

Commentary

A short history of veterinary workforce analyses

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The veterinary medical profession has a long history of attempting to ensure that sufficient numbers of veterinarians with sufficient amounts of training are provided to meet the needs of society. A statement¹ prepared by the Joint Committee on Veterinary Education of the AVMA, the Association of American Veterinary Medical Colleges, and the Association of State Universities and Land-Grant Colleges back in 1964 noted,

Livestock losses in the developing United States caused President Abraham Lincoln in 1862 to sign a bill establishing the U.S. Department of Agriculture. The accumulated data on the death of animals from disease clearly indicated the need for well-trained veterinarians to cope with this problem. The Morrill Act signed by President Lincoln in 1862 enabled each state and territory to support the instruction of veterinary medicine.

By 1900, there were an estimated 9,000 veterinarians in the United States, most of whom were involved in “the control, prevention, and eradication of livestock and poultry diseases to insure [sic] the milk, eggs, meat and their products are disease free.” By 1962, there were 21,565 veterinarians in the United States, with less than half involved in food animal health and approximately 21% involved in small animal practice, 12% involved in government service, 14% involved in teaching, and 4% involved in other areas.

Over the past 150 years, the veterinary profession has faced both increases in the demand for its service, as the population has increased, and changes in the types of services demanded, as interactions between humans and animals have changed. The result has been an overall growth in the demand for veterinarians, such that the total number of veterinarians in the United States has increased from approximately 21,565 in 1962 to approximately 90,705 today. Over the same period, the number of veterinarians per 100,000 people has increased from 11.6 to 28.1. In addition, in contrast to the case in 1962, only 9% of veterinarians are now involved in food animal health, with the majority (76.5%) now involved in small animal practice, while 5.4% are involved in equine practice, 5.1% in mixed animal practice, and 3.8% in all other areas of veterinary service (eg, government and industry).

In the 20 years following the report¹ of the Joint Committee on Veterinary Education, the call to expand the educational capacity in veterinary medicine to meet the growing needs of society changed to a call to sta-

bilize capacity. In a 1978 report² commissioned by the AVMA, for instance, the independent consulting firm of Arthur D. Little Inc found that based on a state-by-state analysis, there was an “overall balance nationally for 1977 between the supply and demand for veterinarians in private practice” but that there was “a slight shortage in the educational institutions sector and a substantial shortage in the industrial sector,” and both shortages could be attributed to “an insufficient number of veterinarians with postgraduate training.” Further, the report predicted that by 1990, there would be 53,000 veterinarians available to provide veterinary services but that only 41,600 would be needed, leaving a surplus of 8,300 veterinarians.

The Committee on Veterinary Medical Sciences³ of the National Research Council Commission on Life Sciences was asked in 1981 to examine the impact of federal legislation and regulations on the national requirements for veterinary medical scientists. Their report³ indicated that “federal legislation revealed many activities with an impact on the functional responsibilities of veterinarians. Some of these, such as laboratory-animal medicine and comparative pathology, are usually identified within the veterinary profession; others such as toxicology, are not the exclusive domain of veterinarians, but veterinarians with specialty training could make contributions.” The report also noted that the number of veterinary graduates produced each year was expected to expand modestly over the remainder of the decade and thus “the need for veterinarians to deliver private practice patient care in [the 1980s] will be met by the projected supply.” This was a modest statement in light of the findings of the Arthur D. Little Inc study.² And, the Committee on Veterinary Medical Sciences³ went further by suggesting that predicting the future needs for veterinarians in non-private practice on the basis of historical trends was difficult, owing to the “lack of suitable existing databases.” The committee also encouraged the Association of American Veterinary Medical Colleges and the AVMA to “expand their data-gathering efforts to collect more information on veterinary manpower used by the non-private practice sector.”

Given their assessment of the supply of and demand for veterinarians, the Committee on Veterinary Medical Sciences³ recommended that “educational opportunities at the D.V.M. level be stabilized at the current number” and that the colleges of veterinary medicine “adjust their curricula, admissions criteria, and clerkship programs to meet societal needs in environmental health protection, food production and protection, economic productivity in animal-related indus-

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tries, biomedical research, and animal welfare, as well as needs for clinical patient care of animals.”

The contrast between the findings of the Committee on Veterinary Medical Sciences and the Arthur D. Little Inc study prompted the AVMA, in 1985, to analyze the supply of and demand for veterinarians. The resulting analysis⁴ provided the first assessment of supply and demand by sector within veterinary medicine, with baseline projections between 1980 and 2000. The authors estimated that over the 20-year period, the demand for small animal services would grow by 31% and the demand for large animal services would grow by 23%. They expected that growth in the demand for services in these two sectors would be outstripped by a growth in supply of 73% and that the ability to provide services in excess of the demand for those services at the current fees (excess capacity) would grow from 24% in 1980 to 29% by 2000. They further predicted that this increase in excess capacity would be accompanied by a reduction in private practitioners' real incomes in 2000 to only 75% of the 1980 level. Geographic differences were noted, with the Northeast facing the greatest adverse impact (a predicted 50% decrease in private practitioners' real income) and the Rocky Mountain region facing the least (only a 15% decrease). An important finding was that reducing the supply of veterinarians by as much as 20% or increasing the demand for veterinary services by as much as 10% alone would have only small to moderate effects on the decline in real incomes. A combination of both an increase in demand and a reduction in supply was thought to be needed to stem the predicted decline in real incomes of veterinary practitioners.

Following the Wise and Kushman⁴ study, the Pew National Veterinary Education Program⁵ identified the changes that would have to be made if veterinary medicine were to meet the needs of society in the years ahead and the changes needed in veterinary medical education programs to equip the profession to serve the needs of society in the 21st century. The report⁵ indicated that although there were social needs for veterinary services that were yet unfulfilled by veterinarians, there was also a need to reduce professional enrollments to reallocate financial resources to other areas of veterinary medicine. Research and public health were identified as the areas that would experience the greatest need for additional veterinarians in the future. The Pew study⁵ encouraged the profession to change its focus from animal disease to animal health in all dimensions and to abandon the concept of a universal veterinarian who would minister to the health needs of all species.

In response to the Pew report,⁵ veterinary medical colleges began to change their curricula to meet the changing demands for veterinary professionals. Eyre,⁶ for example, reported that in response to the Pew report, the Virginia-Maryland Regional College of Veterinary Medicine began offering post-veterinary school education leading to advanced (ie, master's and doctoral) degrees and residency training in public and corporate practice.

In 1994, Pritchard⁷ provided a historical review of the notion that beginning in the early 1980s, there were too many veterinarians in the profession, noting

that the idea was most common among those in small animal practice. The article is of particular interest because the author noted that “insight to the future of the profession can be gained by examining the social, technologic, economic, and political trends that affect the need and demand for veterinary services, and the potential impacts of these changes on veterinary medicine.” More importantly, Pritchard⁷ indicated a few of the changes of particular importance to the veterinary profession.

In *Veterinary Medicine in Economic Transition*, Getz⁸ noted “The market for veterinarians is already saturated. The supply of licensed practitioners has grown much faster than the demand for the last two decades to the point that career prospects are poor relative to other professions.” Getz⁸ described the veterinary profession as suffering in an era of excess supply resulting from the overexpansion of the schools in the 1970s and the early 1980s. He further noted that the veterinary profession was shifting from dominance by males to dominance by females and from being anchored in service to agriculture and rural areas to being focused on cats and dogs in suburban areas. Service to agriculture was shifting from independent practices making calls to farms to the salaried staff of agribusinesses, whereas service to pets in suburban and urban areas was shifting to superclinics (ie, clinics [which may be part of chains] with four or more veterinarians with substantial facilities and ancillary staff). Schools of veterinary medicine were shifting from in-state monopolies receiving a preponderance of their funding from state governments to competitors in a national marketplace. Getz⁸ predicted that state legislatures would close one or more schools of veterinary medicine in the next recession and that successful schools would seek ties to corporate agriculture and superclinics. As a general summary, Getz⁸ wrote, “As these transitions occur, some veterinarians will fare much better than others. Those with the personal and intellectual skills to thrive in corporate environments or who respond well to the performance contracts offered by super clinics will do well economically. As long as the excess supply continues, however, a number of persons trained to be veterinarians seem likely to be disappointed in their economic circumstance.”

The continued focus on the problem of excess capacity of veterinary services led the AVMA, American Animal Hospital Association, and Association of American Veterinary Medical Colleges to engage KPMG to conduct an extensive study⁹ of the markets for veterinary services and veterinarians. The report of the study,⁹ completed in 1999, described “compelling evidence of change and the need for a proactive, comprehensive plan that could be implemented to both counter the serious problems found and exploit a group of remarkable opportunities.” After reviewing the results of the study,⁹ the AVMA, American Animal Hospital Association, and Association of American Veterinary Medical Colleges Joint Steering Committee identified six critical issues important to the economic health of the veterinary profession or that would have to be successfully resolved to improve the economic health of the profession. First, the low incomes of veterinarians, compared with incomes of similar professionals, were

considered problematic, given the high educational debt of most graduating students, and made it difficult to attract the best candidates or invest in professional growth. These low relative incomes were speculated to be a result of excess capacity in the profession, but were also considered to possibly be a result of poor pricing practices, given the cost and quality of the services provided. Second, the percentage of women in the profession was found to be increasing. Women typically received incomes substantially below those of their male colleagues, worked fewer hours, priced their services below the prices assigned by men, and were less likely to be practice owners, and these factors were expected to cause downward pressure on income levels for all veterinarians. Third, consumer spending on veterinary services was found to have been robust and there were considerable markets for veterinarians and veterinary services, particularly in nontraditional and non-private practice arenas. Fourth, most animal care was delivered through a highly fragmented and inefficient system. Fifth, there was evidence that in purely economic terms, there was an excess of veterinarians and the supply may not have matched the demand, but there was also evidence that changes in the education of veterinarians would enable the profession to capture emerging markets. Sixth, there was ample evidence that veterinarians lacked some of the skills and aptitudes known to result in economic success.

An important part of the KPMG study⁹ was an attempt to determine how important the price of veterinary services was in determining the demand for those services. The study⁹ found only a weak link between price and demand, with price identified as the ninth most important factor for choosing a veterinarian, after veterinarian kindness and gentleness, veterinarian respectfulness and informativeness, reputation for high-quality care, past experience with veterinarian, range of services, location, convenient hours, and recommendation from friends. In addition, the study⁹ found that 74% of owners surveyed about pet care would continue to use their current veterinarian if prices for services were increased by 10%. As would be expected, 70% of those with incomes > \$100,000 would continue to use their current veterinarian if prices for services were increased by 20%, but only 50% of those with incomes < \$40,000 would do so. Thus, although the study by Wise and Kushman⁴ indicated a low income elasticity of demand for veterinary services (ie, only a small increase in demand as incomes rose), the KPMG study⁹ indicated a low price elasticity of demand (ie, only a small decrease in demand as price rose). However, the Wise and Kushman⁴ and KPMG⁹ studies only evaluated price and income elasticities, and their results cannot be extended to nonmarginal changes in income (eg, as occurs during a recession) or nonmarginal changes in prices for specific services.

Another important distinction between the Wise and Kushman⁴ and KPMG⁹ studies is the measurement of capacity utilization. Although both studies provide evidence for the existence of excess capacity, Wise and Kushman⁴ estimated the excess capacity of veterinarians, whereas KPMG⁹ estimated the excess capacity of veterinary services. Further, the KPMG study⁹ found

that small animal practitioners could increase caseloads by 20% before extending hours, 22% before adding another veterinary technician, or 42% before hiring a new veterinarian, but the report cautioned that these values may not have been indicative of excess capacity, but could rather be at least partially explained by the indivisibility of veterinarians. That is, the capital and labor required to provide any particular level of veterinary service cannot be cut in half if the demand only requires half the hours of the veterinarian. The short-term ability to add clients or services requires some capacity in excess of what is currently being used.

On the subject of new areas of demand for veterinarians, the KPMG study⁹ was limited to the exploration of future demand for veterinarians in the areas of food safety and public health. The authors concluded that the future demand for veterinarians in government and industry would be limited and that obtaining such positions would require additional professional training. However, some veterinarians surveyed indicated that they believed the global demand for veterinarians in the public health area would be large, although public health would still be a relatively small segment of the profession.

Although the KPMG report⁹ did not specifically address the demand for veterinarians in research, this factor was not excluded as part of the analysis of the demand for veterinarians from government and industry in specific areas of public health. Their conclusion regarding the limited potential for the public health area to require large numbers of veterinarians in the future was in stark contrast to the conclusion of the Pew report.⁵

Felsted^a noted that following the Pew report,⁵ college curricula had an increased focus on the future, and centers of excellence were developed. After the KPMG study,⁹ the National Commission on Veterinary Economics Issues was created, veterinarians began charging higher fees and earning higher incomes, and there was an increased focus on the need for veterinarians in nontraditional and non-private practice fields.

The Brakke study,¹⁰ initiated in late 1998 and completed in 1999, found that several factors negatively impact veterinarians' incomes: failure to use standard management practices, poor service environment at the clinic, low financial acumen of clinic owners, and other business-related factors. The study¹⁰ also found that incomes are negatively impacted by veterinarians' tendencies to offer and price veterinary services to clients on the basis of their perceptions of a client's economic status as well as on the diagnosis and value of the treatment rendered. The study¹⁰ further demonstrated that optimizing the use of good business practices and value-based pricing could have a dramatic, positive impact on income. With respect to gender differences, the authors pointed out two key findings: "Despite the generally low level of income in the profession, income and job satisfaction scores of the veterinarians studied were within expected ranges. Female veterinarians were highly satisfied with incomes at levels with which male veterinarians were much less satisfied," and "Even after extensive analysis, there were income differences between male veterinarians and fe-

male veterinarians that could not be explained by practice ownership, employment, business practices, years in practice, hours worked, personal characteristics, or other factors measured.”

In a 2001 study, Black et al¹¹ found that the Center for Government and Corporate Veterinary Medicine was a valuable national resource for both veterinary students and veterinarians already in the workforce.

Wagner and Brown,¹² in deference to the KPMG study,⁹ suggested in 2002 that there was a growing need for global veterinary leadership “to reduce the global threat of infectious diseases of major food animal and public health importance.” They called for a new program to produce a cadre of veterinarians with practical awareness of diverse cultures, knowledge of regional animal-related health problems and diseases, and experience in working in diverse environments to meet the expanding global threat, stating that “[t]he program will combine a global orientation, language ability, and access to comprehensive, research- and economic-related work/study opportunities to expose veterinarians to the expanding world market for veterinary expertise.”

Perhaps the first comprehensive report on the shortage of food animal veterinarians was the one by Radostits¹³ in 2002. The Radostits¹³ report provided details on the recruitment, education, and placement of food animals veterinarians and identified numerous reasons for the declining interest in food animal veterinary medicine. Radostits¹³ thus focused on supply but did not discuss the demand for services. In the report, Radostits¹³ notes, “Veterinary students and new graduates are not participating in the broad scope and diverse sectors of the profession. There has been a major shift of student interest to small animal practice and away from noncompanion animal veterinary medical careers. Animal agriculture is not being well served by veterinary medicine because of a declining student interest and inadequate numbers of highly qualified veterinarians in all aspects of food animal veterinary education.”

In identifying the changing demographics of veterinary students and the impact of these changes on career paths, Radostits¹³ cited an illustrative example. In a survey¹⁴ of graduates from the Ontario Veterinary College between 1982 and 1986, those from a rural background were 3.7 times as likely to have entered large animal practice, and those from a farm background were 3.02 times as likely. Before admission, a higher percentage of women expressed an interest in small animals, and the percentage increased dramatically by graduation. Before admission and by graduation, the percentage of men interested in large animals was greater than for women. Fewer than 50% of those who entered large animal practice at graduation remained in large animal practice; most who left moved into industry, government, or research and academia. Of the graduates from 1982 to 1986 who were interested in small animals on admission, 87% were still engaged in small animal practice in 1988, but only 28% interested in large animals were still engaged in large animal practice. Radostits¹³ noted in summary,

Food animal veterinarians are not an endangered species. There are many excellent and rewarding career opportunities in private and

public food animal veterinary practice which provides animal health and production management veterinary services to animal agriculture whose primary objective is the production of wholesome and safe food. However, in recent years, an insufficient number of veterinary graduates have been choosing food animal practice for several probable reasons. Most students now have an urban background and are female, and the generalist veterinary curriculum makes them more comfortable in small animal practice than in a rural food animal veterinary practice.

In a review of 27 US veterinary colleges to identify opportunities in public health, epidemiology, and preventative medicine for veterinary students, Riddle et al¹⁵ concluded in 2004 that “most professional veterinary curricula are designed to train students for careers as highly qualified private practitioners. However, advanced training in public health, epidemiology and preventative medicine were available in 79% of the 27 schools and veterinary students were currently receiving a median of 60 hours of exposure to course work in the three areas.” The authors¹⁵ indicated that there was considerable diversity among public health, epidemiology, and preventative medicine curricula in US veterinary schools and that some schools had a “particular strength in these areas.” Most importantly, the study¹⁵ found that in general, all the US schools were responding to the increased need for training in nontraditional areas of veterinary medicine but most were still in the process of developing and evaluating their curricula.

In 2005, Senator Wayne Allard of Colorado introduced the Veterinary Workforce Expansion Act (S-914) as part of the Senate Agricultural Committee’s agrotech initiative. The bill was intended to provide \$1.5 billion over 10 years for new facilities to support expanded enrollments in veterinary colleges, new equipment for biomedical research, and the development of consortial centers for training veterinarians. In a 2006 press release¹⁶ in support of the legislation, the Association of American Veterinary Medical Colleges stated,

The Bureau of Labor Statistics, the National Research Council of the National Academies, the USDA, the Association of American Veterinary Medical Colleges, the American Veterinary Medical Association, the Institute of Laboratory Animal Research, and the American Pet Products Manufacturers’ Association have identified a current shortage of 1,500 veterinarians in these areas. With today’s shortage, plus the projected need over the next 20 years, there will be a shortage of 15,000 veterinarians. The passage of the Veterinary Workforce Expansion Act will mitigate the current and future shortages of veterinarians in public health areas.

The press release¹⁶ also noted that the 28 US veterinary colleges currently were at full capacity and were only graduating 2,500 veterinarians each year.

In 2006, the Association of American Veterinary Medical Colleges identified a shortage of $\geq 1,500$ veterinarians in the area of public health and suggested that by 2020, this shortage would increase 10-fold.

The 2007–2008 CDC Preventive Medicine Fellows conducted a veterinary public health workforce focus group project by using the community mobilization and group facilitation skills learned in the PMF training program.¹⁷ The objective of the project was to gain insight into key areas of recruitment and retention that might reduce the national shortage of public health veterinarians. The Association of American Veterinary Medical Colleges study was followed by a litany of articles discussing new programs and efforts for veterinarians in the public health area.

In 2006, Carpenter and Miller¹⁸ discussed opportunities offered through the American College for Zoological Medicine for veterinary students and graduates “to serve in captive and free-ranging wildlife health positions” but also noted that “existing training programs are inadequate to meet these needs.” Akers et al¹⁹ in a 2008 report described the efforts of Kansas State University to “remedy the immediate and impending shortages of veterinarians in population health and public practice.” That same year, Feldman and Walters²⁰ found that approximately 10% of veterinary students choose the public or corporate veterinary track and gain employment in government organizations (including the USDA, FDA, and CDC), research or industry, and nongovernmental organizations. In recognition of the changing needs of the veterinary profession, the CDC has planned to expand into the fields of public health, public policy, international veterinary medicine, organizational leadership, and one health.

Sterner²¹ in a 2006 commentary addressed the shortage of food supply veterinarians, noting that although other specialty areas in veterinary medicine such as veterinary pathology, parasitology, or anatomy might also express similar concerns about shortages, the implications of a food supply veterinarian shortage for the US economy were greater than the implications of shortages in these other areas because of the importance of food supply veterinarians to the safety of the food supply. Sterner²¹ proclaimed that “it is completely hypocritical for the veterinary profession to declare that we are in the vanguard of ensuring and protecting the food supply of our nation and the world, while at the same time we do not require at least that all veterinary students have a coherent and competent working knowledge of food production practices and systems.”

An analysis of the demand for food supply veterinary medical services was conducted for several specific subsectors by Andrus et al²² in 2006. The study²² looked at 13 professional sectors of food supply veterinary medicine, including academe, dairy, swine, poultry, beef cattle, state or provincial public service, three sectors of US federal service (public health, animal health, and food safety and security), Canadian federal service, industrial veterinarians in pharmaceuticals, small ruminants, and mixed food animal practitioners in rural settings. For each of these subsectors, expert opinions were solicited on a variety of factors that may influence the future needs and availability of food animal veterinary medical services. The authors²² concluded, “Substantial market segments exist in the food supply chain with needs that are not being fully met by existing services in the veterinary profession.”

The persistent focus in the profession on the current and growing shortage of food animal veterinarians is in sharp contrast to USDA reports indicating a continued decline in the number of potential patients. For example, the National Agricultural Statistics Service²³ released cattle inventory statistics on February 1, 2013, that indicated a drop of 2%, compared with the preceding year. According to the report,²³ “[a]ll cattle and calves in the United States as of January 1, 2013 totaled 89.3 million head, 2 percent below the 90.8 million on January 1, 2012. This is the lowest January 1 inventory of all cattle and calves since the 88.1 million on hand in 1952.” Further, “[a]ll cows and heifers that have calved totaled 38.5 million and were down 2 percent from the 39.4 million on January 1, 2012. This is the lowest January 1 inventory of all cows and heifers that have calved since the 36.8 million head in 1941.”

In 2008, Funk and Bartlett,²⁴ indicating the “need for the veterinary profession to fill critical shortages of veterinarians in public health and food safety,” described the graduate degree programs offered by the Michigan State University College of Veterinary Medicine. They elaborated on both the collaborative program with the University of Minnesota for the Master of Public Health degree and an innovative Online Professional Master of Science in Food Safety degree program. That same year, Bickett-Weddle et al²⁵ pointed out that in response to the “growing recognition of the need to increase the number of veterinarians trained in public health, the Center for Food Security and Public Health (CFSPH) at Iowa State University (ISU), College of Veterinary Medicine, received a grant from the CDC to support veterinarians working at CFSPH while pursuing the Master of Public Health degree. Administrators from CFSPH and ISU worked with the University of Iowa (UI) College of Public Health to establish three cooperative programs for veterinarians to earn the MPH degree.” The authors described how these programs were developed and operated and noted that as of January 2008, three students had received their DVM and MPH degrees and 16 students were enrolled in the program.

Hoet et al²⁶ in 2008 described the joint effort between the College of Veterinary Medicine and the College of Public Health in developing the Veterinary Public Health specialization at Ohio State University. Hoet et al²⁶ indicated that

the main objective of the VPH specialization is to educate and train professionals to provide them with the skills, knowledge, and resources necessary to protect and improve human health using a One Medicine approach and that the program has been successful in attracting students from the primary target population, but it has also attracted students wanting the MPH as a terminal degree and veterinarians returning to school to expand their career options.

Also in 2008, Olsen and Remington²⁷ described the new Master of Public Health program offered by the School of Veterinary Medicine at the University of Wisconsin-Madison and noted that between the start of the program in 2005 and 2008, 87 students had been

admitted, including both full-time students and part-time students, who continue to work in health-care or public health-related sectors.

Hernandez et al²⁸ described that in 2003, recognizing the need for global veterinary leadership, the University of Florida College of Veterinary Medicine created an Office of International Programs “to create development practitioners equipped with cross-disciplinary knowledge and skills needed to formulate, implement and evaluate solutions aimed at breaking the cycle of poverty and disease in low income societies.” In their discussion of the role of the new Office of International Programs, the authors issued a call to the AVMA Council on Education “to assess the need to recognize the importance of internationalization of the veterinary curriculum as a key standard for accreditation of colleges or schools of veterinary medicine.”

Hird,²⁹ in a 2009 perspective, described involvement in international veterinary medicine as being both interesting and socially useful. Hird²⁹ provided details of the Master of Preventive Veterinary Medicine (MPVM) program and the school’s Office of International Programs at the University of California-Davis, noting that “many international veterinarians have prepared themselves for careers in population and preventive medicine in the MPVM program.” Hird²⁹ further noted that “there is strong justification for increased emphasis in global medicine for veterinarians, and our schools and colleges should take the lead in developing and implementing educational initiatives in this important field.”

The most comprehensive review³⁰ of the market for veterinarians in the federal government was conducted by the US Government Accountability Office (an independent congressional support agency) in 2009. The Government Accountability Office provided the following as the reason for the study:

Veterinarians are essential for controlling zoonotic diseases—which spread between animals and humans—such as avian influenza. Most federal veterinarians work in the Departments of Agriculture (USDA), Defense (DOD), and Health and Human Services (HHS). However, there is a growing national shortage of veterinarians. GAO determined the extent to which (1) the federal government has assessed the sufficiency of its veterinarian workforce for routine activities, (2) the federal government has identified the veterinarian workforce needed during a catastrophic event, and (3) federal and state agencies encountered veterinarian workforce challenges during four recent zoonotic outbreaks.

They found, “[t]he federal government lacks a comprehensive understanding of the sufficiency of its veterinarian workforce.” In a review of 24 federal entities that employ veterinarians, 16 raised concerns about the adequacy of the workforce, with current and future shortages and noncompetitive salaries the most common concerns. However, there was no government-wide effort to identify solutions, and some agencies such as the US FDA have not done assessments of their veterinary workforce. Another major concern raised by the study³⁰

was that 27% of the veterinarians at USDA APHIS, the Food Safety and Inspection Service, the Agricultural Research Service, the US Army, and the FDA will be eligible to retire within three years.

In 2011, Jarman et al³¹ surveyed a small cohort of veterinarians in the CDC to identify factors that have contributed to the shortage of veterinarians in the public health sector. Each of the veterinarians was asked what specific problems the CDC faces when actively developing the veterinary public health workforce and when supporting veterinarians engaged in public health practice. In response to the question regarding recruitment, “focus group participants identified the top three problems faced when addressing this question—lack of awareness of the veterinary contribution to public health, lack of competitive salaries, and lack of employment and training opportunities.” In response to the question regarding retention, “focus group participants identified the top three problems faced when addressing this question—lack of recognition of veterinary qualifications in public health, lack of competitive salaries, and lack of seamless integration of veterinary and human public health.” Generally, the findings indicated that the number and role of veterinarians could be expanded in the CDC and other public health-related government agencies if there were increased awareness by veterinarians of the opportunities in the public health sector, compensation was more in line with that for other medical professionals, and training opportunities were increased.

In 2011, Olson and Salman³² produced an issue paper to promote a discussion of the changes needed in the veterinary profession to meet the future needs in a global environment. The purpose of their paper was stated as follows:

The National Research Council (NRC) convened an expert committee in 2007 to study the broad scope of issues related to the veterinary workforce in the United States. The NRC committee was to explore the historical changes in the size and characteristics of the veterinary workforce, the adequacy of the current supply of veterinarians in different occupational categories and employment sectors, and the factors that are likely to affect the numbers of veterinarians seeking jobs in different sectors in the future. The diversity of current (and future) employment sectors makes such an evaluation challenging. Examples of current sectors include small animal (dogs, cats) and large animal (food animals, horses) practitioners; laboratory animal veterinarians; pathologists; wildlife and zoo veterinarians; veterinarians specializing in exotic medicine; veterinarians working for federal agencies (eg, US Fish and Wildlife Service [USFWS], FDA, US Department of Agriculture [USDA], National Institutes of Health [NIH], Department of Defense [DoD], Department of Homeland Security [DHS], US Agency for International Development [USAID], congressional offices/committees); veterinarians working for international agencies (eg, World Health Organization [WHO], World Organization for Animal Health [OIE], Food and Agricul-

ture Organization [FAO]); industry veterinarians (eg, pharmaceutical, insurance, and food companies) and many other sectors. Political issues may have also delayed the report, since practicing veterinarians experiencing reduced client visits during the recent recession may seriously doubt the need to educate more veterinarians. Additionally, academic veterinarians are often reluctant to consider new models for educating students. Anxiously awaited, the NCR report has not been published as of the writing of this document (August 2011). The profession does not seem capable of promptly gathering and analyzing significant trends, surveying customers and other stakeholders, and responding rapidly enough to the changing needs of society and global market challenges/opportunities.

This statement by Olson and Salman³² expressed the frustration among veterinarians with the lack of knowledge regarding future demands for veterinary services or the extent of excess capacity of veterinary services. Throughout the literature on the supply and demand for veterinarians and veterinary services, excess capacity has been identified as chronic, persistent, and in lockstep with the changing demand for veterinary services.

The AVMA recently approved a new strategic plan with a major emphasis on economics. Specifically, the AVMA has formulated the following economics goal statements for the next three years:

- The veterinary medical profession's economic growth and profitability are improved within private veterinary medical practice.
- Veterinary employment opportunities are identified and solutions developed to effectively balance the needs of society with the supply of veterinarians.

In 2011, the AVMA approved the establishment of a new Veterinary Economics Division and an Economics Strategy Committee. These two new entities are to collaborate to develop economics research, policy analysis, and economic development programs to address the critical economic challenges facing the veterinary profession. A major focus of both entities is the Veterinary Workforce Study program, which is intended to accomplish the following research objectives:

Supply

- Identify and evaluate factors, current and emerging, that affect the supply of veterinarians in the United States.
- Estimate the current and future supply and distribution of veterinarians in the United States.

Demand

- Identify and evaluate factors, current and emerging, that affect the demand and need for US veterinarians and veterinary medical services.
- Estimate current and future demand for US veterinarians and their services for existing and emerging market segments.

Supply and Demand Interaction

- Analyze the interaction between the supply of and demand for veterinarians and veterinary medical services in the US across all identified market segments.
- Project and compare alternative future scenarios of changes in the supply of and demand for veterinarians and their services.

In 2012, the US Bureau of Labor Statistics³³ indicated that employment of veterinarians is expected to grow 36% from 2010 to 2020, a rate much faster than the average for all occupations. The Bureau of Labor Statistics *Occupational Outlook Handbook*³³ states that "job opportunities should be particularly good in government and in farm animal care."

In support of this contention, the BLS stated that the USDA Food Safety and Inspection Service "is the largest employer of veterinarians with more than 1100 professionals employed"³⁴ and indicated that the veterinary professional is a critical member of the agency's regulatory team with the primary responsibility of ensuring the safety of meat and poultry products made available to the public.³⁴ Difficulty in filling positions seems evident, considering that the agency offers recruitment incentives based on hiring needs and budget.

The CDC created preventative medicine residency and fellowship programs in response to the 2007 Institute of Medicine report³⁵ documenting a shortage of trained public health workers, including public health and preventative medicine physicians. These two 24-month programs are intended to promote public health leadership and enable the integration of knowledge and skills of medicine and other clinical professions with population health.

The National Research Council formed the Committee to Assess the Current and Future Workforce Needs in Veterinary Medicine in 2007.³⁶ The formation of the committee was "motivated by concerns about how well the veterinary profession was presently meeting its public responsibilities and, in terms of human resources and facilities, how well it could adjust to the complex challenges facing society in the 21st century."³⁶

The preface of the report³⁶ states,

Many of the concerns about the profession came into focus following the outbreak of West Nile fever in 1999: despite the spread of a zoonotic disease, human and veterinary public health agencies acted independently and did not communicate with one another. Subsequent outbreaks of SARS, monkeypox, bovine spongiform encephalopathy, highly pathogenic avian influenza, H1N1 influenza, and a variety of food safety and environmental issues heightened public concerns. They also raised further questions about the directions of veterinary medicine and the capacity of public health services the profession provides both in the United States and abroad. After September 11, 2001, concern about the vulnerability of the food supply, including the American live-

stock and poultry industries, drew attention to the declining presence of veterinarians serving the animal industries across the nation.

In the same direction as the Wise and Kushman⁴ and KPMG⁹ studies, the National Research Council study³⁶ found little evidence of workforce shortages in most fields of veterinary medicine. The authors noted that “true personnel shortages are indicated when salaries rise sharply in an attempt to attract qualified candidates to fill persistent vacancies. That is not occurring in any sector of veterinary medicine, except industry, where high salaries are offered to candidates with both a doctoral degree in veterinary medicine (DVM) and a PhD, or with advanced training in pathology or laboratory-animal medicine.”³⁶

The authors also noted that not only have existing veterinary colleges increased enrollments, but new veterinary colleges have been accredited, and this is likely to increase the number of veterinarians entering companion animal practice and do so at a time when demand for the services of companion animal practices is uncertain. One explanation given for the increase in enrollment was the need to compensate for inadequate resources at the veterinary colleges in regard to clinical faculty and specialists. In a period of sharp economic downturn and persistent declines in state funding of public education, increased enrollment had become an important means of maintaining revenues.

An important recommendation of the National Research Council study³⁶ was that “future actions should be informed by reliable national data on consumer demand for companion-animal care and the economics of private practice (including the work patterns of practitioners and the role of veterinary technicians), by the need to maintain the quality and affordability of a veterinary education, and by the need to educate veterinarians for other sectors of the profession.” In concurrence with authors of many other workforce studies, the authors of the report³⁶ stated that an “important challenge to the profession is its ability to evolve veterinary services in synchrony with societal needs.” They noted the need for more food animal practitioners that would be oriented toward improving herd health and optimizing the productivity of farm operations.³⁶ Rural food animal veterinarians would help to strengthen disease surveillance and assist state regulatory officials. The authors also noted that the profession should expand its capacity to address complex global food security problems.³⁶

Getz³⁷ in 2012 compared the incomes of health-care professionals and noted that earnings are a quadratic function of years of education. He compared three clusters of health-care providers, including providers in human medicine, dentistry, and veterinary medicine. The human medicine cluster included physician assistants, primary care physicians, and specialists. The dentistry cluster included dental hygienists, doctors of dental science, and prosthodontic specialists. The veterinary medicine cluster included veterinary technicians, veterinarians, and board-certified specialists. Importantly, although all three clusters had the

same quadratic relationship between education and earnings, the earnings for the veterinary cluster were below earnings for the medical and dental clusters. Getz³⁷ also noted,

The rising cost of health care is reducing our ability to use tax dollars for any other purpose. The veterinary colleges themselves (or their universities) see an increasing share of expenditures going to the health care of employees. Opportunities for federal support for veterinary medicine are limited by the health care demands on federal budgets. The declining standard of living of most Americans undercuts demand for veterinary services in companion animals. For a variety of reasons, successful health care reform will be beneficial for veterinary medicine and nearly everyone else.

He further noted,

A principle challenge [for veterinary colleges] is the significant, recent decline in funding from state governments, more than \$100 million in the aggregate. Although the recession accelerated the decline, this trend is of longer standing. The historic support of agricultural interests in several state legislatures has diminished as large-scale livestock producers in a small number of focused regions have come to dominate total production in the nation. The large producers are sophisticated in a variety of ways and use much less veterinary service per animal than the livestock producers of 50 years ago. More broadly, as noted above, rising health care costs will pinch state governments until more aggressive reform turns the tide. Anti-tax fervor in part of the electorate further narrows the states' fiscal choices.

Getz³⁷ pointed out that there are limits to tuition increases, noting that the ratio of debt to earnings is 0.85 for physicians and 1.17 for dentists, but 1.69 for veterinarians, and suggested that rising tuition, especially in relation to earnings, would likely reduce the pool of talented students.

The Institute of Medicine Forum on Microbial Threats held a conference in December 2011 to discuss the challenges associated with microbial threats to the human food supply. As a continuation of the discussion of the need for an expansion of public health professionals, it was agreed that “[g]lobalization of the food supply has created conditions favorable for emergence, reemergence, and spread of food-borne pathogens and has compounded the challenge of anticipating, detecting, and effectively responding to foodborne threats to health.”³⁵

The attendees discussed the need for a “One Health initiative that recognizes the interconnectedness of people, animals, and the environment and emphasizes disease prevention.” A one health approach to food safety is defined by the AVMA³⁸ as “the integrative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals,

and the environment.” The Institute of Medicine³⁵ pointed out that the recent “multistate and multicountry outbreaks of food-borne morbidity and mortality linked to *Listeria* in cantaloupe; *Salmonella* spp in eggs, ground turkey, and ground beef; and *Escherichia coli* in bean sprouts are but some of the most recent examples of a growing threat to health, trade, and local economies.” The local, national, and international trade in food poses a serious challenge to governments, food industry, and producers to maintain a safe food supply. The One Health Initiative was proposed as the platform to accomplish this task.

Summary

This review of literature pertaining to the veterinary workforce is not exhaustive but does describe a profession in constant change over the past century as new challenges appeared. The most common themes have been discussed, such as excess capacity in small animal practice, insufficient capacity in public health and food animal veterinary medicine, low incomes for practitioners, and the need for greater financial literacy.

The literature also indicates that some friction in the change process occurs as a result of the time required to educate new teachers so that the needed changes can be implemented by the colleges of veterinary medicine and their students. Each of the major workforce studies yielded its own set of outcomes with respect to increasing attention on the need for further research or action by some segment of the profession.

One of the most frequent findings throughout the literature was the measurement of need, and this presents a new set of problems for the profession as a whole, particularly when that need is given as the needs of society. A great effort to meet society's needs without any thought as to who will pay for the supply of services to meet these needs may have nudged the profession toward an excess of veterinarians. The literature clearly defines the need for an expanded role for veterinarians in the areas of public health and related sectors but offers no measure of the willingness to pay for the needed services by specific public or private entities. A similar situation appears with companion animals, where the need apparently exceeds the demand and the question should be whether that need can be met by a profit-maximizing business or will require public support. The same may be said of the need for food animal veterinarians in rural areas. If the need in these areas does not come with sufficient expenditures on services to operate a profitable veterinary practice, then any incentive, short of a publicly supported salary, may be unsustainable.

Currently, there are three major initiatives within the veterinary profession that have been identified in this review. These are an emphasis on expanding food animal veterinarians, an emphasis on expanding public health veterinarians, and an emphasis on expanding preventative health care in companion animal practice. Considerable private and public funds have been brought to bear in each of these, and the question may be asked, “How has this affected the national supply and demand for veterinary medical services and veterinarians?”

The AVMA Veterinary Economics Strategy Committee, Workforce Advisory Group, and Veterinary Eco-

nomics Division have been well positioned to address the numerous issues involved in measuring capacity and capacity utilization in veterinary medicine and understanding the factors that contribute to both. The Workforce Advisory Group contracted last year with IHS Global to begin to construct a model of the market for veterinary services and veterinarians, and the first baseline model will be completed by April 2013. This model will evolve as more in-depth analyses of specific sectors and subsectors are performed. This systematic evaluation of the market for veterinary services and veterinarians will be helpful as public funds become ever more difficult to acquire.

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