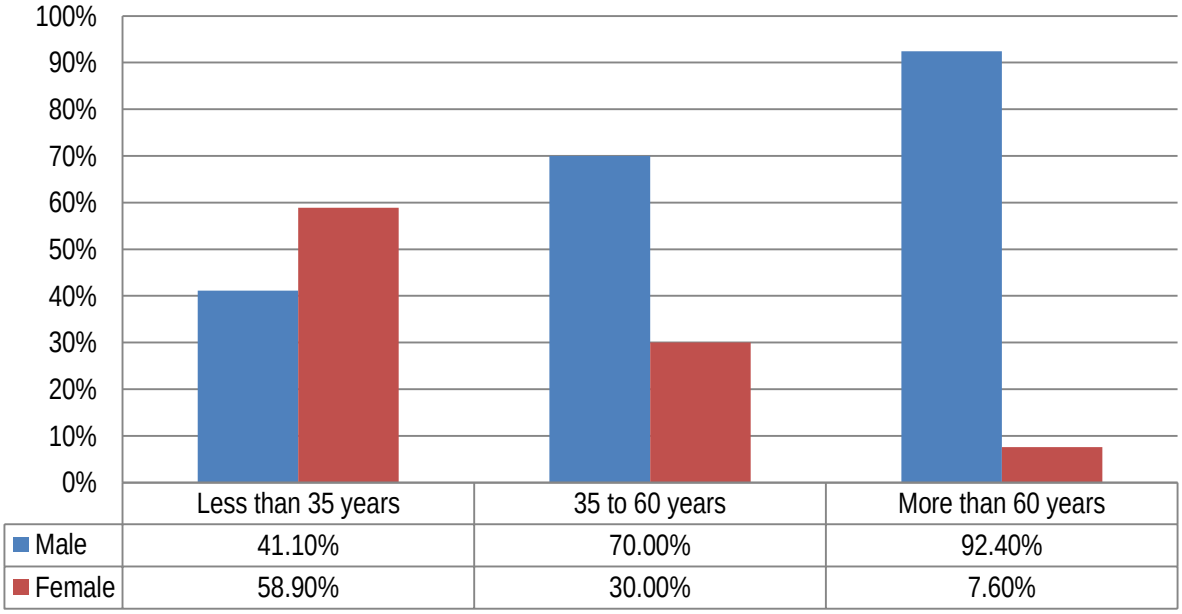


Figure 1.3: AABP Membership by Gender and Age

1.2.4 Type of Employment

Among the respondents of bovine practitioners there is a wide array of practice types (Table 1.3), with 40.8 percent practicing as food animal veterinarians, 23.2 percent practicing as mixed animal veterinarians, 10.5 percent working in colleges or universities, and the remaining 25.5 percent in other veterinary and non-veterinary employment.

Table 1.3 ABBP Sample Respondents vs AVMA Membership by Type of Employment

	AABP Sample	AVMA Membership
Food animal practice	40.8%	6.1%
Mixed practice	23.2%	3.9%
Companion animal practice	5.5%	66.5%
Equine practice	0.9%	4.4%
Federal Government	0.7%	1.3%
Uniformed services	0.0%	0.6%
College or University	10.5%	6.3%
State/Local government	1.5%	0.9%
Industry/commercial organizations	8.6%	3.1%
Other Veterinary Employment	6.5%	6.9%
Non-Veterinary Employment	1.9%	.

1.2.5 Regional Distribution

The distribution of respondents by district is presented in Figure 1.4. AABP districts are presented in Appendix A. District 5 and District 6 are the leading districts with 17.2 percent and 10.4 percent, respectively. The district with the lowest rate of participation is District 8 (4.7 percent).

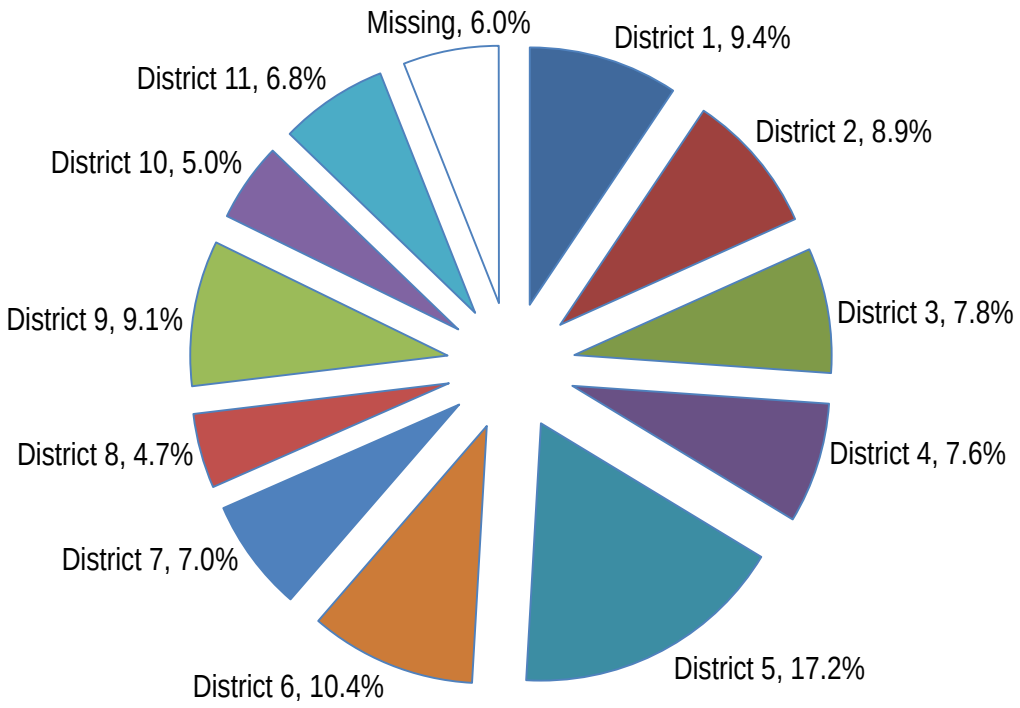


Figure 1.4: Distribution of Respondents by AABP District

1.2.6 Distribution of Bovine Veterinarians by ethnicity

The distribution of bovine veterinarians by ethnicity (Figure 1.5) differs markedly from the U.S. population demographics. Caucasians make up 94.4 percent of bovine veterinarians but only 77.1 percent of the U.S. population. The sum of all non-Caucasian ethnicities comprises 40 percent of the U.S. population but only 5.6 percent of bovine practitioners.

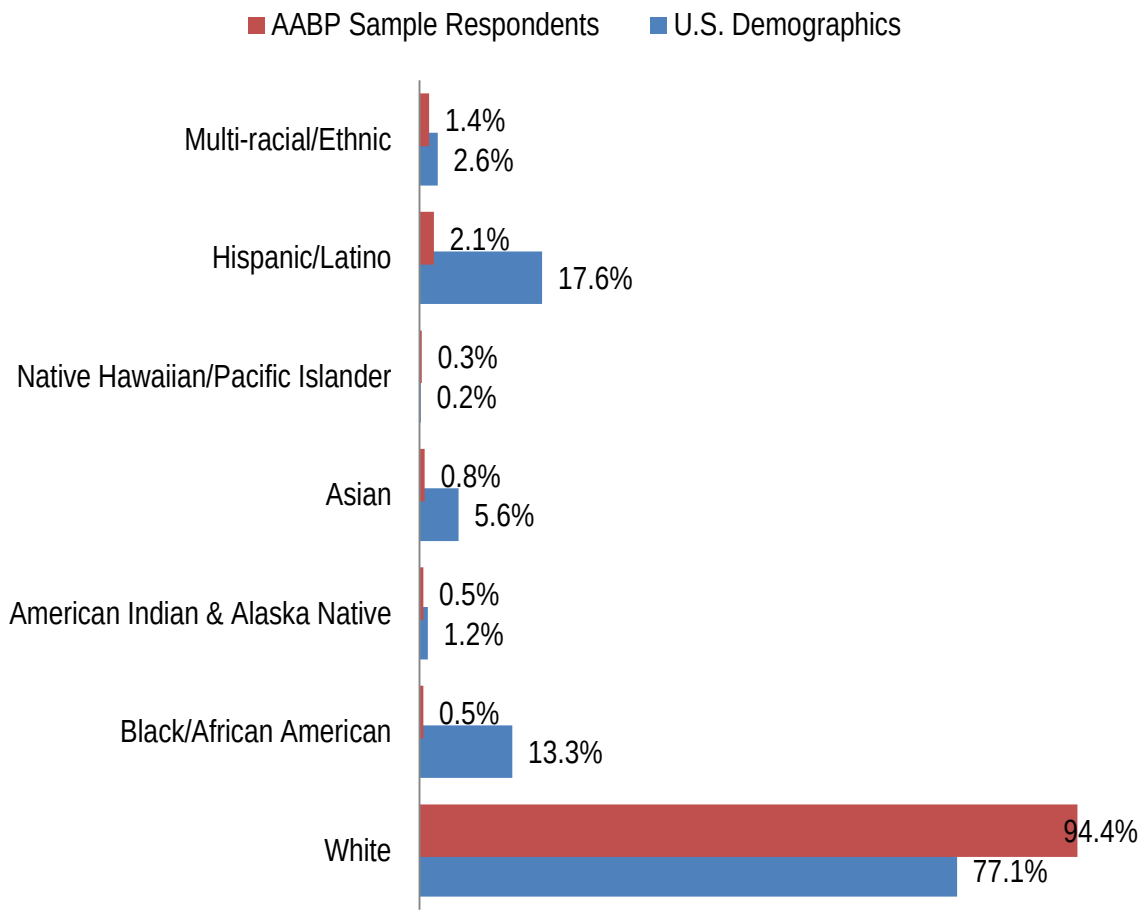


Figure 1.5: Distribution of Respondents by Racial/Ethnic Group

The ethnicity of bovine veterinarians is segmented by age in Figure 1.6. In the White/Caucasian group, each generation is almost equally represented. In groups such as Native American, Black, and Hispanic/Latino, there are no veterinarians under 30 years of age. This indicates that young people from these communities either failed to respond to the survey or are not represented in bovine practices. For Asians, the majority (68 percent) of veterinarians representing this racial group are under 30 years old.

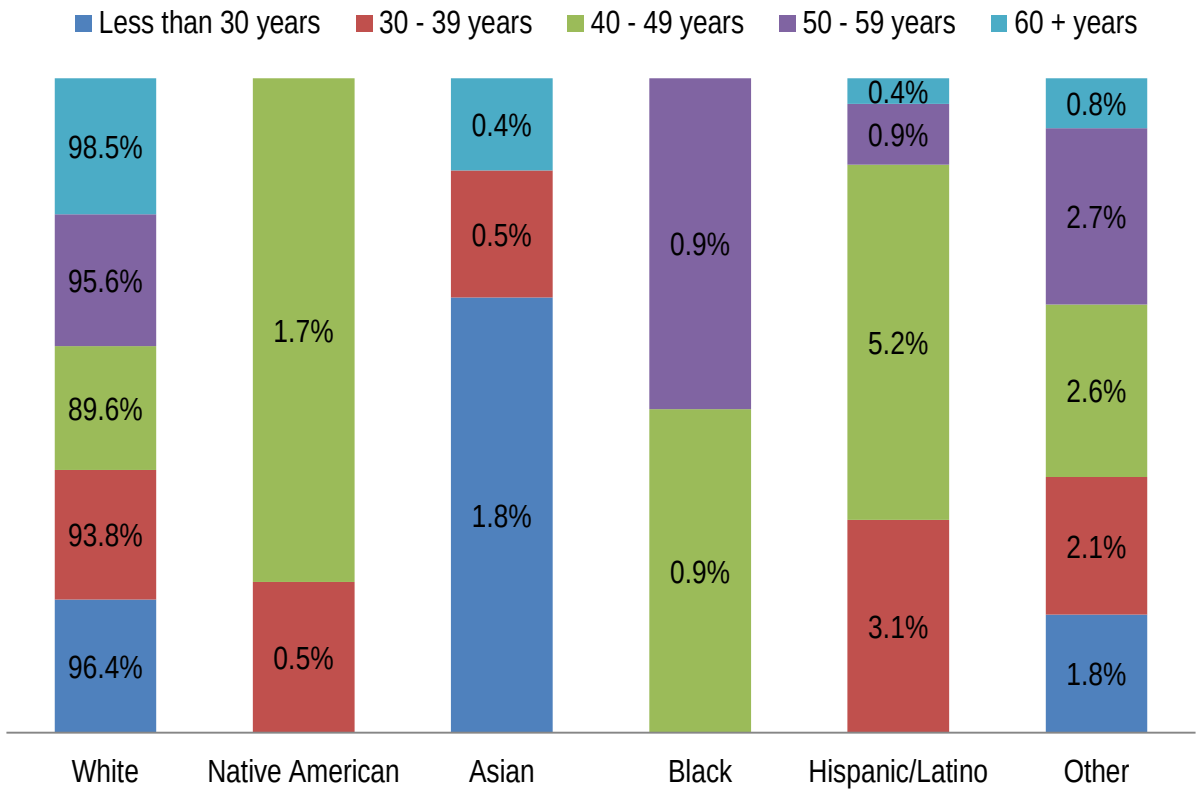


Figure 1.6: Distribution of Respondents by Age and by Racial/Ethnic Group

SECTION 2: MARKET FOR BOVINE VETERINARIANS AND VETERINARY SERVICES

The bovine veterinary profession is a sub-sector of the food-animal veterinary profession. Bovine veterinarians provide goods and services to the nation's beef and milk production industries at many points of the supply chain to ensure that the products are safe and secure for the American people, and that their quality meets international standards. Bovine veterinarians are employed as private practitioners in the delivery of veterinary medical services and in public practice as educators, researchers, inspectors in the food supply chain, sectors that supply private practitioners with goods and services, and in the regulation of veterinary services, and meat and milk production.

A disease outbreak can cause significant damage to the livestock industry and have a considerable effect on the national economy. Bovine tuberculosis, *E. coli* O157:H7, salmonellosis, and brucellosis are examples of livestock health threats that food animal veterinarians help prevent, and rapidly address in

cases of outbreak. Because of the important role that livestock production plays in the national economy, the bovine veterinary profession is a particularly important segment of the U.S. veterinary profession.

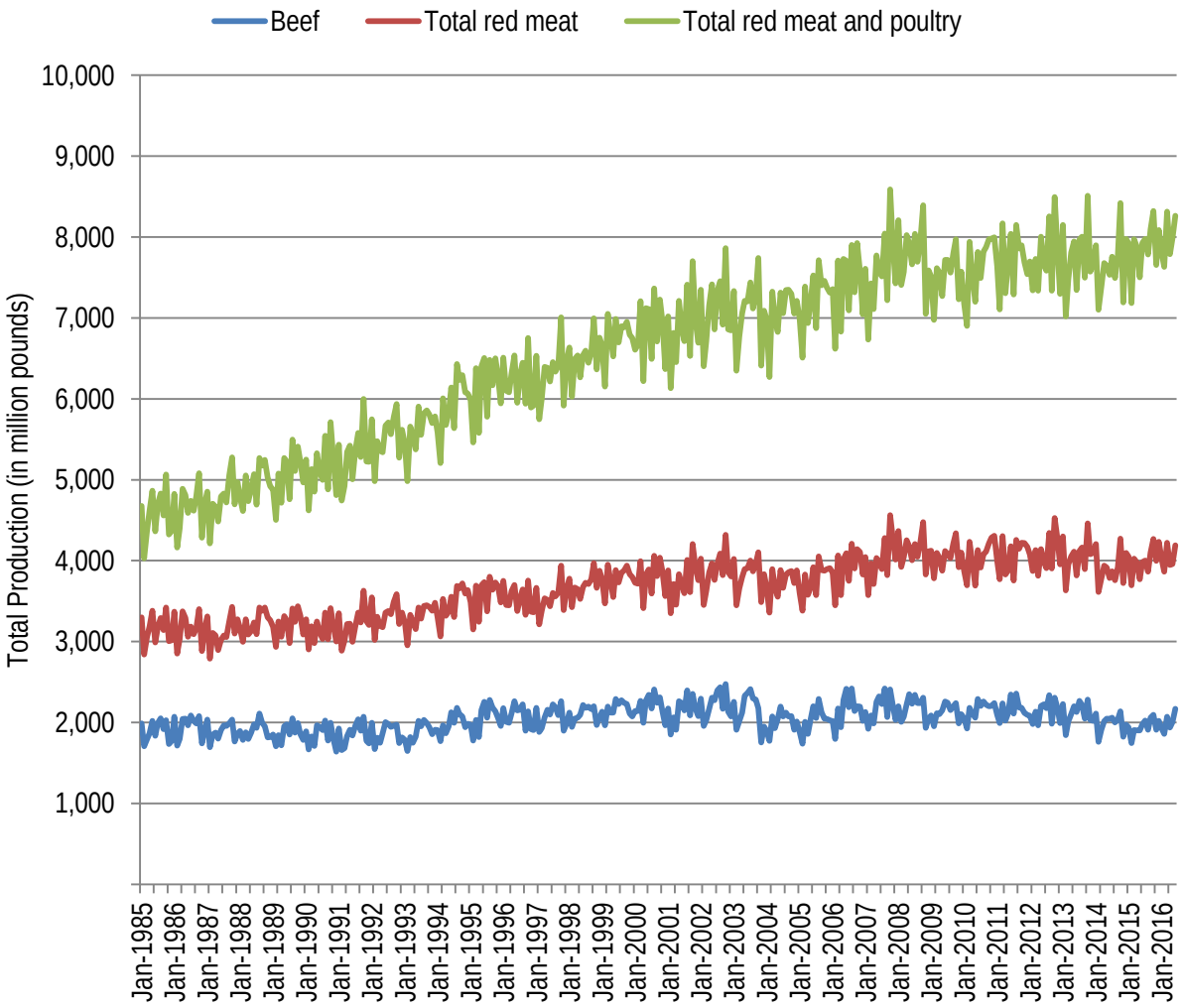
2.1 Factors Affecting Demand for Bovine Veterinary Services

The bovine veterinary profession is strongly tied to the U.S. food industry. A change in the production of food animals or food animal products (dairy and beef products) directly affects the demand for veterinary services. In this analysis, we first consider the macroeconomic variables that can affect the economic health of the bovine veterinary profession.

2.1.1 Domestic Demand for Food Animal Products

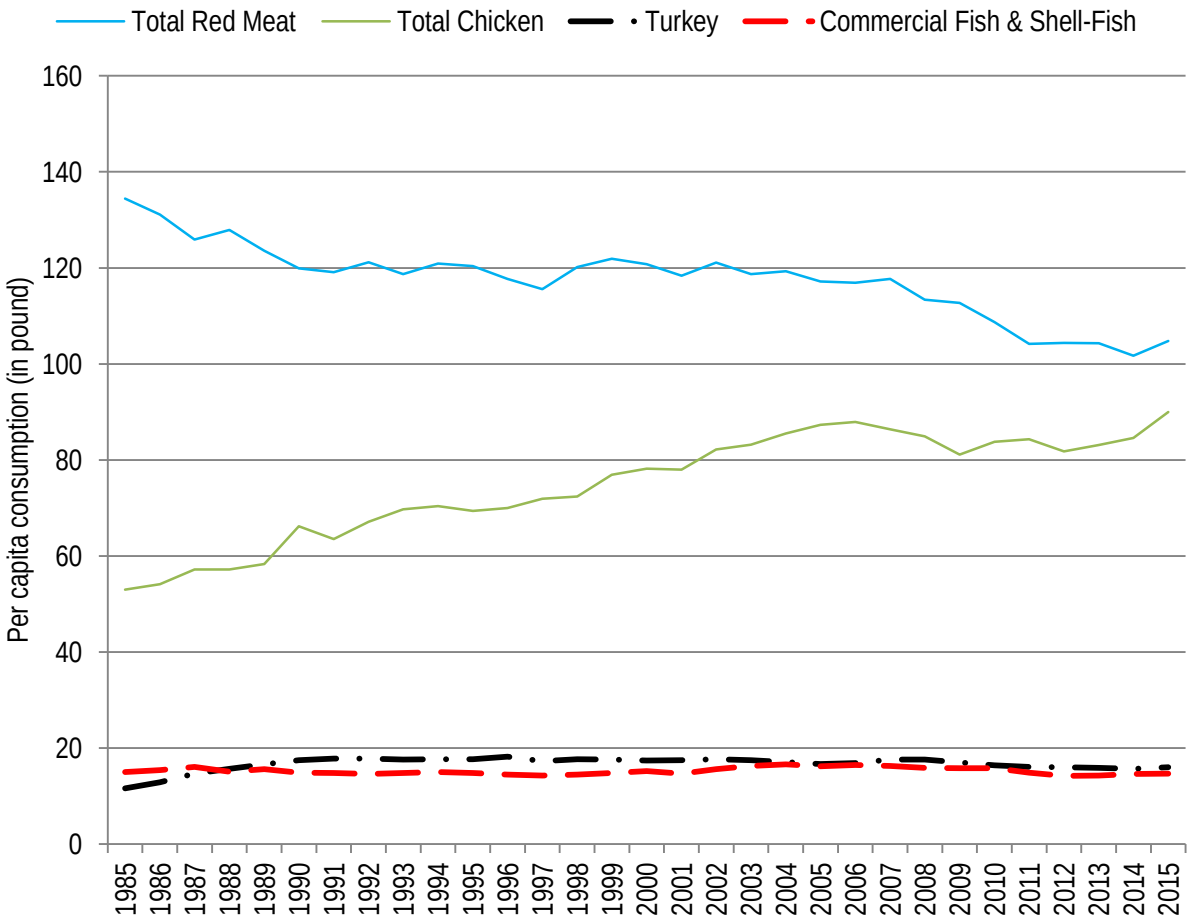
The monthly production volume of red meat, beef, and the aggregated red meat – poultry levels between 1985 and 2016 are presented in Figure 2.1. The trend in the U.S. beef production has been almost flat during the last three decades, averaging 2,000 million pounds per year. During the last decade, however, beef production has fallen below the long-term average of 2,000 million pounds per year. During the same period, the per capita consumption of red meat in the U.S has substantially declined (Figure 2.2), dropping from more than 130 pounds per person per year on average to almost 100 pounds. Although the per capita consumption has drastically declined, the red meat industry's production has not substantially declined. International markets consume the proportion of the U.S red meat production that is not consumed domestically. So, despite the drop in the U.S. consumption of red meat in recent years, an increase in consumption shown in the international market has assisted in sustaining U.S. red meat production. This export market plays an increasingly important role in not only the beef market itself, but also the market for bovine practitioners.

While the total consumption of animal protein in the United States has remained at around 225 pounds per person per year for several decades, the components of this consumption volume have changed. The proportion of red meat consumed has declined while the consumption of fish and poultry has increased. This shift is attributed to changing tastes and preferences for non-red meat sources of animal protein as well as changing relative prices of the sources of animal protein.



Source: USDA, Economic Research Service

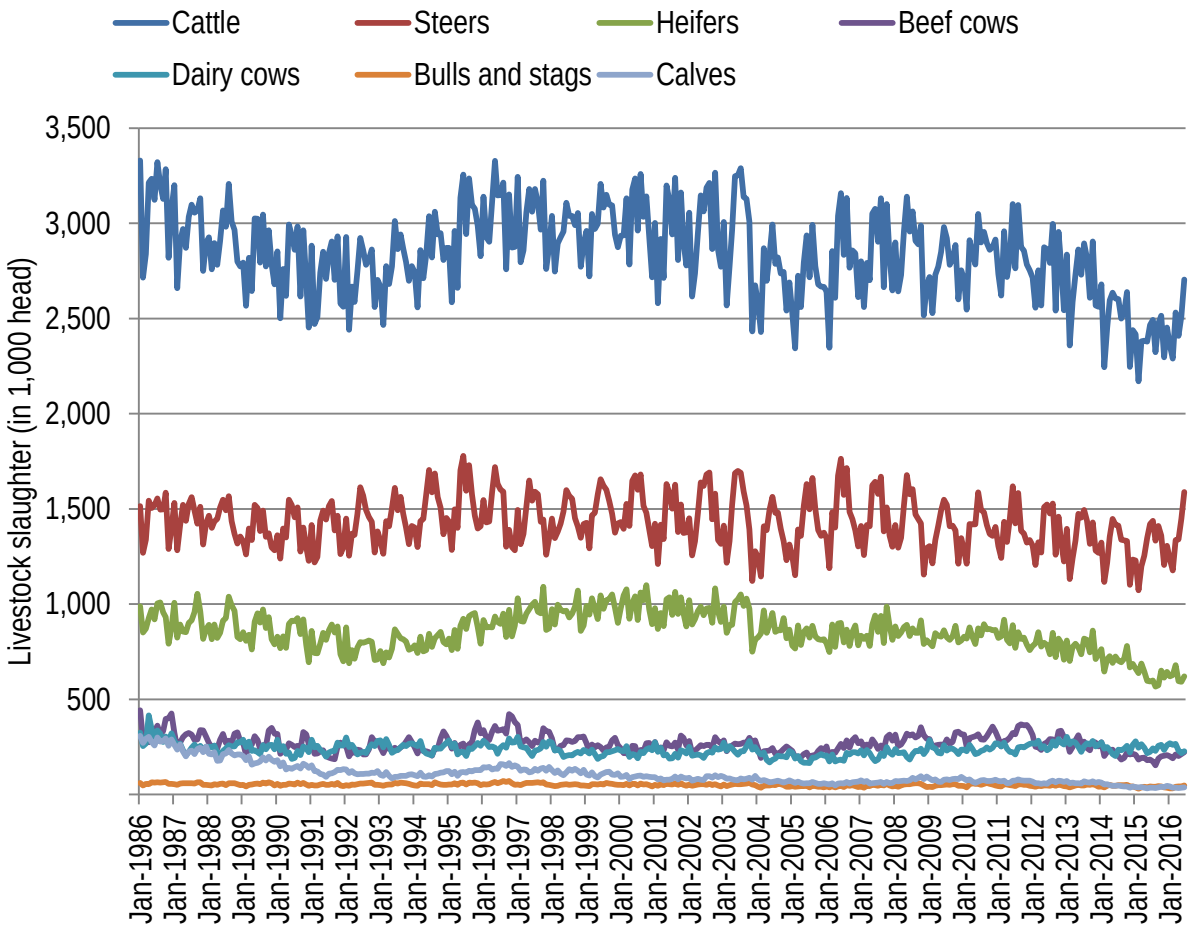
Figure 2.1: Monthly Red Meat and Poultry Production in the United States -- 1985 to 2016



Source: USDA, Economic Research Service

Figure 2.2: Per Capita Consumption of Poultry and Livestock in the United States – 1985 to 2015

The total number of cattle harvested monthly in the U.S from 1986 to 2016 is presented in Figure 2.3. Between 2.5 million to 3 million cattle are being harvested each month on average. Steers and heifers comprise the largest share of harvested cattle. The production of livestock for human consumption requires the services of food animal veterinarians. Veterinarians not only ensure the safety and the quality of livestock and their products being produced and consumed domestically, but also safeguard the production being exported to ensure that the U.S. maintains its reputation as the leader in food animal production in both quantity and quality.

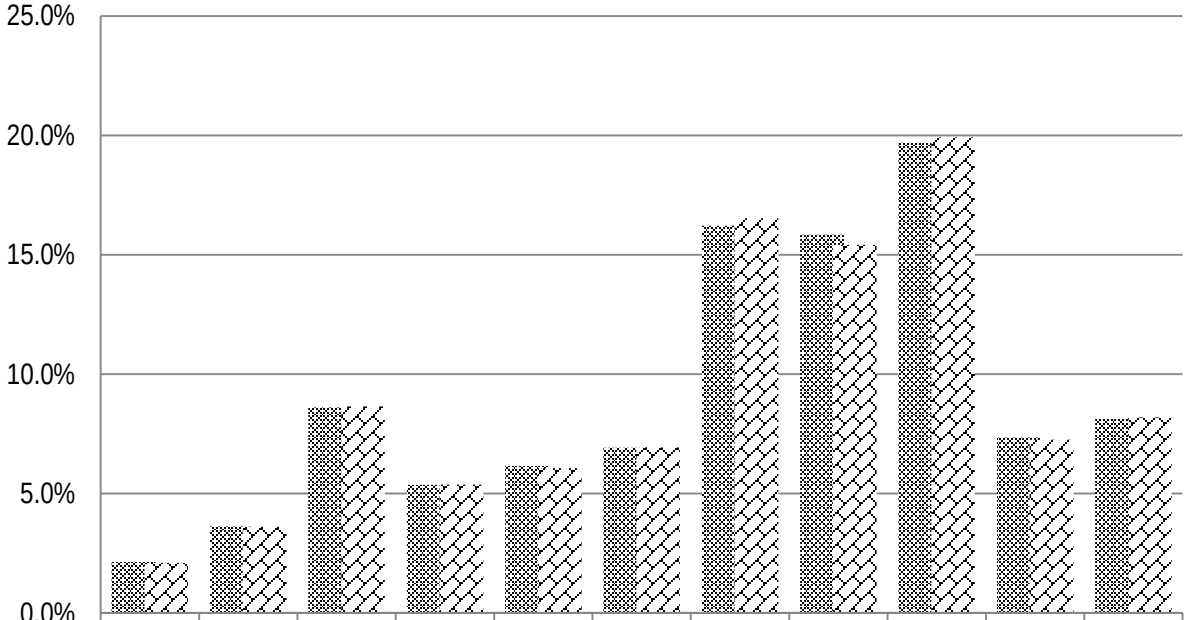


Source: USDA, Economic Research Service

Figure 2.3: Monthly Livestock Slaughter by Class in the United States --1986 to 2016

2.1.2. Change in Livestock Production

The AABP divides the United State into 11 districts (Appendix A) that were used in this report. The regional production of cattle and calves from 2014 to 2016 is presented in Figure 2.4. District 9 is the leading region in cattle and calves production, with 19.9 percent of the total production in the United States. District 9 contains the greatest concentration of cattle feed yards where large concentrations of beef cattle are fed to finish for harvest. In addition, District 9 provides a major source of winter grazing prior to animals moving to the feed yards. Young beef animals are shipped to District 9 in the fall to graze on wheat, rye and other cool season grasses, a source of lower-cost feed. Districts 8, 7 and 3 have the next largest concentration of livestock as they are the primary locations for cow-calf operations. These districts have historically been the major cattle producers within the United States.

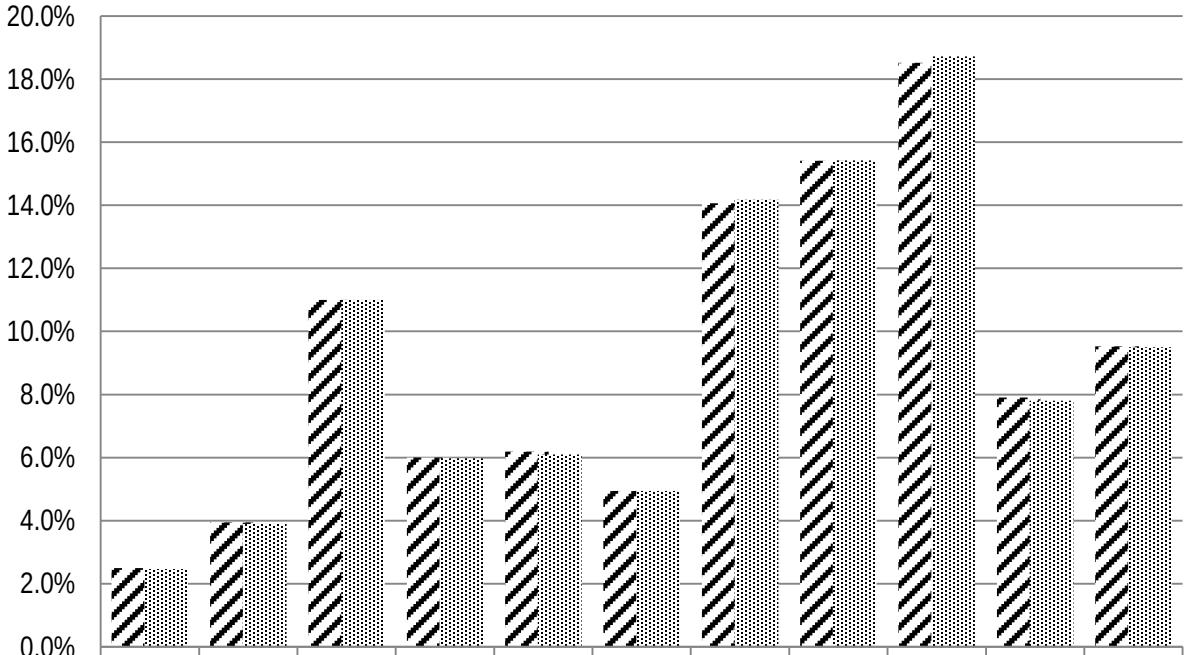


	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	2.1%	3.6%	8.6%	5.4%	6.2%	6.9%	16.2%	15.8%	19.7%	7.3%	8.1%
2016	2.1%	3.6%	8.6%	5.4%	6.1%	6.9%	16.5%	15.4%	19.9%	7.3%	8.2%

Source: USDA. National Agricultural Statistics Service

Figure 2.4: Cattle and Calves Production by AABP District

The distribution of beef and dairy cow production (only cows that have calved), is not that different from cattle production (Figure 2.5). Districts 9, 8, 7 and 3 accounts for more than 59 percent of the total national cow herd. The year-to-year volatility in the regional distribution of the cow herd is related to the weather, as these animal populations are highly dependent on the availability of forages. Again, because the demand for bovine practitioner's services is dependent upon the number of animals, events such as droughts or economic recessions that affect herd size will affect the demand for bovine veterinary services.

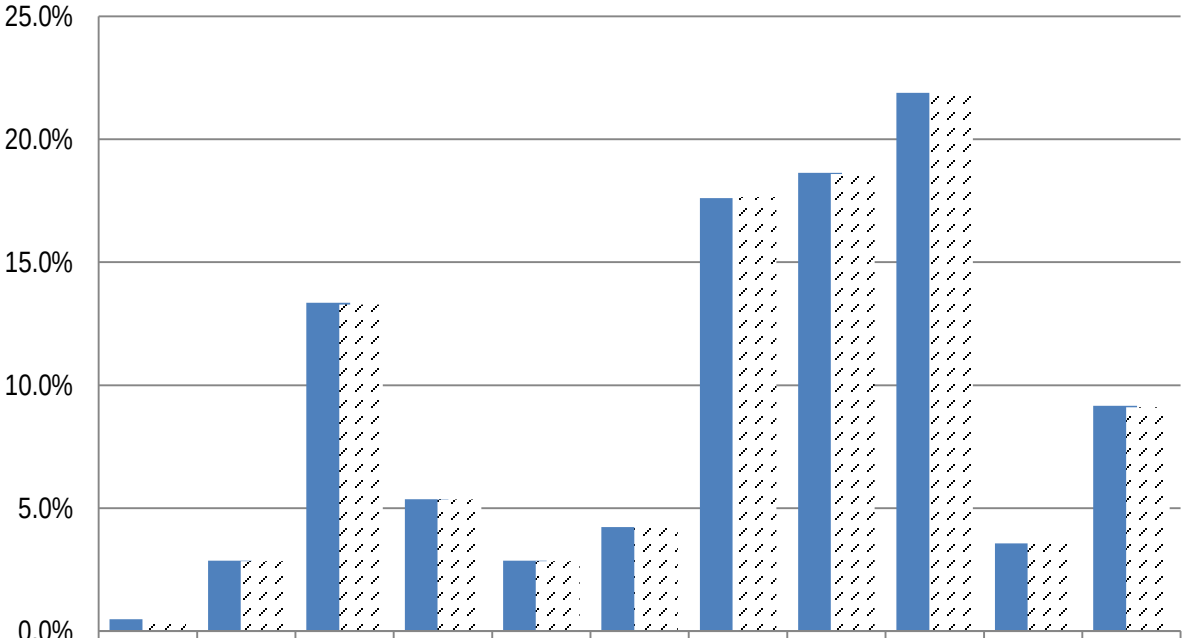


	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	2.5%	3.9%	11.0%	6.0%	6.2%	4.9%	14.1%	15.4%	18.5%	7.9%	9.5%
2016	2.5%	3.9%	11.0%	6.0%	6.1%	4.9%	14.2%	15.4%	18.7%	7.8%	9.5%

Source: USDA. National Agricultural Statistics Service

Figure 2.5: Cows (Calved cows only) Production by AABP District

For beef cows, the districts of greatest production are districts 9, 8, 7 and 3. The combined output of these four regions is nearly 73.0 percent of the total beef cow production, with districts 9 and 8 accounting for nearly 60.0 percent of that four-district total.

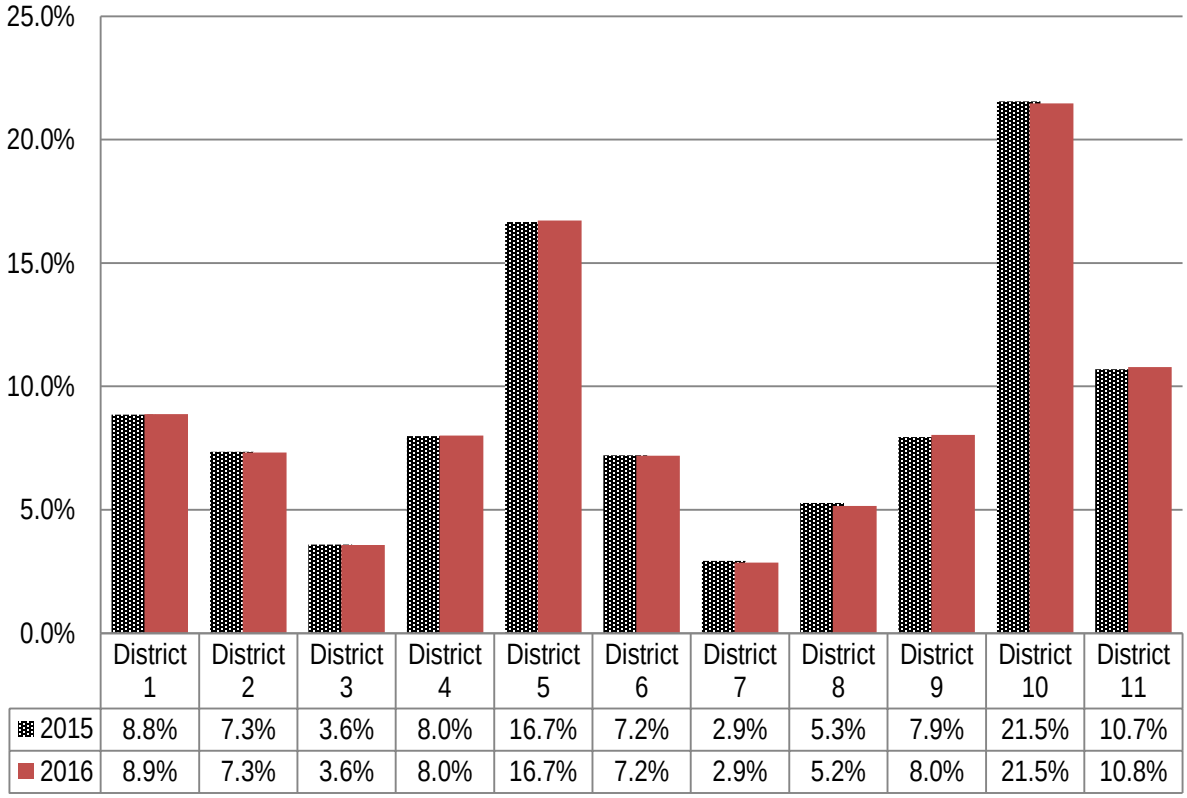


	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	0.5%	2.9%	13.3%	5.4%	2.9%	4.2%	17.6%	18.6%	21.9%	3.6%	9.2%
2016	0.5%	2.8%	13.3%	5.4%	2.8%	4.3%	17.6%	18.6%	22.0%	3.6%	9.1%

Source: USDA. National Agricultural Statistics Service

Figure 2.6: Beef Cow Production by AABP District

The major milk production areas in the U.S. are districts 10 (21.5 percent), 5 (16.7 percent), and 11 (10.8 percent) as illustrated by the distribution of dairy cows provided in Figure 2.7. This suggests that the focus of bovine practitioners differs by district with those specific to dairy herds concentrated in districts 5, 10 and 11 and those specific to beef cattle production concentrated in districts 3, 7, 8 and 9.

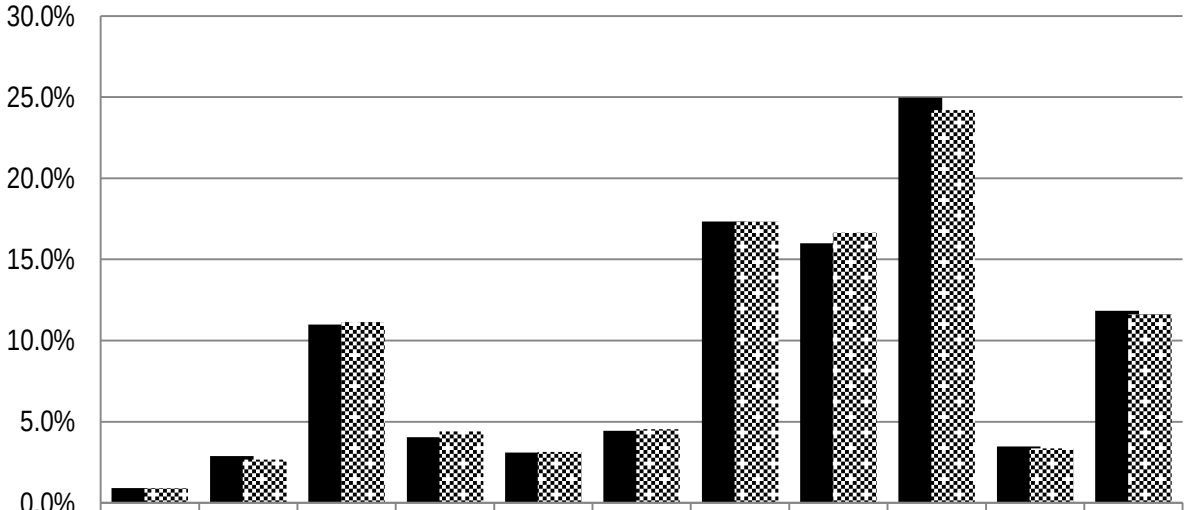


	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	8.8%	7.3%	3.6%	8.0%	16.7%	7.2%	2.9%	5.3%	7.9%	21.5%	10.7%
2016	8.9%	7.3%	3.6%	8.0%	16.7%	7.2%	2.9%	5.2%	8.0%	21.5%	10.8%

Source: USDA. National Agricultural Statistics Service

Figure 2.7: Milk Cows Production by AABP District

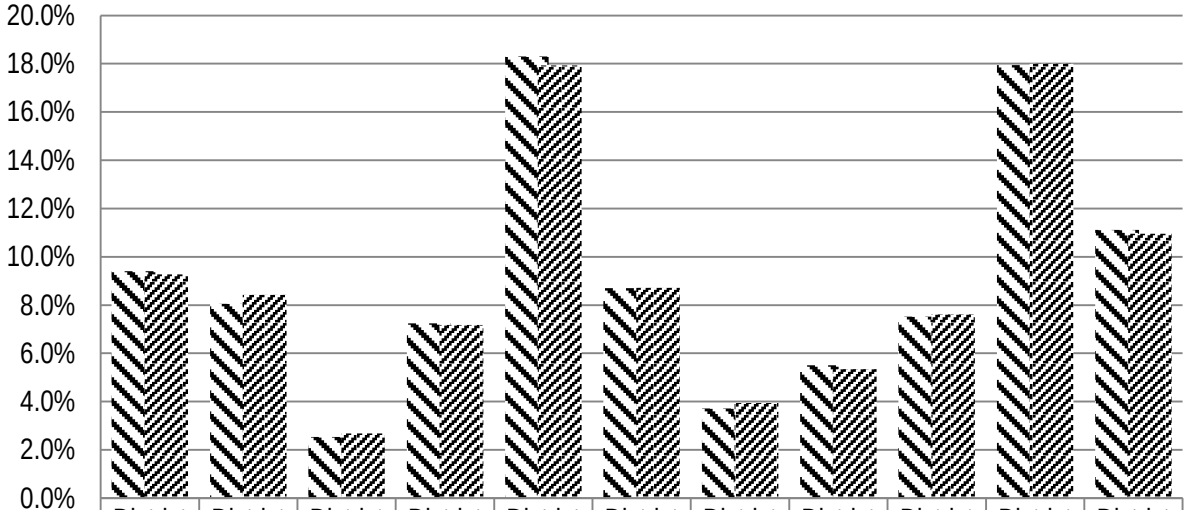
The distribution of replacement cattle by class (heifers, steers, bulls and calves) also varies considerably by district (Figure 2.8 through Figure 2.12). Roughly 60 percent of beef heifers are located in districts 7, 8 and 9, while nearly 36 percent of dairy heifers are located in districts 5 and 10. Because heifer development is the backbone of the cattle industry this is a major area of demand for veterinary services.



	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	0.9%	2.9%	11.0%	4.0%	3.1%	4.4%	17.3%	16.0%	25.0%	3.5%	11.8%
2016	0.9%	2.7%	11.2%	4.4%	3.1%	4.5%	17.3%	16.6%	24.2%	3.4%	11.6%

Source: USDA. National Agricultural Statistics Service

Figure 2.8: Regional Distribution of Beef Heifers – 500 Pounds and Over

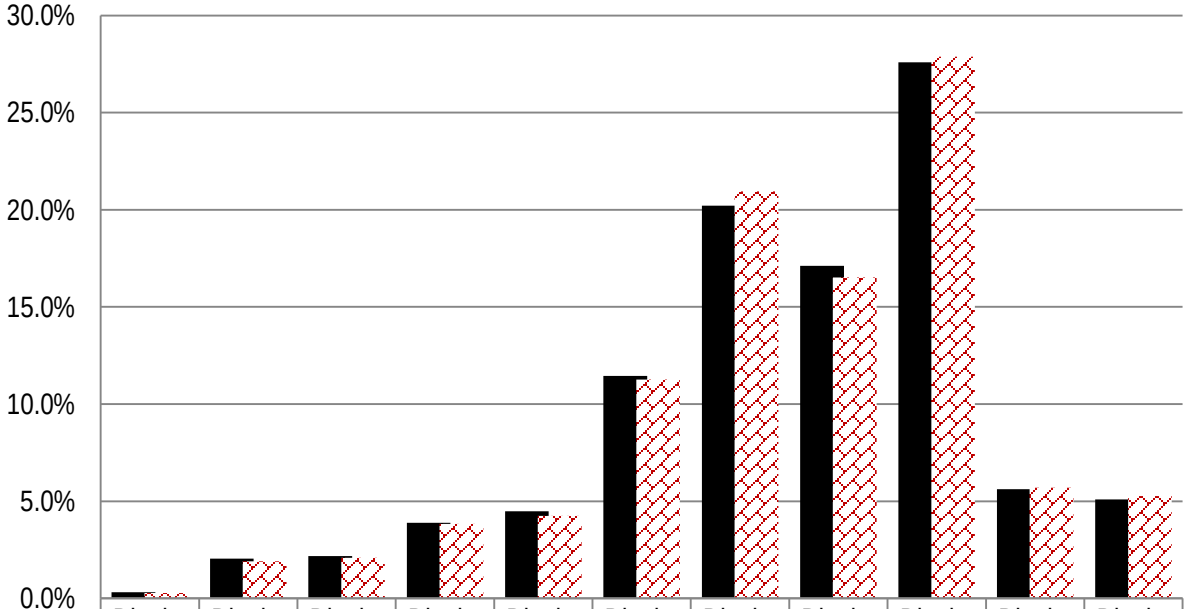


	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	9.4%	8.1%	2.5%	7.2%	18.3%	8.7%	3.7%	5.5%	7.5%	17.9%	11.1%
2016	9.3%	8.4%	2.7%	7.2%	17.9%	8.7%	3.9%	5.3%	7.6%	18.0%	10.9%

Source: USDA. National Agricultural Statistics Service

Figure 2.9: Regional Distribution of Dairy Heifers – 500 Pounds and Over

District 9 contains nearly 30 percent of the total population of steers (500 pounds and over), followed by districts 7 and 8, with the three regions containing nearly 66 percent of the total population of steers. The preponderance of these animals is located in confined animal feeding operations (CAFOs) with unique veterinary medical needs due to their high density. However, the large CAFOs often provide their own veterinary services. Thus, even as District 9 has shown to have a large percentage of the total cattle inventory, much of this inventory are cattle on feed and have lower demand for services from veterinarians.

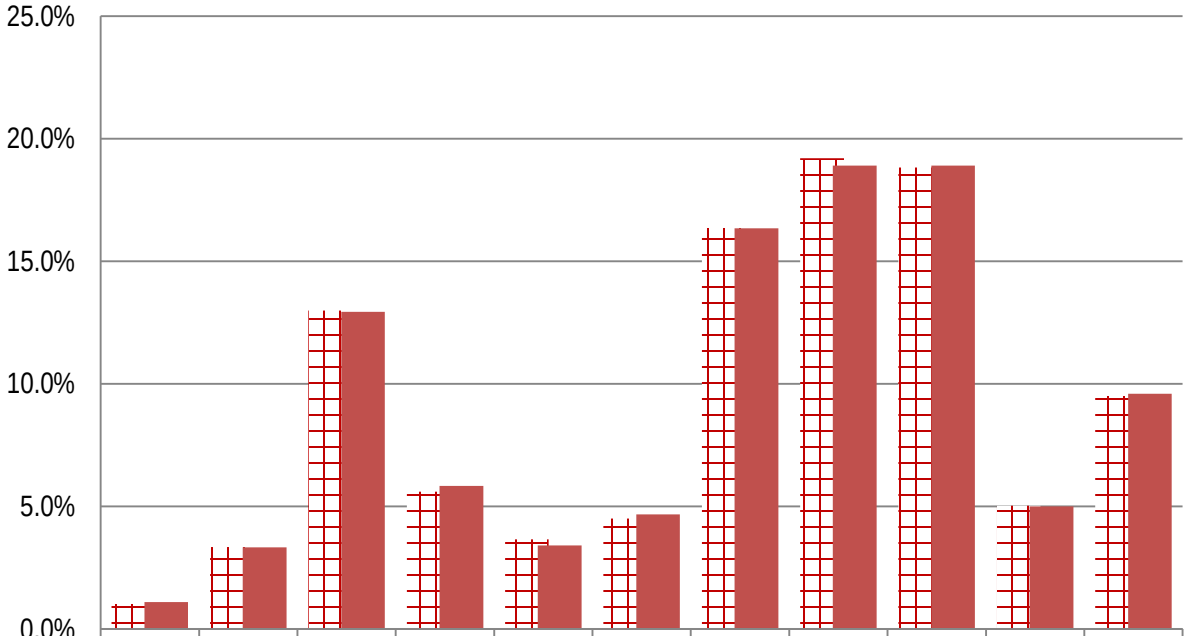


	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	0.3%	2.0%	2.2%	3.9%	4.5%	11.5%	20.2%	17.1%	27.6%	5.6%	5.1%
2016	0.3%	1.9%	2.1%	3.8%	4.3%	11.3%	21.0%	16.5%	27.9%	5.7%	5.3%

Source: USDA. National Agricultural Statistics Service

Figure 2.10: Regional Distribution of Steers – 500 Pounds and Over

The location of bulls provides an indication of where the production of cattle is greatest. Each bull can naturally service 25-50 cows, depending on the age of the bull and its environment. While artificial insemination and embryo transfer has enabled a single bull to service hundreds of cows per year, the majority of beef calves are produced through natural service. For dairy calves the opposite is true, more calves are produced through artificial methods than through natural service. This is reflected in the distribution of bulls (Figure 2.11) versus the distribution of calves (Figure 2.12). The majority of bulls are located in districts 8 and 9.

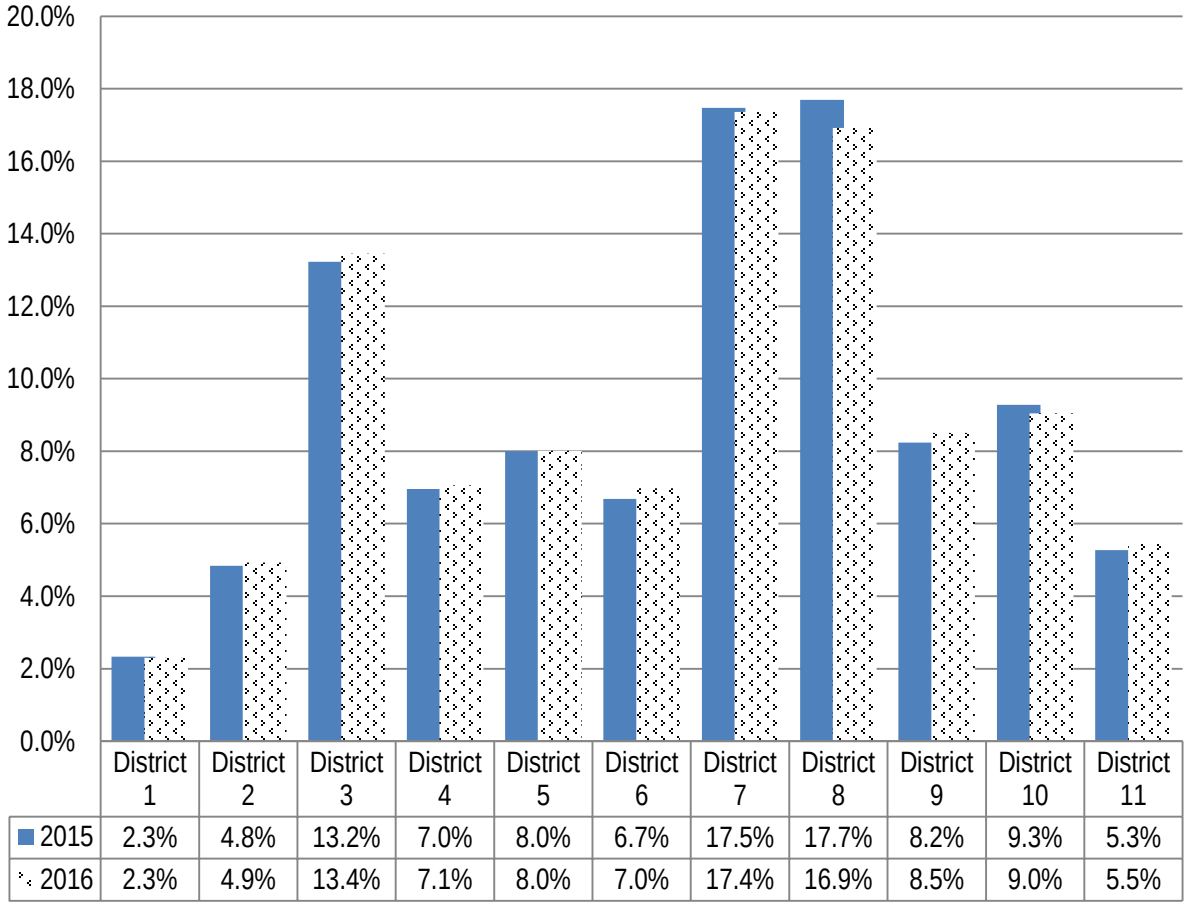


	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	1.0%	3.3%	13.0%	5.6%	3.7%	4.5%	16.4%	19.2%	18.8%	5.0%	9.5%
2016	1.1%	3.3%	12.9%	5.8%	3.4%	4.7%	16.3%	18.9%	18.9%	5.0%	9.6%

Source: USDA. National Agricultural Statistics Service

Figure 2.11: Regional Distribution of Bulls – 500 Pounds and Over

The distribution of calves differs from the distribution of bulls due to the difference in breeding methods of dairy and beef cows. The large population of bulls in districts 8 and 9 are predominately for beef cow breeding and thus beef calves are produced. In districts 5 and 10 there are fewer bulls but calve inventory is high as these districts are focused on dairy production which uses fewer bulls to service a larger number of cows.



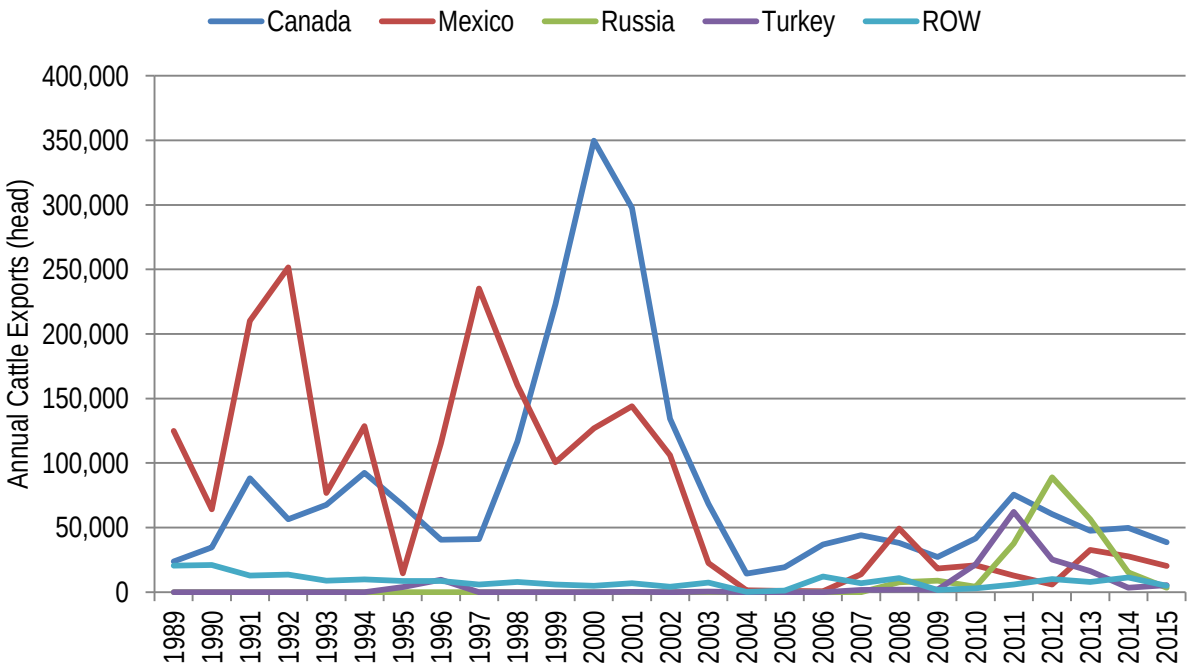
	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	District 10	District 11
2015	2.3%	4.8%	13.2%	7.0%	8.0%	6.7%	17.5%	17.7%	8.2%	9.3%	5.3%
2016	2.3%	4.9%	13.4%	7.1%	8.0%	7.0%	17.4%	16.9%	8.5%	9.0%	5.5%

Source: USDA. National Agricultural Statistics Service

Figure 2.12: Regional Distribution of Calves – 500 Pounds and Over

2.1.3. International Demand for U.S. Beef

The United States leads the world in beef production (Cook, 2016) and is the largest supplier of beef to the international market. Canada, Mexico, Russia and Turkey are the largest importers of U.S. cattle (Figure 2.13). In 2010, the Canadian demand for U.S beef reached roughly 350,000 head. Between 2000 and 2004, the demand for U.S beef declined as a result of the bovine spongiform encephalopathy (BSE) occurrence that resulted in bans of U.S beef from the international markets. Since 2009 demand for U.S beef from Canada and Mexico has begun to return but is still far below its average prior to 2000.



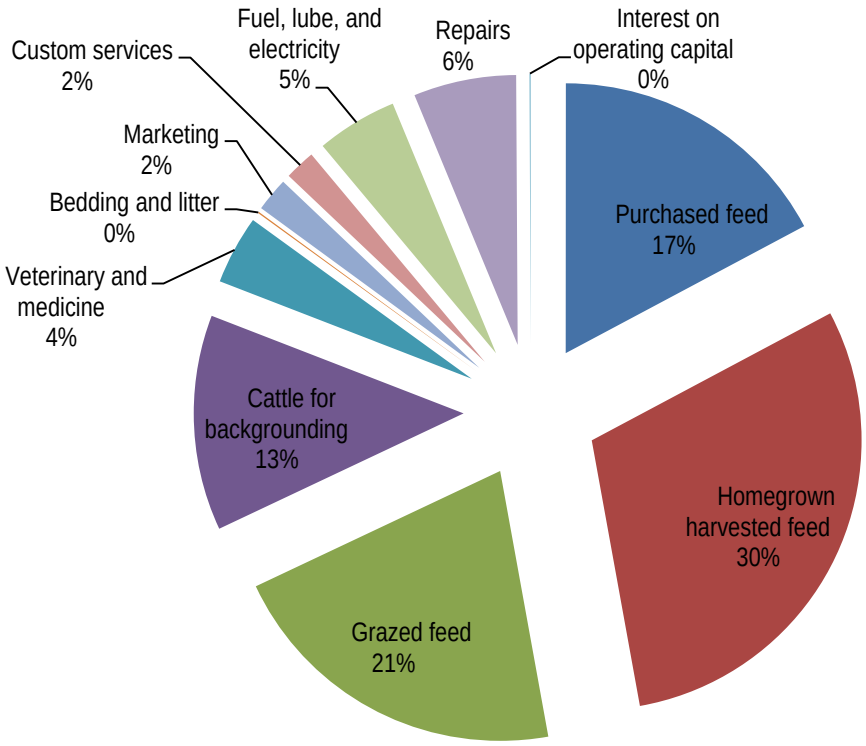
Source: USDA, Economic Research Service

Figure 2.13: Total Annual U.S. Cattle Exports (1989 – 2015)

2.2 Market for Bovine Veterinary Services

To better understand the market for bovine veterinary services, we consider the cattle producers' operating costs. Bovine veterinarians sell services to cattle producers and the amount spent by cattle producers on veterinary services as a share of the cost per cow per year varies as a result of their herd size, distance to the veterinarian, health of the herd, ability of the farm manager to provide veterinary services, and the willingness and ability of the farm manager to purchase veterinary services.

The operating expense sheet of a typical cattle producer is given in Figure 2.14. Veterinary services represent 4 percent of the total expenses. Using the average operating cost of roughly $600 per cow (USDA, 2014) and the regional distribution of cattle, we estimated the value of total operating expenses per region and applying the 4 percent share for veterinary services, we obtained the potential demand for veterinary services per region (Table 2.1). The aggregate demand for veterinary services for the seven regions is estimated at approximately $2.2 billion.



Source: USDA, Economic Research Service

Figure 2.14: Expenditure Share in Cattle Production Operating Expenses

	Herd Size	Operating Costs ($600/cow)	Veterinary Services (4%)	Percent of U.S. Total
District 1	1,928,000	$1,156,800,000.00	$46,272,000.00	2%
District 2	3,314,000	$1,988,400,000.00	$79,536,000.00	4%
District 3	7,950,000	$4,770,000,000.00	$190,800,000.00	9%
District 4	4,950,000	$2,970,000,000.00	$118,800,000.00	5%
District 5	5,570,000	$3,342,000,000.00	$133,680,000.00	6%
District 6	6,370,000	$3,822,000,000.00	$152,880,000.00	7%
District 7	15,200,000	$9,120,000,000.00	$364,800,000.00	17%
District 8	14,180,000	$8,508,000,000.00	$340,320,000.00	15%
District 9	18,320,000	$10,992,000,000.00	$439,680,000.00	20%
District 10	6,675,000	$4,005,000,000.00	$160,200,000.00	7%
District 11	7,531,000	$4,518,600,000.00	$180,744,000.00	8%

Source: USDA National Agricultural Statistical Service Data

Table 2.1: Herd Size and Average Costs for Veterinary Services by AABP District

2.3 Market Share for Bovine veterinarians

The bovine veterinary market share is the portion of the cattle producers' expenditures for health related products and services that each veterinarian may obtain if they are the sole provider of veterinary medical goods and services.

In the market for bovine veterinary services, we compute the potential demand for veterinary services per veterinarian as the total value of all cattle producers' spending on bovine veterinary services divided by the number of practitioners in the district. This is the value of the annual potential services that an average practitioner may be able to capture in the market. However, this potential may not be reached as cattle producers may choose sources for veterinary medical goods and services other than the local veterinarian.

To calculate the market share, we used the APTIFY data to identify the number of bovine practitioners by district and the average costs of veterinary service in Table 2.1. The number of bovine practitioners per district, herd size by district, ratio of head of cattle per practitioner and value of the veterinary services per practitioner in the district is provided in Table 2.2. Districts 1, 2, 3, 4 and 10 represent more than 60 percent of the total bovine practitioners in the U.S., while districts 7, 8 and 9 represent more than 50 percent of the cattle. Thus, the ratio of bovine veterinary practitioner to animal is highest in districts 7 and 9 and lower in districts 1 and 2.

Table 2.2: Number of Bovine Practitioners, Herd Size, and Market Potential by AABP District

	Number of Bovine Practitioners	Cattle Herd Size	Ratio (Animal/Vet)	Market Potential (total service value per vet)
District 1	404	1,928,000	4,772	$ 114,534.65
District 2	506	3,314,000	6,549	$ 157,185.77
District 3	713	7,950,000	11,150	$ 267,601.68
District 4	471	4,950,000	10,510	$ 252,229.30
District 5	329	5,570,000	16,930	$ 406,322.19
District 6	155	6,370,000	41,097	$ 986,322.58
District 7	177	15,200,000	85,876	$ 2,061,016.95
District 8	337	14,180,000	42,077	$ 1,009,851.63
District 9	243	18,320,000	75,391	$ 1,809,382.72
District 10	482	6,675,000	13,849	$ 332,365.15
District 11	225	7,531,000	33,471	$ 803,306.67

From the simple calculations provided in Table 2.2 the average potential demand for veterinary services for each bovine veterinarian ranges from $114,535 to $2,061,017. This is a considerable difference in potential demand per bovine veterinarian and warrants further research to provide a better estimate and, if this does represent a true picture of the variation in demand per veterinarian by region, to identify what factors have led to this maldistribution. On the other hand it may also suggest that the demand for veterinary services decreases as herd size increases, a prospect discussed in further detail in Section 5.4.

2.4 Market for Bovine Veterinarians

The market for veterinarians is really a set of horizontally related markets. Horizontally related markets are those markets that use similar resources and/or produce similar outputs, with inputs (such as labor in the case of the market for veterinarians) able to move from one market to the other. Two integrated sub-sections of the profession that interact in the market for veterinarians are the public sector and the private sector. Within each sub-sector, board certification and specialization create unique markets within these two sub-sectors. The allocation of veterinarians across all of these markets is guided by market price (compensation). Increasing compensation in one market relative to the other suggest an increasing labor scarcity in that market, which should provide an incentive for veterinarians to move to the higher paying market when possible. Specialization weakens the possibility of substitution in the labor market, as the cost of obtaining the specialization acts as a deterrent to mobility from other markets to a specific specialty.

For bovine practice generally, and the wide array of employment opportunities that a bovine practitioner may elect to pursue, the question is whether the mean incomes are significantly different such that veterinarians could discern the relative scarcity in the various horizontally related markets and thus begin to shift towards these markets. Using historical data, the compensation reported in the current bovine practitioner's survey will enable a comparison between bovine practice and their peers in the other types of practices.

The real mean income for the veterinary profession by private practice type is provided in Figure 2.15 and the real mean income for the veterinary profession by public practice type is provided in Figure 2.16 (2015 AVMA report on the market for veterinarians). Bovine practitioners are found in each of these private and public markets, though predominately in the large animal or mixed animal private practice.

PRIVATE PRACTICE

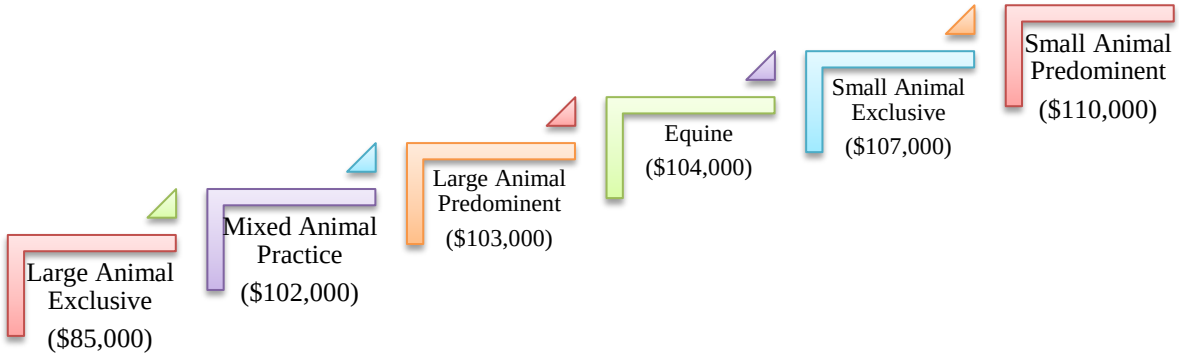


Figure 2.15: Real Mean Income of U.S. Private Practice Veterinarians (2014)

PUBLIC PRACTICE

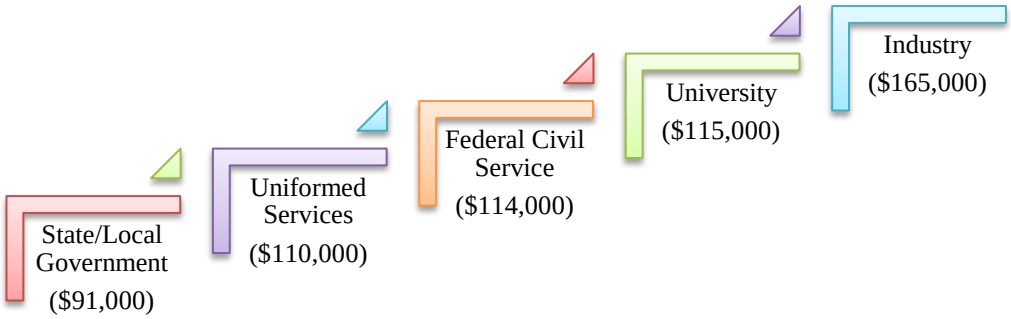


Figure 2.16: Real Mean Income of U.S. Public Practice Veterinarians (2014)

The mean salary of the respondents to the AABP Survey for private (Table 2.3) and public (Table 2.4) practice types are provided below. The mean income for veterinarians in the private sector is within the range of $89,000 to $170,000. The mean income is lower for veterinarians in the companion animal exclusive ($89,250) and veterinarians in the equine practice maintain the highest mean income of $170,000. Bovine practitioners that identify their practice as exclusively food animal earn the highest mean income across all private practice types at roughly $134,000, except for equine practice. Interestingly, those bovine practitioners who have moved to the exclusive practice of companion animal medicine have the lowest mean salary at just over $89,000.

Table 2.3: Mean Salary (in $) of AABP Respondents by Private Practice Type

	Mean	Std. Dev
Food Animal Practice (Excl.)	134,464.83	71,905.60
Food Animal Practice (Pred.)	111,841.05	58,975.74
Mixed Animal Practice	105,961.74	58,213.64
Companion Animal Practice (Pred.)	115,033.33	50,331.21
Companion Animal Practice (Excl.)	89,250.00	36,126.36
Equine Practice	170,000.00	153,419.36

Table 2.4: Mean Salary (in $) of AABP Respondents in the Public Sector

	Mean	Std. Dev
College/University	121,366.67	56,338.09
State/Local Government	78,000.00	.
Industry/Commercial Organizations	167,700.00	66,453.07
Not-for-Profit Organizations	115,000.00	7,071.07
Other Veterinary Employment	171,687.50	67,227.69

SECTION 3: UNEMPLOYMENT AND UNDEREMPLOYMENT

3.1. Unemployment in Bovine Veterinary Profession

The descriptive statistics of unemployment in the bovine veterinary profession by selected demographic variables is presented followed by an analysis of the associated factors. The results unemployment rates and associated factors are compared with the national sample results to identify any differences between the bovine veterinary segment and the general profession.

For the AABP sample, the analysis indicates that approximately 1 out of 100 respondents were in a situation of unemployment in 2014 (Table 3.1), a rate that is lower than the unemployment rate obtained from the national sample (3 percent). Table 3.2 presents the rate of unemployment by gender from the national sample and the AABP sample. The highest rate of unemployment in the general population of veterinarian is for female veterinarians (3.8 percent) while under the AABP sample, male respondents record the highest rate (1.8 percent).

Table 3.1: Current Unemployment between AABP and National Sample

	Are you currently employed?			
	AABP Sample		U.S Veterinarian Sample	
	N	PERCENT	N	PERCENT
Yes	583	97.3%	1787	95.0%
No	10	1.7%	62	3.3%
Missing	6	1.0%	32	1.7%

Table 3.2: Unemployment by Gender – AABP vs National Sample

	Are You currently employed?			
	AABP Sample		U.S Veterinarian Sample	
	YES	NO	YES	NO
FEMALE	98.4%	1.6%	96.2%	3.8%
MALE	98.3%	1.8%	97.6%	2.4%

Of those reporting unemployment, the average number of weeks they were unemployed in 2014 was about six weeks, an average unemployment period below the national average of 56 weeks (Table 3.3). However, the mean number of isolated periods of unemployment in the AABP sample (2.56) exceeds the national average (1.74), though this difference is not statistically significant. And the mean total number of days unemployed during the bovine veterinarians' career was roughly half that for the national sample.

Table 3.3: Length and Duration of Unemployment

	AABP Sample		U.S Veterinarian Sample	
	MEAN	STD. DEV	MEAN	STD. DEV
How many weeks have you been unemployed in veterinary medicine?	5.94	14.97	55.72	49.7
How many isolated periods of unemployment have you had?	2.56	2.96	1.74	1.28
For approximately how many days, in total have you been unemployed during your veterinary career?	205.69	397.59	371.23	307.54

Mean length of time between graduation and first employment for AABP members, based on the first veterinary position, is given in Table 3.4. Food animal practitioners have lower waiting times (two to five weeks) relative to other practitioners such as mixed practitioners (seven weeks) or companion animal practitioners (eight to 13 weeks).

Table 3.4: Average Waiting Time (in weeks) between DVM Graduation and First Employment by Type of Practice

	N	Mean	Std. Dev
Food Animal Exclusive Practice	117	2.9	4.9
Food Animal Predominant Practice	117	5.5	15.8
Mixed Animal Practice	135	7.3	20.8
Comp Animal Predominant Practice	19	13.9	33.8
Comp Animal Exclusive Practice	12	8.0	9.5
Equine Practice	5	2.0	3.4
Federal Gov. Civil Service	11	5.2	8.5
College/University	11	6.2	8.8
State/Local Government	2	2.0	2.8
Industry/Commercial Org.	2	1.0	1.4
Non-for-Profit Institution	18	0.4	1.2
Other	6	0.8	1.6

The time between graduation and first employment also varies by year of graduation (Table 3.5). The graduates from early years had a smaller time between graduation and first employment than those who graduated in later years. While the trend in waiting times is upward sloping indicating an increasing waiting time, periods with deeper recessions such as those in the 1980s and 2000s, that were periods with the highest wait times, certainly affect this trend. No statistically significant difference in wait times was found between periods.

Table 3.5: Average Waiting Time (in weeks) between DVM Graduation and First Employment by Year of Graduation

	N	Mean	Std. Dev
1950 - 1969	17	3.2	8.0
1970 - 1979	72	3.9	17.9
1980 - 1989	105	5.6	22.0
1990 - 1999	73	4.3	18.3
2000 - 2009	79	4.4	6.6
2010 - 2015	110	8.3	10.9

3.2. Underemployment in Bovine Veterinary Profession

Underemployment, measured in total hours, represents the number of hours that veterinarians desire to work above the amount they are currently working. To determine the level of underemployment in the bovine veterinary profession, respondents indicated their willingness to increase or decrease the current number of hours worked per week with an accompanying increase/decrease in compensation.

Of the 572 respondents, 19.4 percent desired fewer hours per week with less pay while 13.6 percent desired more hours for greater compensation. More than 26 percent of female and nearly16 percent of male veterinarians indicated a desire to reduce their current work hours with less compensation (Table 3.6). These numbers are consistent with the national data where 21 percent of female and 16 percent of male veterinarians indicated a desire to decrease their current work hours with less compensation.

On the other hand, nearly 17 percent of female veterinarians and more than 12 percent of male veterinarians in the AABP sample indicated a desire to increase their current work load for an increase in compensation. In the U.S veterinarian sample, the trend is different. The U.S. sample had a higher percentage of men indicating a desire to work more hours for greater compensation but a lower percentage of women in the national sample who desire to work more hours per week for greater compensation. However, this difference may be associated with the difference in the male and female age distributions between the AABP and national samples.

Table 3.6: Underemployment in the Bovine Veterinary Profession

	AABP Sample		U.S Veterinarian Sample	
	Female	Male	Female	Male
Work less hours	26.6%	15.9%	21.2%	16.1%
Work more hours	16.9%	12.2%	13.9%	16.6%

District 6 and District 11 require special analysis given the high proportion of veterinarians asking for fewer hours of work per week. The number of veterinarians asking for more hours of work per week in District 11 is also among the lowest, indicating a high work load for bovine veterinarians in these districts, necessitating veterinarians there to work more hours than normal.

Conversely, Districts 2, 8 and 10 present indications of excess capacity. In fact, 29.7 percent of veterinarians in District 2, 27.3 percent of veterinarians in District 8, and 22.2 percent of veterinarians in

District 10 are asking for an increase in their current time at work per week (Figure 3.1). For districts 2 and 10, the potential market for each practitioner in that district was low compared to districts 6 through 9 (Table 2.2). However, as just noted district has a high potential market per veterinarian and thus the high response for more hours would appear out of place. In general, based on the market potential per veterinarian in the district, districts 6 through 9 would be expected to have more bovine veterinarians seeking fewer hours and seeking more hours while district 1 through 5 and 10 would be expected to have more veterinarians seeking more hours than seeking fewer hours of employment per week. These expectations however are based solely on the market potential with respect to bovine veterinary medical goods and services that are currently being used by the owners of the bovine animals.

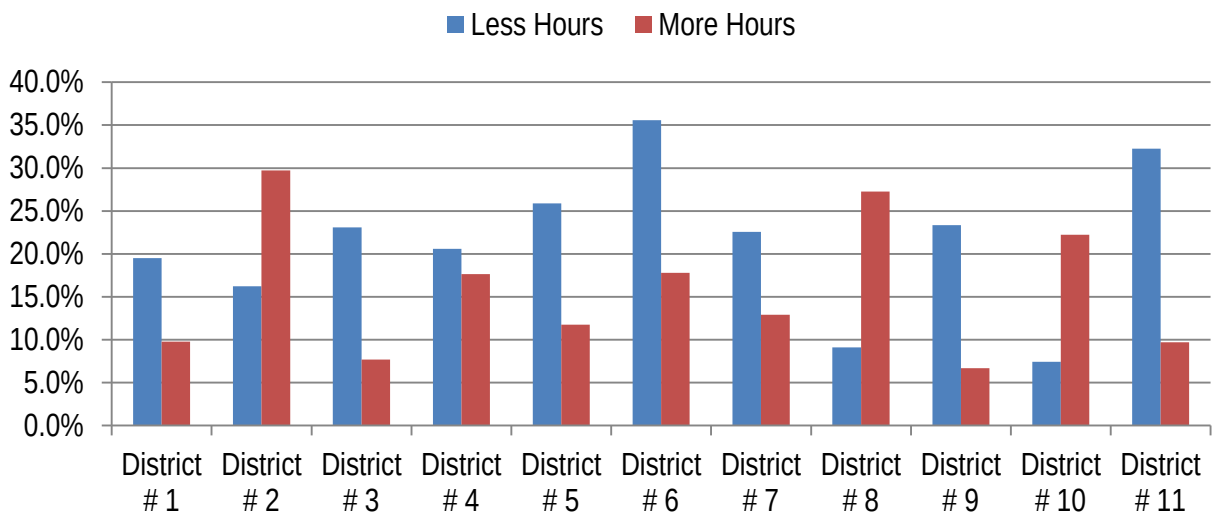


Figure 3.1 Work Preferences by District

Generally, the first veterinary position is not reflected among the group expressing a desire to work more or less in ether the AABP sample or the national sample. While there is some variation in the desire to work more or less for a change in compensation between first employment practice types, these difference are not statistically significant.

Table 3.7: Underemployment by First Veterinary Position

	AABP Sample		U.S Veterinary Sample	
	Less Hours	More Hours	Less Hours	More Hours
Food animal practice (excl.)	19.6%	15.5%	16.7%	12.5%
Food animal practice (pred.)	23.2%	10.2%	19.4%	22.6%
Mixed animal practice	19.4%	17.1%	26.4%	10.4%
Companion animal practice (pred.)	16.7%	8.3%	19.9%	15.3%
Companion animal practice (excl.)	10.0%	10.0%	21.6%	12.9%
Equine practice	18.2%	18.2%	16.4%	35.8%
Federal Government	25.0%	0.0%	4.5%	13.6%
Uniformed services	0.0%	20.0%	14.3%	0.0%
College/University	14.3%	0.0%	18.6%	11.6%
State/Local Gov.	NA	NA	11.1%	11.1%
Industry/Commercial Org.	0.0%	0.0%	18.8%	16.7%
Non-for profit Org.	NA	NA	12.8%	14.9%
Other	7.1%	14.3%	15.8%	25.0%
Currently a resident/Post-doc	0.0%	25.0%	11.1%	14.3%

The number of hours per week respondents reported they currently work ranges from one hour to 100 hours (Figure 3.1), and a look at the percentage of all respondents' hourly work week (Figure 3.2) indicates that the majority (57 percent) of respondents work an average of between 50 and 60 hours per week. The pattern of hours worked per week among men and women is very similar except for the percentage of each gender who works more than 50 hours per week: a higher percentage of men than women work about 50 hours per week. On average, both male and female veterinarians work 51 hours/week.

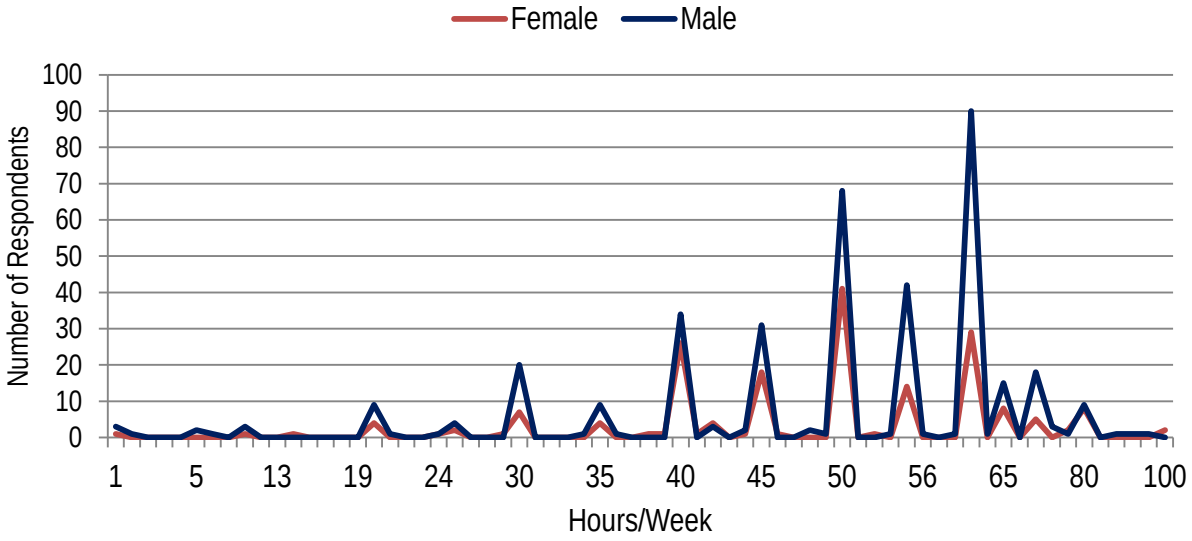


Figure 3.2: Number of Hours per Week – Female vs Male

To determine the average number of hours that respondents would like to increase or decrease relative to their current hours, the following figure plots number of hours that each respondent desired to change per week (Figure 3.3). The number of hours they would like to change ranges from five to 100 hours. For those who desire a decrease in the number of hours, the majority prefer a decrease of 10 hours relative to their current schedule. For those who desired more hours, their request for increase ranges between five to 20 hours per week.

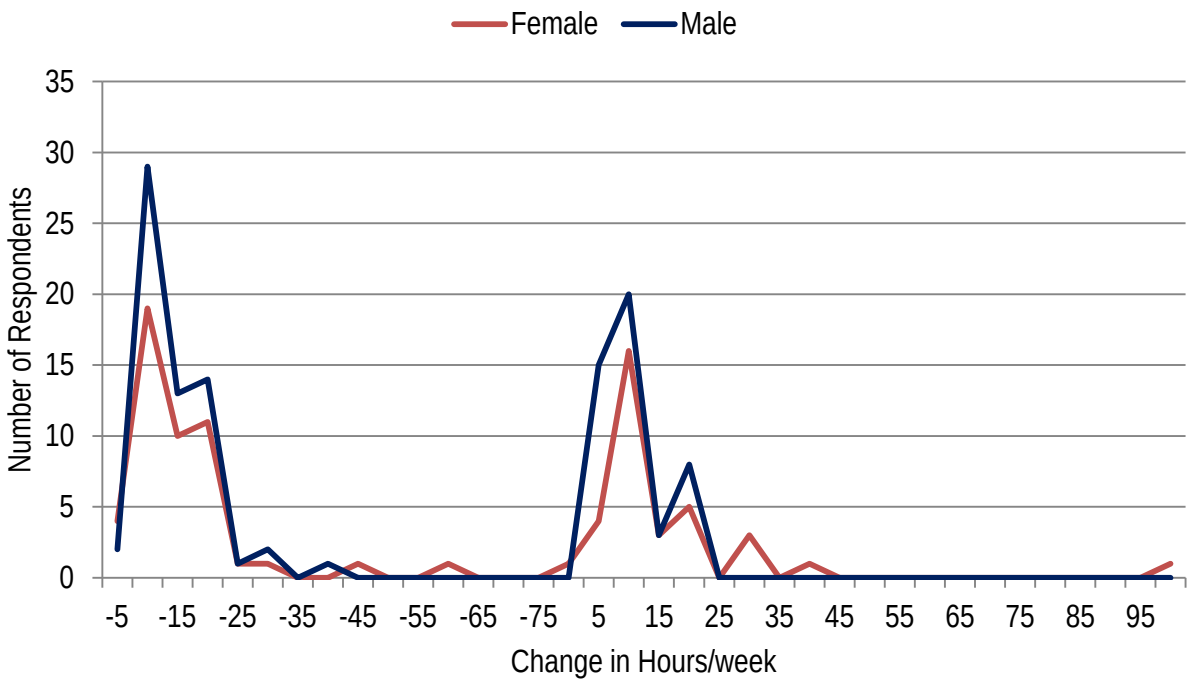


Figure 3.3: Change in Hours by Gender

The average hourly work week preferred by men and women very closely resembles the distribution of hours per week actually worked with little difference between men and women (Figure 3.4).

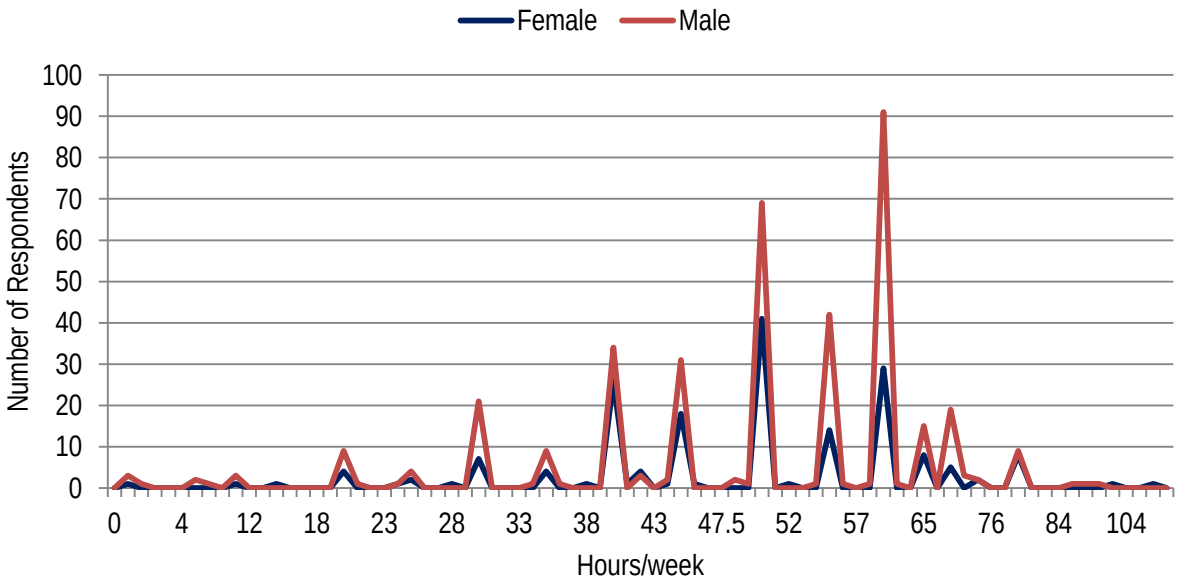


Figure 3.4: Net Hours Desired by Gender

The desired change in average hourly work week by number of years since DVM graduation provides insight into the lifetime earnings path of bovine veterinarians. For female bovine veterinarians in the beginning of their careers, there is a greater number who desire to work additional hours for more compensation than want to work fewer hours for less compensation. However, female bovine veterinarians more than five years post-graduation generally want to work fewer hours until they are more than 25 years post-graduate (Figure 3.5).

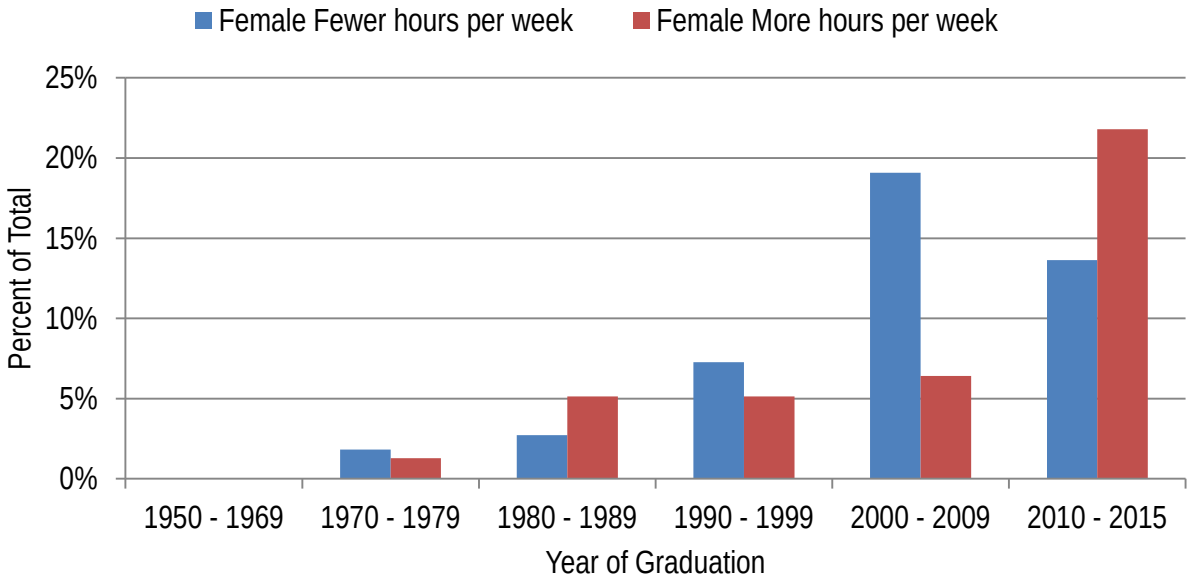


Figure 3.5: Work Preference by Number of Years since DVM – Female Veterinarians

For male bovine veterinarians, the distribution of desired change in hourly work week is different, especially in the early career groups (Figure 3.6). Not unlike the female bovine veterinarians, the group of men less than five years post-grad had more respondents who want to work additional hours than those who want to work fewer hours. But this is also the case for the men five-15 years post-graduate. And, in the 0-15 years post graduate group, there is a considerably lower percentage of men who want to change (either increase or decrease) their average hourly work week compared to women. The opposite pattern occurs for men and women more than 25 years post-graduate, with a higher percent of men desiring to change their current number of hours per week of work compared to women.

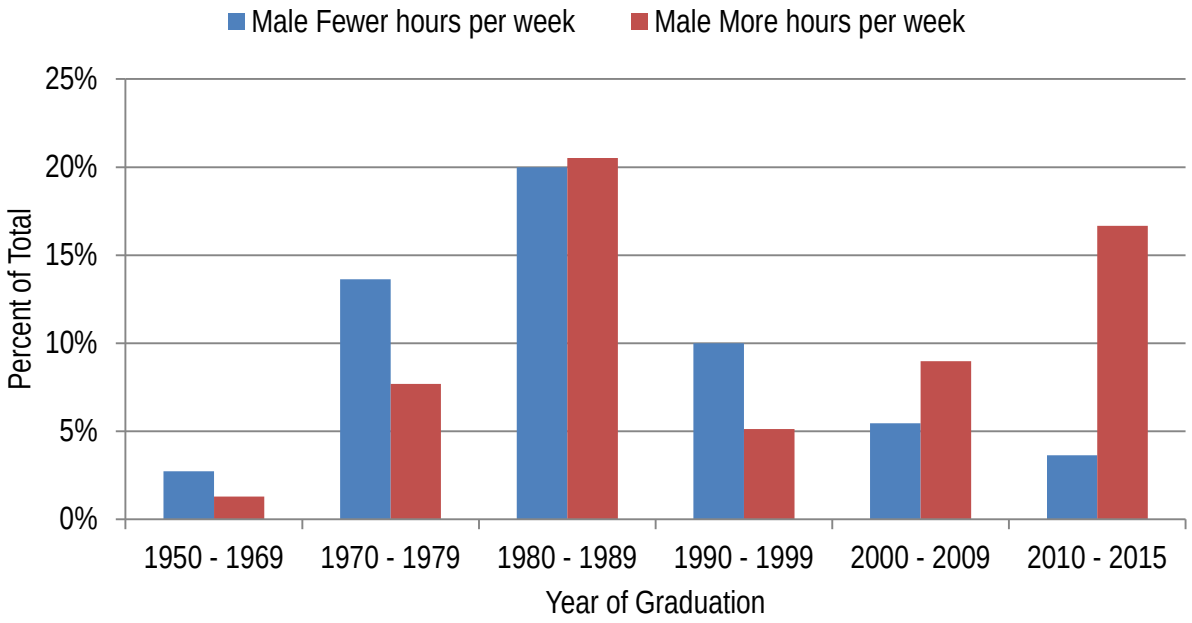


Figure 3.6: Work Preference by Number of Years since DVM – Male Veterinarians

The work hour preference by type of employment is presented in Figure 3.7. In the private practice, the percentage of people who prefer to change their current number of hours ranges from 23 percent to 44 percent. Mixed animal practice records the highest percentage of veterinarians who desire to change their current work hours. In the public sector, the rate is relatively low compared to the private sector. The percentage of people who would like to change their work hours is between 10 percent (industry/commercial organizations) and 33 percent (state/local government).

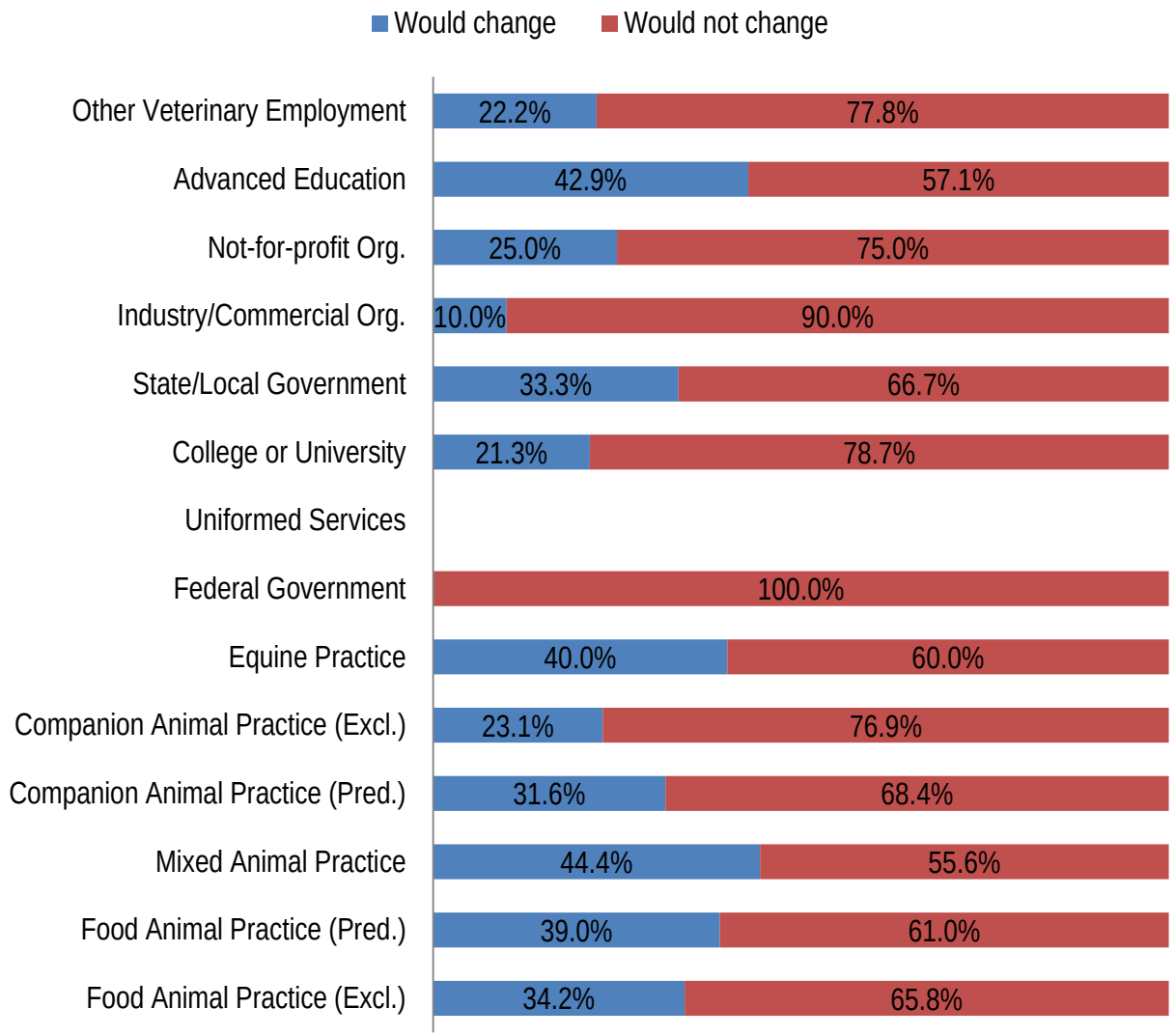
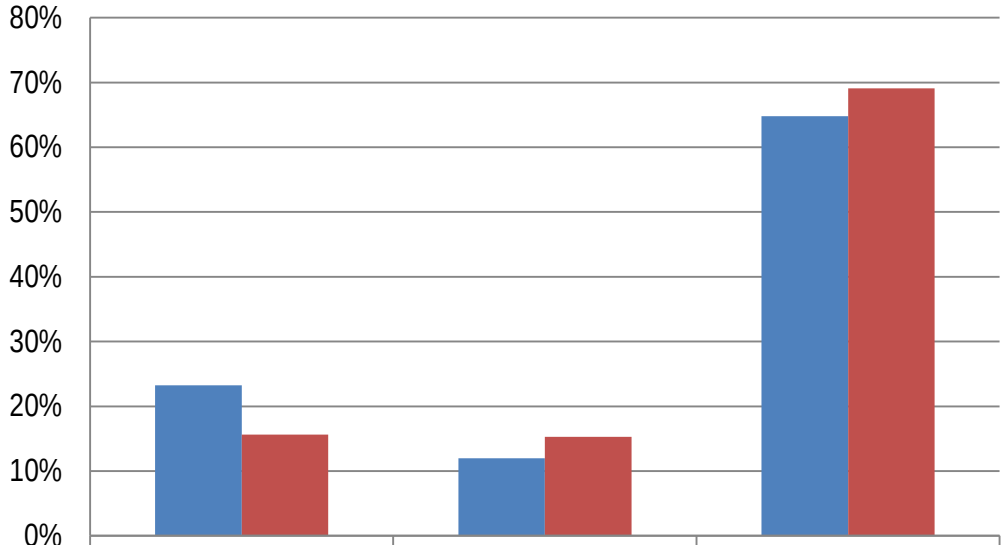


Figure 3.7: Work Preference by Type of Employment

Examining practice owner versus non-practice owner bovine veterinarians finds that by a large margin a higher percentage of practice owners desire to work fewer hours per week than do non-practice owners.



	Would prefer fewer hours per week	Would prefer more hours per week	Would prefer the same hours per week
practice owner	23.2%	12.0%	64.8%
non-practice owner	15.6%	15.3%	69.1%

Figure 3.8: Work Preference – Practice Owners vs Non-Practice Owners

Most of the bovine veterinarians in private practice are from rural areas and so the majority of bovine veterinarians (almost 90 percent) who wish to change their average hourly work week are located in the rural areas. The percent of rural veterinarians who prefer a different hourly work week is more than 15 percent higher than those who practice in suburban settings, with the majority of these rural veterinarians desiring to work fewer hours while those in urban and suburban settings have a majority that prefer an increase in the number of hours per week.

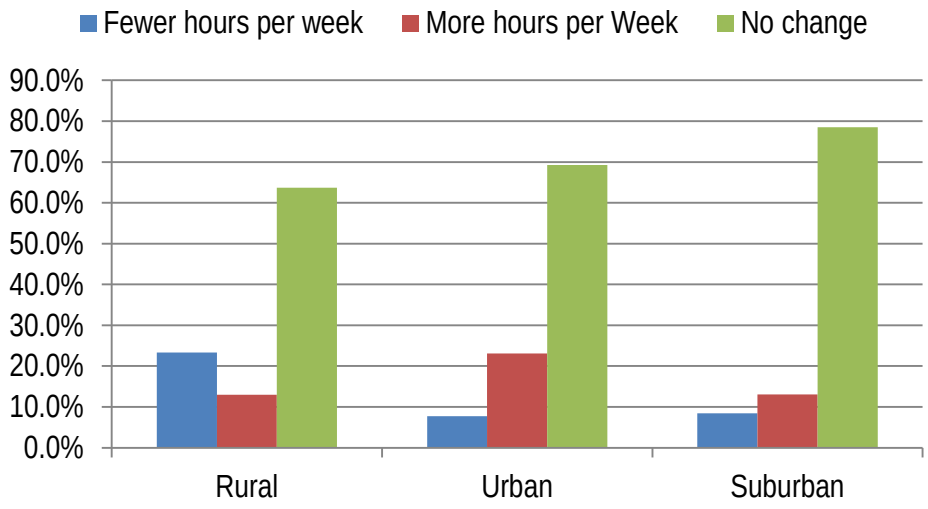


Figure 3.9: Work Preference by Type of Community in which Respondent Belongs

As one might hypothesize, the greater the school debt a veterinarian has, the greater desire to change their average hourly work week, which is illustrated in Figure 3.10. Roughly 72 percent of veterinarians with less than $100,000 of debt are content with their current average hourly work week. However, only about 50 percent of those with more than $100,000 in debt are content with the current average hourly work week. The majority of those with more than $100,000 in debt and who indicated a desire to change their current number of hours per week, wish to work more hours for greater compensation.

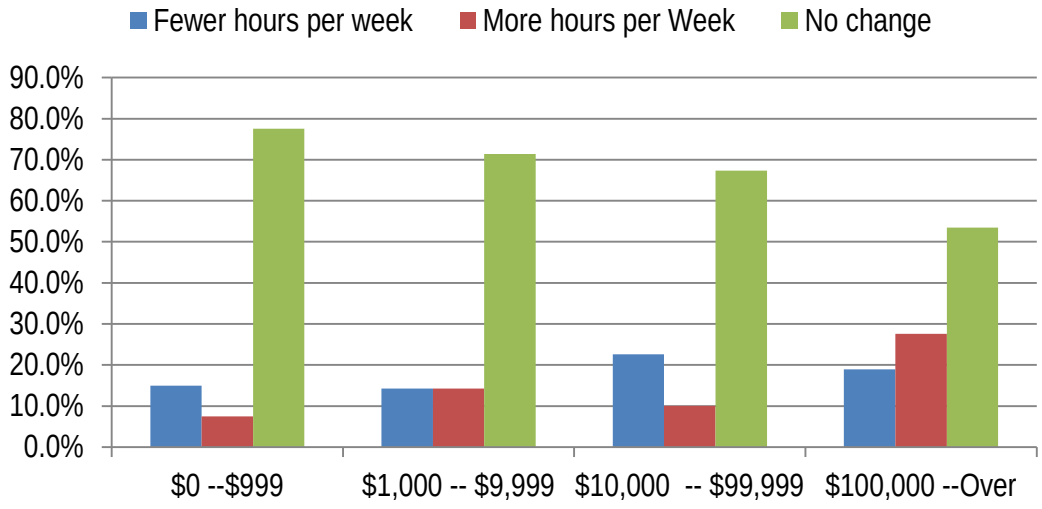


Figure 3.10: Work Preference and Level of Educational Debt

Incentives matter in markets, and this is readily seen in the desire of bovine veterinarians to change their current hourly work week based on the method of compensation (Figure 3.11). Veterinarians paid either a

flat salary or an hourly rate are more likely to be content with their current average hourly work week or want to reduce the number of hours they work. On the other hand, those paid a minimum salary with a production bonus (prosal) are the least content with their current average hourly work week. The greatest share of the prosal veterinarians who are discontent with their current hourly work week wish to increase the number of hours in their work week. However, those bovine veterinarians paid only on production are found to be most content with their current average hourly work week.

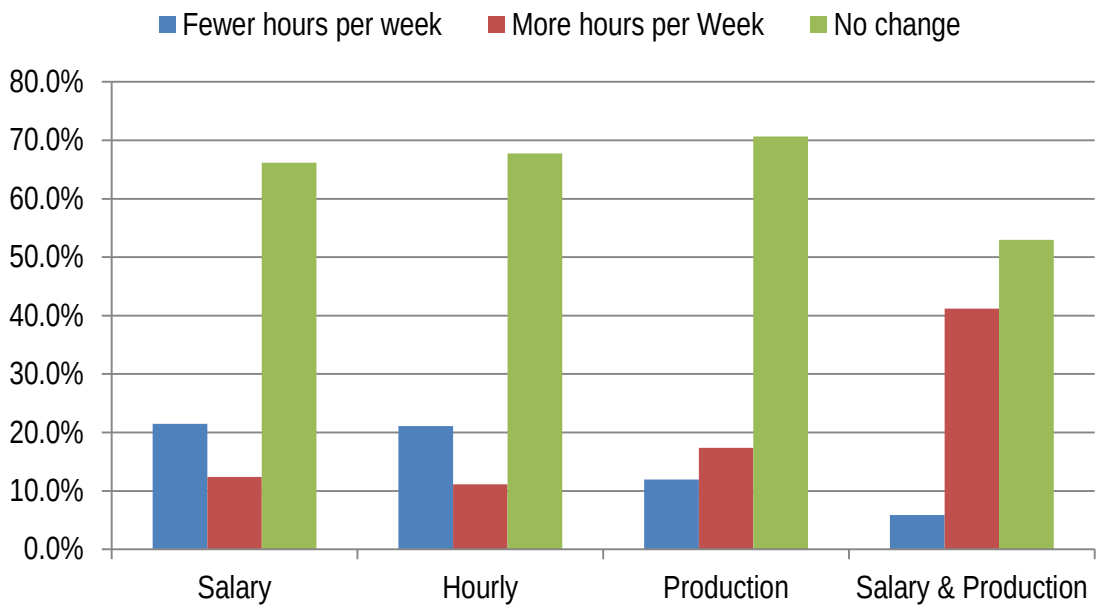


Figure 3.11: Work Preference and Compensation Methods

Health issues might also be considered in understanding why veterinarians desire to work fewer hours than they currently do. The data suggest this is the case. Of all veterinarians who said their health condition is fair, approximately 32 percent wish to reduce the number of hours per week while only 5 percent would like an increase in their work hours (Figure 3.12). However, on the other side of that scale, those bovine veterinarians who indicated they were in excellent health had the highest percent content with their current average hourly work week and were evenly split between wanting additional or fewer hours per week.

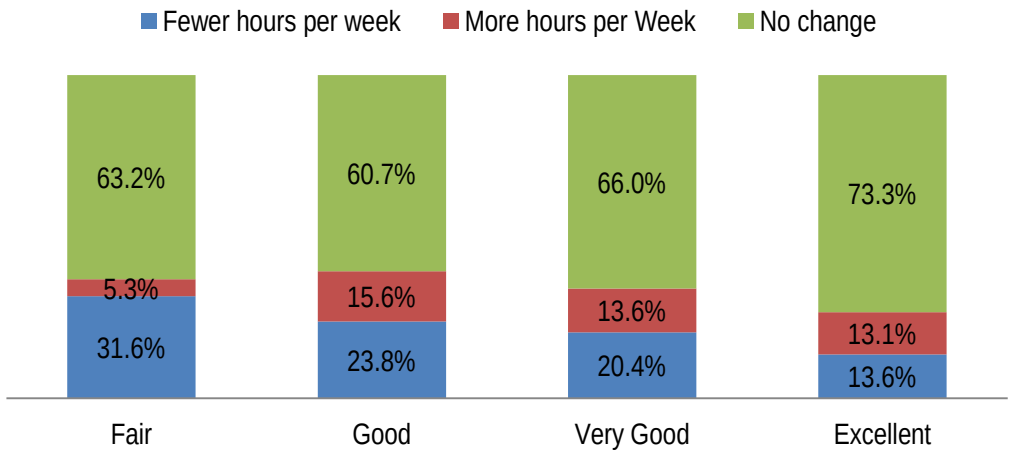


Figure 3.12: Work Preference and Health Condition

3.3. Bovine Veterinarian Health and Wellness

When performing their professional tasks, veterinarians establish a relationship with their client that sometimes goes beyond the traditional seller-client relationship. The attachment of a veterinarian to the animal he/she treats can be strong, and the compassion that they have for animals may affect them in positive and negative ways. Questions are included in the survey to help elucidate the effect of compassion on veterinarians' life.

Compassion satisfaction, the level of pleasure veterinarians derive from their work - the feeling of pleasure from helping others, the positivity toward colleagues contributing to the work setting, and even the greater good of society through their work—all this falls under the umbrella of compassion satisfaction.

Compassion fatigue, the negative feelings derived from work – both from burnout (exhaustion, frustration, anger, depression) and secondary traumatic stress (work-related trauma) were measured using the ProQol tool.

Based on responses to validated ProQoL questions by thousands of individuals across a number of occupations, scores have been established to describe low, normal and high compassion satisfaction and fatigue as well as burnout and secondary trauma.

Responses to the ProQoL questions were collected in AABP employment survey and presented in the context of the gender of the respondents (Table 3.8). For each question, we calculated the mean score and compared it between female and male veterinarians. The difference in means is statistically significant in most cases, suggesting that female and male veterinarians are affected differently in their practice of veterinary medicine.

For instance, female veterinarians are more likely to find it difficult to separate their personal life from their life as helpers. The difference in means is statistically significant with female veterinarians having a mean score of 3.09 against 2.66 for male veterinarians. At the same time, female veterinarians feel more trapped by their job as helper than do their male counterparts. Female veterinarians also tend to feel more depressed than male veterinarians because of the traumatic experiences of the people they help. In addition, female veterinarians tend to be more overwhelmed because they believe their case work load seems endless. In gauging overall appreciation of their job, male veterinarians have a higher score in being happy with their career choice (4.38) than do female veterinarians (4.17).

Table 3.8: Effect of Compassion on Veterinarians: Male vs Female veterinarians

	Male			Female			
	N	Mean	Std. Dev	N	Mean	Std. Dev	Pr > |t|*
I am happy.	373	4.27	0.77	181	4.09	0.80	0.0153
I am preoccupied with more than one person I help.	371	2.48	1.10	180	2.66	1.08	0.0727
I get satisfaction from being able to help people.	371	4.39	0.65	181	4.25	0.74	0.0265
I feel connected to others.	368	4.02	0.81	181	3.92	0.87	0.1756
I jump or am startled by unexpected sounds.	371	1.85	0.83	181	2.09	0.93	0.0025
I feel invigorated after working with those I help.	371	3.97	0.78	180	3.88	0.85	0.2496
I find it difficult to separate my personal life from my life as a helper.	370	2.66	1.16	181	3.09	1.22	0.0001
I am not as productive at work because I am losing sleep over traumatic experiences of a person I help.	371	1.50	0.66	181	1.69	0.81	0.0034
I think that I might have been affected by the traumatic stress of those I help.	370	1.71	0.81	181	1.99	0.97	0.0004
I feel trapped by my job as a helper.	371	1.92	0.99	181	2.15	1.02	0.0103
Because of my helping, I have felt "on edge" about various things.	370	2.09	1.00	180	2.43	1.04	0.0003
I like my work as a helper.	372	4.15	0.73	180	4.09	0.75	0.3792
I feel depressed because of the traumatic experiences of the people I help.	369	1.66	0.75	181	1.82	0.87	0.0273
I feel as though I am experiencing the trauma of someone I have helped.	368	1.76	0.86	181	1.77	0.83	0.8426
I have beliefs that sustain me.	369	4.23	0.97	180	4.22	0.95	0.8759

**p-value* less than 0.05 means that the difference between means is statistically significant at 5 percent significance level

Table 3.8: Effect of Compassion on Veterinarians: Male vs Female veterinarians (Cont.)

	Male			Female			
	N	Mean	Std. Dev	N	Mean	Std. Dev	Pr > |t|*
I am pleased with how I am able to keep up with helping techniques and protocols.	371	3.73	0.84	181	3.57	0.85	0.0327
I am the person I always wanted to be.	373	3.91	0.79	181	3.70	0.79	0.0041
My work makes me feel satisfied.	371	4.22	0.74	180	4.08	0.75	0.0467
I feel worn out because of my work as a helper.	370	2.44	0.98	180	3.02	1.07	0.0001
I have happy thoughts and feelings about those I help and how I could help them.	371	4.02	0.78	181	3.87	0.78	0.0302
I feel overwhelmed because my case work load seems endless.	367	2.43	1.01	181	2.78	1.07	0.0002
I believe I can make a difference through my work.	372	4.23	0.78	180	4.14	0.80	0.2120
I avoid certain activities or situations because they remind me of frightening experiences of the people I help.	372	1.48	0.72	180	1.51	0.73	0.6805
I am proud of what I can do to help.	373	4.31	0.75	178	4.26	0.76	0.4917
As a result of my helping, I have intrusive, frightening thoughts.	372	1.35	0.61	181	1.47	0.73	0.0385
I feel "bogged down" by the system.	370	2.54	1.04	180	2.89	1.13	0.0003
I have thoughts that I am a "success" as a helper.	370	3.79	0.91	180	3.67	0.86	0.1319
I can't recall important parts of my work with trauma victims.	360	1.63	0.82	180	1.58	0.71	0.4371
I am a very caring person.	373	3.98	0.73	181	4.21	0.75	0.0005
I am happy that I chose to do this work.	372	4.38	0.73	181	4.17	0.81	0.0021

**p-value* less than 0.05 means that the difference between means is statistically significant at 5 percent significance level

The ProQoL tool is used to compute a score for both burnout and secondary traumatic stress. The percent of respondents across scores for burnout is present in figure 3.13 of and for secondary traumatic stress in figure 3.14. The normal range is between 24 and 42 and scores above 35 are considered to be in the high range and may warrant the implementation of strategies to improve the work environment.

For both burnout and secondary traumatic stress the mean for the bovine practitioners is in the low range. While the scores are normally distribution they are skewed right and slightly kurtotic. That is the distribution

has many observations outside of one standard deviation to the right of the mean and is more closely centered on the mean than a typical normal distribution. This suggests the wellness is not a problem in the Bovine veterinary profession generally but that there is a percentage of practitioners who are I need of assistance because of their high levels of burnout and secondary stress. Overall, the bovine profession is less affected by compassion fatigue then their counterparts in companion animal medicine.

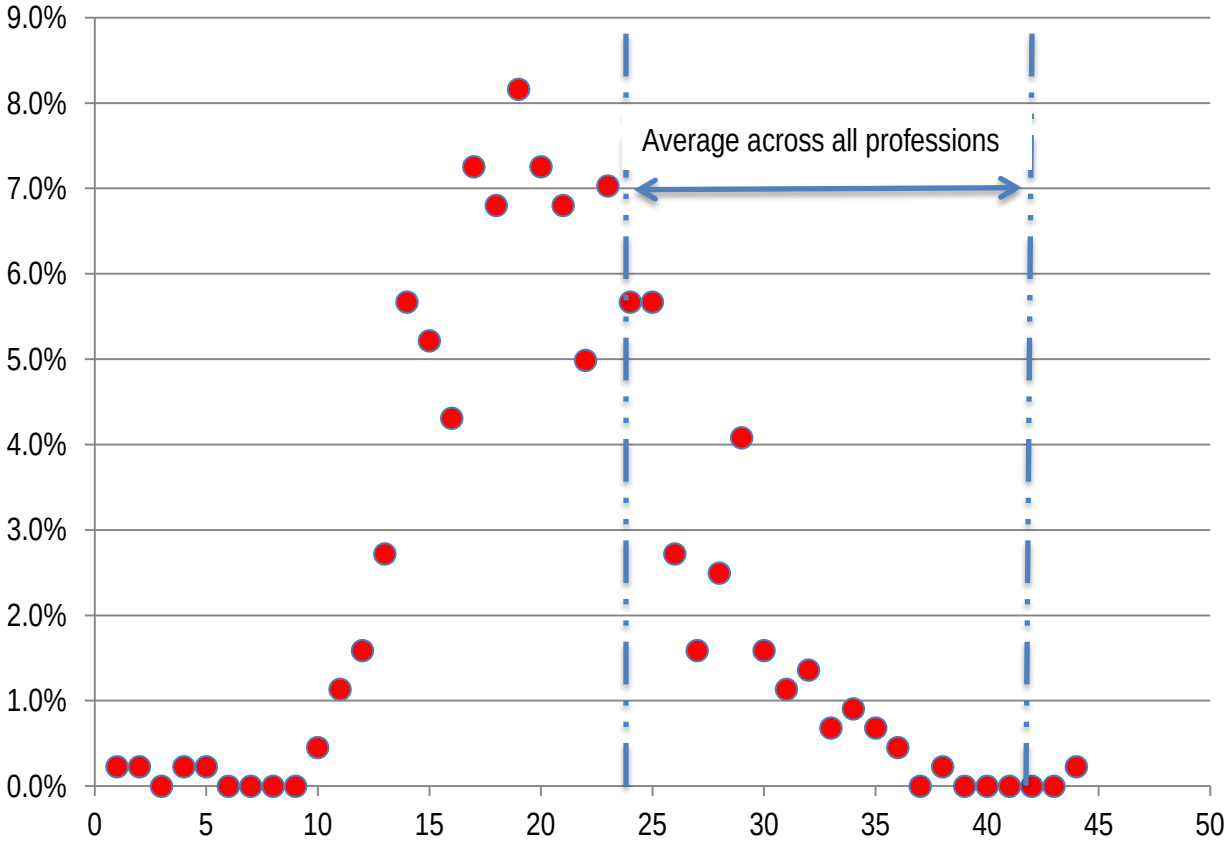


Figure 3.13: Burnout Scale

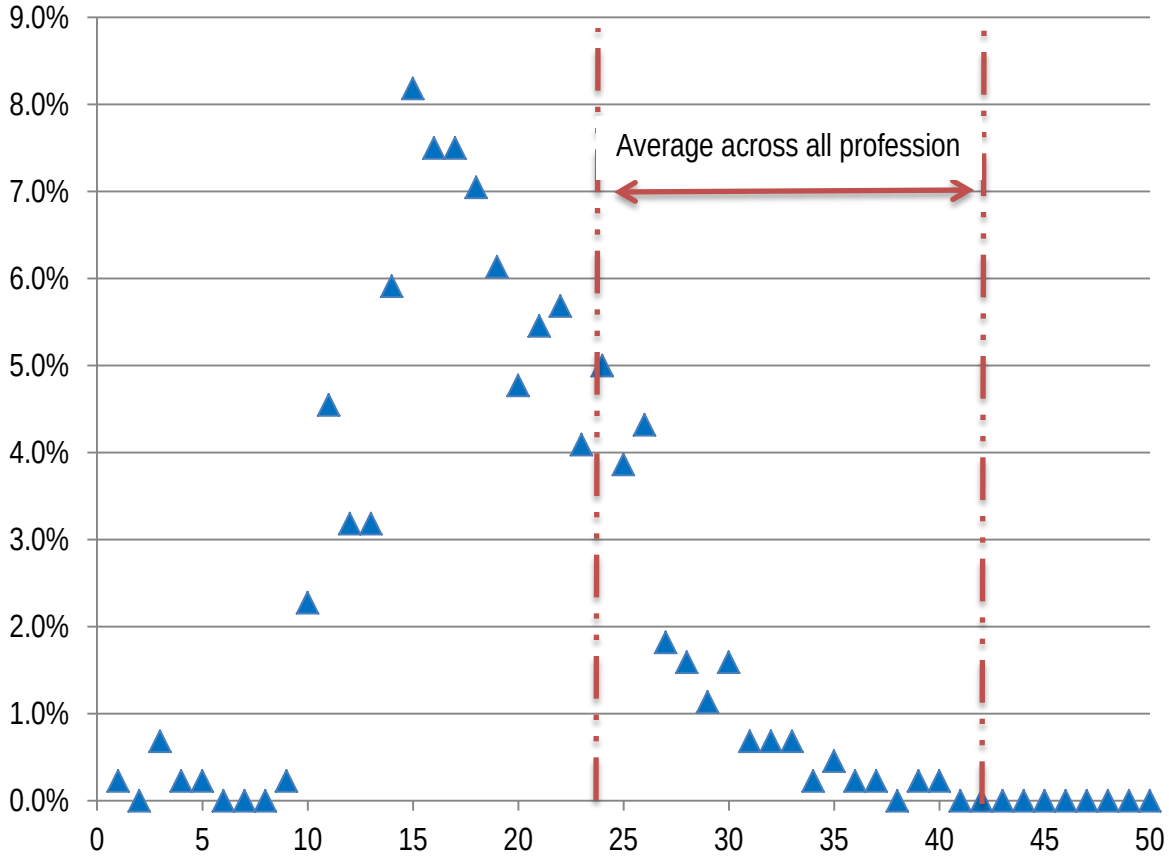


Figure 3.14: Secondary Traumatic Stress

3.4. Veterinary College Outcomes

As part of the effort for U.S. accreditation, U.S. colleges of veterinary medicine are required to perform an assessment of outcomes of their students one year and five years after graduation. In the employment survey, each bovine veterinarian that graduated one year or five years ago was asked to rate how well their veterinary college education prepared them for specific technical skills within veterinary medicine. The rankings were such that a rating of one represented no or low preparation for the technical competency at graduation, while a five indicated a high degree of preparedness. One of the principle reasons for this analysis was to examine the role of internships in improving technical competencies. Survey respondents were assigned to one of two categories, based on their participation or non-participation in an internship program. The AVMA accreditation assessment criteria were used as the measure of professional performance. Each respondent was asked to rate his/her level of satisfaction with how well veterinary college prepared them,(Table 3.9) as well as their satisfaction, as measured by multiple criteria, with their work experience after graduating (Table 3.10).

3.4.1 Internship Participation

Only 11 percent of the respondents have participated or are currently participating in an internship program compared to 23.7 percent of the general population of U.S. veterinarians. Respondents were asked to identify their internship experience by “employment options” and “types of animal.” Employment type includes private referral practice, private general practice, academic, non-profit organizations, corporate-owned practice, and others. Animal type options include companion animal, exotic animal, equine, food animal, mixed animal, and others.

The results from the two sub-groups are presented in Figure 3.15 and 3.16. In terms of employment type, most of the respondents who indicated that they served in an internship did so through academic positions (73.7 percent), with the second largest group reporting experience in private general practice (15.2 percent). The species focus is consistent with the future employment of the respondents. (AABP is an association of food animal practitioners). More than 48 percent of interns went through internship programs that mainly focused on large animals. Mixed animal and Equine follow with 13.2 percent and 9.1 percent, respectively.

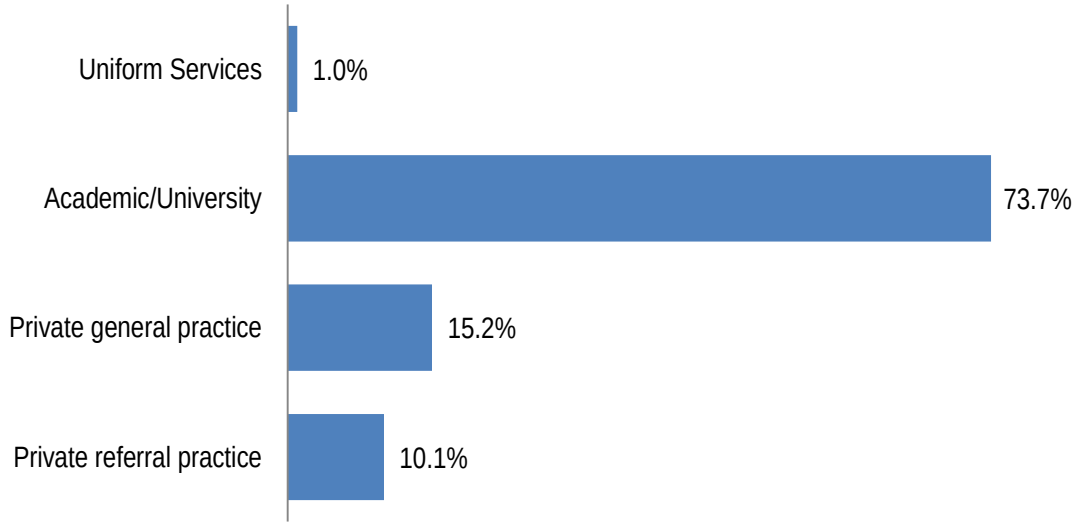


Figure 3.15: Program Focus of Internship

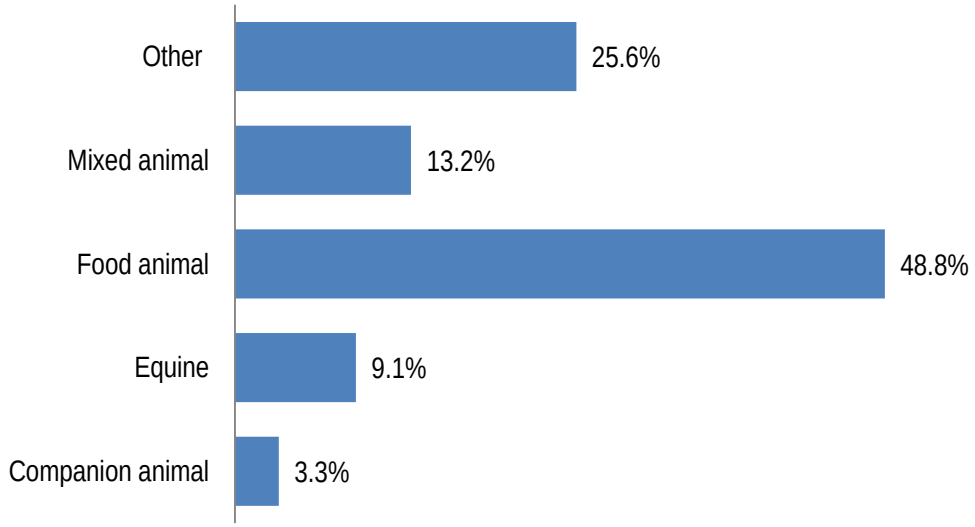


Figure 3.16: Species Focus of Internship

College preparedness reveals how the respondent felt about their technical competency prior to graduation. Satisfaction with the experience measures the individual's perception of college preparedness at one year and five year post-graduation. For each category, the average rate for each technical competency is provided as well as the difference in means between expectations and satisfaction.

For college preparedness, only a few criteria show statistically significant difference. Veterinarians who participated in an internship program are more successful in career development opportunities for learning

and professional growth than those who did not participate. The mean score for those who participated is 4.67 and those who did not participate in an internship had a self-reported mean score of 4.07. In addition, internship participation increases the performance in communication between employees and senior staff, intravenous injections, diagnostics of gastrointestinal and cardiac disease, and orthopedic surgery.

After one year and five years in the profession, the perspective of college preparedness of technical skills changed. Those who had completed an internship rated the college preparedness higher than those who had not done an internship when it came to opportunities to network, implement fluid therapy, advising clients on nutrition and diagnosing difficult cases, interpretation of radiographs, interpretation of hematologic values, diagnosis/therapy of gastrointestinal disease, diagnosis/therapy of respiratory disease, diagnosis/therapy of neurological disease, diagnosis/therapy of ocular disorders, and the ability to manage a successful veterinary practice.

While differences in perceived preparedness of technical skills exist among those who had completed an internship and those who had not, no impact of these improved ratings for those with internships was found on income levels. It might seem counterintuitive that those who served in an internship rated their college preparedness higher than those who did not do internships. However, consider that lower perceptions of college preparedness are thought to be associated with a higher propensity for completing an internship. If the internship is considered part of the educational process than those doing an internship may consider themselves more prepared upon completion of the internship. This is a common finding. Education is primarily a transfer of knowledge. An internship may provide an opportunity to apply that knowledge in a protected environment where students can gain confidence in both their knowledge and their application of that knowledge. Thus, while there is no statistical difference in incomes between those having completed an internship and those not completing an internship we have no data to examine what the incomes might have been had those that completed an internship not have done so.

Table 3.9: Competency Scores by Internship Participation – College Preparedness

	INTERNSHIP			NO INTERNSHIP			
	N	Mean	Std. Dev	N	Mean	Std. Dev	Pr > |t|
Career development opportunities for learning and professional growth	9	4.67	0.5	139	4.07	1	0.0809
Opportunities to network with others to help in advancing one's career	9	4.22	0.83	138	3.8	1.07	0.2441
Communication between employees and senior staff	9	4.78	0.44	138	4.26	0.92	0.0982
Management recognition of employee job performance	9	4.22	0.97	138	4.04	0.93	0.5771
Opportunities for variable pay	9	3.67	1.22	138	3.43	1.32	0.5972
Benefits: Health care/medical benefits	9	4.22	0.97	136	3.9	1.2	0.44
Feeling safe in the work environment	9	4.56	0.73	138	4.32	0.85	0.4183
Overall culture of work place	9	4.44	1.01	139	4.32	0.68	0.598
Confidence with ability as a veterinarian	9	3.44	0.53	115	3.38	0.97	0.8507
Physical examination	9	4.67	0.5	111	4.47	0.66	0.3797
History taking	9	4.22	0.67	111	4.44	0.68	0.3558
Diagnosis of lameness	9	3.44	0.88	111	3.53	0.92	0.7852
Diagnosis/treatment of parasitic diseases	9	3.56	0.53	111	3.72	0.95	0.6067
Anesthesia	9	3.78	1.3	111	3.68	1.02	0.7777
Fluid therapy	9	4	0.71	111	3.65	0.88	0.2462
Intravenous injection	9	4.78	0.44	111	4.08	1.06	0.054
Development/adaptation of vaccination protocols	9	3.56	0.53	111	3.3	1.15	0.5063
Advising clients on nutrition	9	3.22	0.97	112	2.58	1.21	0.1225
Developing diagnostic plans for difficult cases	9	3.78	0.67	111	3.72	0.84	0.8437
Investigation of potential toxin exposure	9	3.11	1.05	111	3.01	1.01	0.7724
Prescribing medications	9	3.67	0.87	111	3.54	1.02	0.7184
Interpretation of cytologic specimens	9	3.67	0.5	107	3.33	1.11	0.3679
Interpretation of post-mortem specimens	9	4	0.87	107	3.81	0.86	0.5323

**p-value* less than 0.1 means that the difference between means is statistically significant at 10 percent significance level

Table 3.9: Competency Scores by Internship Participation – College Preparedness (Cont.)

	INTERNSHIP			NO INTERNSHIP			
	N	Mean	Std. Dev	N	Mean	Std. Dev	Pr > |t|
Interpretation of ultrasound examinations	9	2.89	0.78	107	2.93	1.13	0.9250
Interpretation of radiographs	9	3.33	0.50	107	3.35	1.05	0.9719
Interpretation of hematologic values	9	4.22	0.67	107	3.83	0.85	0.1834
Diagnosis/therapy of gastrointestinal disease	9	4.11	0.33	105	3.64	0.80	0.0813
Diagnosis/therapy of dermatological disease	9	2.89	0.78	104	3.24	0.95	0.2837
Diagnosis/therapy of endocrine disease	9	3.33	0.50	105	3.25	1.01	0.8016
Diagnosis/therapy of cardiac disease	9	3.67	0.87	104	3.08	0.92	0.0669
Diagnosis/therapy of respiratory disease	9	3.89	0.60	104	3.57	0.76	0.2197
Diagnosis/therapy of renal disease	9	3.89	0.60	103	3.44	0.86	0.1260
Diagnosis/therapy of neurological disease	9	3.44	1.01	104	3.21	0.94	0.4806
Diagnosis/therapy of ocular disorders	9	3.33	1.00	104	3.09	0.95	0.4563
Orthopedic surgery	9	2.22	1.39	108	1.63	0.93	0.0817
Soft tissue surgery	9	2.78	1.39	107	3.13	1.15	0.3859
Spay/ Neuter	9	3.22	1.48	108	3.61	1.15	0.3428
Management of reproductive programs	9	3.11	0.60	107	3.21	1.06	0.7720
Evaluation of disease outbreaks	9	3.33	0.87	105	3.13	0.91	0.5268
Evaluation of new drugs/products	9	3.56	0.88	105	3.30	1.19	0.5241
Interpretation of medical literature	9	3.89	0.93	105	3.75	0.96	0.6819
Dealing with people	9	3.56	0.73	108	3.35	1.10	0.5859
Veterinary Medicine as a business	9	3.00	1.22	108	2.35	1.17	0.1144
Giving educational presentations to the community	9	3.11	1.27	107	2.93	1.25	0.6843
Client Communications	9	3.78	0.83	108	3.62	1.02	0.6537

**p-value* less than 0.1 means that the difference between means is statistically significant at 10 percent significance level

Table 3.10: Competency Scores by Internship Participation – Satisfaction with Experience

	INTERNSHIP			NO INTERNSHIP			
	N	Mean	Std. Dev	N	Mean	Std. Dev	Pr > |t|*
Career development opportunities for learning and professional growth	9	4.00	0.71	138	3.41	1.12	0.1184
Opportunities to network with others to help in advancing one's career	9	4.00	0.87	138	3.33	1.12	0.0813
Communication between employees and senior staff:	9	3.11	1.05	137	3.04	1.22	0.8717
Management recognition of employee job performance	9	3.33	1.41	137	2.85	1.15	0.2357
Opportunities for variable pay	9	3.00	1.50	137	2.78	1.39	0.6497
Benefits: Health care/medical benefits	9	3.67	1.22	135	3.39	1.49	0.5796
Feeling safe in the work environment	9	4.11	1.17	137	3.98	1.11	0.7299
Overall culture of work place	9	3.56	1.01	137	3.44	1.25	0.7835
Physical examination	9	4.89	0.33	108	4.44	0.82	0.1045
History taking	9	4.78	0.44	109	4.35	0.86	0.1445
Diagnosis of lameness	9	4.11	0.78	109	3.71	1.10	0.2825
Diagnosis/treatment of parasitic diseases	9	4.11	0.78	108	3.75	1.13	0.3494
Anesthesia	9	3.89	1.45	108	3.57	1.15	0.4423
Fluid therapy	9	4.33	0.87	109	3.74	1.02	0.0953
Intravenous injection	9	4.89	0.33	109	4.47	0.89	0.1613
Development/adaptation of vaccination protocols	9	4.11	0.60	109	3.83	1.24	0.4962
Advising clients on nutrition	9	3.78	0.97	109	2.83	1.27	0.0323
Developing diagnostic plans for difficult cases	9	4.33	0.71	109	3.66	1.07	0.0678
Investigation of potential toxin exposure	9	3.11	1.76	109	3.05	1.23	0.8827
Prescribing medications	9	4.22	0.97	109	4.00	1.00	0.5222
Interpretation of cytologic specimens	9	3.67	0.71	104	2.96	1.41	0.1428
Interpretation of post-mortem specimens	9	3.67	1.12	105	3.76	1.15	0.8113

**p-value* less than 0.05 means that the difference between means is statistically significant at 5 percent significance level

Table 3.10: Competency Scores by Internship Participation – Satisfaction with Experience (Cont.)

	INTERNSHIP			NO INTERNSHIP			
	N	Mean	Std. Dev	N	Mean	Std. Dev	Pr > |t|*
Interpretation of ultrasound examinations	9	3.89	0.60	105	3.42	1.41	0.3258
Interpretation of radiographs	9	3.89	0.60	103	3.06	1.45	0.0914
Interpretation of hematologic values	9	4.56	0.53	105	3.61	1.17	0.0184
Diagnosis/therapy of gastrointestinal disease	9	4.56	0.53	104	3.85	0.94	0.0283
Diagnosis/therapy of dermatological disease	9	3.33	1.32	103	3.43	1.16	0.8183
Diagnosis/therapy of endocrine disease	9	3.78	0.44	104	3.27	1.26	0.2339
Diagnosis/therapy of cardiac disease	9	3.78	0.83	103	3.17	1.09	0.1021
Diagnosis/therapy of respiratory disease	9	4.33	0.71	103	3.77	0.83	0.0501
Diagnosis/therapy of renal disease	9	3.89	0.78	103	3.44	1.19	0.2683
Diagnosis/therapy of neurological disease	9	3.89	0.93	103	3.28	1.03	0.0913
Diagnosis/therapy of ocular disorders	9	3.78	0.83	103	3.15	1.04	0.0798
Orthopedic surgery	9	2.11	1.69	107	1.72	1.48	0.4536
Soft tissue surgery	9	3.44	1.67	107	3.66	1.24	0.6222
Spay/ Neuter	9	2.89	1.90	106	3.54	1.75	0.29
Management of reproductive programs	9	3.33	1.00	106	3.33	1.41	0.9948
Evaluation of disease outbreaks	9	3.44	1.24	104	3.17	1.32	0.5529
Evaluation of new drugs/products	9	3.89	0.78	104	3.82	0.92	0.8218
Interpretation of medical literature	9	4.22	0.67	104	3.89	0.92	0.3005
Dealing with people	9	4.22	0.44	107	4.01	0.93	0.4974
Veterinary Medicine as a business	9	3.78	0.67	106	2.94	1.22	0.0453
Giving educational presentations to the community	9	3.78	1.56	106	3.11	1.58	0.2283
Client Communications	9	4.44	0.53	107	4.02	0.93	0.1798

**p-value* less than 0.05 means that the difference between means is statistically significant at 5 percent significance level

3.4.2 College Preparedness of Bovine Veterinarians and the General Profession

There are few statistically significant differences between the ratings of preparedness of bovine veterinarians and the general profession in how well they thought veterinary college prepared them for those who graduated both one year and five years prior. There were no statistically significant differences in the primary care components (Table 3.11).

Table 3.11: College Preparedness and Professional Satisfaction with Respect to Primary Care Components

	AVMA Sample		AABP Sample	
	N	Mean	N	Mean
College preparedness (before you started working)				
Physical examination	1126	4.19	125	4.48
History taking	1121	4.33	125	4.44
Diagnosis of lameness	1116	3.48	125	3.54
Diagnosis/treatment of parasitic diseases	1120	3.91	125	3.70
Anesthesia	1122	3.93	125	3.70
Fluid therapy	1123	3.78	125	3.66
Intravenous injection	1119	3.98	125	4.16
Development/adaptation of vaccination protocols	1117	3.63	125	3.31
Advising clients on nutrition	1116	2.89	126	2.60
Developing diagnostic plans for difficult cases	1126	3.76	125	3.72
Investigation of potential toxin exposure	1125	3.19	125	3.01
Prescribing medications	1122	3.65	125	3.55
Satisfaction with your experience while in the profession				
Physical examination	1101	4.32	122	4.48
History taking	1104	4.40	123	4.40
Diagnosis of lameness	1075	3.64	123	3.73
Diagnosis/treatment of parasitic diseases	1097	4.00	122	3.78
Anesthesia	1096	3.95	122	3.61
Fluid therapy	1090	3.88	123	3.78
Intravenous injection	1093	4.33	123	4.49
Development/adaptation of vaccination protocols	1070	4.01	123	3.83
Advising clients on nutrition	1086	3.23	123	2.90
Developing diagnostic plans for difficult cases	1099	3.91	123	3.71
Investigation of potential toxin exposure	1089	3.40	123	3.02
Prescribing medications	1098	4.10	123	4.00

For laboratory activities (Table 3.12), bovine veterinarians have more confident in their college preparedness for interpretation of ultrasound examination. Their mean score for this activity (3.42) is higher than that for the general population (2.90).

Table 3.12: College Preparedness and Professional Satisfaction with Respect to Laboratory Activities

	AVMA Sample		AABP Sample	
	N	Mean	N	Mean
College preparedness (before you started working)				
Interpretation of cytologic specimens	1117	3.39	121	3.34
Interpretation of post-mortem specimens	1113	3.58	121	3.81
Interpretation of ultrasound examinations	1105	2.64	121	2.94
Interpretation of radiographs	1115	3.61	121	3.34
Interpretation of hematologic values	1114	3.99	121	3.83
Satisfaction with your experience while in the profession				
Interpretation of cytologic specimens	1073	3.29	118	2.97
Interpretation of post-mortem specimens	975	3.34	119	3.75
Interpretation of ultrasound examinations	1006	2.90	119	3.42
Interpretation of radiographs	1079	3.53	117	3.10
Interpretation of hematologic values	1090	3.97	119	3.66

With respect to surgical activities (Table 3.13), bovine veterinarians have no statistically significant differences from the general profession. However, both bovine practitioners and the general profession have very low ratings for orthopedic surgery.

Table 3.13: College Preparedness and Professional Satisfaction with Respect to Surgical Activities

	AVMA Sample		AABP Sample	
	N	Mean	N	Mean
College preparedness (before you started working)				
Orthopedic surgery	1073	2.00	121	1.68
Soft tissue surgery	1096	2.97	121	3.09
Spay/ Neuter	1098	3.63	122	3.57
Satisfaction with your experience while in the profession				
Orthopedic surgery	865	2.26	121	1.73
Soft tissue surgery	1045	3.51	121	3.63
Spay/ Neuter	1024	4.02	120	3.49

In internal medicine (Table 3.14), as before, there are no technical competencies where bovine veterinarians' scores are statically different from the general profession. However, bovine practitioners score higher in both their college preparedness and their satisfaction with experience to perform diagnosis/therapy of respiratory disease than the general population.

Table 3.14: College Preparedness and Professional Satisfaction with Respect to Internal Med. Components

	AVMA Sample		AABP Sample	
	N	Mean	N	Mean
College preparedness (before you started working)				
Diagnosis/therapy of gastrointestinal disease	1097	3.77	119	3.66
Diagnosis/therapy of dermatological disease	1097	3.54	118	3.18
Diagnosis/therapy of endocrine disease	1096	3.68	119	3.24
Diagnosis/therapy of cardiac disease	1095	3.36	118	3.12
Diagnosis/therapy of respiratory disease	1099	3.42	118	3.58
Diagnosis/therapy of renal disease	1096	3.81	117	3.47
Diagnosis/therapy of neurological disease	1096	3.41	118	3.24
Diagnosis/therapy of ocular disorders	1094	3.25	118	3.09
Satisfaction with your experience while in the profession				
Diagnosis/therapy of gastrointestinal disease	1081	3.95	118	3.90
Diagnosis/therapy of dermatological disease	1078	3.68	117	3.40
Diagnosis/therapy of endocrine disease	1074	3.70	118	3.30
Diagnosis/therapy of cardiac disease	1073	3.42	117	3.21
Diagnosis/therapy of respiratory disease	1078	3.53	117	3.81
Diagnosis/therapy of renal disease	1070	3.92	117	3.47
Diagnosis/therapy of neurological disease	1070	3.44	117	3.33
Diagnosis/therapy of ocular disorders	1071	3.25	117	3.19

Within the medicine technical competencies the bovine veterinarians rated their preparedness in the management of reproductive programs significantly higher than the general population (Table 3.15).

Table 3.15: College Preparedness and Professional Satisfaction with Respect to Population Med. Components

	AVMA Sample		AABP Sample	
	N	Mean	N	Mean
College preparedness (before you started working)				
Management of reproductive programs	1053	2.69	121	3.18
Evaluation of disease outbreaks	1069	2.93	119	3.14
Evaluation of new drugs/products	1091	3.14	119	3.32
Interpretation of medical literature	1104	3.64	119	3.77
Satisfaction with your experience while in the profession				
Management of reproductive programs	836	2.76	120	3.29
Evaluation of disease outbreaks	851	2.95	118	3.16
Evaluation of new drugs/products	1062	3.56	118	3.84
Interpretation of medical literature	1087	3.77	118	3.93

For professional competencies, bovine veterinarians have no differences from the general profession and both rate their business acumen very low both in their perception prior to graduation and in their perception of college preparedness one year and five years post-graduation.

Table 3.16: College Preparedness and Professional Satisfaction with Respect to Professional Competencies

	AVMA Sample		AABP Sample	
	N	Mean	N	Mean
College preparedness (before you started working)				
Dealing with people	1109	3.36	122	3.40
Veterinary Medicine as a business	1099	2.54	122	2.43
Giving educational presentations to the community	1043	2.87	121	2.93
Client Communications	1102	3.63	122	3.66
Satisfaction with your experience while in the profession				
Dealing with people	1099	4.00	121	4.04
Veterinary Medicine as a business	1041	3.01	120	3.03
Giving educational presentations to the community	918	3.50	120	3.20
Client Communications	1085	4.14	121	4.07

3.4.3 Most Important Skills for New Veterinarians

Bovine practice owners were asked to select the skills that they believed to be the most important for new veterinarians to have as they enter practice. The response to this question provides insight into the skills

that employers are seeking. Thus, new graduates can be guided as to what skills to focus on prior to graduation. Relying on the economic principle that scarce resources are always the most valued, new graduates might take heed that compensation is greatest for those who master these skills. Figure 3.17 lists skills deemed by practice owners to be most important to have when entering the profession. The top three procedures are: performing a comprehensive necropsy, correcting a prolapsed uterus, and palpating and diagnosing cows. At the bottom of this classification is the capability to determine the sex of a fetus using ultrasound.

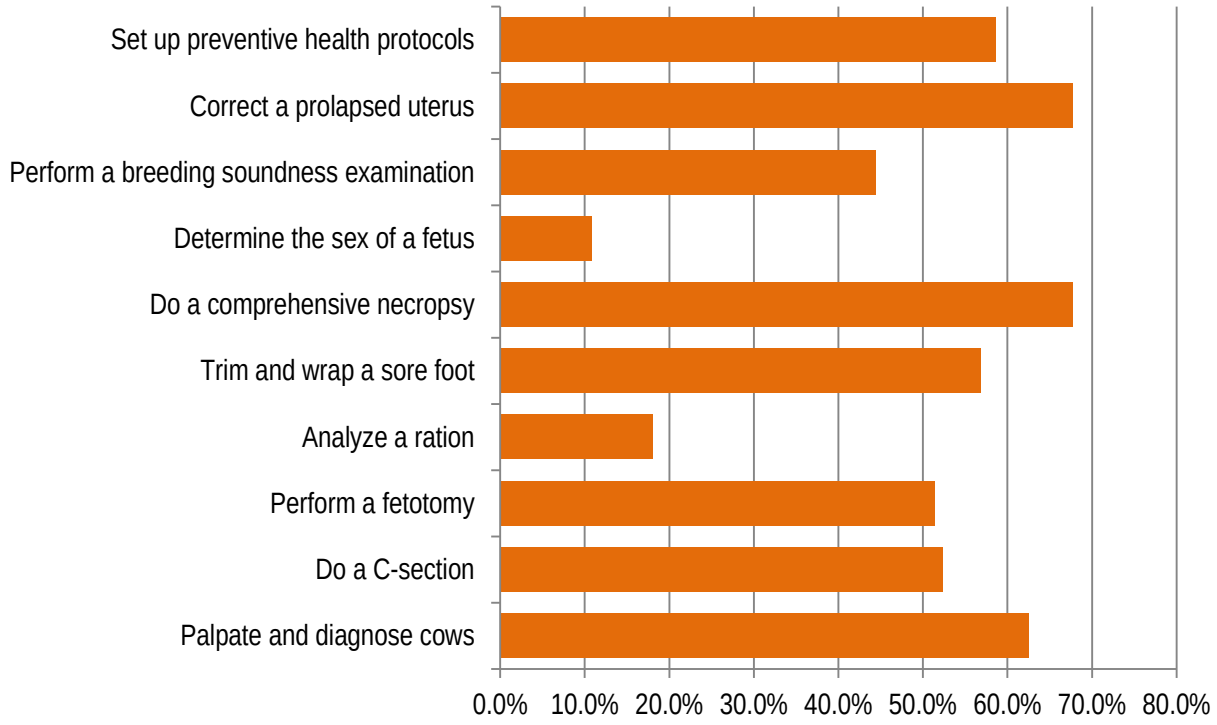


Figure 3.17: Procedures Ranked by Importance for Private Practice Owner

SECTION 4: INCOME AND DEBT OF BOVINE VETERINARIANS

This section uses data from both the employment and the compensation surveys. One of the objectives of the analysis is to determine whether there exists significant differences in mean professional income between bovine veterinarians with different demographics. To answer this question, we presented the mean earning for comparable groups (e.g., mean annual income for men vs mean annual income for women) and we used the t-statistics to check whether or not the difference observed is statistically significant. The factors considered are: number of years since DVM graduation, level of education, internship and residency participation, board certificate, gender, type of employment, location, practice

ownership status, and type of community. The generalized linear model was applied to the data using the SAS 9.4. For each group, in addition to the mean and the standard deviation of professional income, we presented the first, the second, and the third quartiles. The second objective is to determine factors affecting professional income. For this analysis, a linear regression model was used.

4.1 Difference in Professional Income for Selected Characteristics

4.1.1 Number of Years since DVM Graduation

This analysis of the relationship between years in practice and income uses five categories:

(1) If the respondent graduated less than 10 years ago
(2) If the respondent graduated between 10 and 19 years ago
(3) If the respondent graduated between 20 and 29 years ago
(4) If the respondent graduated between 30 and 39 years ago
(5) If the respondent graduated between 40 and more years ago

Of those included in the analysis, 121 (34.5 percent) graduated during the last 10 years, 51 (14.5 percent) graduated 10 to 19 years ago, 65 (18.5 percent) graduated 20 to 29 years ago, 85 (24.2 percent) graduated 30 to 39 years ago, and the remaining 29 (8.3 percent) graduated 40 years and more ago. Only veterinarians with professional income between $40,000 and $500,000 are included in this analysis. We used this truncation to avoid the effect of outliers. Few people have reported a professional income of less than $10,000 and few others have reported an annual income of more than $1,000,000. This might be possible, but adding them to the data set could skew the central tendencies.

The summary statistics are presented in the Table 4.2, below. The difference is statistically significant at 5 percent significance level (p-value < 0.0001). The quadratic shape of the distribution shows that professional earnings increase with the number of years of experience until a certain period of time, and then decline. Veterinarians with fewer than 10 years of professional experience earn on average $84,107.91 per annum. The others receive on average $115,036.60 (group 2), $142,929.80 (group 3), $158,127.70 (group 4), and $125,120.70 (group 5). Those in the group 4, between 30 and 39 years since graduation, receive the highest annual income.

Table 4.1: Distribution of Professional Income with Respect to the Number of Years since DVM Graduation

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
1 to 9 years	84,107.91	38,987.01	66,000.00	78,000.00	95,000.00
10 to 19 years	115,036.61	62,834.45	70,000.00	100,000.00	150,000.00
20 to 29 years	142,929.82	80,429.34	85,000.00	120,000.00	179,000.00
30 to 39 years	158,127.68	67,379.39	114,000.00	142,000.00	195,000.00
40 years and over	125,120.69	44,344.76	100,000.00	120,000.00	132,000.00

4.1.2 Level of Education

Respondents were classified into three categories with respect to the highest degree obtained besides the DVM. The three categories are:

(1) DVM + Graduate Degree, if the respondent has completed a Doctoral degree (Ph.D., Ed.D.), or a Master's degree (Master of Science, Master of Arts, Master of Business Administration, Master of Public Health, or any degree equivalent to a Master's degree),
(2) DVM + Other Degree, if the respondent has completed a Bachelor's degree or any other professional degree of certificate, and
(3) DVM, if the respondent did not obtain any degree or professional certificate in addition to her DVM.

The descriptive statistics of respondents are as follow: 59 (17.1 percent) of respondents have no additional degrees, 198 (57.2 percent) have an undergraduate degree in addition to their DVM, and 89 (25.7 percent) have a DVM plus a Ph.D. or a master's degree. The difference in mean earnings is statistically significant at 5 percent level (p-value < 0.0001).

The mean professional incomes for the three groups are $137,669.10 for veterinarians with DVM + graduated degree, $112,068.50 for those with DVM + undergraduate degree, and $126,230.50 for veterinarians with only DVM degree (Table 4.1). The results indicate that veterinarians with a graduate degree earn more than veterinarians with an undergraduate or no other degree. This is expected since a veterinarian with a doctoral degree can vary his/her source of income by taking a part-time position in the public sector, such as a university position, while working in their own private practice or as a consultant.

Table 4.2: Distribution of Professional Income with Respect to Additional Degree

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
DVM	126,230.51	69,542.15	83,000.00	110,000.00	150,000.00
DVM + Undergrad. Degree	112,068.53	61,578.81	73,392.00	93,500.00	130,000.00
DVM + Grad. Degree	137,669.06	73,122.27	90,000.00	118,000.00	180,000.00

4.1.3 Internship Participation

The relationship between annual professional income and internship participation was examined. The rate of internship participation for the respondents is lower than 10 out of 100 respondents. In total, 319 (90.9 percent) of respondents have not completed an internship program. The results of this section could help graduating veterinarians decide whether or not to participate in an internship upon graduation before entering the job market. While those having completed an internship had a lower salary, the results of the statistical analysis showed no statistical significance (*p-value = 0.7674*) (Table 4.3).

Table 4.3: Distribution of Professional Income with Respect to Internship Participation

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
DVM	121,141.22	67,339.96	75,000.00	100,000.00	150,000.00
DVM + Internship	117,489.59	57,705.56	80,050.00	100,000.00	134,000.00

4.1.4 Residency Participation

As in the previous section, this section examines the relationship between participation in a residency program and professional income of bovine veterinarians. Of those included in the analysis, 308 (87.7 percent) have never participated in a residency program and the remaining 43 (12.3 percent) have a residency experience. Although the mean values of income differ between those who have and have not completed a residency, the results indicate that residency participation has no effect on professional income (*p-value = 0.4698*) (Table 4.4).

Table 4.4: Distribution of Professional Income with Respect to Residency Participation

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
DVM	119,848.60	67,699.73	75,000.00	100,000.00	150,000.00
DVM + Residency	127,682.47	56,960.01	95,000.00	112,000.00	145,000.00

4.1.5 Board Certificate

This analysis looks at the difference in professional income between veterinarians with board certification and those without board certification. Of those who respondended to the survey, only 45 (12.8 percent) are AVMA-board certified specialists and 306 (87.2 percent) are in the control group.The mean professional income for veterinarians with board certification is higher than that of their colleagues with no-board certification. The difference is statistically significant (p-value = 0.0023). Veterinarians with board certification earn on average $148,888.90 per year whereas those with no board certification earn $116,678.80.

Table 4.5: Distribution of Professional Income with Respect to Board Certificate

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
DVM	116,678.81	65,212.01	75,000.00	99,500.00	140,000.00
DVM + Board certificate	148,888.89	68,737.72	110,000.00	135,000.00	175,000.00

4.1.5 Gender

The difference in income between genders (the gender wage gap) is well known and exists in nearly all professions, including the veterinary profession. (Pharmacy is the only profession without a pronounced gender wage gap). Some of the gender wage gap can be explained by differences in hours worked, type of employment, location of employment, educational background and employment preparation, and other factors, but even after all pronounced variables are considered, a gap remains in salaries between men and women. For new veterinary graduates, who have little if any difference in experience or preparation and controlling for hours worked, age, location and practice type, women earn 92 percent of what their male counterparts earn.

The majority of students in the veterinary medical colleges are females and the number of males graduating from veterinary medical school has declined over the years. Women now comprise 57 percent of the veterinary profession but only about a third of the bovine practitioners. Since income is correlated with years of experience, and because the percentage of men who have been in the profession more than 20 years will comprise a higher percentage than the percentage who have been in the profession for fewer than 20 years, women can be expected to have a lower average income than men when these factors are not taken into account.

In this analysis, 100 (28.6 percent) female veterinarians and 250 (71.4 percent) male veterinarians were included. The results show that gender does have a significant impact on professional income (*p-value* < *0.0001*). Male veterinarians receive an average annual income of $134,954.20, and female veterinarians receive an average annual income of $84,851.59 (Table 4.6). However, as noted above there are other demographic factors such as hours worked, practice type, education and age that play a major role in this gender salary gap.

Table 4.6: Distribution of Professional Income with Respect to Gender

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
Female	84,851.59	40,189.44	65,000.00	77,000.00	98,000.00
Male	134,954.22	69,505.37	85,000.00	119,000.00	172,000.00

4.1.6 Type of Employment

In this section we categorized the respondents by type of employment, with the objective of determining whether the type of employment affects professional income. The *F-statistics* (3.35) and the *p-value* = 0.0023 indicate that type of employment affects professional income (Table 4.7).

Table 4.7: Distribution of Professional Income with Respect to Type of Employment

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
Food Animal Practice	126,629.24	74,109.79	75,000.00	100,000.00	155,000.00
Mixed Animal Practice	96,700.65	60,537.48	65,000.00	80,050.00	105,000.00
Companion Animal Practice	110,050.67	50,039.75	75,000.00	98,000.00	150,000.00
Equine Practice	68,333.33	36,170.89	45,000.00	50,000.00	110,000.00
Federal Government	89,333.33	19,502.14	67,000.00	98,000.00	103,000.00
College/University	137,438.27	48,419.62	109,000.00	128,500.00	156,500.00
State/Local Government	89,000.00	18,384.78	76,000.00	89,000.00	102,000.00
Industry/Commercial Org.	151,652.33	57,015.03	125,000.00	150,000.00	195,000.00
Other Vet. Employment	143,750.00	69,447.22	92,500.00	140,000.00	195,000.00

4.1.7 Geographic Location

Table 4.8 shows the distribution of the average professional income for each of the 11 AABP Districts. The districts with the highest mean professional income are District 11 ($147,236) and District 10 ($139,114); the district with the lowest average professional income is District 8 ($101,941).

Table 4.8: Distribution of Professional Income with Respect to AABP District

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
District 1	117,435.71	76,900.82	70,000.00	85,500.00	140,000.00
District 2	121,378.46	51,123.83	83,000.00	120,000.00	150,000.00
District 3	115,782.85	46,529.18	90,000.00	110,000.00	154,800.00
District 4	111,831.03	50,538.63	80,000.00	95,000.00	115,000.00
District 5	117,877.01	68,297.36	75,000.00	102,000.00	140,000.00
District 6	131,443.59	77,544.62	89,000.00	105,000.00	150,000.00
District 7	115,096.00	68,928.11	65,000.00	100,000.00	145,000.00
District 8	101,941.18	41,761.93	75,000.00	95,000.00	125,000.00
District 9	115,612.90	59,562.67	72,000.00	95,000.00	150,000.00
District 10	139,113.64	84,909.47	90,000.00	108,000.00	170,000.00
District 11	147,235.75	84,639.53	71,696.00	117,500.00	223,128.00

4.1.8 Practice Ownership

Practice ownership has a significant impact on professional income (p-value < 0.0001). Of the 345 respondents, 50.4 percent are non-practice owners and the remaining 49.6 percent own or co-own a veterinary practice. Table 4.9 presents the mean annual income for practice owners and non-practice owners. Those who own a practice earn on average $53,800 higher than their non-practice owner colleagues.

Table 4.9: Distribution of Professional Income with Respect to Practice Ownership

	Mean	Std. Dev	1st.Quartile	Median	3rd.Quartile
Non-Practice Owner	102,739.70	47,154.44	70,000.00	90,000.00	124,000.00
Practice Owner	138,615.84	77,721.60	82,000.00	115,000.00	180,000.00

4.1.9 Type of Community

Of those who provided information regarding the type of community in which they provide their veterinary services, 168 (61.3 percent) of respondents are from rural areas, 70 (25.5 percent) from urban areas, and 36 (13.1 percent) from suburban areas. This analysis provides answers to whether or not type of community has significant impact on professional income. The higher p-value indicates that even though mean income differs across the three groups, we do not have enough evidence to conclude that the incomes are different by type of community.

Table 4.10: Distribution of Professional Income with Respect to Type of Community

	Mean	Std. Dev	1st.Quartile	Median	3rd.Quartile
Rural areas	116,881.30	68,754.65	73,750.00	93,500.00	140,000.00
Urban areas	114,182.47	73,989.38	70,000.00	90,500.00	120,000.00
Suburban areas	112,375.00	68,150.50	70,000.00	100,000.00	120,000.00

4.2. Factors Affecting Income

In total, 339 respondents were studied in this analysis. A log-linear model was used to fit the income data. The analyses above provided the independent effect of each variable on salary. However, it is likely that some of these factors are highly correlated and although they independently effect income they may not when other factors are considered.

The p-value <0.0001 indicates that the model fits the data relatively well. The results are presented in Table 4.11. Because the logarithm of the income was used, the intercept corresponds to a conditional expected mean. Taking the exponential of the estimated intercept yields an approximated $49,943, which represents the mean income for a bovine veterinarian when none of the factors are taken into account (the intercept). In addition, the results indicate that for each additional year of experience professional income increases by 4.3 percent.

For the rest of the interpretation, we make the assumption that all other factors are held constant. For example, veterinarians with a Ph.D. degree in addition to the DVM earn 30 percent more than veterinarians with only a DVM degree. In the same way, male veterinarians earn on average 23.2 percent more than their female colleagues, keeping all other factors constant. In terms of employment type, mixed animal veterinarians receive annually 11.3 percent less than food animal veterinarians. Veterinarians in rural and suburban areas receive less than their peers who work in urban areas. And only those veterinarians working in district 10 have a significantly different income (27% more) than the control group (district 1).

Table 4.11: Factors Affecting Professional Income of Bovine Veterinarians

	% Interpretation	Parameter Estimate	Std. Error	Pr > |t|
Constant		10.81864	0.18664	0.0001
Log(Year Hours)		0.0523	0.04159	0.2095
Experience	4.3%	0.0419	0.00774	0.0001
Experience 2	-0.1%	-0.00072381	0.0001712	0.0001
DVM + Doctorate	30.1%	0.26338	0.1106	0.0178
DVM + Masters		0.0611	0.06659	0.3596
DVM + Residency		-0.14799	0.09149	0.1068
DVM + Board Certificate		0.08988	0.09125	0.3254
Male	23.2%	0.20881	0.05765	0.0003
Mixed Animal Practice	-11.3%	-0.11951	0.05803	0.0403
Other Veterinary Employment		-0.06065	0.07311	0.4074
Rural Area	-9.5%	-0.10003	0.05692	0.0798
Suburban Area	-13.6%	-0.14671	0.08644	0.0906
Practice Owner	11.4%	0.10774	0.06111	0.0789
District 2		0.06459	0.10005	0.519
District 3		-0.06076	0.12018	0.6135
District 4		0.00192	0.10331	0.9852
District 5		-0.01701	0.08818	0.8471
District 6		0.04975	0.0969	0.608
District 7		-0.08161	0.10887	0.4541
District 8		-0.02459	0.12349	0.8423
District 9		0.0293	0.10331	0.7769
District 10	26.7%	0.23673	0.11654	0.0431
District 11		0.07788	0.11545	0.5004
Observations		339		
R-squared		0.383		

4.3 Fringe Benefits Received

Bovine veterinarians were asked to indicate the non-salary benefits that they receive from their employer (Figure 4.1). These benefits can be classified into three major components: health care and insurance, professional development and profit sharing, and other advantages. Health care and insurance encompass medical/hospitalization plan, dental plan, life insurance and disability insurance. The majority (57.4 percent) of bovine veterinarians receive a medical/hospitalization plan. Life insurance, disability insurance, and

dental plan benefits are received by 38.1 percent, 42.8 percent, and 25.1 percent of the members, respectively.

Professional development and profit sharing refer to benefits such as continuing education expenses and leave, informal profit sharing, employer contribution match, tax deferred retirement plan, liability insurance, licenses, and association dues. In terms of professional development, more than 60 percent of bovine veterinarians receive various incentives (continuing education expenses and leave, licenses, and association dues). Employer contribution/match to a tax-deferred retirement plan (i.e. 401K, IRS qualified profit sharing plan) and tax-deferred retirement plan (i.e. 401K, IRS qualified profit sharing plan) cover 46.7 percent and 44.0 percent of bovine veterinarians, respectively.

Other advantages include discounted pet care, which covers 38.6 percent of the bovine veterinarians, personal use of vehicle (35.3 percent), paid legal holidays (45.3 percent), paid sick leave (47.6 percent), and paid vacation leave (61.3 percent).

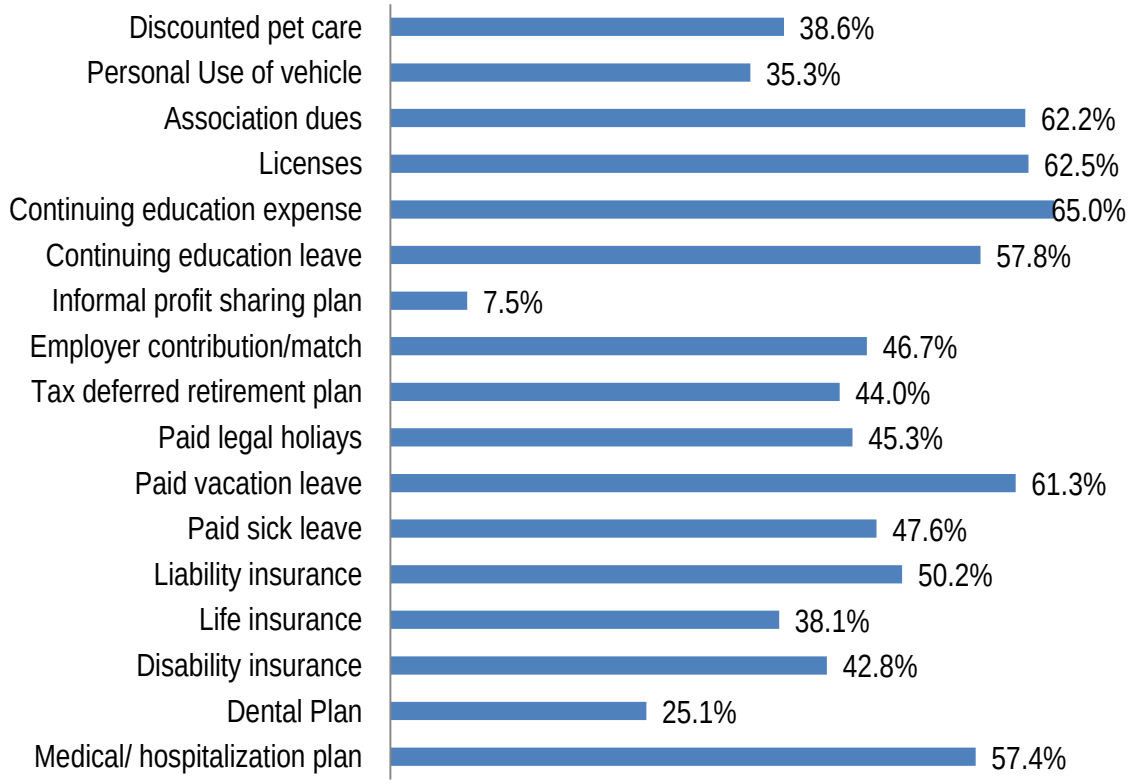


Figure 4.1: Fringe Benefits Received from the Employer

4.4 Student Educational Debt

This sub-section deals with student loan debt for bovine veterinarians. The response variable is, therefore, the amount of educational debt each veterinarian incurred to fund his/her DVM education. In the survey, the respondents were asked to approximate the amount of debt they contracted during their time as a veterinary medical student. This question was made specific to distinguish between other educational debt (secondary and post-secondary debt) and debt that was used to only to obtain the DVM degree. This sub-section starts with some descriptive statistics and then evaluates the factors affecting bovine veterinarians' student debt.

4.4.1 Educational Debt by Number of Years since DVM Graduation

Student educational debt has increased over the last two decades. The DVM debt was on average $8,694.48 for veterinarians who graduated more than 40 years ago and more than $132,500.00 for veterinarians who graduated during the last 10 years. The analysis shows that the difference between time period means is statistically significant (*P-value < 0.0001*).

Table 4.12: Distribution of Student Debt with Respect to the Number of Years since Graduation

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
1 to 9 years	132,500.22	88,751.28	75,000.00	120,000.00	185,000.00
10 to 19 years	80,000.00	51,608.42	55,000.00	82,500.00	110,000.00
20 to 29 years	28,576.92	23,458.45	7,000.00	28,000.00	40,000.00
30 to 39 years	15,382.20	16,386.72	0.00	10,000.00	25,000.00
40 years and over	8,694.48	11,467.46	0.00	5,000.00	10,000.00

4.4.2 Educational Debt by Level of Education

The analysis shows that mean student debt differs significantly with respect to the degree obtained in addition to the DVM (p-value = 0.0010). On average, a veterinarian with a Ph.D. or M.S degree carries a student loan debt worth $45,118.97 and those with an undergraduate degree carry on average $80,122.17 of student debt. The average student debt of veterinarians who did not complete any additional degree or professional certificate is estimated at $51,796.92.

Table 4.13: Distribution of Student Debt with Respect to Additional Degree

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
DVM	51,796.92	79,012.50	600.00	20,000.00	70,000.00
DVM + Undergrad. Degree	80,122.17	79,717.64	16,752.50	58,500.00	120,000.00
DVM + Grad. Degree	45,118.97	55,599.81	5,000.00	21,600.00	60,000.00

4.4.3 Educational Debt by Internship Participation

Veterinarians who completed an internship program have an average student debt higher than those who did not complete an internship, but the difference is not statistically significant (p-value = 0.9059). Therefore, we cannot conclude whether or not the debt level has an effect on an individual's decision to complete an internship or not.

Table 4.14: Distribution of Student Debt with Respect to Internship Participation

	Mean	Std. Dev	1st.Quartile	Median	3rd. Quartile
DVM	66,803.07	77,694.83	9,250.00	35,500.00	100,000.00
DVM + Internship	68,500.00	73,856.44	0.00	28,000.00	123,000.00

4.4.4 Educational Debt by Residency Participation

The mean difference in student debt between veterinarians who completed residency and those who did not is statistically significant (p-value = 0.0321). The mean student debt is lower for those who completed residency ($43,344.19) than that for those who did not. Veterinarians with high student debt might rush into the job market in order to start paying down debt instead of spending additional years in residency.

Table 4.15: Distribution of Student Debt with Respect to Residency Participation

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
DVM	70,288.43	79,176.90	10,000.00	40,000.00	110,000.00
DVM + Residency	43,344.19	57,226.44	3,000.00	20,000.00	70,000.00

4.4.5 Educational Debt by Board Certificate

Among those opting for residency, veterinarians with higher student debt avoid completing a board certificate. The mean difference is statistically significant (p-value < 0.0001). The average debt is $24,506.67 and $73,263.93, respectively, for veterinarians with board certification and veterinarians without board certification.

Table 4.16: Distribution of Student Debt with Respect to Board Certificate

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
DVM	73,263.93	79,120.94	10,000.00	45,000.00	120,000.00
DVM + Board certificate	24,506.67	44,459.84	0.00	10,000.00	27,500.00

4.4.6 Educational Debt by Gender

The difference in mean student debt between male and female bovine veterinarians is statistically significant (*P-value < 0.0001*). The average student debt for females is twice that for male veterinarians (Table 4.31). This may be largely a result of the difference in age distribution between men and women bovine practitioners.

Table 4.17: Distribution of Student Debt with Respect to Gender

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
Female	107,408.16	87,183.28	46,000.00	95,000.00	144,000.00
Male	51,187.84	66,893.77	5,000.00	25,000.00	75,000.00

4.4.7 Educational Debt by Type of Employment

The difference in mean student debt across veterinarians of different employment types is statistically significant (p-value =0.0238). The type of employment with the highest student debt is that of Federal government employment ($88,333.33), followed by companion animal practitioners ($87,100.00), and mixed animal veterinarians ($84,257.62).

Table 4.18: Distribution of Student Debt with Respect to Type of Employment

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
Food Animal Practice	69,366.02	71,489.83	10,000.00	42,750.00	120,000.00
Mixed Animal Practice	84,257.62	88,260.22	10,000.00	71,500.00	120,000.00
Companion Animal Practice	87,100.00	116,457.56	9,500.00	40,000.00	130,000.00
Equine Practice	9,333.33	10,066.45	0.00	8,000.00	20,000.00
Federal Government	88,333.33	115,361.75	5,000.00	40,000.00	220,000.00
College/University	34,229.17	51,833.61	0.00	17,500.00	30,000.00
State/Local Government	29,000.00	26,870.06	10,000.00	29,000.00	48,000.00
Industry/Commercial Org.	53,362.96	63,561.26	6,000.00	26,000.00	85,000.00
Other Vet. Employment	37,000.00	33,156.20	11,500.00	31,500.00	62,500.00

4.4.8 Educational Debt by AABP District

The difference in mean debt by district is statistically significant at a 10 percent significance level (p-value = 0.0827). District 1 and District 9 have the highest student loan debt with $91,302.63 and $94,700.00, respectively. At the bottom of the rank are Districts 11 ($48,973.68) and 5 ($46,092.10).

Table 4.19: Distribution of Student Debt with Respect to AABP District

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
District 1	91,302.63	98,339.29	25,000.00	49,500.00	120,000.00
District 2	82,029.41	73,324.61	20,000.00	77,500.00	133,000.00
District 3	64,333.33	110,441.07	0.00	13,000.00	70,000.00
District 4	52,627.59	63,004.17	3,600.00	30,000.00	80,000.00
District 5	46,092.10	49,391.08	7,526.00	30,000.00	80,000.00
District 6	63,922.50	82,947.99	7,750.00	24,000.00	109,000.00
District 7	73,208.33	65,362.52	29,000.00	62,500.00	99,500.00
District 8	75,823.53	94,278.33	0.00	15,000.00	130,000.00
District 9	94,700.00	82,343.33	25,000.00	77,500.00	160,000.00
District 10	59,068.18	71,975.57	4,000.00	20,500.00	125,000.00
District 11	48,973.68	41,315.34	10,000.00	32,000.00	92,000.00

4.4.9 Educational Debt by Practice Ownership

The mean debt of non-practice owners ($86,880.50) is almost twice that of practice owners ($47,718.61), and is statistically significant at a 1-percent significance level (p-value < 0.0001). Either a high student debt prevents veterinarians from having their own practice or practice owners skewed in age (older) or those who desired practice ownership may be better at managing finances.

Table 4.20: Distribution of Student Debt with Respect to Practice Ownership

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
Non-Practice Owner	86,880.50	92,319.09	6,000.00	70,000.00	140,000.00
Practice Owner	47,718.61	52,474.11	10,000.00	30,000.00	75,000.00

4.4.10 Educational Debt by Type of Community

We did not have enough evidence to conclude whether or not debt level affects the decision to establish a practice in one type of community or another.

Table 4.21: Distribution of Student Debt with Respect to Type of Community

	Mean	Std. Dev	1st. Quartile	Median	3rd. Quartile
Rural	71,791.39	74,215.80	10,000.00	45,000.00	120,000.00
Urban	77,240.58	93,705.54	10,000.00	46,000.00	110,000.00
Suburban	74,805.56	71,772.59	7,500.00	59,500.00	135,000.00

4.4.11. Factors Affecting Debt for Bovine Veterinarians

A multiple linear regression model was used to fit the student debt data. The objective is to determine what combination of factors have significant effect on student debt for bovine veterinarians. Only respondents with DVM debt were included in the analysis. After cleaning the data set and dropping off respondents with no student debt, 273 observations were finally used for the regression. The F-statistics (19.3) of the overall model and its corresponding p-value (<.0001) indicates that some of the covariates used in explaining the student debt are statistically significantly different than 0. The R square indicates that 54.7 percent of the variation in student debt is explained by the number of years since the DVM graduation, the location of the veterinary college attended, and gender. The regression results are presented in Table 4.22.

The constant ($146,652) represents the typical DVM debt when none of the covariates is consider. The coefficient of number of years since DVM graduation represents the change in average student debt from two consecutive years. The negative sign indicates that student debt increases each year. In other words, the mean debt is higher this year than it was last year. Thus, for every year that a bovine practitioner has been out of school their debt has dropped by $4369.40. Or conversely, each year, the debt of the graduate has increased by more than $4000.

The bovine practitioners in only two districts have shown statistically significant difference in student debt compared to bovine practitioners in District 1. Mean debt in district 5 is $30,666 lower than that in District 1. In the same way, District 8 has a mean student debt which is $54,039 lower than that of District 1.

Female veterinarians have higher student debt than their male counterparts. The results indicate that men have on average $17,306 less debt than women.

Table 4.22: Factors Affecting DVM Education Debt for Bovine Veterinarians

Variable	Parameter Estimate	Standard Error	Pr > |t|
Constant	146652.00	30965.00	0.0001
Number of years since DVM	-4369.40	1038.52	0.0001
DVM College in District 2	13512.00	16083.00	0.4016
DVM College in District 3	-16946.00	14609.00	0.2472
DVM College in District 4	-12810.00	13716.00	0.3512
DVM College in District 5	-30666.00	14341.00	0.0334
DVM College in District 6	-6128.50	12990.00	0.6375
DVM College in District 7	-17650.00	14237.00	0.2162
DVM College in District 8	-45039.00	22184.00	0.0434
DVM College in District 9	-21320.00	17172.00	0.2155
DVM College in District 10	5640.95	16752.00	0.7366
DVM College in District 11	-14727.00	20375.00	0.4705
Board certificate	-8849.58	11917.00	0.4584
Practice Owner	-5793.60	7641.24	0.4490
Income	-0.03	0.05	0.6151
Gender	-17306.00	7951.81	0.0304
Age	983.06	1094.35	0.3699
Observations	273.00		
R-Square	0.5472		

SECTION 5: BOVINE VETERINARY PRACTICE

Bovine veterinary practices have commonalities with multiple other types of veterinary practices in the provision of veterinary medical services. But bovine practices have several unique characteristics that separate them from other types of practices, such as the dependence on service calls, the delivery of services to multiple animals in a single visit, and the typical assortment of services they provide. This section focuses on some of these unique characteristics and the implications of those characteristics on veterinary incomes.

5.1. Service Calls

Of the bovine veterinarian respondents, the majority (60.8 percent) provide ambulatory or mobile services only. Those that have both a hospital for services and an ambulatory practice comprise about a third of the

practitioners (29.6 percent). Less than 1 percent provide veterinary services in the hospital only and no ambulatory services (Figure 5.1).

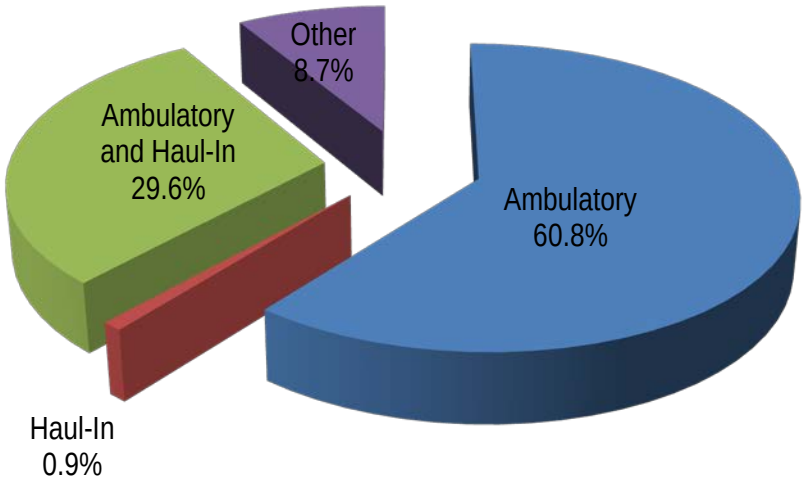


Figure 5.1: Distribution of Veterinarians by Type of Bovine Practice

Bovine animal veterinarians spend a substantial amount of their time providing on-site services to clients. From those who identified as a provider of mobile services, 61.9 percent said they spend an average of no more than one hour per visit, while 38.1 percent spend between one and four hours per call.

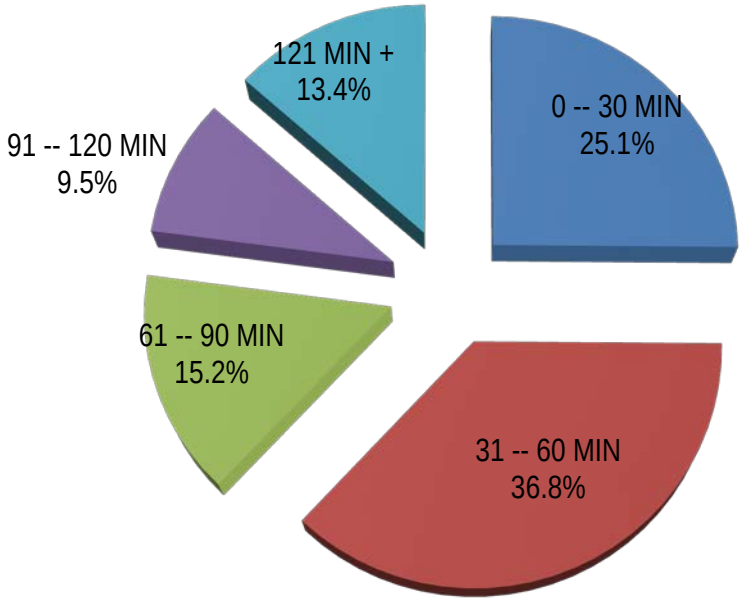


Figure 5.2: Average Time (in minutes) Spent during a Typical Call

Because bovine veterinarians often travel long distances to farms to deliver services and assessing service efficiency is important. Spending too much time in transit rather than in the provision of services reduces labor efficiency, defined here as the number of billable services provided per hour. Respondents were asked to estimate the average percent of their total call that is billable. The summary statistics are presented in Figure 5.3. More than 46 percent of respondents said that 75 percent to 100 percent of their call time is billable. Only 7.7 percent of respondents claim that 0 percent to 25 percent of their call time is billable. These 7.7 percent of veterinarians spend the majority of their time getting to farms and very little time providing veterinary services.

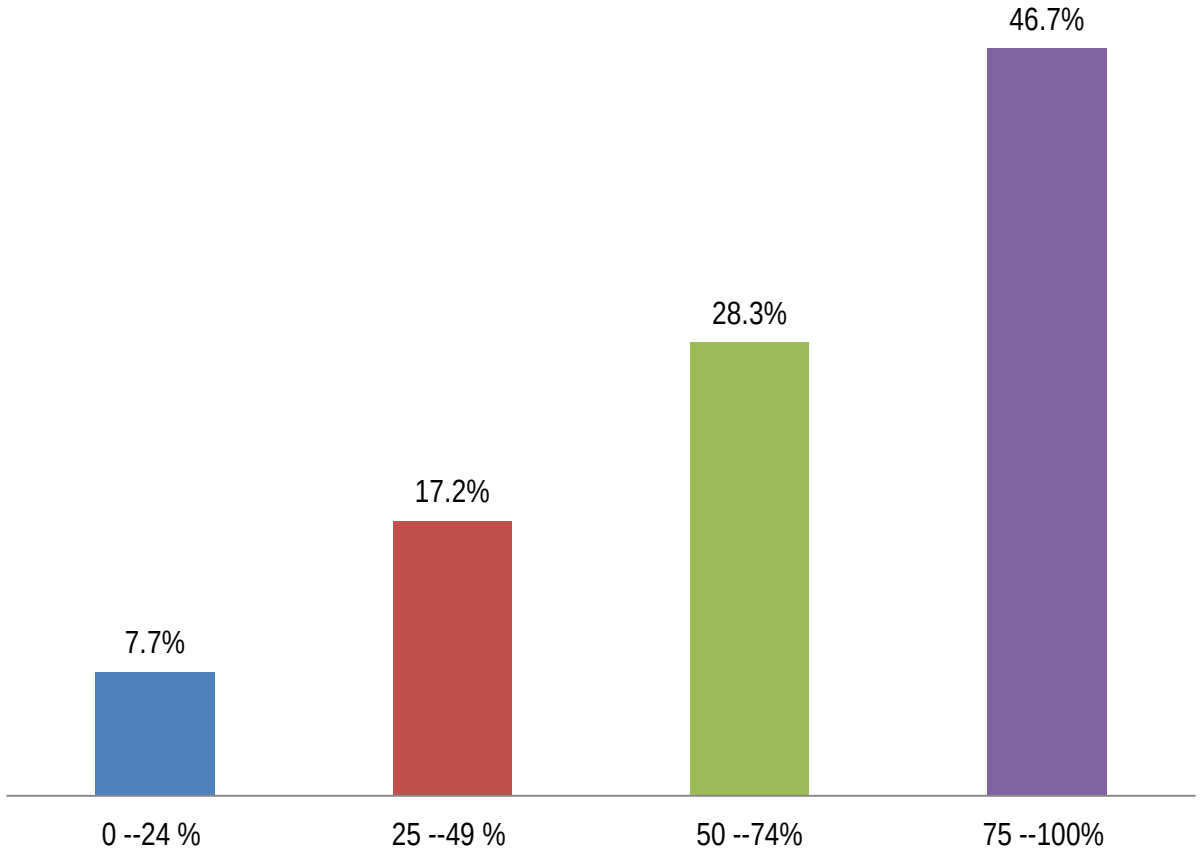


Figure 5.3: Distribution of Respondents by Time Spent on Providing Services

5.2 Parallel Service Providers

There are many types of non-veterinarian providers of services, such as pharmaceutical sales representatives, reproductive service technicians and nutrition providers 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 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 (Figure 5.4).

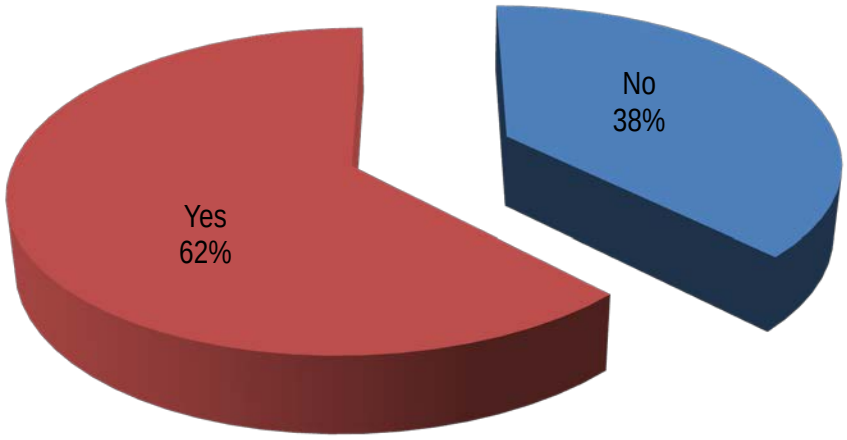


Figure 5.4: Competition from Non-Veterinarian Animal Service Providers

Only 15.3 percent of the respondents said they have never been affected by any of the parallel service providers (Figure 5.5). The primary type of parallel services provider that affects bovine veterinarians consists of route trucks that deliver supplies to farms. More than 50 percent of respondents claim that they have been in some way affected by these service providers. Roughly 50 percent of survey respondents indicated the activities of non-licensed veterinary service providers negatively impacted their bovine veterinary practices. Consultant veterinarians who visit farms once a year are also listed as potential threats to bovine veterinary practices.

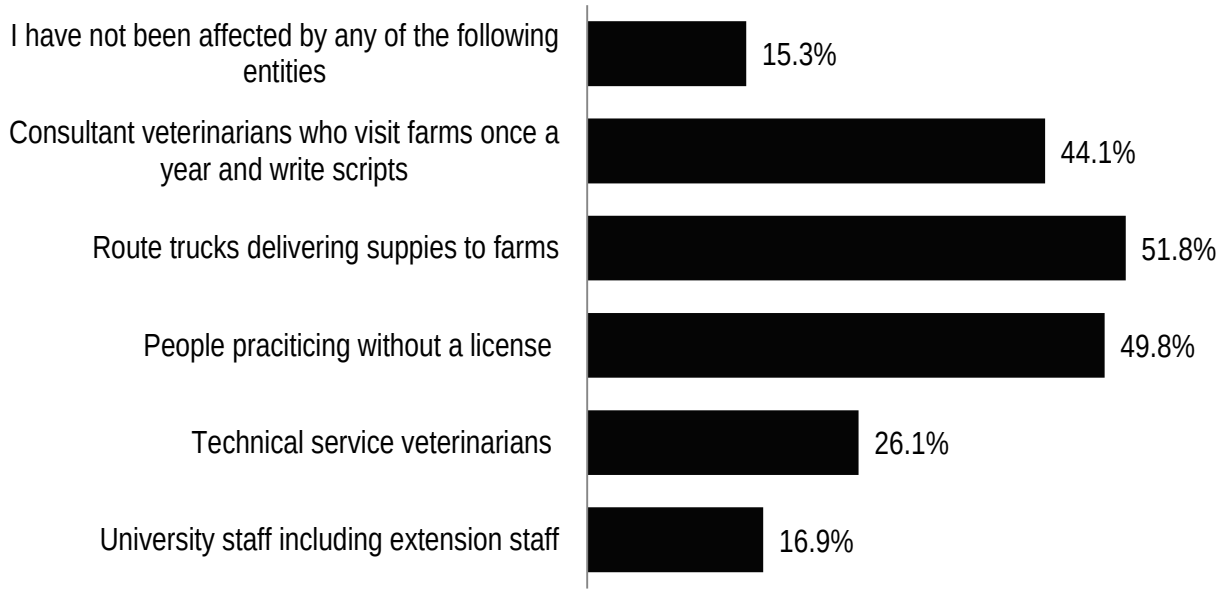


Figure 5.5: Parallel Veterinary Service Providers and their Impact on Bovine Veterinarians' Practice

5.2.1 Effect of parallel providers on the Number of Clients

Of those 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.

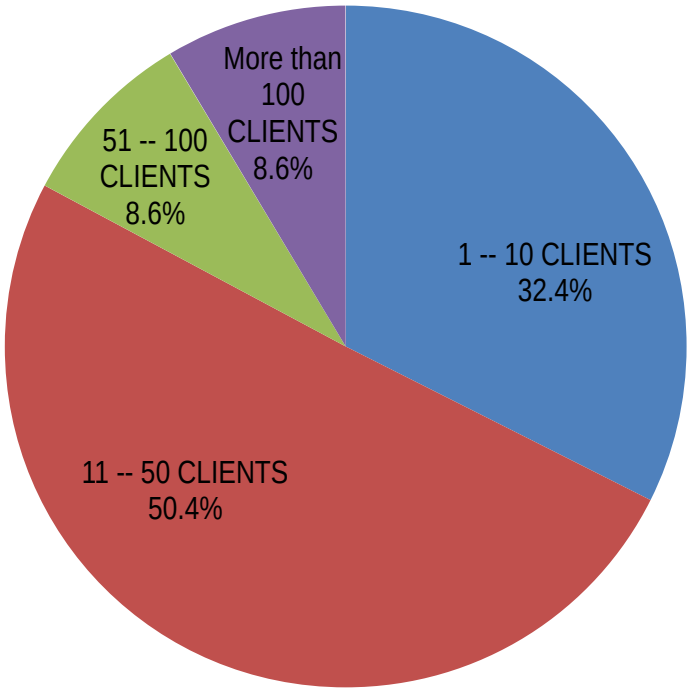


Figure 5.6: Number of Clients Not Seeing Because of Non-Veterinarian Animal Service Providers

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 5.7). Between 15 and 20 percent lose approximately the same number of cow-calf pairs each year.

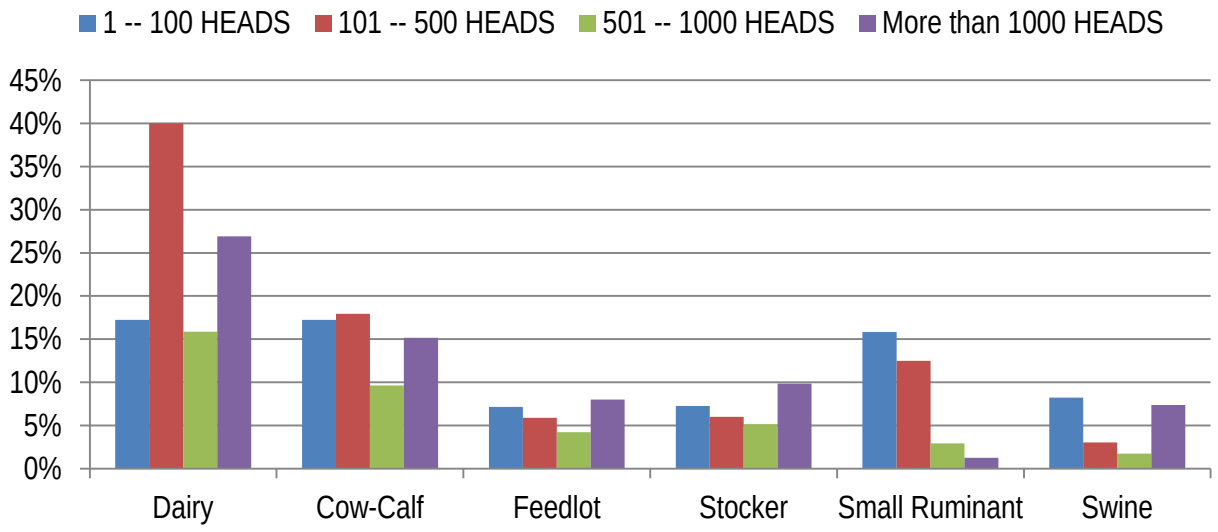


Figure 5.7: Number of Animals Not Seeing Because of Non-Veterinarian Animal Service Providers

5.3 Practice Revenue Trends

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.

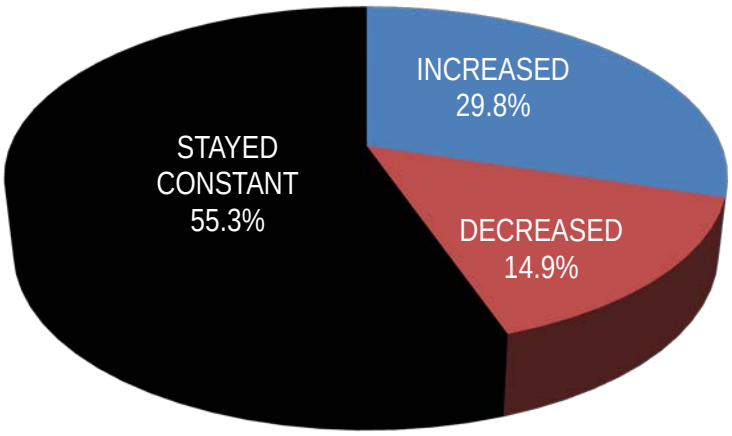


Figure 5.8: Change in the Practice Revenue during the Last Five Years

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 5.9). Roughly one-fifth have seen an increase of 20 percent or more during the last five years.

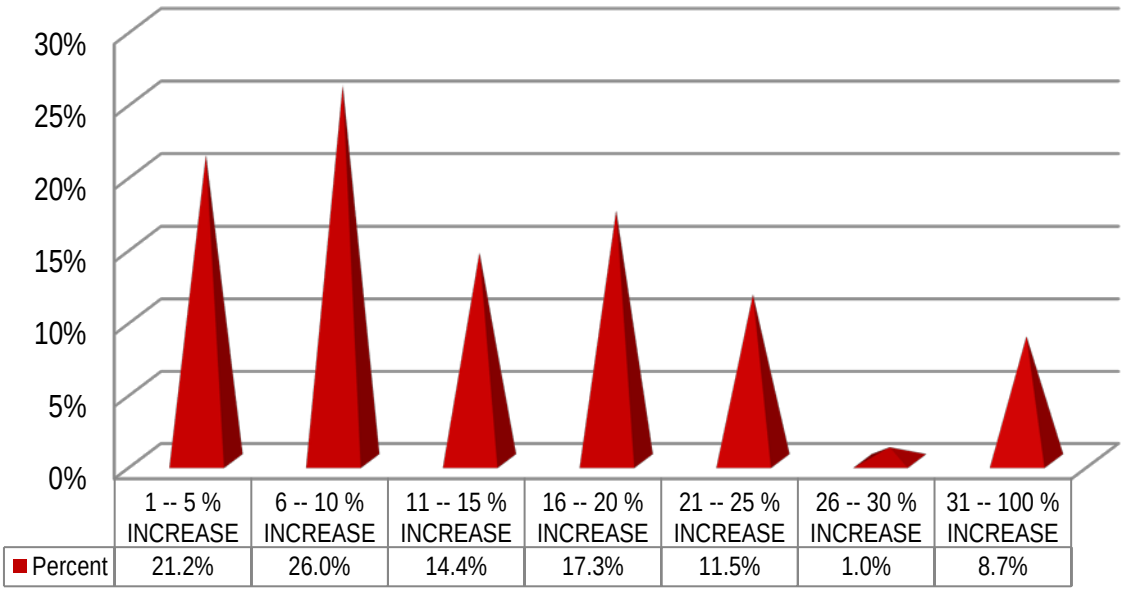


Figure 5.9: Rate of Increase in the Practice Gross Revenue

5.3.1 Practice Revenue by Type of Animal

As noted earlier, bovine veterinarians provide veterinary services to many types of animals. Table 5.1 indicates the percentage of practices that make one of six categories of revenue. Most of the bovine practitioners indicated that they make 0 percent or 1-10 percent of revenue from providing services to feedlots, while 29.5 percent indicated that they earn more than 76 percent of their revenue from providing services to dairy animals. Cow-calf, dairy and small ruminant are the primary sources of the bovine practitioners demand for services.

Table 5.1: Percentage of Practice Revenue by Type of Animal

	0%	1--10%	11--25%	26--50%	51--75%	76--100%
Dairy (N = 400)	14.8%	20.8%	8.3%	12.0%	14.8%	29.5%
Cow-calf (N = 371)	8.9%	40.2%	21.3%	15.6%	9.2%	4.9%
Feedlot (N = 332)	43.7%	39.8%	10.5%	4.2%	0.9%	0.9%
Stocker (N = 324)	41.1%	41.7%	9.6%	5.3%	2.2%	0.3%
Small Ruminant (N = 348)	15.2%	72.1%	7.8%	4.3%	0.6%	-
Swine (N = 335)	37.3%	55.2%	4.8%	2.1%	0.6%	-
Equine (N = 352)	21.3%	51.4%	17.1%	6.5%	2.6%	1.1%
Companion Animal (N = 339)	23.0%	18.9%	14.2%	20.4%	18.0%	5.6%

5.3.2 Revenue by Type of Activity

The percentage of a bovine practice's that indicated what category of revenue was obtained for each service is provided in Table 5.2. 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 41-50 percent of the practices' revenue was obtained through the provision of reproductive services. Most of the revenue in the practice is generated by a DVM (as opposed to a technician). And the provision of preventative care (protocol development, preventative medicine) is not a main source of revenue.

Table 5.2: Percentage of revenue by Type of Activity

	≤ 10%	11 -- 20%	21 -- 30%	31 -- 40%	41 -- 50%
Call Fees (N = 300)	74.3%	20.7%	2.3%	0.7%	1.0%
Reproduction services (N =323)	24.8%	18.3%	19.2%	13.3%	11.5%
Individual sick animal (N = 314)	51.6%	29.6%	12.1%	4.8%	1.0%
Surgery (N = 299)	65.6%	23.8%	7.4%	2.0%	1.0%
Technician Generated (N = 88)	94.3%	4.6%	1.1%	-	-
Protocol development consultation (N = 154)	94.8%	3.3%	0.7%	-	0.7%
Consultation other (N = 254)	33.9%	54.3%	4.3%	-	1.6%
Sale of products (N = 284)	45.4%	25.0%	15.1%	6.7%	3.9%
Radiology (N = 102)	92.2%	5.9%	2.0%	-	-
Preventive medicine (N = 294)	59.9%	17.4%	12.6%	4.8%	2.4%
Embryo Transfer (N = 47)	70.2%	6.4%	6.4%	2.1%	2.1%
Laboratory, diagnostics (N = 233)	94.0%	4.7%	0.9%	0.4%	-
Other revenues (N = 52)	61.5%	7.7%	1.9%	-	3.9%

	51 -- 60%	61 -- 70%	71 --80%	81 --90%	91 -- 100%
Call Fees	0.7%	0.3%	-	-	-
Reproduction services	5.3%	3.4%	1.9%	2.5%	-
Individual sick animal	0.6%	0.3%	-	-	-
Surgery	0.3%	-	-	-	-
Technician Generated	-	-	-	-	-
Protocol development consultation	-	-	-	0.7%	-
Consultation other	0.8%	0.4%	0.8%	0.8%	3.2%
Sale of products	1.8%	1.1%	0.7%	0.4%	-
Radiology	-	-	-	-	-
Preventive medicine	0.7%	1.0%	1.0%	0.3%	-
Embryo Transfer	4.3%	-	2.1%	2.1%	4.3%
Laboratory, diagnostics	-	-	-	-	-
Other revenues	1.9%	-	-	1.9%	21.2%

5.4 Effect of Herd Size on Incomes

The 2013 U.S. veterinary workforce study noted several factors that may influence the weekly hours worked (hours/week) for veterinarians. These factors included the changing gender distribution in the workforce, the age distribution of veterinarians, the generational shifts, the employment type (employed vs self-employed), the imbalances between supply and demand for veterinary services, the changes in the economics of veterinary practice, and the changes in technology, additional education and training and geographic location.

An additional factor that might affect food animal and rural veterinary salaries is a factor that is known to have an adverse impact on the local businesses and economies throughout rural America. As agricultural production continues to become more concentrated in fewer, larger farms, there are fewer purchases of farm inputs and fewer sales of farm outputs locally as producers seek pecuniary economies of size. 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' population and supporting businesses.

The fewer and larger food animal producers have employees who perform reproductive services, vaccinations, deworming and parasite control and other services that smaller operations once purchased

only 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 small farms (approximately 1.6 million) belong to retirement or lifestyle owners who have not engaged in production agriculture as a profession and typically need more services to assist with their production activities than do professional producers. These small farms are more typically positioned on the rural-suburban fringe and the become scarce as distance from an urban center increases.

Over time, the size of professional farmers' land and livestock holdings have increased, and, as noted earlier, reduced the demand for local goods and services as these large operators seek to gain lower costs through purchasing and selling in bulk (pecuniary economies of size). This reduced number of agricultural producers and associated rural businesses has reduced the density of inhabitants in rural areas, increasing the distance between veterinary clients. To this extent, the demand for veterinary services may be tied to the average herd size in a business area. The hypothesis is that the larger the herd size, the fewer the services demanded per animal.

The objective of this analysis is to determine whether there exists a relationship between the demand for veterinary services and the demographics of the animals in the area. Due to the lack of information about the gross revenue of the practices, we used the owners' professional income as a proxy. In total, 157 practice owners are included in the analysis; after cleaning for missing values, 132 owners were retained. Because we used professional income instead of gross revenue of the practice, we controlled for factors such as year of graduation, gender, and location of the practice. Professional income is categorized into 16 categories as shown in Table 5.3. More than 84 percent of practice owners have professional income greater or equal to $70,000 per year. The majority of them are male veterinarians (79.6 percent).

Table 5.3: Distribution of Practice Owners by Range of Professional Income

Group	Income Range	Percent
1	Less than $10,000	0.4%
2	$10,000 to $19,999	2.7%
3	$20,000 to $29,999	1.5%
4	$30,000 to $39,999	1.1%
5	$40,000 to $49,999	2.3%
6	$50,000 to $59,999	4.2%
7	$60,000 to $69,999	3.0%
8	$70,000 to $79,999	10.3%
9	$80,000 to $89,999	5.3%
10	$90,000 to $99,999	3.4%
11	$100,000 to $124,999	18.6%
12	$125,000 to $149,999	9.5%
13	$150,000 to $174,999	12.9%
14	$175,000 to $199,999	4.9%
15	$200,000 to $249,999	11.4%
16	$250,000 and over	8.4%

A linear regression model was used to fit the data. The variables of interest were number of unique clients and unique animals seen each year, the average size herds by type of animal, and the herd size of animals of each type in the area. The types of animals listed are dairy, cow-calf, feedlot, stocker, and small ruminant. The results of this analysis will help understand the need versus demand for veterinarians in rural America. The average herd size ranges from one (no animal of this type served) to eight (at least 3,000 animals of this type).

The parameter estimates are presented in Table 5.4. The overall statistics show that the model fits the data relatively well (*p-value* <0.0001). The r-squared indicates that 43.64 percent of the variation in the professional income is explained by the variables included in the model. The significant variables cannot be viewed as causative, but rather relational. A significant variable can be said to be related to the dependent variable but not that it causes an increase or decrease in the dependent variable. To determine the cause and effect relationship would require a continuous time series of observations.

The intercept represents the average professional income when none of the factors is considered. If we translate the estimated intercept (9.55) into income, the intercept becomes $14,050. Some of the variables did not yield statistically significant estimates. Only the numbers of years since DVM graduation, number of

hours per week, gender, and herd size, have significant impacts on professional income. The results indicate that one additional year in the profession increases professional income by approximately 2.8 percent. None of the practice locations (districts) shows a statistically significant effect. These were entered into the model as dummy variables with District 1 taken as base district. Thus, none of the other districts' incomes of veterinarians are significantly different from District 1.

Male veterinarians earn on average 77.1 percent higher income than their female counterparts. An extensive literature exists about the gender wage gap among veterinarians.

With respect to the herd size of each type of animal in the practice area, the results indicate that an increase in herd size of dairy cows, cow-calf, and feedlot positively affects veterinary income, whereas an increase in herd size of stocker cattle negatively affects professional income. The size of small ruminants does not yield statistically significant impact on the income of bovine veterinarians.

Table 5.4: Effects 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)	2.8036%	0.02765	0.01174	0.02030
Quadratic term of (1)	-0.0492%	-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)	77.0567%	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	0.0001%	0.00000	0.00000	0.05470
Population of cow-calf in the area	0.0004%	0.00000	0.00000	0.01700
Population of stocker in the area	-0.0010%	-0.00001	0.00001	0.05360
Population of feedlot in the area	0.0000%	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

5.5. Bovine Practitioner and Business Management

The respondents were asked to indicate the business management skills that they believe were not fully transmitted to them by their instructors during their career as veterinary students (Figure 5.10). The management skills enumerated are business finance, business statistics, marketing, strategic management, accounting, managerial business analysis, and human resource management. The top three skills that veterinarians cited as needing more development are business finance (26.6 percent), human resource management (20.5 percent), and managerial business analysis (19.9 percent). As the veterinary sector is witnessing considerable changes and becoming a more business-oriented activity, it is necessary to strengthen the ability of veterinarians in terms of management skills. Business finance is one of the most important components in understanding how capital flows through the practice to create revenue.

Veterinarians need to know how to use key financial ratios to understand and assess the financial health of their activities.

Human resource management is as crucial as knowledge of finance. The ability to motivate people is a key for a successful business. It is clear that bovine practitioners would prefer veterinary medical schools to revise their curricula to devote more attention to these disciplines.

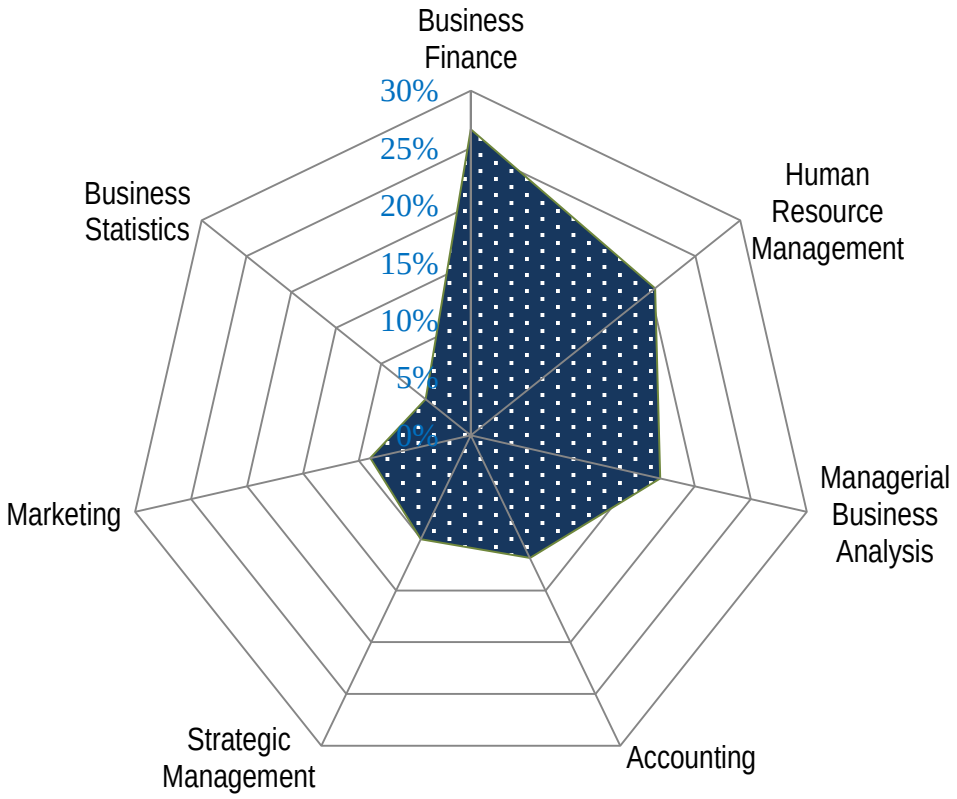


Figure 5.10: Upon graduation, in which of the following business management areas did you feel most inadequate and would have liked to learn more about?

SECTION 6: ECONOMY-WIDE IMPACTS OF BOVINE PRACTICES

Bovine veterinary practices both affect and are affected by the general economy. As noted earlier, the growth in GDP affects the demand for animal protein and this affects the demand for bovine veterinary services. But bovine practices also have an impact on national, state and local economies. First, bovine practices hire labor, purchase goods and services for their business and personal needs, pay taxes and contribute to local and state economies through other means such as charitable giving. Second, bovine practices, not unlike most veterinary practices, contribute unmeasurable benefits to the economy in reducing animal protein production costs and human health costs through the management of animal diseases. And, in many cases, as a result of the consolidation in US production agricultural, veterinary hospitals are often one of the few remaining businesses in many rural communities.

This section provides the first estimate of the contribution of bovine practitioners to the U.S. economy, however it does not provide a measure of the foregone costs of not managing animal diseases, which would result in a much larger impact.

6.1. Economic Impact Analysis: A Brief Introduction

Economic Impact Analysis (EIA) captures the changes in the level of economic activity due to an exogenous change in the economic environment of the study area. The change might be (for example), a new investment, a new government policy, increased demand for a specific good or service, or a change in the condition of an existing facility or project. Any of these changes will have an impact on the employment, total economic output, the value added to purchased goods and services, and the wealth of the communities within the study area and the surrounding regions. For the purposed of this study, the economic impacts of the absence of bovine veterinary services in 11 regional economies are considered to assess the relative importance of the bovine veterinary profession.

The EIA provides estimates of changes in total employment, aggregate personal income, total value added (Gross Regional Product), business output, and fiscal revenues (state and federal tax revenues) associated with the change in the economic activity. In this analysis, results are presented for the eleven AABP Districts. The general statistics for each district are presented in APPENDIX B. The model information provides insights about some relevant macroeconomic variables (Gross Regional Product, total

employment, number of industries, population, total households, and average household income) that can help in putting the results of the analysis into appropriate perspective.

The value-added components summarize the gross income generated by all industries in the region and the distribution of that income among major contributors (employees, proprietors and government). The final demand provides the movements of the economic activities between alternative industries or sectors of the economy. A positive value represents how much the industry obtains from its sales. The major destination for sector or industry output (sales) are the households, the government (state and federal government), and the rest of the world (exports). A negative value represents the expenses of the industry. The expenses include the value of purchases of goods and services (intermediate goods) from outside of the region and the dollar value of the interindustry trade (institutional sales).

6.2. Determining the Number of Practices by District

No regional statistics specific to veterinarians were available and thus food animal veterinarians were used as a proxy to construct the expenditure patterns of a bovine practice. While the results will be similar, better estimates can be obtained by developing an average expenditure pattern (costs of inputs) for each type of bovine practice (e.g., cow-calf vs dairy). Since the analysis is made regionally, we aggregate the total number of veterinarians by state into the 11 AABP districts. The APTIFY database provides a national distribution of U.S veterinarians by state. Since the APTIFY data encompass all veterinarians regardless of their employment status (active veterinarians or retired veterinarians), we cleaned the dataset and maintain only active veterinarians. In total, 76,140 active veterinarians were maintained in the final dataset and used to determine the distribution by state.

Once the distribution of the APTIFY sample was set, we standardized it to reflect the AVMA 2015 estimate of U.S veterinarians. According to the AVMA statistics, there are approximately 105,000 active veterinarians in the United States. The AVMA statistics also provides the distribution of veterinarians by type of employment (Table 6.1) and thus we use this to distribute the 105,000 active veterinarians.

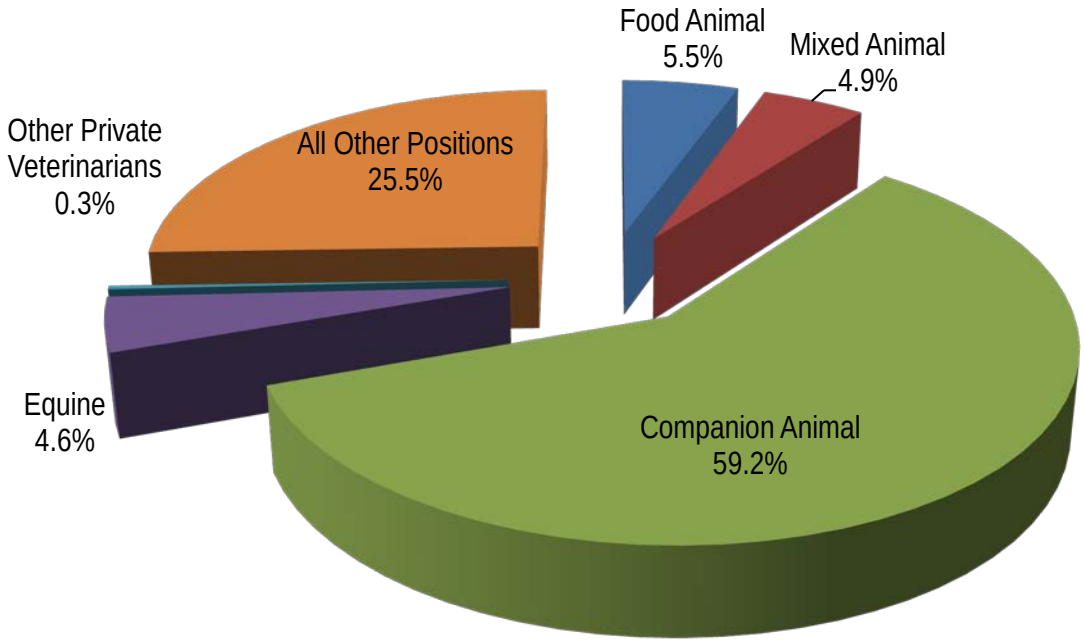


Figure 6.1: Distribution of Veterinarians by Type of Practice in 2015

On average, food animal veterinarians represent about 5.5 percent of the total U.S. veterinarians. Thus, for the remainder of the analysis food animal (bovine) veterinarians are assumed to represent 5.5 percent of the total number of active veterinarians. Applying these distributions to the state level veterinarians, the total number of food animal veterinarians per district was computed (Table 6.2).

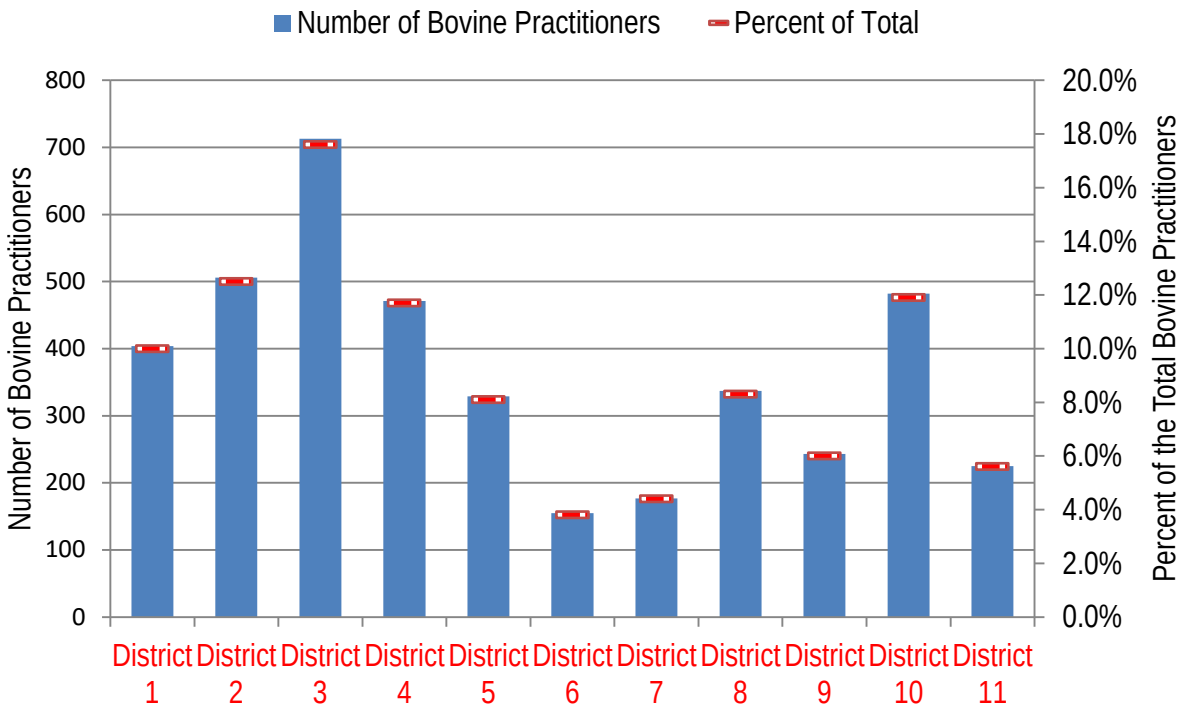


Figure 6.2: Number of Food Animal Veterinarians by AABP District

After determining the number of practices by district, the average gross revenue of the practice was computed for each district, and multiplying this average by the total number of practices, we came up with an estimated gross revenue of bovine veterinary practice by district, as shown in Table 6.1.

Table 6.1: Number of Practitioners, Average and Total Gross revenue by AABP District

	# Practitioners	Avg. Gross Revenue	Total Gross Revenue
District 1	404	$ 398,405	$ 160,955,735
District 2	506	$ 660,000	$ 333,960,000
District 3	713	$ 276,250	$ 196,966,250
District 4	471	$ 285,000	$ 134,235,000
District 5	329	$ 316,635	$ 104,173,031
District 6	155	$ 395,422	$ 61,290,461
District 7	177	$ 473,411	$ 83,793,791
District 8	337	$ 297,945	$ 100,407,549
District 9	243	$ 439,714	$ 106,850,571
District 10	482	$ 266,667	$ 128,533,333
District 11	225	$ 375,625	$ 84,515,625

To determine the economic impacts of bovine veterinary practices, we subtracted the estimated value of output to the total industry output (IMPLAN sector 459) for each district.

6.3. The IMPLAN Software and the Input/Output Analysis

IMPLAN is an economic impact modeling system initially introduced by the U.S. Forest Service and developed by the Minnesota IMPLAN Group, and currently managed by the IMPLAN Group LLC. Today, IMPLAN is widely used to quantify the economic contribution of an organization, industry or investment at local, region and country level.

IMPLAN uses the Leontief input-output model that maps the interrelationship between sectors and industries in the economy. The input-output model presents the economic activities in a form of a matrix with details on the purchases and the sales of a given sector. For example, for veterinary services, the input-output model provides the dollar value of all goods and services used to produce a dollar's worth of veterinary service. Data in IMPLAN come from various sources including but not limited to the U.S. Departments of Agriculture, Commerce and Labor.

Currently, IMPLAN has identified 536 unique economic sectors in the U.S. economy. Each sector is related to the rest of the sectors via a multiplier so that for a dollar's worth of investment made by one sector, IMPLAN tracts the dollar flow and generates the share of each sector out of the dollar. For example, to produce a unit of veterinary service, a veterinarian needs a certain amount of labor, a certain amount of pharmaceuticals, a certain amount of medical imagery, and so on. All the expenses used to produce the service are standardized into a percentage.

6.4. Results and Discussion

For the impact summaries, the results are presented in terms of direct, indirect and induced effects. Direct effects refer to the change in employment, value of output or Gross Regional Product (GRP), and fiscal revenue (taxes) generated by the bovine veterinary profession. Indirect impacts are the changes in the employment, GRP and fiscal revenue from all other sectors that are impacted by any change in the production of the bovine veterinary profession. Induced impacts are jobs, GRP and fiscal revenue created by the spending patterns of the employees of the bovine veterinary profession and all of the sectors providing goods and services to the providers of bovine veterinary services. In addition, APPENDIX C provides a summary of the top 10 sectors affected by the entry of a new practice in each region and the magnitude of the impact in terms of employment, labor income, value added, and output.

6.4.1. Economic Effect of Bovine Veterinary Medicine on Employment

The employment effects of the bovine veterinary profession are presented in Table 6.2. The results indicate that the bovine veterinary profession generates at the national level an estimated 20,636 direct jobs (jobs directly related to the provision of bovine veterinary services including veterinarians and veterinary staff), supports 3,848 indirect jobs (providers of good and services to veterinarians to enable them to provide bovine veterinary services), and induces 6,013 other jobs (employees required to provide goods and services needed for the direct and indirect employees to live) for a total of 30,497 jobs for the entire economy.

Table 6.2: Economic Impacts of Food Animal Practice on Employment

	Direct Effect	Indirect Effect	Induced Effect	Total Effect
District 1	2,064	339	573	2,977
District 2	4,347	774	1,370	6,492
District 3	2,847	622	896	4,366
District 4	1,894	329	551	2,773
District 5	1,417	266	448	2,131
District 6	890	149	231	1,270
District 7	1,250	230	319	1,799
District 8	1,390	271	394	2,055
District 9	1,541	294	403	2,239
District 10	1,743	356	524	2,623
District 11	1,252	218	303	1,772

6.4.2. Economic Effect of Bovine Veterinary Medicine on Labor Income

The results of the impact of bovine veterinary profession on employee compensation and proprietor income are presented in Table 6.3. The total direct impacts at a national level are estimated at $729,809,504. This value corresponds to the total dollar amount invested by bovine veterinary practice owners into the national economy as payroll expenditures and owner's share. The total indirect effects are estimated at $218,147,387 and represent the total additional investment on labor income of all other industries necessary that have to vary their production as a result of the existence of the bovine veterinary profession. The induced effects at the national level are equivalent to $290,644,895. The aggregated effects are estimated at $1,238,601,786 for the U.S. economy.

Table 6.3: Economic Impacts of Food Animal Practices on Labor Income

	Direct Effect	Indirect Effect	Induced Effect	Total Effect
District 1	$ 84,748,191	$ 23,835,399	$ 33,103,674	$ 141,687,264
District 2	$ 171,929,409	$ 50,297,298	$ 71,651,481	$ 293,878,188
District 3	$ 91,155,410	$ 30,479,303	$ 39,503,832	$ 161,138,545
District 4	$ 64,862,496	$ 16,348,008	$ 23,768,004	$ 104,978,507
District 5	$ 50,662,845	$ 15,465,336	$ 21,242,641	$ 87,370,822
District 6	$ 28,522,922	$ 8,025,078	$ 10,243,681	$ 46,791,681
District 7	$ 37,607,126	$ 11,313,460	$ 13,890,453	$ 62,811,039
District 8	$ 48,586,767	$ 14,351,096	$ 18,185,179	$ 81,123,042
District 9	$ 49,294,673	$ 14,886,178	$ 17,606,470	$ 81,787,321
District 10	$ 64,290,177	$ 21,959,720	$ 27,400,239	$ 113,650,136
District 11	$ 38,149,489	$ 11,186,511	$ 14,049,241	$ 63,385,241

6.4.3. Economic Effect of Bovine Veterinary Medicine on Value Added

The results of the impacts of veterinary profession on value added are presented in Table 6.4. The value added represents the increase in the GRP generated by the profession. The direct contributions of food animal practice to the GRP vary between $38,852,330 and $174,841,280. At the national level, the direct effects are estimated at $1,642,370,571.

Table 6.4: Economic Impacts of Food Animal Practice on Total Value Added

	Direct Effect	Indirect Effect	Induced Effect	Total Effect
District 1	$ 85,359,280	$ 42,715,973	$ 57,195,692	$ 185,270,945
District 2	$ 174,841,791	$ 89,105,780	$ 124,109,191	$ 388,056,762
District 3	$ 93,058,055	$ 55,851,911	$ 69,874,482	$ 218,784,448
District 4	$ 65,081,128	$ 28,339,861	$ 42,587,618	$ 136,008,607
District 5	$ 52,356,806	$ 28,134,751	$ 37,462,847	$ 117,954,404
District 6	$ 28,818,785	$ 13,551,398	$ 17,888,180	$ 60,258,363
District 7	$ 38,211,410	$ 19,084,678	$ 24,303,650	$ 81,599,738
District 8	$ 49,636,602	$ 25,071,958	$ 32,040,499	$ 106,749,058
District 9	$ 50,592,211	$ 27,063,450	$ 31,750,381	$ 109,406,042
District 10	$ 64,820,020	$ 41,288,568	$ 48,207,177	$ 154,315,765
District 11	$ 38,852,330	$ 20,079,106	$ 25,035,003	$ 83,966,438

6.4.4. Economic Effect of Bovine Veterinary Medicine on Output

This effect represents the gross sales of the bovine veterinary profession. In other words, the direct effect represents the total dollar value of the bovine veterinary services sold to consumers. In total, the direct

effects of food animal veterinary practices are estimated at $1,495,681,349. Because the bovine veterinary profession uses inputs from other industries, the total value of the products of these suppliers is captured in the indirect effect. The total indirect and induced effects at the national level are $677,502,645 and $876,297,434, respectively. The aggregated effect for the entire economy is estimated at nearly $3,050,000,000.

Table 6.5: Economy-Wide Impact of Food Animal Practice on Industry Output

	Direct Effect	Indirect Effect	Induced Effect	Total Effect
District 1	$ 160,955,735	$ 69,515,000	$ 90,773,599	$ 321,244,334
District 2	$ 333,960,000	$ 150,059,281	$ 207,200,214	$ 691,219,495
District 3	$ 196,966,250	$ 100,167,171	$ 124,035,481	$ 421,168,901
District 4	$ 134,235,000	$ 51,014,816	$ 75,493,076	$ 260,742,893
District 5	$ 104,173,031	$ 49,053,849	$ 65,021,156	$ 218,248,036
District 6	$ 61,290,462	$ 23,852,888	$ 31,476,412	$ 116,619,761
District 7	$ 83,793,791	$ 34,617,380	$ 43,647,709	$ 162,058,881
District 8	$ 100,407,549	$ 44,224,626	$ 56,452,936	$ 201,085,111
District 9	$ 106,850,571	$ 48,900,434	$ 56,477,545	$ 212,228,550
District 10	$ 128,533,333	$ 70,644,047	$ 81,958,156	$ 281,135,536
District 11	$ 84,515,625	$ 35,453,155	$ 43,761,150	$ 163,729,930

6.4.5. Economic Effect of Bovine Veterinary Medicine on Tax

Veterinary practices pay tax to the local and federal government through different channels: tax on employee and proprietor compensation, tax on production and imports, service tax, and corporations tax. These effects (Table 6.6 and Table 6.7) estimate the total value of the tax money received from bovine veterinary practices in each district. In total, states and local governments have received $1,907,949, $89,640,200, $32,734,174, and $3,408,172 as part of the payroll tax, tax on production and imports, veterinary service tax paid by households, and corporations tax, respectively. In addition to the $245,642,935 received from employee compensation, production and imports, households, and corporations, the federal government receives an estimated $8,975,983 as tax on proprietor income. Thus, the bovine veterinary profession pays and estimated $382,309,413 to the state and federal governments.

Table 6.6: Economy-Wide Impact of Food Animal Practice on State and Local Tax Revenues

	Employee Compensation	Tax on Production and Imports	Households	Corporations
District 1	$ 169,110	$ 9,672,897	$ 5,487,755	$ 809,988
District 2	$ 333,722	$ 20,149,805	$ 8,412,171	$ 838,121
District 3	$ 236,603	$ 12,868,565	$ 2,656,322	$ 405,548
District 4	$ 226,365	$ 6,947,971	$ 2,920,321	$ 148,860
District 5	$ 144,771	$ 7,443,831	$ 2,566,422	$ 317,428
District 6	$ 84,408	$ 3,263,911	$ 1,474,268	$ 119,991
District 7	$ 113,040	$ 4,311,232	$ 1,479,917	$ 103,181
District 8	$ 113,761	$ 6,039,256	$ 851,874	$ 35,512
District 9	$ 132,131	$ 6,017,273	$ 1,902,936	$ 156,835
District 10	$ 287,236	$ 8,104,864	$ 3,882,685	$ 371,703
District 11	$ 66,802	$ 4,820,595	$ 1,099,503	$ 101,005

Table 6.7: Economy-Wide Impact of Food Animal Practice on Federal Tax Revenues

	Employee Compensation	Proprietor Income	Tax on Production and Imports	Households	Corporations
District 1	$ 12,324,583	$ 1,177,356	$ 1,041,986	$ 12,584,955	$ 2,344,675
District 2	$ 29,302,256	$ 1,904,978	$ 2,417,260	$ 23,125,719	$ 5,108,362
District 3	$ 16,263,430	$ 1,103,182	$ 1,722,332	$ 10,869,798	$ 3,071,302
District 4	$ 10,434,935	$ 766,303	$ 920,185	$ 6,739,378	$ 1,652,243
District 5	$ 8,205,441	$ 656,564	$ 847,882	$ 6,475,141	$ 1,590,177
District 6	$ 4,696,455	$ 350,451	$ 370,969	$ 3,341,590	$ 701,345
District 7	$ 6,227,070	$ 478,646	$ 579,220	$ 4,054,488	$ 991,423
District 8	$ 7,170,111	$ 706,218	$ 790,055	$ 6,400,925	$ 1,340,851
District 9	$ 8,219,176	$ 534,562	$ 743,270	$ 5,965,294	$ 1,487,905
District 10	$ 10,516,826	$ 795,548	$ 1,082,616	$ 9,010,660	$ 2,245,474
District 11	$ 6,457,981	$ 502,175	$ 590,059	$ 4,534,951	$ 1,082,181

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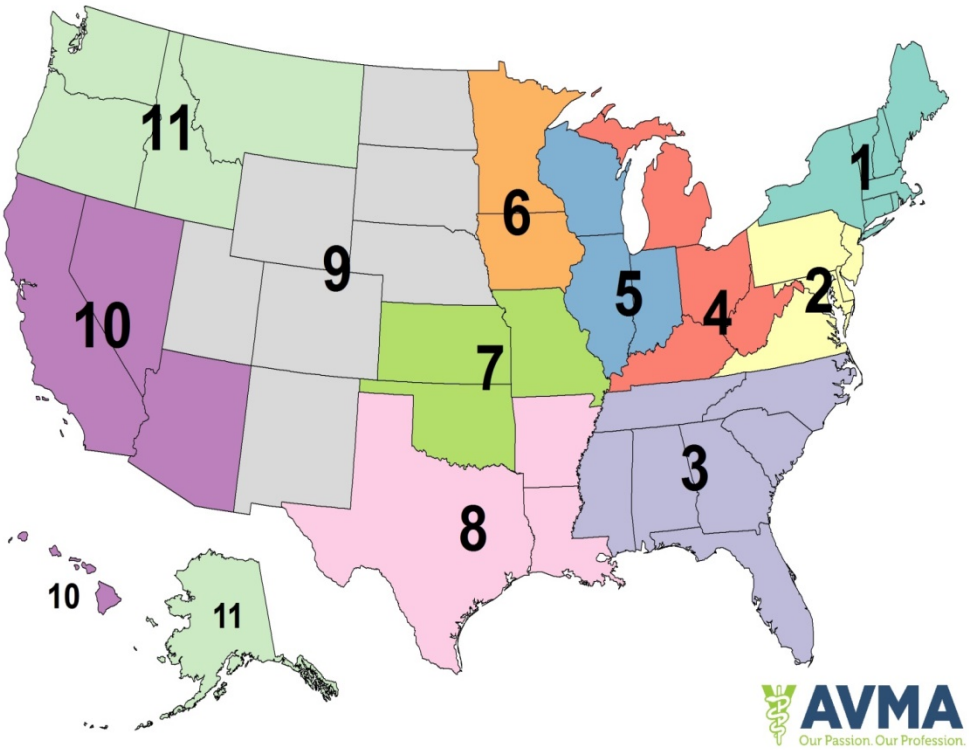
APPENDIX A

U.S. Map with AABP Districts

AABP Districts in the U.S.A.



APPENDIX B

Model Information by AABP District:

Demographics, Value Added, Final Demand, and Veterinary Services

	District 1	District 2	District 3
GRP ($)	2,200,772,317,746	2,144,191,501,620	2,508,973,569,700
Total Personal Income ($)	1,861,156,000,000	1,899,435,000,000	2,279,705,000,000
Total Employment	20,940,225	22,155,212	31,825,263
Number of Industries	516	519	529
Land Area (Sq. Miles)	110,035	103,627	329,569
Area Count	7	6	7
Population	34,269,940	37,434,560	58,488,830
Total Households	13,335,860	14,440,110	22,405,930
Average Household Income ($)	139,560	131,539	101,746
Value Added ($)			
Employee Compensation	1,217,959,182,351	1,199,868,520,370	1,342,931,300,590
Proprietor Income	176,865,181,872	161,568,267,581	183,159,288,992
Other Property Type Income	669,302,246,333	652,980,833,728	799,620,496,951
Tax on Production and Import	136,645,707,190	129,773,879,941	183,262,483,167
Total Value Added	2,200,772,317,746	2,144,191,501,620	2,508,973,569,700
Final Demand ($)			
Households	1,384,406,047,185	1,518,589,448,708	2,006,645,686,103
State/Local Government	328,455,931,567	285,590,926,604	371,704,747,031
Federal Government	101,493,571,693	339,866,889,930	214,528,269,390
Capital	294,099,109,356	321,770,388,284	473,746,246,089
Exports	957,600,755,117	722,959,539,511	928,833,342,773
Imports	(806,111,239,417)	(973,895,729,090)	(1,370,020,046,711)
Institutional Sales	(59,171,847,968)	(70,689,973,997)	(116,464,683,300)
Total Final Demand:	2,200,772,327,532	2,144,191,489,949	2,508,973,561,375
Veterinary Services			
Employment	46,740	52,260	88,557
Output ($)	3,394,666,748	3,739,865,967	5,707,035,156
Employee Compensation ($)	1,366,201,904	1,605,074,951	2,161,216,309
Proprietor Income ($)	446,525,116	347,568,878	517,411,987
Tax on Production & Imports ($)	58,901,512	69,437,279	112,553,406

	District 4	District 5	District 6
GRP ($)	1,268,668,028,766	1,315,400,540,385	472,676,294,587
Total Personal Income ($)	1,086,218,000,000	1,105,447,000,000	398,818,600,000
Total Employment	15,388,288	14,823,255	5,617,316
Number of Industries	520	518	506
Land Area (Sq. Miles)	161,581	145,777	135,491
Area Count	4	3	2
Population	27,716,030	25,195,750	8,510,796
Total Households	11,111,650	9,791,696	3,459,761
Average Household Income	97,755	112,896	115,274
Value Added ($)			
Employee Compensation	689,902,175,787	719,015,469,177	253,091,144,785
Proprietor Income	84,372,982,768	88,638,191,144	45,717,872,050
Other Property Type Income	408,293,057,718	426,270,819,596	145,747,949,764
Tax on Production and Import	86,099,812,494	81,476,060,467	28,119,327,988
Total Value Added	1,268,668,028,766	1,315,400,540,385	472,676,294,587
Final Demand ($)			
Households	991,438,805,009	934,290,684,512	334,994,118,180
State/Local Government	185,757,078,738	178,044,783,744	68,558,698,581
Federal Government	70,570,392,686	45,901,299,637	15,103,961,110
Capital	199,482,131,749	196,811,711,952	84,337,870,831
Exports	771,903,873,794	761,640,125,630	314,262,616,043
Imports	(896,984,763,985)	(755,065,411,283)	(323,361,922,090)
Institutional Sales	(53,499,484,590)	(46,222,652,973)	(21,219,047,729)
Total Final Demand:	1,268,668,033,400	1,315,400,541,219	472,676,294,925
Veterinary Services			
Employment	38,614	36,034	13,688
Output ($)	2,549,888,184	2,466,988,037	878,228,027
Employee Compensation ($)	990,782,837	935,944,946	325,435,028
Proprietor Income ($)	258,786,316	280,836,578	89,060,364
Tax on Production & Imports ($)	35,916,920	75,245,232	15,009,342

	District 7	District 8	District 9
GRP ($)	610,633,339,167	1,923,062,429,119	769,725,486,879
Total Personal Income ($)	528,365,200,000	1,446,868,000,000	621,914,400,000
Total Employment	7,703,638	19,607,103	8,992,080
Number of Industries	510	524	515
Land Area (Sq. Miles)	219,400	357,556	626,134
Area Count	3	3	7
Population	12,788,700	34,033,040	14,273,970
Total Households	5,085,415	12,260,500	5,419,092
Average Household Income	103,898	118,011	114,764
Value Added ($)			
Employee Compensation	321,974,882,380	888,808,408,192	390,807,123,015
Proprietor Income	60,752,435,221	209,672,530,962	72,035,529,242
Other Property Type Income	188,903,341,182	690,364,051,733	257,154,128,087
Tax on Production and Import	39,002,680,385	134,217,438,232	49,728,706,534
Total Value Added	610,633,339,167	1,923,062,429,119	769,725,486,879
Final Demand ($)			
Households	456,491,620,068	1,145,130,572,483	519,985,534,103
State/Local Government	87,874,975,983	231,935,298,576	109,368,589,510
Federal Government	50,150,671,818	112,275,819,489	77,511,393,575
Capital	111,713,744,567	389,829,480,853	154,815,316,004
Exports	361,114,476,615	1,129,060,371,932	385,818,081,989
Imports	(431,188,457,603)	(1,022,559,639,155)	(445,005,274,331)
Institutional Sales	(25,523,694,709)	(62,609,475,161)	(32,768,157,287)
Total Final Demand:	610,633,336,738	1,923,062,429,017	769,725,483,564
Veterinary Services			
Employment	19,748	45,334	22,931
Output ($)	1,233,179,688	3,051,651,367	1,480,718,140
Employee Compensation ($)	445,726,685	1,135,160,278	574,266,846
Proprietor Income ($)	115,574,501	362,446,594	118,531,464
Tax on Production & Imports ($)	22,688,271	57,754,082	30,854,328

	District 10	District 11
GRP ($)	2,688,689,753,843	785,356,326,967
Total Personal Income ($)	2,233,713,000,000	619,602,100,000
Total Employment	27,265,544	8,327,408
Number of Industries	528	517
Land Area (Sq. Miles)	385,844	961,265
Area Count	4	5
Population	49,153,340	14,263,900
Total Households	16,864,870	5,570,896
Average Household Income ($)	132,448	111,221
Value Added ($)		
Employee Compensation	1,431,945,363,449	397,330,418,302
Proprietor Income	199,918,035,625	53,899,677,247
Other Property Type Income	876,711,812,910	280,366,865,828
Tax on Production and Import	180,114,541,859	53,759,365,591
Total Value Added	2,688,689,753,843	785,356,326,967
Final Demand ($)		
Households	1,733,940,087,312	536,971,438,004
State/Local Government	386,443,537,022	111,965,423,869
Federal Government	193,949,349,454	67,706,628,965
Capital	391,048,650,222	134,368,436,064
Exports	1,008,042,073,148	383,619,956,618
Imports	(928,763,148,911)	(418,399,529,064)
Institutional Sales	(95,970,791,981)	(30,876,029,234)
Total Final Demand:	2,688,689,756,266	785,356,325,222
Veterinary Services		
Employment	62,904	27,702
Output ($)	4,321,802,734	1,741,960,693
Employee Compensation ($)	1,753,975,708	615,023,193
Proprietor Income ($)	438,350,037	182,422,943
Tax on Production & Imports ($)	61,083,858	27,540,569

APPENDIX C

Top 10 Industries Impacted by a Change in the Veterinary Industry:

Effects on Employment, Labor Income, Total Value Added, and Output

District # 1

Description	Employment	Labor Income	Output
Veterinary services	2,067	$ 84,856,298.26	$ 161,161,056.12
Real estate	64	$ 2,076,149.23	$ 15,293,649.00
Full-service restaurants	64	$ 1,765,980.47	$ 3,690,576.22
Wholesale trade	47	$ 4,521,115.73	$ 11,805,525.85
Hospitals	33	$ 2,811,190.46	$ 5,431,928.45
Limited-service restaurants	33	$ 890,507.65	$ 2,205,909.04
Accounting, tax preparation	22	$ 1,867,412.03	$ 2,724,991.58
Retail - Food and beverage stores	20	$ 601,493.44	$ 1,293,009.40
Offices of physicians	19	$ 2,101,654.12	$ 2,694,484.10
Individual and family services	17	$ 477,128.54	$ 725,185.10

District # 2

Description	Employment	Labor Income	Output
Veterinary services	4,353	$ 172,172,147.78	$ 334,431,501.41
Real estate	152	$ 3,142,958.45	$ 32,526,457.07
Full-service restaurants	135	$ 3,203,081.19	$ 7,006,242.12
Wholesale trade	103	$ 9,569,440.03	$ 25,216,886.52
Limited-service restaurants	86	$ 2,143,802.50	$ 5,171,370.60
Hospitals	76	$ 5,777,021.02	$ 11,562,442.71
Accounting, tax preparation	46	$ 3,684,483.06	$ 5,949,902.73
Employment services	46	$ 1,855,299.25	$ 2,678,803.12
Offices of physicians	43	$ 4,695,099.88	$ 6,019,677.79
Retail - Food and beverage stores	43	$ 1,377,602.52	$ 2,889,469.57

District # 3

Description	Employment	Labor Income	Output
Veterinary services	2,851	$ 91,290,793.29	$ 197,258,783.13
Real estate	132	$ 2,011,471.91	$ 20,534,397.16
Full-service restaurants	98	$ 2,252,922.36	$ 5,071,432.35
Wholesale trade	71	$ 5,631,572.06	$ 16,341,241.63
Limited-service restaurants	68	$ 1,572,649.89	$ 3,930,657.03
Employment services	49	$ 1,482,522.29	$ 2,242,820.42
Hospitals	39	$ 2,912,469.83	$ 5,723,046.28
Accounting, tax preparation	38	$ 2,252,508.48	$ 3,748,596.80
Offices of physicians	29	$ 2,737,915.45	$ 3,721,922.51
Monetary authorities and depository	26	$ 2,047,603.44	$ 6,713,711.48

District # 4

Description	Employment	Labor Income	Output
Veterinary services	1,896	$ 64,953,371.46	$ 134,423,070.67
Full-service restaurants	62	$ 1,252,380.07	$ 2,959,951.55
Real estate	58	$ 1,272,163.03	$ 10,843,963.76
Limited-service restaurants	46	$ 1,017,410.12	$ 2,532,109.88
Wholesale trade	38	$ 3,013,290.49	$ 8,698,275.48
Hospitals	33	$ 2,265,748.64	$ 4,718,399.89
Employment services	25	$ 816,211.52	$ 1,228,196.46
Accounting, tax preparation	22	$ 1,290,693.84	$ 2,106,675.22
Offices of physicians	17	$ 1,749,620.69	$ 2,287,084.80
Retail - General merchandise stores	17	$ 456,692.53	$ 1,189,930.75

District # 5

Description	Employment	Labor Income	Output
Veterinary services	1,420	$ 50,737,002.82	$ 104,325,514.60
Full-service restaurants	47	$ 1,040,903.82	$ 2,369,645.30
Real estate	46	$ 699,214.77	$ 9,542,132.32
Limited-service restaurants	34	$ 757,065.74	$ 1,913,984.78
Wholesale trade	34	$ 2,898,609.10	$ 7,775,065.88
Hospitals	25	$ 1,792,851.47	$ 3,741,483.61
Employment services	21	$ 674,771.84	$ 1,004,472.71
Accounting, tax preparation	17	$ 1,148,777.70	$ 1,746,977.83
Monetary authorities and depository	14	$ 1,021,057.69	$ 3,299,132.02
Retail - General merchandise stores	13	$ 374,985.12	$ 942,229.59

District # 6

Description	Employment	Labor Income	Output
Veterinary services	891	$ 28,558,171.71	$ 61,366,207.33
Full-service restaurants	26	$ 521,274.65	$ 1,258,499.34
Real estate	25	$ 526,832.03	$ 5,335,418.90
Wholesale trade	19	$ 1,659,800.53	$ 4,312,232.47
Limited-service restaurants	18	$ 365,604.19	$ 973,010.13
Hospitals	12	$ 832,204.62	$ 1,770,455.03
Employment services	10	$ 307,085.64	$ 465,279.71
Monetary authorities and depository	10	$ 743,780.94	$ 1,856,468.37
Accounting, tax preparation	8	$ 477,056.36	$ 767,527.44
Retail - General merchandise stores	7	$ 197,360.88	$ 494,199.58

District # 7

Description	Employment	Labor Income	Output
Veterinary services	1,252	$ 37,655,812.78	$ 83,902,271.07
Real estate	40	$ 582,587.26	$ 6,273,696.00
Full-service restaurants	40	$ 805,335.01	$ 1,927,295.00
Limited-service restaurants	27	$ 662,784.39	$ 1,569,149.90
Wholesale trade	27	$ 2,014,441.58	$ 5,849,485.46
Hospitals	18	$ 1,246,130.94	$ 2,627,991.38
Accounting, tax preparation	17	$ 879,512.28	$ 1,471,623.94
Employment services	15	$ 489,809.21	$ 746,841.91
Monetary authorities and depository	12	$ 709,051.67	$ 2,574,272.24
Business and professional associations	11	$ 795,954.79	$ 872,594.38

District # 8

Description	Employment	Labor Income	Output
Veterinary services	1,391	$ 48,652,296.03	$ 100,542,969.88
Real estate	54	$ 1,202,795.71	$ 8,264,075.51
Full-service restaurants	46	$ 1,035,254.55	$ 2,392,994.32
Wholesale trade	31	$ 2,825,305.13	$ 7,812,747.46
Limited-service restaurants	31	$ 746,359.32	$ 1,854,092.62
Employment services	19	$ 628,836.24	$ 962,701.81
Hospitals	18	$ 1,354,660.07	$ 2,644,511.22
Accounting, tax preparation	17	$ 1,049,473.00	$ 1,750,247.03
Monetary authorities and depository	13	$ 909,312.53	$ 2,727,845.87
Business and professional associations	13	$ 887,318.34	$ 978,883.51

District # 9

Description	Employment	Labor Income	Output
Veterinary services	1,543	$ 49,357,622.76	$ 106,987,020.66
Real estate	59	$ 825,742.75	$ 9,969,506.22
Full-service restaurants	49	$ 1,087,147.35	$ 2,463,538.04
Wholesale trade	35	$ 2,755,223.28	$ 7,638,827.63
Limited-service restaurants	34	$ 789,660.55	$ 1,957,022.16
Hospitals	18	$ 1,242,610.71	$ 2,620,329.42
Accounting, tax preparation	17	$ 892,737.70	$ 1,561,196.63
Employment services	13	$ 459,087.05	$ 675,749.95
Management of companies and	13	$ 1,403,343.25	$ 2,960,729.72
Retail - General merchandise stores	12	$ 351,673.91	$ 868,807.42

District # 10

Description	Employment	Labor Income	Output
Veterinary services	1,745	$ 64,379,402.26	$ 128,711,719.37
Real estate	71	$ 1,370,313.48	$ 13,382,022.73
Full-service restaurants	57	$ 1,492,675.01	$ 3,156,328.40
Wholesale trade	45	$ 3,756,754.81	$ 10,783,364.76
Limited-service restaurants	38	$ 1,041,278.44	$ 2,470,928.74
Employment services	25	$ 915,327.34	$ 1,357,009.33
Accounting, tax preparation	23	$ 1,468,361.41	$ 2,445,204.00
Hospitals	19	$ 1,771,584.58	$ 3,282,891.60
Individual and family services	19	$ 337,457.61	$ 612,971.36
Management of companies and	18	$ 2,214,496.22	$ 4,393,230.78

District # 11

Description	Employment		Labor Income		Output
Veterinary services	1,254	$	38,200,237.39	$	84,628,051.15
Real estate	44	$	829,523.61	$	8,651,023.26
Full-service restaurants	37	$	943,929.43	$	1,993,341.47
Wholesale trade	26	$	2,077,181.01	$	5,917,513.87
Limited-service restaurants	23	$	578,255.13	$	1,415,498.34
Hospitals	14	$	1,125,917.19	$	2,203,126.14
Accounting, tax preparation	14	$	688,510.26	$	1,222,330.88
Employment services	10	$	419,170.95	$	603,339.92
Individual and family services	10	$	210,234.12	$	350,561.56
All other food and drinking places	9	$	263,787.62	$	778,799.76

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