

Table of Contents

Chapter 1	Introduction, Problem Statement, and Literature Review
Chapter 2	The Future Demand for Food Supply Veterinarians in Academic Careers
Chapter 3	The Future Demand for Food Supply Veterinarians in Industrial Careers
Chapter 4	The Future Demand for Food Supply Veterinarians in Beef Cattle Careers
Chapter 5	The Future Demand for Food Supply Veterinarians in Dairy Cattle Careers
Chapter 6	The Future Demand for Food Supply Veterinarians in Mixed Food Animal Careers
Chapter 7	The Future Demand for Food Supply Veterinarians in Swine Practice Careers
Chapter 8	The Future Demand for Food Supply Veterinarians in Poultry Practice Careers
Chapter 9	The Future Demand for Food Supply Veterinarians in Small Ruminant Careers
Chapter 10	The Future Demand for Food Supply Veterinarians in State/Provincial Government Careers
Chapter 11	The Future Demand for Food Supply Veterinarians in Federal Government Careers
Chapter 12	First Year Student Career Path Study
Chapter 13	First Year Student Recruitment Study
Chapter 14	Student Career Focus Switching Study
Chapter 15	Importance – Performance Analysis of Food Supply Veterinary Medicine Career Commitment Study
Chapter 16	Third and Fourth Year Food Animal Student Career Selection Study
Chapter 17	Faculty Perceptions of Student Employment Selection and Career Commitment Study
Chapter 18	Recruiter Perceptions of Veterinary Employment Decisions Study
Chapter 19	Food Supply Veterinarian Early Career Study
Chapter 20	Food Supply Veterinarian Career Retention Study
Chapter 21	Veterinary Student and Faculty Focus Groups
Chapter 22	Overall Conclusions and Recommendations
Chapter 23	References
Appendix A	Cover letter and First Survey Instrument for Mixed Food Animal Delphi Panel
Appendix B	Cover letter and Second Survey Instrument for Mixed Food Animal Delphi Panel
Appendix C	Cover letter and Third Survey Instrument for Mixed Food Animal Delphi Panel
Appendix D	Cover letters and Combined Survey Instrument for Chapters 12 and 13
Appendix E	Cover letters and Combined Survey Instrument for Chapters 14 and 15
Appendix F	Cover letters and Survey Instrument for Chapter 16
Appendix G	Cover letters and Survey Instrument for Chapter 17
Appendix H	Cover letters and Survey Instrument for Chapter 18
Appendix I	Cover letters and Survey Instrument for Chapter 19
Appendix J	Cover letters and Survey Instrument for Chapter 20
Appendix K	Focus Group Discussion Guides and Participant Exercises

Estimating FSVM Demand and Maintaining the Availability of Veterinarians for Careers in Food Supply Related Disciplines in the United States and Canada

Problem Statement

The future demand and supply for food supply veterinary medicine (FSVM) professionals is at an uncertain juncture. Over 200 experts from academia, industry, and government concluded at a food animal conference in October, 2002 that the North American veterinary profession was facing a shortage of food animal veterinarians in the public, private, industrial, and academic sectors. Various societal trends and economic events have led to growing concerns. These range from worries about food safety, public health, and animal welfare to negative consequences of changing dietary habits to industrial consolidation in agribusiness and the threat of bioterrorism/agroterrorism. These changes and threats have the potential for altering the structure of labor markets and the future demand for FSVM professionals. In addition, the threat of zoonotic diseases and public anxiety about biodiversity and the impact of large and highly concentrated food production systems on the environment are expected to influence the demand for food supply veterinarians. These concerns led to the formation of the Food Supply Veterinary Medical Coalition in 2003.

The term “food animal medicine” has recently been expanded into “food supply veterinary medicine” in order to more fully account for the broad and varied career paths and job responsibilities that veterinarians have in a modern and highly integrated food system. These responsibilities can include “...livestock health and production, product wholesomeness, and distribution and availability of products to meet the needs of global consumers” (Uhlenhopp et al., 2004).

FSVMC Members and Mission

The following organizations are the founding members of the Food Supply Veterinary Medical Coalition (FSVMC). It is through their support and leadership that the direction for this series of research studies was developed. Members include (listed alphabetically): Bayer Animal Health, American Association of Avian Pathologists, American Association of Bovine Practitioners, American Association of Food Hygiene Veterinarians, American Association of Small Ruminants Practitioners, American Association of Swine Veterinarians, American Association of Veterinary Medical Colleges, American Veterinary Medical Association, Association of Veterinary Consultants, and the Food Safety and Inspection Service. Although not officially a member, the Canadian Veterinary Medical Association was very supportive of this research program and instrumental in the data collection process in Canada.

The food supply in the USA and Canada, long considered to be the safest in the world, relies on veterinarians to keep it that way. The premise of the Coalition is that foods produced are enhanced, both in safety and wholesomeness, when veterinarians are involved in all steps of production and processing. The FSVMC's mission is to assure the public that food continues to be abundant, safe and wholesome by ensuring that veterinarians are appropriately involved throughout the food supply system. The Coalition's first major project was to conduct a comprehensive study to examine the demand and supply trends for food supply veterinarians and the issues shaping those trends.

We agree with the FSVMC's position that a safe and wholesome food supply from animal sources is heavily dependent upon the veterinary profession. Unfortunately, as noted by FSVMC executives, the number of individuals interested in pursuing a career in veterinary medicine as it relates to food animal production has dwindled. This is despite projected growth

in several areas, including more than 2,220 federal positions earmarked for DVMs in the public health arena alone (Fiala, 2005).

External Threats and Opportunities

The current environment brings a great deal of potential opportunities and harm to the veterinary profession, food animal industry, and North American society. The opportunities and threats can be manifested in several trends that appear in various forms. Some of the threats and opportunities deal with consumer concerns about animal identification and trace back capability, organic foods versus the use of chemical additives, labeling of foods to a loss of biodiversity and environmental degradation with corporate farms, damage to rural communities due to industry consolidation, and animal abuse including consumer anxiety about the conditions under which farm animals are kept, transported and slaughtered. Much of what is publicized about these issues is often based upon emotions and political agendas or anecdotal examples rather than sound science.

The increased vulnerability of both the food animal industry and the public to disease, coupled with concerns over the numbers of veterinarians with appropriate skills to provide adequate protection can damage the entire profession. At the same time, these concerns can be the catalyst for strategic actions that will improve the FSVM profession and create exciting opportunities. For example, the USA appears to be unprepared for a foot-and-mouth disease outbreak, which the Homeland Security Department has identified as a potential terrorist weapon (Hegeman 2005). The agency estimates that the USA would lose from 24 million to 40 million animals. Food supply veterinarians would serve as the first line of defense to diagnose and contain such a tragedy. Quick response and containment is needed to counter and lessen the

devastation of such an event. However, this is only possible if there are adequate numbers of properly trained and deployed food animal veterinarians.

The U.S. Federal government has been made aware that more veterinarians are needed to prepare for and respond to foreign animal diseases that can be transferred to humans (Walker 2005). Seventy–five percent of new emerging diseases are zoonotic. Additional food supply veterinarians with public health expertise will be needed to combat these existing and emerging diseases. Our increasingly global food supply system increases our vulnerability. Sufficient numbers of adequately prepared food supply veterinarians are needed to fill the role of first-responders to these threats.

The lack of food supply veterinarians to prevent such harm could produce a significant decline in the demand for animal agricultural products and result in damage to state, provincial, and national economies in terms of increased unemployment in the food and transportation sectors, loss of export markets, decreased industry profits, and lower tax revenues. Certain state and provincial economies that are heavily dependent on the food animal agriculture sector would be devastated. U.S. agricultural exports are approximately \$59 billion in 2005, and the U.S. food system contributes \$1.24 trillion or more than 12 percent to gross domestic product and employs 18 percent of the work force (Walker 2005). King (2004) notes that 21 billion animals are produced for food and fiber around the world and 38,000 animals cross U.S. borders daily. The integrated nature of our economics can lead to ripples of secondary economic shocks in linked industries and devastate whole economies. Thus, additional food supply veterinarians must be attracted to and retained in this career area to assure open export markets and to protect the economic prosperity of the USA and Canada.

Globalization of markets and increasing population growth will also affect the need to attract and retain people in food supply veterinary medicine in the USA and Canada. Ninety-six percent of consumers live outside the U.S. and there is expected to be a 60 percent demand increase for meat from those who reside in developing countries as the world's population grows to eight billion people by 2020 (King 2004). The USA and Canada are important providers of animal protein to the planet and input from food animal veterinarians will continue to be critical to support human diets and prevent starvation in many developing countries.

There is another view that must also be addressed. There have been some concerns that the process of consolidation and integration in food industries will lead to economies-of-scale that will lessen the need for veterinarians. There is also the prospect of lower-cost labor substitutes emerging to fill producers' veterinary needs. Will this lead to a world where veterinarians train veterinary technicians, animal science specialists and even lesser trained producer staff members to provide the services previously done by food supply veterinarians? The continuing search to reduce costs in food industries is not a trend that is likely to go away. Producers' business models are changing. Those who survive will find ways to remove costs and develop production systems where each element, including veterinarians that serve these industries, must add more value than cost to the final product. Veterinarians must either adapt to this changing reality or find themselves unemployed.

Not systematically studying in a scientific-based manner this changing mix of threats and opportunities will leave the FSVM profession blind and unable to prepare for a reality that will be nothing like James Harriott's world. Responses to the challenges that endanger the good health of the veterinary profession must be guided by good theory and good data. Sick herds are not made well when the veterinary medical knowledge-base is ignored and systematic data is not

gathered and evaluated. Similarly, constituents interested in working to counter threats and realize opportunities in the FSVM profession cannot rely on only pessimistic anecdotal evidence. In order to create meaningful strategies aimed at increasing student and practitioner interest and commitment in this area, a thorough understanding of the individual and external forces influencing student recruitment, student job selection, and career retention in the field of food supply veterinary medicine is needed. Additionally, the trends shaping the demand for veterinary services and the net effect of both demand-decreasing and demand-increasing trends must be understood. This study supplies this information. Specifically, this research program assesses student and practitioner recruitment, job selection, and career retention in the field of food supply veterinary medicine and the shape of future demand for food supply veterinarians.

Literature Review

In general, the veterinary professional and educational literatures have not focused on (1) veterinary students' motivations for selecting a particular career focus area, (2) why students and practitioners switch into or out of particular career focus areas, and (3) the factors important to students and practitioners in maintaining a lifetime commitment to a food supply veterinary medicine career. There have been some articles that report on workshop or conference meetings, most notably in the area of public health, that speculate, based upon the discussions generated among the meeting participants, how to encourage more students to enter food animal careers. However, by in large, these reports lack a "voice-of-the-customer" approach that enables students and practitioners a say in what factors are important to them in these matters. That is not to say that the perspectives of faculty, industry, and government representatives who often have participated in these meetings are not important. Indeed, we rely on them in our series of

studies for additional perspectives into the thoughts and motivating factors behind student's decisions. However, there is no substitute from getting information straight from the "horse's mouth," which is a large portion of what our research program does. This section reports on the findings and ideas from the veterinary literature in the area of career attraction and retention.

Attracting Students to Food Supply Medicine

Although very little has been written in the veterinary literature with regard to what *attracts* students to a particular career focus, many articles have offered *strategies* for how to encourage more individuals into a FSVM career. This is unfortunate as accurate information of the motivations driving student career selection is needed in order to have confidence that the strategies being proposed are appealing to the targeted group. Hoblet et al. (2003) believe that if new graduates can not be attracted to the field of food animal medicine, the industry, agribusiness, and the government will employ either foreign-trained veterinarians or non-veterinarians to do the work.

Very little is known about what influences veterinary students career choice selection from the literature. The articles that have been published on this topic tend to be based on personal observation and anecdotal evidence rather than empirical study. In contrast, many published articles have offered strategies for increasing student interest in particular career fields. In these cases it is possible to speculate on the underlying motivation being addressed by the proposed strategy, but the underlying motivation is typically not explicitly stated. For example, if an article recommends the development of a media campaign to promote the benefits of a food animal career, one might speculate that this is to overcome a lack of career awareness among

potential students. However, the extent to which a particular motivation is appropriate (such as career awareness) has never before been systematically studied.

The limited research on student career choice in veterinary medicine has tended to focus on the influence of role models and the influence of students' educational experiences while in veterinary school. Research by Lloyd et al. (2004) suggest that systems should be created that involve practicing veterinarians in the student recruitment process because "...veterinarians have one of the most important influences on applicants' career choices" (p. 436). Thus, these authors espouse the notion that a good mentor or role model can play a large part in the development of career interest. While several studies suggest that additional role models may lead to more food animal veterinarians, an empirical connection has not been established in the literature.

Others have focused on the influence that one's veterinary school experiences and courses have on career selection. For example, there is some evidence that curricular and summer externships dealing with swine influenced students to select a particular type of practice (Dewey et al. 2000). Research by Peter Eyre (2001) states that the "veterinary medical professoriate must understand how profoundly the educational process affects students' career choices..." (pg 4) in arguing for veterinary medical education to make fundamental changes in how it educates students. Nielsen (2003) speculates that a lack of clinical experiences in food animal medicine leads students to opt for careers in other areas. So we see literature that suggests that both the emphasis of an area as well as the de-emphasis of others will impact student career choice. In the case of both role models and educational experiences, the underlying issue is positive exposure to particular career options. A student will not select what they do not know. Indeed, Karen Becker (2003) states that the biggest obstacle to recruiting students into public health careers is their lack of knowledge of the opportunities available in that

field and their advisors lack of appreciation for the full span of career opportunities available in public health.

A vast number of articles have been written regarding potential strategies that might be employed to encourage students to consider food animal careers. Often times the suggested strategies are based upon the personal experiences of the authors or a summary of discussions that have taken place at conferences especially held to address such issues. The following summarizes the recent writings on potential strategies suggested to encourage more students to enter FSVM.

In 1996 Peter Chenoweth advocated that the recruitment of more students into animal agriculture would benefit from recruitment as early as primary school, exposure to positive, inspirational role models, and close coordination between veterinary colleges and feeder educational programs such as animal science departments. In 2002, Chenoweth provided a summary of a meeting held on October 25th and 26th at Kansas State University to discuss the perceived shortage of food animal veterinarians in North America. From this meeting of over 200 participants, several potential solutions were offered. Among those strategies most relevant for the recruitment and retention of students into food animal veterinary careers were the following: the development of a national multimedia campaign that promotes the benefits of a food animal career, initiation of a strong mentoring program for prospective and new graduate veterinary students, the development of food animal centers of veterinary excellence to provide targeted and intense training in specific food animal species, developing alliances with core groups (e.g., AVMA and CVMA) to address issues such as limited licensure and accreditation, strengthen educational links to key constituencies in government and industry, expanding the usage of veterinary technicians, easing student debt load, and revamping the veterinary education

process. This last point including suggestions such as instituting modified tracking, teaching business skills, hiring high quality faculty who teach well, and improving/increasing the availability of graduate programs aimed at food animal veterinarians.

In a report on the deliberations taking place at the Agenda for Action Conference, Baker et al. (2003) discuss how the veterinary profession might become better prepared to meet societal needs in the areas of biodefense and public health. Of particular relevance to our study is their discussion related to the issues preventing students from becoming engaged in biodefense and public health careers. A sub-group at the conference reporting on these student issues identified the following challenges: (1) traditional veterinary curriculums do not prepare students for nontraditional careers, (2) national and state board examinations are clinical practice oriented, which lowers curricular attention for non-traditional careers, (3) prior veterinary experience admissions requirements favors the selection of students more likely to enter traditional practices, (4) a general lack of awareness and lower level of career esteem for non-traditional careers, (5) high student debt loads and low entry level salaries in public health negatively impact student selection of advanced degrees and public health careers. To assist in overcoming these issues this group recommends debt forgiveness on educational loans for individuals entering advanced training programs, higher starting salary levels, early exposure of non-traditional career opportunities to high school and college students, changed admissions criteria to adequately recognize non-traditional careers, increasing enrollment in veterinary colleges to meet demand, and a review of the existing veterinary curriculum to consider a specialty training model, board examinations, and the sharing of expertise among colleges.

A student group (LaBranche et al. 2003) responding to these same challenges echoed many of the same strategies in suggesting more elective courses in biomedical sciences and

public health, guest speakers in the public health sector, reaching students in high schools, admissions criteria changes, and post-DVM training.

A rather comprehensive report by Radostits (2002) summarizes many of the major studies conducted in regard to food animal medicine education since the 1988 Pew report and provides some suggestions for perceived shortages of food animal veterinarians. Among the suggestions are early exposure of the profession to pre-college students, changes in the admissions criteria, abandonment of the generalist model and a move toward an engineering model of veterinary education, setting student quotas for veterinary specialty tracks, developing regional centers of excellence to focus resources and caseloads into specific programs, and designated or limited licensure. Edmonson (2002) stresses that admissions processes at veterinary colleges are “products of institutional values and societal forces, reflecting emphases in professional values, goals, and standards that may change over time” (p. 95). This suggests that colleges have a responsibility to consider multiple perspectives when considering their admissions policies.

In a recent commentary, Nielsen (2003) discusses several changes that should take place in order for the veterinary profession to be successful in the future. In that discussion he lends his support for the notion of tracks that will provide graduates with an increased range and depth of skills. He also believes that there needs to be a shift in the profession from the provision of technical skills such as pregnancy detection and inoculation to the provision of health management related advice to managers. However, he feels that current veterinary curriculums do not deliver this type of skill set to graduates.

Hoblet et al. (2004) report on the status of veterinarians in population health and public practice careers. They suggest several strategies for overcoming what they perceive to be a

shortage of veterinarians in these areas. Most pertinent to our study are the suggestions they provide in the areas of recruitment and retention. In the area of student recruitment, potential steps to take in these areas, according to Hoblet et al., are greater exposure for students to the diverse career fields available in veterinary medicine through survey courses, faculty mentors engaging students interested in these career areas, a broadening of the professional experience requirement of the veterinary school admissions process, admission process changes that will benefit those likely to pursue either public health careers or private population health practice with a significant food animal focus, and the growth of scholarships and loan forgiveness programs targeted at students entering public health and population health fields. Suggestions related to retaining students interested in these career areas while in school include: (1) the rewarding of faculty who serve as role models and initiators of meaningful cocurricular activities in the areas of population health and public practice, and (2) longitudinal studies of students that participate in tracking programs to determine the curriculum's influence on career satisfaction and retention. Finally, these authors make three suggestions for retaining professionals in these career paths. Veterinary medical colleges need to make students more aware of the concept of developing career pathways, adapt the NCVEI benchmarking study to food animal practices, and an increase in salaries in public health areas to make them more competitive with students' alternative career options. Additional suggestions deal with the expansion of course offerings in public and population health, greater clinical experience for those interested in population health and public practice and the development of regional alliances.

King (2003) points to early exposures and experiences in diverse careers, public health role models, and curriculum changes that support non-traditional careers as several near-term strategies that might be employed for increasing student interest in public health careers. For

students desiring to enter production, Hoblet et al. (2003) make the same call but also assert that Colleges of Veterinary Medicine need to create regional alliances to provide a full range of clinical experiences

Hird et al. (2002) report on a symposium dealing with population health education held at the University of California, Davis in 2002. The 66 participants at the program identified several potential actions related to building awareness of veterinary careers in population health and recruiting veterinary students into this career field. Their recommendations included: (1) the establishment of a liaison at each veterinary college who would be responsible for maintaining relationships with public and corporate partners in public health, and (2) broader exposure of population health careers to students in the form of outside speakers in courses, career days, a speaker series on population health, and industry tours. More specific recommendations included the creation of an “Animal Planet” styled television program targeting young people that focused on population health issues, early and continuing exposure of population health career opportunities to pre and current veterinary students, and partnerships with governmental agencies (e.g., CDC, FDA, etc.) to provide sponsored learning and training opportunities in population health. In terms of expanding the pool of potential recruits for population health careers symposium participants suggested greater promotion of population health recruitment efforts, quickly providing veterinary school admission to a small number of extra students in several colleges that will focus in this area, offers of tuition reimbursement, more summer classes, and international experiences in exchange for a service commitment after graduation, and better promotion of the critical role of veterinarians in dealing with bio-terrorism, agro-terrorism, and bio-security.

In an analysis of the availability of students potentially interested in food animal veterinary careers, Elmore (2003) suggested three strategies to encourage more students to enter food animal careers. First, is for veterinarians in practice to serve as ambassadors for the career. This includes becoming visibly and actively involved in organizations where young people might be recruited and allowing job shadowing opportunities for interested young people. Second, he recommends food animal career opportunities be better advertised to show veterinary students that there are many attractive career opportunities. Finally, he suggests that food animal employers consider debt repayment as part of their compensation plans or scholarships for food animal students while they are enrolled in college.

A 2003 report in JAVMA News discusses the results of a brainstorming session at the AAVMC sponsored conference, “Agenda for Action: Veterinary Medicine’s Role in Biodefense and Public Health” held in Washington, D.C. in November 2002. From that discussion strategies to encourage more students to enter public health careers included increasing exposure to diverse career areas, creating continuing education programs in zoonosis and bioterrorism for private practitioners, and establishing co-curricular programs. Long term strategies that might encourage more students into public health included changes to veterinary curricula to support non-practice careers and more emphasis on DVM/MPH and DVM/MS dual degree programs.

In a report on the Skills, Knowledge, Aptitude, and Attitude Colloquium held in August 2003 Lloyd et al. (2004) present several suggestions for recruiting veterinary students. These suggestions, although couched in light of the SKAs discussed at the meeting have merit for different recruiting goals. Their suggestions in the area of recruiting include the development of an attractive message to provide potential applicants with a realistic job profile, the development of age-appropriate materials aimed at K-12 students, incorporation of food animal material in

career promotional materials, recruiting broadly to increase the diversity of the applicant pool, educating current faculty regarding the opportunities for veterinary graduates in emerging career areas, providing guidance counselors with up-to-date and accurate veterinary career materials, including practicing veterinarians in the recruitment process, organizing speakers to share the message about the wide ranging career options available in veterinary medicine, developing links to other programs within a university, and utilizing Internet resources more effectively.

As discussed in some of the articles above, the idea of schools pooling resources to form strategic alliances or regional centers of excellence in food animal medicine is an often mentioned strategy. The rationale is that food animal veterinary medicine is too broad of an area for each college to adequately cover all aspects. The suggestion has been made by several industry experts that individual schools should seek to specialize in a particular area or species. Indeed, Peter Eyre (2001) goes so far as to say that the “myth of the autonomous, self-sufficient veterinary college is outmoded and counterproductive. Strategic alliances of many kinds will play prominent roles at many levels in the veterinary school of the future” (pg 6). Cook et al. (2004) agree that regional centers of excellence, where students from multiple universities converge for training in a particular area are a good idea, but they note several challenges to making regional centers work. First, the financial burden placed on the student who must travel and find accommodations. Second, the additional time required by faculty at the regional center to train students from other institutions. Third, the financial challenges of a student paying tuition at one school must be balanced with the cost of the training being borne by another institution. Lloyd et al. (2004) also support the idea of centers of excellence because it may not be feasible to maintain a “full breadth of clinical specialists at each VTH” (pg. 438). They caution that a consortium approach is needed, funding for sending students and faculty to

different universities should be secured, and that appropriate buy-in must be obtained to avoid accreditation issues.

Another often mentioned strategy is to provide additional enhanced food animal related experiences for students in the veterinary curriculum. The initiatives at several schools have been written about that deal with this issue. An article in the JAVMA News (2003) reported on the AgScholars program at the University of Missouri-Columbia College of Veterinary Medicine. This program is a pre-veterinary program designed to nurture interest in food animal medicine. The program is aimed at college freshmen and will direct them through a intensive and structured food production focused undergraduate curriculum. Upon successful completion of the program, the AgScholars participants are ensured acceptance into the Missouri College of Veterinary Medicine.

Faculty and students recognized that the number of opportunities for experiences in dairy production at the College of Veterinary Medicine at Cornell University were many - but not well publicized (Mitchell et al. 2004). As such they created an “Opportunities Map” for students and faculty that outlines all of the available experiences. This documentation is used to familiarize students with the opportunities and resources available through their university and has been useful in pointing students without food animal backgrounds to experiences that can increase their knowledge and confidence in food production medicine.

As reported in a special issue of JVME, several veterinary schools have in place experiential programs aimed at providing students interested in food animal medicine a practical and meaningful experience working directly with animals. For example, Smith (2004) reports on the University of California, Davis Early Dairy Experience Program where selected students spend six weeks during the summer working on carefully screened dairy farms in California.

According to Smith (2004), a key goal of this program is for "...students to picture themselves in the role of the veterinarian. They see veterinarians making a very good income, enjoying their work and their clients, and leading balanced lives, with time for family and activities other than work" (p. 366). Recognizing that their veterinary teaching hospital has inadequate dairy case loads, the College of Veterinary Medicine at the University of Minnesota has developed a private-public affiliation with a large dairy farm near campus to educate their students interested in dairy medicine (Fetrow et al. 2004). Cook et al. (2004) report on the use of a dairy teaching herd and a private-practice based ambulatory clinic rotation at the University of Wisconsin's School of Veterinary Medicine. Like the initiatives reported above, Wisconsin's program is designed to overcome a lack of exposure many students have to animal production and the challenges veterinary teaching hospitals face in trying to maintain an adequate food animal case load for training students. At the Ohio State University College of Veterinary Medicine they have taken the route of maintaining an ambulatory practice to assist in providing large animal experience to their students by acquiring established practices from their alumni (Masterson et al. 2004). This allows them to offer a two-week rotation that is required of all fourth-year professional students.

Although not specifically aimed at improving the recruitment and retention of food animal veterinarians, curriculum changes designed to formally track students into specific career fields has definite implications for attracting students to this area of the profession. While not without controversy, the notion of tracking is based on the idea that veterinary knowledge base has grown too deep and sophisticated to adequately educate every student in all aspects of veterinary medicine. Nielsen (2003) supports the idea of limited licensure and adoption of the engineering model to veterinary education as he recognizes that it is "impossible to provide

entry-level competence in all the major branches of veterinary medicine through the present educational and licensing practices.” Radostits (2003) is also a supporter of the engineering model for veterinary education and advocates that student quotas be put in place to ensure adequate representation in the different veterinary fields for the good of society. Radostits feels that most current tracking programs utilized in veterinary medical colleges contain too much core curriculum and, as such, do not have enough time to devoted to instruction in specific areas of specialization. Hand-in-hand with more specialized tracking programs, Radostits advocates designated licensure. This is in line with the thoughts of Peter Eyre (2002) who writes that “We need a new model for veterinary education – one that continues to impart a strong core of fundamental biomedical knowledge and multi-species clinical experience to all students and then allows a genuine opportunity for differentiation into strongly focused subject areas (“tracks”) that provide in-depth education and training appropriate to a student’s chosen career” (pg. 196). Dean Gage (2002) repeats a call he made 20 years ago for designated licensure of veterinarians. He suggests that designated licensure “would set in motion a wave of changes in veterinary medical education that could allow our profession to better meet the needs of an ever changing world.

Career Switching and Retention

Exacerbating a shortage of food supply veterinarians is the phenomenon of changing occupational areas in veterinary medicine. This has been discussed in terms of switching during the years spent in a College of Veterinary Medicine as well as changing career areas after one’s first job. Switching from a food animal medicine career track is reported to be high. One study found that approximately half of all new graduates initially entering food animal practice exit

within five years (Osborne 2003). This figure is aggravated by anecdotal stories of rural practitioners being unable to retain employees, declining numbers of members in food animal professional veterinary associations, and changing numbers of AVMA members in various categories (Elmore 2003). Retirements and other anecdotal stories about the inability of senior rural veterinarians in the large animal area being unable to sell their practices have also brought attention to the issue (Hegeman 2005). An alleged high rate of turnover in food animal medicine may be a reflection of the fact that most Americans change jobs every four-and-one-half years (Sullivan 1999).

Many factors have been reported to cause the alleged turnover problem and the presumed inability of the profession to retain people in the food animal medicine area. Gender is one such variable that supposedly is related to the turnover and retention issue in the veterinary profession. One argument is that women do not commit to a career or stay in food animal medicine based on a variety of allegations including a poor work/family balance, time management issues, a desire to live in an urban area, fear of large animals, and problems dealing with discrimination in the workplace. Others maintain an opposite position and argue that the rural lifestyle of a food supply practitioner offers a superior quality of living characterized by low crime, lower cost of living, friendlier clientele, less stress, and a more peaceful existence that many female veterinarians would find attractive (Breithaupt 2005).

Many of the attributes of a food supply career have been found to be important to women as opposed to men. These include flexibility, teamwork, knowledge growth, and management of work/non-work demands. Women at different times in their lives may emphasize their career or their relationships or seek a balance between both. The flexibility and intellectual challenges of

a career in food supply medicine may be more conducive to women in the veterinary profession who may have a different career timetable than men.

The gender debate posits that since 73% of students enrolled in the 28 Colleges of Veterinary medicine in the USA are women and most are interested in companion animal medicine, there will be few who enter or stay in food supply medicine. Perry (2005) maintains that this is part of a larger trend in higher education in general. Women constituted 45 percent of USA college students in 1975, but now comprise 57.6 percent and are estimated to grow to 60 percent of all bachelor degree holders and will earn a majority of professional and doctoral degrees by 2014. A related generational dynamic may also be at play. Census Bureau figures indicate that 51 percent of adults under 35 are men who supposedly are becoming less engaged in work and occupational pursuits. This prospect adds to the possibility that there may be a shortage of food supply veterinarians and that those historically most likely to enter the area (men) will also be unlikely to stay.

The implication of this is that if the profession does not become more attuned to the needs and preferences of women in the workplace, there will not be an adequate number of FSVM professionals. Employers that can view employees as family members, understand workplace stress, and recognize the relationship between home life and workplace performance may be better able to attract and retain women in food animal practice than those that operate from a more traditional management model (Netemeyer et al. 2005). Providing childcare, family leave, flex-time, and stress management workshops may appeal to the female majority in colleges of veterinary medicine. Research on women's careers suggest that women's experiences with balancing work and non-work demands may make women better suited than men to a challenging FSVM career (Fondas 1996).

Many other trends may affect turnover and retention in food animal medicine and are part of the changing nature of careers. Today's students have come of age in an era when firms were downsizing and the traditional psychological contract between firms and workers has changed from exchanging loyalty for job security to exchanging performance for continuous learning opportunities and marketability (Sullivan 1999; Altman and Post 1996; Hall and Mirvis 1996). This loss of employee loyalty coincides with the move from a career that is, at the extreme, a one-employer-for-life mutual commitment to a more "boundaryless" career, which is marked by frequent changes in jobs, employers and occupational areas (Arthur et al. 1995 Baker and Aldrich 1996) in a search for meaningful work (Mirvis and Hall 1996) and the responsibility for one's own career management (Brousseau et al. 1996). To the extent that current jobs in food animal medicine provide for flexibility, change, and personal fulfillment there may be less career switching. Being able to transfer skills to other career areas makes food animal veterinarians less organizationally bound and more marketable in the workforce (Sullivan et al. 1998).

Job stress and attractive career alternatives may also contribute to turnover (Van Yperen and Janssen 2002). Job demands, such as on-call hours and emergency work, are increasing in today's work organization and may generate stress (Landsbergis et al. 1999). This stress might lead to dissatisfaction with an occupational area and cause people to either avoid a particular area such as food animal medicine or to change from it. Having a greater number of career alternatives has been found to increase the desire and intention to change careers (Greenhaus and Callanan 1994). Stress may lead people to search for job alternatives and many exist in the veterinary profession.

Two important constructs that have been proposed to affect turnover and career switching are job satisfaction and commitment (Chiu and Francesco 2003; Meyer and Herscovitch 2000;

Janssen and Van Yperen 2004). These two constructs have also been found to relate to job performance as well (Phillips and Gully 1997; Higgins 2001). Research suggests that organizational commitment and job satisfaction are positively related to professional tenure (Lee et al. 2000; Lynn, Cao, and Horn 1996). Despite popular beliefs, women are more likely to leave their job because of a lack of career opportunities or job dissatisfaction with the employer, rather than for family considerations.

Occupational commitment refers to a person's emotional attachment to their occupation; sense of obligation to remain in the occupation; and the perception of high costs associated with leaving the occupation (Blau 2003). Most veterinarians have made an emotional commitment to the welfare of animals and feel obligated to protect and treat animals. Accumulated costs may lead to a greater sense of obligation to food animal medicine and the belief that a veterinarian has a responsibility to remain in it. Costs may be attributed to educational expenses, time dedicated to becoming a veterinarian, and the development of professional network contacts and clientele. One way to increase accumulated occupational commitment costs over time is by increased participation in continuing education courses or professional associations. Providing opportunities for students to work in underserved rural areas in exchange for student loan debt relief may also increase turnover costs as they become integrated into the rural community.

The career theory touched on in this introductory section establishes a need to take a marketing view and frame the problem of career retention from the "voice of the customer" perspective. Members of a profession are like a customer in that if they *perceive* that they are gaining their monies worth from continuing their association with a career area, then they will stay engaged. A Nobel Lariat in Economics, Hebert Simon, has also argued that commitment has an exchange basis. If members have a sense that their career time and effort based

“contributions” are receiving sufficient “inducements” in terms of gaining things that they value, then they will continue and may even increase their efforts. Theory is a useful lens to organize thinking, but the missing link in the on-going discussion of this issue in the FSVM profession is the lack of systematic data on what the “member as customer” thinks. We need to listen to the voice of that customer.

Overview of Methodology

The Delphi forecasting technique was used to study demand for food animal veterinarians. Two primary data collection methods were utilized in the examination of the career attraction and career retention issues: focus groups and internet based surveys. This section provides an overview of the data collection methods used. Each chapter provides specific methodological details unique to that study.

Delphi Forecasting Technique

Food supply veterinarians live in a changing world. Predicting the future is never an easy task and the changing context of the FSVM profession makes the linear extrapolation of historical trends with econometric models, as was used in the KPMG Mega Study, more problematic. The Delphi forecasting method¹ is an expert judgment forecasting method and is the main alternative to historical trend-based methods. It is the best method for identifying emerging trends, the likely patterns of future demand for FSVM professionals, and determining whether there will be shortages or surpluses of food supply veterinarians in the future.

¹ For a recent review of the scientific literature on this forecasting technique, see Rowe, G., & Wright, G. (1999). The Delphi Technique as a Forecasting Tool: Issues and Analysis, *International Journal of Forecasting*, 15, 353-375.

The Delphi method works hand-in-hand with strategic planning processes in that it appreciates that the future is only partly a function of unfolding larger societal forces that cannot be easily managed or changed. It appreciates that the future is largely a function of trends that, if better understood now, can be acted upon before the future arrives. It is designed to identify leverage points that are important to planned change efforts. Strategic action by thoughtful leaders taken now can change the pattern of future demand and shortages/surpluses that experts predict will occur if current trends continue and no catastrophic events occur.

In this study, 13 different sectors of FSVM profession were identified and a Delphi forecasting process was used to evaluate each sector. The FSVM sectors evaluated are: Academe, Dairy, Swine, Poultry, Beef Cattle, State/Provincial Public Service, three sectors of US Federal Service (Public Health, Animal Health, and Food Safety & Security), Canadian Federal, Industrial Veterinarians in Pharmaceuticals, Small Ruminants, and Mixed Food Animal Practitioners in Rural Settings. After identifying a sector, experts were identified and their participation solicited. In general, panels of 15-25 members for each sector were created.

The Delphi method gathers expert opinion and then provides a structured feedback process where experts have an opportunity to consider the views of other experts. The feedback process is structured so that experts can change their predictions without any dysfunctional group dynamics that can plague interacting groups. It sets up a learning process where experts have an opportunity to reconsider their judgments in the face of conflicting viewpoints. This should make the Delphi panel collectively smarter at the end of the process. The Delphi process used had three stages:

1. Panel members completed a first survey on issues relevant to demand forecasting. Specifically, we included potential influence items, identified from the FSVM literature, and asked panel members to rate each item's influence on the future supply or demand for food supply veterinarians in their sector. We also included open-ended questions giving panel members an opportunity to suggest additional relevant issues not included in the initial listing. After getting panel members to think about the trends and issues driving future demand, we then asked them to forecast demand changes over various time periods between 2004 and 2016. Panel members then rated the influence of various supply related trends. This was designed to help them think about likely future labor supply flows and prepared them to forecast whether there would be shortages or surpluses of veterinarians over these same time periods.
2. The results of the first survey were incorporated into the second survey. New items were derived from a content analysis of the open-ended replies. Demand and supply influences items where there was higher levels of disagreement within the panel were repeated and the average rating and middle 50% range (between the 25th and 75th percentile) information were presented with each repeated item. A brief report explaining the general patterns in the data, including explanations for disagreement within the panel on future demand and shortage/surplus forecasts, accompanied the second survey. Thus, when panel members re-estimated future demand and shortages/surpluses they did this while considering panel information from the first survey.

3. The third survey followed a similar design strategy. Items with higher disagreement were repeated and the panel average and middle 50% range information were presented in this last survey. In addition, a brief report summarized the results of the second survey. Finally, items describing 18 different possible solutions to shortages were added to this survey.

Panel members came primarily from the US but experts that focused on Canada were also included. Panel members identified whether they had focused on the Canadian or the US context and additional analysis evaluated whether there seemed to be significant differences between the ratings of the US and Canadian sub-groups. While we see all panel members as having good expertise, we appreciate that some may be more expert than others. Panel members rated their own forecasting expertise and additional analyses contrasted those better than the median “expertise” score with those on the less-expert side of the median. This analysis identified items where there were significant differences between those two sub-groups. Whenever Canadian versus US and expert versus less-expert differences were found, they were noted in the feedback to the panel. Examples of three of the surveys used for one expert panel are displayed in the appendix.

Focus Groups

Focus groups were conducted with both faculty and students at five different colleges of veterinary medicine. The focus group data was utilized in two ways. Some focus groups were conducted for the purpose of deriving an initial understanding the phenomenon being studied and

to use these insights to develop survey items for further inclusion in the questionnaires. Other focus groups were utilized to gain an in-depth view of the factors revealed from the quantitative survey instruments.

Students and faculty were recruited with the assistance of the veterinary college administration at each institution. Separate faculty and student focus groups were conducted at both the University of California – Davis and Kansas State University. Additionally, student focus groups were conducted at the University of Georgia, Iowa State University, and North Carolina State University. Each focus group averaged 12 participants. We were also able to have informal conversations about the major issues facing food supply veterinary medicine with food animal faculty at the institutions where the student focus groups were conducted. Focus group participants were provided breakfast or lunch during the session and compensated for their time with a gift card to Borders Book store. Each focus group session was audio and video taped and lasted between 60 and 85 minutes. These tapes were subsequently used to create a transcript of the session. Focus group results were developed based upon an interpretation of notes made during the focus group meetings, a review of the audio and video recordings, and a content analysis of the typed transcripts.

Each focus group began with the focus group moderator introducing the researchers, the topic being discussed, discussion guidelines, and a short self-introduction of each participant. Participants next engaged in a short written exercise designed to focus their thinking on the topics to be covered during the session. Following this activity the main discussion took place typically covering 5 to 7 topic areas. At the end of each focus group a summary of the session was offered by the researchers and the participants were de-briefed on the purpose of the study. The discussion guides for each study and the short written exercises are included in the appendix.

Internet Surveys

Surveys were conducted with the following constituencies: veterinary students at various stages of completion of their education, veterinary faculty, veterinary Deans and department heads, recruiters of veterinary students, veterinary college alumni 1 to 5 years out of school, and veterinary college alumni 6 or more years out of school.

Internet based surveys were used in all studies due to the ease of administration, convenience for the respondent, and the high rate of Internet use among the target population. Each survey was pre-tested prior to administration and all were pre-approved by the FSVMC and AAVMC. We used a survey software product named Perseus to create the surveys. Subjects received an email message from the research team that explained the purpose of the research project, identified the sponsoring organizations, and invited them to participate in the study. A web URL was included in the email message that linked directly to the online survey. After completing the survey, subjects clicked on a “submit” button and the data was sent to a secure database housed on the researchers’ host server. Three waves of emails, separated by one week increments, were sent out inviting subjects to participate in order to increase response rates.

Email addresses for faculty and students were secured by personally contacting each Dean at all 32 Colleges of Veterinary medicine in the United States and Canada. Tremendous support was received with 19 colleges providing email listings directly to the research team and the other 13 colleges agreeing to send out the survey directly to their students and faculty. In most cases, an email message was sent from each Dean’s office prior to our email invitation to participate in the survey which endorsed the study and encouraged subjects to participate.

Email addresses for veterinary school alumni and recruiters of veterinary students were secured from veterinary professional associations and some of the Colleges of Veterinary

Medicine. The following organizations either provided email addresses for this study or sent our email message directly to their members: American Veterinary Medical Association, American Association of Bovine Practitioners, American Association of Veterinary Medical Colleges, American Association of Food Hygiene Veterinarians, American Association of Avian Pathologists, National Association of State Public Health Veterinarians, American Association of Small Ruminant Practitioners, American Association of Swine Veterinarians USA/Canada, American Association of Public Health Veterinarians, Academy of Rural Veterinarians, United States Animal Health Association, National Association of Federal Veterinarians, Academy of Veterinary Consultants, Canadian Veterinary Medical Association, United States Aquaculture Society, and the Kansas Veterinary Medical Association. The email addresses provided directly to the research team were compiled into a single list and duplicate email addresses eliminated.

In all surveys statistical analyses were carried out to assess non-response bias. A wave analysis with the Student's t-test was used to look for differences between early and late returns. This provides useful information for determining whether the data from completed questionnaires are biased by the likelihood of non-response. The wave analysis method assumes that subjects who respond less rapidly are more like non-respondents (Zou and Andrus 1997; Armstrong and Overton 1977). Using the t-test for two sample proportions and a 95 per cent level of confidence, it was found that there were no significant differences between early and late returns for items in the questionnaire at the 0.05 level. As such, it was concluded that there was no compelling reason to believe that the response group systematically possessed different response tendencies from non-responders. Survey response rates were strong and allow us to conclude with a high level of confidence that the results obtained from the sample are consistent with the larger population.

Survey items were developed based on insights from an extensive review of the veterinary career literature, general human resource/career selection literature, and job commitment literature as well as many discussions with practicing veterinarians, veterinary profession association officers, veterinary school Deans, students, and food animal faculty in the USA and Canada. Items were also culled from existing scales that had been validated and had reliability assessed in earlier studies (Bruner, Hensel, and James 2005).

The data from each survey was imported into the statistical program SPSS 13.0 for analysis. A variety of analyses were performed depending upon the particular issue being explored. In all cases descriptive statistics in the form of distribution frequencies were calculated. Cross-tabulation between variables of interest was also used to initially identify potential group differences. ANOVA, MANOVA, and multiple comparison tests were utilized to test for significant differences between groups of respondents. A combination of principle components analysis and both stepwise linear and binary logistic regression analyses were performed as appropriate to assess dependence relationships between variables of interest.

Organization of Chapters

The research program that studies demand issues in food supply medicine is comprised of thirteen Delphi panels of experts that were surveyed three times each to create forecasts. The research program addressing career attraction and career retention issues consists of 17 studies, seven focus group studies and ten surveys, which provide insight into FSVM career path attraction and retention in the United States and Canada. Each chapter presents detailed results addressing a particular objective and has summary sections dispersed throughout that focus on a particular area of the survey instruments. At the end of the results we present a section that

contains overall conclusions and strategies for each conclusion. The chapters are organized around the five primary objectives set forth by FSVMC.

Objective 1: Estimate the demand for FSVM professionals in rural practice, academia and industry as well as governmental and new areas such as food safety, biosecurity, and epidemiology and process verification across all food and fiber producing animal species in the United States and Canada. This objective is addressed in chapters 2 through 11.

Objective 2: Identify and evaluate existing and emerging factors (societal and economic) affecting applicant pool of students attracted to FSVM in the United States and Canada. This objective is addressed in Chapters 12 and 21.

Objective 3: Determine how to recruit students, and develop and/or maintain student's interest in FSVM while in U.S. and Canadian veterinary schools. This objective is addressed in Chapters 13, 14, 15 and 21.

Objective 4: Determine factors that affect selection of employment by FSVM graduates in the United States and Canada. This objective is addressed in Chapters 16, 17, 18, and 21.

Objective 5: Determine how to retain recent graduates for 5+ years in FSVM in the United States and Canada. This objective is addressed in chapters 17, 19, 20, and 21.