

A photograph of a person wearing a blue lab coat, holding a brown and white dog. The dog is looking directly at the camera. The background is a plain, light-colored wall.

UNIVERSITY  
OF  
CALIFORNIA

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# An Era of Change

A Closer Look at Veterinary  
Education and Practice

2015







# **LEADING VETERINARY MEDICINE, ADDRESSING SOCIETAL NEEDS**







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## EXECUTIVE SUMMARY

This report reviews state and national veterinary medicine workforce projections and considers educational programs and workforce trends to help guide the future steps the University of California might take in addressing current and projected needs.

### EMERGING TRENDS

Veterinarians have a multitude of career opportunities based on their unique education and expertise. They may engage in private clinical practice; become employees of the government as public practice veterinarians, wildlife health specialists, meat and poultry inspectors, disease control workers, or commissioned officers in the U.S. Public Health Service or the military; or pursue teaching and/or research careers as faculty or in private industry jobs at pharmaceutical, biotechnology, diagnostic, agrochemical, contract research or other private firms and companies. New graduates also may enter internships and residencies at veterinary medicine colleges or private veterinary practices.

After reviewing the current status of the veterinary profession, the following trends have emerged with regard to workforce supply and demand:

- Employment of veterinarians is expected to grow by 12 percent between 2012 and 2022.
- Approximately 12 percent of U.S. veterinarians are specialists and the number of veterinarians pursuing advanced specialty training is increasing.
- A shift in gender is occurring, as younger veterinarians are disproportionately women.
- There are unmet needs in: public sector practice, equine and food animal practice and academia, which will be further impacted by the aging professionals in these areas who are expected to retire in the next decade.

The veterinary workforce supply and demand is out of balance, influenced by different factors. The supply of veterinarians is driven by: enrollment capacity of veterinary schools; ability of graduates to manage financial considerations associated with educational debt and lower salaries; changing demographics (gender, age, career focus) and workforce participation of veterinarians; increasing use

and cost of medical technology; and the role and utilization of veterinary technicians.

The demand for veterinarians is driven by: changing economic conditions of animal owners, which impact their ability to seek and pay for veterinary care; increasing global population growth, which will require food production to double by 2050; increasing rates of pet ownership (approximately 65 percent of U.S. households have one or more pets); greater understanding of the One Health approach to animal, human and environmental health; impacts of climate change; and the regulations on product safety, which drive the need for veterinarians in industry, government, academia and other sectors with specialized training.

### VETERINARY MEDICAL EDUCATION

Significant changes in the educational requirements for veterinary medicine have occurred over the years, with additional changes anticipated as the profession evolves to meet society's needs in the 21st century. Influencing these changes have been major advances in veterinary science and technology; growing societal expectations regarding the quality and efficacy of veterinary services; a significant decline in state support for veterinary medical education and federal funding for advanced research; the increasing need for public practice veterinarians to ensure healthy food from healthy animals and to protect against bioterrorism/agroterrorism and other emerging diseases that affect human health; and the desire to protect the ecosystem balance and environmental health.

Currently, there are 28 fully accredited schools of veterinary medicine in the U.S. graduating about 2,700 students per year, with nearly 11,500 students enrolled across a four-year educational program. Upon graduation, students earn a Doctor of Veterinary Medicine (D.V.M.) degree and following a licensing exam, may begin to practice. No postdoctoral veterinary training is required. However, advanced clinical training (residencies) and/or research training (M.S., Ph.D.) is often necessary for career paths in academia, public practice and private industry.

As California's population continues to grow, the limited opportunities for a veterinary education have become increasingly competitive. There are only two veterinary

schools in California: the University of California, Davis, and the Western University of Health Sciences (WUHS). Currently, there are approximately 950 D.V.M. students enrolled in these programs.

WUHS provides a four-year D.V.M. curriculum using a problem-based learning (PBL) approach. Students utilize case studies to learn basic science and clinical concepts. The clinical year is taught using a distributed clinical program where students spend all of their time in off-campus clinical environments.

The UC Davis School of Veterinary Medicine, ranked first in the nation (U.S. News and World Report) and first in the world (QS World University Rankings), has influenced the transformation of veterinary medicine from a primarily livestock-oriented health profession to one that encompasses stewardship of all animal species. Through the vision, leadership, breadth of program and collaborative efforts of the school's faculty, UC Davis provides excellent teaching, groundbreaking research and innovative clinical treatments to improve the health of animals, people and the environment.

Faculty provide basic and clinical teaching to more than 500 D.V.M. students through an innovative newly developed curriculum model built upon learning outcomes and core competencies. More than 170 graduate students pursue advanced science training at the school, which also has the largest residency program of any veterinary school in the country. Through an extensive teaching hospital in Davis and satellite clinics in Tulare and San Diego, UC Davis provides services throughout the state to more than 50,000 animal patients annually in 34 specialties.

The following findings and recommendations summarize the outcome of the university's analysis and review of California's workforce needs as they relate to enrollment planning for veterinary medicine.

### SUMMARY OF FINDINGS

- Nationally, there is little evidence of veterinary workforce shortages in most fields, but there may be unmet demand for veterinary services in certain sectors and regions in California as a result of maldistribution.

- Veterinary educational costs and student debt have rapidly increased, yet salaries for veterinarians remain relatively low.
- The One Health movement is gaining momentum, with increasing needs in public sector practice.
- Opportunities to obtain a veterinary education in California are severely limited. Many California residents attend veterinary schools out of state, or outside of the U.S.
- Recruitment of faculty is increasingly difficult.
- An increasing number of veterinarians are pursuing specialty training.
- The veterinary workforce, students and faculty do not reflect the ethnic diversity of California.

### SUMMARY OF RECOMMENDATIONS

- UC should work with educational leaders, associations, and public and private industry to develop a national strategy to address the impact of rising student debt on career choice and future workforce needs.
- UC should expand the graduate academic education program, contingent on resource availability and partnerships with industry and the biomedical research sector, in recognition of the more than 300 zoonotic diseases and new emerging diseases that threaten animal and human health.
- UC should develop and implement strategies to improve the recruitment and retention of faculty.
- UC should increase the diversity and cultural competence of the faculty and students.
- UC should contribute to increasing the number of veterinarians practicing in sectors with workforce shortages (e.g., research and public practice).
- UC should expand capacity to promote the One Health concept to address complex, global health problems.



## VETERINARIANS

diagnose and control animal diseases, treat sick and injured animals, prevent the transmission of animal diseases to people, and advise owners on proper care of pets and livestock. They ensure a safe food supply by maintaining the health of food animals. Veterinarians are also involved in wildlife preservation and conservation and public health of the human population.







# I. BACKGROUND AND INTRODUCTION

Animal and human diseases are not confined by state, country or continental boundaries as air transportation can move an individual across the world in a matter of hours. Seventy percent of all infectious diseases are zoonotic (transmitted between animals and people). A global approach to health is required and veterinary medicine is at the nexus of these issues, interfacing with human medicine, animal agriculture, wildlife and the environment, and the regulatory agencies protecting public health. Many animal-related discoveries have human health implications and collaborative efforts with physicians and biomedical engineers have applied human surgical procedures to solve animal patient health issues. This integrated One Health approach has long been embraced by the nation's veterinary faculty who are recognized around the world for their expertise and who are at the forefront of advancing health and innovation in veterinary medicine.

The UC Davis School of Veterinary Medicine is an extraordinary public resource that brings together biomedical science, education, public health, production agriculture, ecosystem health and patient care for the benefit of animals, people and the environment. It is a multidisciplinary, collaborative enterprise with partnerships across the campus and university system, and with industry, environmental groups and other academic, government and private organizations both nationally and internationally.

The UC Davis School of Veterinary Medicine is the top-ranked veterinary school in the nation and the world. The school's faculty is transforming animal health through outstanding educational programs, an extensive translational research enterprise generating more than \$70 million annually, and the development of pioneering clinical advances focused on food safety, zoonotic diseases and the control of global disease outbreaks; developing vaccines; creating genetic therapies; and training the next generation of veterinary scientists. The clinical operation, with 34 specialties and serving more than 50,000 animal patients annually, is the largest veterinary training hospital in the world.

This report was prepared by the University of California (UC) Office of the President's UC Health division, with review and guidance provided by the UC Health Sciences Committee, and data gathered with the assistance of the UC Davis

School of Veterinary Medicine. The report reviews state and national veterinary medicine workforce projections; reviews educational programs, application and enrollment trends in California; and provides findings and recommendations regarding future steps the University of California might take in addressing current and projected needs.

## VETERINARY HEALTH INFRASTRUCTURE

The veterinary health system includes teams of professionals – primarily veterinarians, veterinary technicians and veterinary assistants. The team also may include a veterinary hospital administrator, adoption counselors, grief counselors, kennel workers and volunteers. Their efforts focus on protecting the health and welfare of animals and people.

Veterinary graduates may engage in private clinical practice; become employees of the government as public practice veterinarians, wildlife health specialists, meat and poultry inspectors, disease control workers or commissioned officers in the U.S. Public Health Service or the military; or pursue teaching and/or research careers as faculty or in private industry jobs at pharmaceutical, biotechnology, diagnostic, agrochemical, contract research or other private firms and companies. New graduates also may enter internships and residencies at veterinary medicine colleges or private veterinary practices.

**Professional Activities of California Veterinarians** The range of professional activities among veterinarians is exceptionally broad. The services currently provided by California veterinarians include:

- Delivery of primary health care for pet animals, horses and other performance animals, livestock, laboratory animals, captive and free-ranging wildlife, aquatic animals (including wild and farmed aquatic species) and wild or farmed birds;
- Provision of secondary and, less commonly, tertiary care for virtually all animal species;
- Coordination and oversight of preventive health services for food animal species, including maintenance of animal health and production, and development of quality assurance programs to minimize the possibility



that “on-farm” events might reduce the wholesomeness of animal products;

- Disease surveillance of livestock, poultry and aquatic species to protect these food producing industries, prevent disease transmission and protect against international trade sanctions on California's animal agricultural products;
- Organization of preventive health services for wild animals, including population management to maintaining healthy “herds,” and monitoring of environmental contamination through wild animal health;
- Protection of the environment through epidemiological studies in areas such as animal waste management, drug residue research and bio-containment;
- Participation in emergency disaster relief activities for wild animals (e.g., oiled waterfowl) and domestic animals (e.g., livestock and pet flood victims);
- Maintenance of public health through diagnostic testing and inspection of the processing of foods of animal origin;
- Protection of the public's health through local, state and/or federal programs to reduce the likelihood of transmission of an estimated 300 zoonotic diseases from animals to humans (e.g., rabies, brucellosis, hantavirus, Lyme disease, West Nile virus);
- Development of strategies to protect and defend animal and human health in the event of a bioterrorist/agroterrorist action involving a zoonotic disease;
- Education of students to become veterinarians and veterinary technicians; provide graduate academic and graduate clinical programs to train veterinary scientists, veterinary specialists and academics; and provide continuing professional education for veterinarians, and educational outreach to animal owners and producers, and to the public of California;
- Application of comparative medicine expertise to basic and applied biomedical research in university, public agency and private settings;

- Development of pharmaceuticals and biologicals for human use through animal testing; and
- Application of biotechnology advances (e.g., assisted reproductive technologies) to propagate endangered wild species or valuable domestic species.

### **VETERINARY HEALTH FINANCING AND SERVICE DELIVERY**

Veterinary health care is primarily financed by animal owners. Limited pet insurance is available, but it has not been embraced widely by animal owners due to its relatively high costs. As clients pay for services “out-of-pocket,” veterinarians must often adjust their prices to fit what the market will bear in their communities. In most instances, veterinarians work with owners to review estimated costs of veterinary care at the time services are delivered and may work out a payment plan if necessary. They also must consider when clients cannot pay the cost of saving their animal, even though the health issue may be treatable and could restore the animal back to a normal, healthy condition. As medical services become more complex, the demand for more sophisticated services at low prices is increasing. Without the benefit of third party insurance however, meeting this demand to lower prices for high-cost services is unrealistic for most veterinarians.

Changes in the organization and delivery of veterinary services also have occurred in recent years. Ownership and practice arrangements have diversified, with a marked increase in the number of group practices and a concurrent decrease in the number of “solo” practitioners. Corporate, franchised practices have developed, with projections that these trends will result in growing employment opportunities within these settings.







**MORE  
VETERINARIANS  
ARE PURSUING  
SPECIALTY  
TRAINING**

## II. THE VETERINARY WORKFORCE

### CURRENT ESTIMATES

**Veterinarians** In early 2012, there were an estimated 90,200 professionally active veterinarians in the United States (U.S.) and approximately 7,980 working in California. For purposes of comparison, it is noted that the national veterinary medical workforce is about one-tenth the size of the physician workforce. In 2014, the national average veterinarian to working-age population ratio is approximately 39 per 100,000 population. By contrast, the average ratio of veterinary professionals to working-age population in California is 18.7:100,000.

Based on North American Veterinary Licensing Exam (NAVLE) data, a 2013 national workforce study prepared for the American Veterinary Medical Association (AVMA) estimated that 3,457 graduates from accredited and non-accredited colleges of veterinary medicine completed their education in 2012. Data from the American Association of Veterinary Medical Colleges (AAVMC) indicate that 2,781 students graduated from U.S. colleges of veterinary medicine in 2014, with an additional 1,035 U.S. citizens graduating from AAVMC's International Member

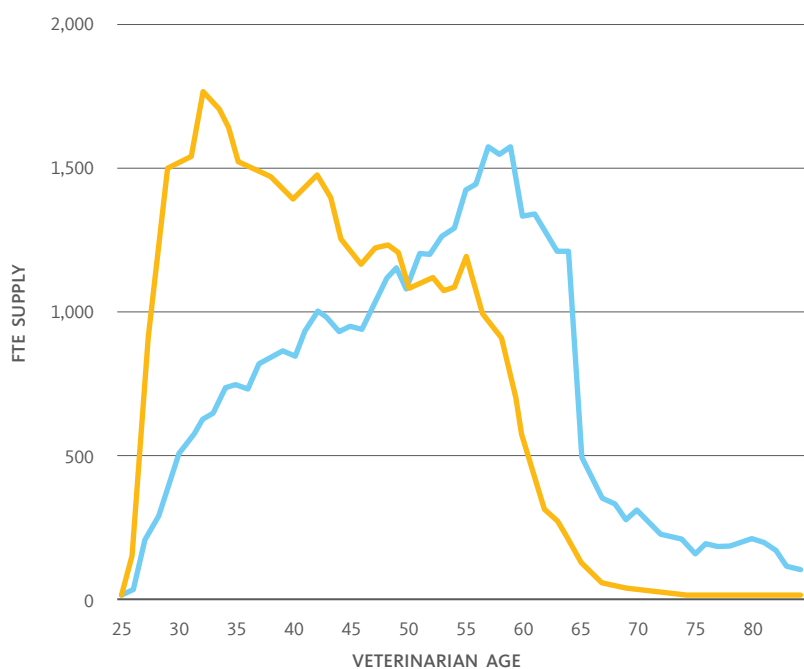
institutions, suggesting that foreign-trained veterinarians (likely including U.S. citizens trained abroad) also are entering the U.S. workforce.

In California, the California Veterinary Medical Board (Board) is the entity that issues licenses to veterinarians to practice. According to the Board, as of August 2014, there were 11,815 total active licenses, with 9,265 active licensees residing in California (i.e., an estimated 2,550 veterinarians with California licenses appear to be living out of state). Typically, the Board issues new licenses to approximately 600 veterinarians annually.

**Demographic Profile of Veterinarians** Historically, the veterinary profession has been predominately male. The demographics of veterinarians, however, began to shift in the mid-1970s, as the number of women accepted to veterinary schools steadily increased. In 2014, roughly 56 percent of active veterinarians in the U.S. were women. This figure is anticipated to grow to 71 percent of the workforce by 2030, given that nationally three-fourths of entering D.V.M. students are now female. In California, approximately 52 percent of practicing veterinarians are female. Figure 1 illustrates this shift in gender, showing younger veterinarians are disproportionately women.

**FIGURE 1:** Veterinarian Age and Gender Distribution, 2013 American Veterinary Medical Association report (Graphic used with AVMA's permission)

— Women  
— Men





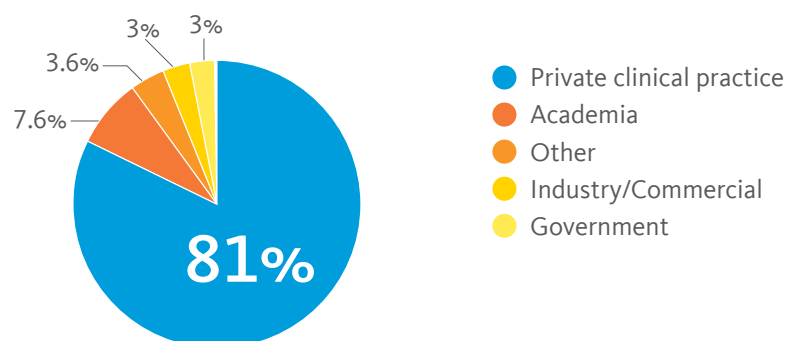
Files reviewed by the study team for the 2013 AVMA report suggested that approximately 18 percent of the active workforce in the U.S. was age 65 or older, with 7 percent age 75 or older. However, after reviewing three separate data sources, researchers involved with the 2013 workforce study for AVMA suspect that the number of active veterinarians older than age 65 was likely overstated in AVMA's files (i.e., some members listed as "active" may not actually be working in veterinary medicine). Ten percent may be more consistent with other estimates of active veterinarians age 65 or older. For comparison, across all industries, the Bureau of Labor Statistics (BLS) reported that 5.4 percent of workers were age 65 or older in 2010. In California, 35 percent of veterinarians in 2012 were age 55 or older, slightly higher than the national average of 32 percent.

The veterinary workforce remains among one of the least diverse of the health professions. Since data on the diversity of practicing veterinarians is not readily available, AAVMC enrollment data for students can serve as a proxy for the diversity anticipated in the future workforce. Although the number of racially and/or ethnically underrepresented students enrolled is at an all-time high – and has increased 64 percent since the launch of the AAVMC's DiVersity Matters initiative in 2005 – only 14.6 percent of students in U.S. colleges of veterinary medicine in 2014-15 were racially and ethnically underrepresented students. California's two schools of veterinary medicine are among the most diverse in the country, with approximately 30 percent Underrepresented

in Veterinary Medicine (URVM). URVM is defined by AAVMC as "populations of individuals whose advancement in the veterinary medical profession has historically been disproportionately impacted by six specific aspects of diversity (gender, race, ethnicity, geographic, socioeconomic, and educational disadvantage). Students who are of Asian descent are considered underrepresented in the veterinary medical profession." Veterinary medicine's relative lack of diversity has anecdotally been attributed to a number of factors including the lack of minority role models within the profession, lower salaries when compared to other health professionals and the predominately urban origin of minority households, which have significantly fewer pets and opportunities for experience with farm animals.

**Practice Characteristics of Veterinarians** Approximately 82 percent of all veterinarians work in private clinical practices. Of the estimated 90,000 members of the AVMA employed in the U.S. in 2010, the employment status is known for over 76,000 (85 percent). More than 70 percent of those whose employment status was known spent all or part of their time dedicated to companion-animal practice, a proportion that has remained relatively steady for the last 14 years. There has been a notable increase in work in this sector since the 1960s. Public practice veterinarians (employed by local, state and federal government agencies) accounted for 3.7 percent (2,879), and 4 percent (3,218) worked in industry. In California, approximately 81 percent of active veterinarians (6,460) are engaged in private clinical

**FIGURE 2:** Practice Setting of California Veterinarians



practice; 3 percent in industry/commercial; 3 percent in government; 7.6 percent in academia; and 3.6 percent in other settings. There are a growing number of veterinary practices owned by large corporations in California. Of respondents (who were clinicians in private practice in California) to a 2013 Economic Issues Survey commissioned by the California Veterinary Medical Association (CVMA), approximately 15 percent worked in large, corporate practices – such as VCA (6 percent), Banfield (4 percent), National Veterinary Associates (1 percent), or other multi-location partnerships (5 percent) – which have networks of hundreds of animal hospitals or clinics.

**Ancillary Providers** There are approximately 84,800 Veterinary Technologists and Registered Veterinary Technicians (RVT) working in the U.S. As of March 2014, California had 9,649 RVTs registered with the state, and of those, 5,731 reside in California. Veterinary technicians typically earn a two-year associate’s degree in a veterinary technology program, as compared to veterinary technologists who generally obtain a four-year bachelor’s degree in veterinary technology. RVTs often work in private clinical practices under the guidance of a licensed veterinarian, to treat or to help veterinarians diagnose the illness and injuries of animals. In California, specifically, a veterinarian may delegate the following tasks to a RVT under “direct supervision” — meaning that the veterinarian is physically present and readily available. As presently authorized by state law, RVTs may:

- induce anesthesia;
- apply casts or splints;

- extract teeth;
- suture cutaneous and subcutaneous tissues, gingival and oral mucous membranes; and
- create a relief hole in the skin for IV catheter placement.

If a D.V.M. is not present, an RVT may only: operate radiographic equipment; render certain life-saving emergency care; and provide treatment outside of an animal hospital setting (i.e., “off premise”).

The AVMA Committee on Veterinary Technician Education and Activities (CVTEA) accredits veterinary technology programs. As of February 2015, there were approximately 225 programs with accreditation status in the U.S. Eighteen of these programs are in California. Only one is a four-year baccalaureate RVT program at California State Polytechnic University, Pomona. All others are associate degree programs (five are public, 12 are private, for-profit). In addition, there is one California community college in San Diego that offers an associate of science degree program that is accredited by the California Department of Consumer Affairs, Veterinary Medical Board (i.e., the program is not accredited by the AVMA).

**EMERGING TRENDS**

**Increasing number of veterinarians pursuing specialty training** More than 11,000 veterinarians have been awarded diplomate status in the U.S., or 12 percent of the profession. The title “diplomate” refers to a veterinarian who has completed postgraduate training and is board certified

**FIGURE 3:** Listing of AVMA-recognized Veterinary Medicine Specialty Organizations

1. Anesthesia and Analgesia	12. Ophthalmology
2. Animal Welfare	13. Pathology
3. Behaviorists	14. Poultry
4. Clinical Pharmacology	15. Preventive Medicine
5. Dentistry	16. Radiology
6. Dermatology	17. Sports Medicine and Rehabilitation
7. Emergency and Critical Care	18. Theriogenology
8. Internal Medicine	19. Toxicology
9. Laboratory Animal Medicine	20. Veterinary Practitioners
10. Microbiology	21. Veterinary Surgery
11. Nutrition	22. Zoological Medicine



in a recognized veterinary specialty area. Board-certified specialists commonly have four to eight years of additional training after veterinary school, which includes a residency (typically three years in length). There are currently 22 AVMA-recognized veterinary specialty organizations (see Figure 3 for listing), some of these are comprised of two or more related specialties. For example, the American College of Veterinary Internal Medicine includes specialties in internal medicine, as well as in cardiology, neurology and oncology.

In 2010, about half of veterinary graduates pursued advanced study (including internships) in some specialty. Explanations for this trend include increased demand for specialization (e.g., pets are living longer, and may have more complex health needs), higher earning potential of specialists coupled with graduates with higher debt burdens and intellectual interest in the specialty fields. A 2013 CVMA Economic Issues Survey found that respondents who completed residencies or additional degrees made significantly higher salaries, even when controlling for time since graduation — with an overall median salary of those with a D.V.M. at \$90,000, and a D.V.M. with residency training at \$130,000.

**Little evidence of veterinary workforce shortages in most fields, although shortages exist in certain geographic areas and in certain sectors in veterinary medicine** According to the 2014-15 Bureau of Labor Statistics' Occupational Outlook handbook, employment of veterinarians is expected to grow by 12 percent from 2012 to 2022, about as fast as the average for all occupations.

In May 2012, the National Research Council (NRC) of the National Academies released a report that concluded that there are sectors of unmet need for veterinarians, yet little evidence of current, widespread workforce shortages. Researchers stated that true personnel shortages are generally recognized when salaries rise sharply in an attempt to attract qualified candidates to fill vacancies. Such increases in compensation are not occurring in most sectors, except in "industry," where individuals with dual D.V.M. and Ph.D. degrees (or other advanced expertise in specialized areas) are in demand. The 2013 Veterinary Workforce Study prepared for the AVMA estimated that in

2012, the supply for veterinarians in the U.S. was 90,200, which exceeded the estimated demand for veterinarians by roughly 12.5 percent.

### Needs in Public Sector Practice

The public practice veterinary corps plays a critical role in protecting animal and human health. Employed largely through federal and state agencies, these veterinarians work to ensure the health of the food supply through food animal health and management programs, diagnostic testing, food safety and biosecurity strategies. These professionals focus on protecting food animals from accidental or intentional introductions of pathogens that could be transmitted through animal products to humans or that could decimate food animal populations. There are likely fewer than 1,500 veterinarians in the U.S. employed in state governments working in departments of public health, agriculture and national resources.

Approximately 3,000 veterinarians work in the federal government, with the majority in three main agencies — the U.S. Department of Agriculture (USDA), Department of Defense (DOD) and the Department of Health and Human Services (DHHS). A 2009 Government Accountability Office (GAO) report indicated that nearly a third (approximately 697) of veterinarians employed by several key federal agencies (e.g., USDA, Food and Drug Administration, etc.) were eligible for retirement between 2009 and 2012. Despite some recent progress with hires and increased compensation, there are significant challenges in meeting the needs of the public sector veterinary workforce. Some positions in the federal government require a Ph.D. or additional experience. However, there are few individuals available to fill those jobs given that similarly qualified veterinarians could choose to work in the biomedical industry for significantly higher salaries.

### Equine Veterinary Medicine Practice Declines

The United States had an equine population of over 9.2 million horses in 2005, the largest population in the world. Veterinarians in the equine sector provide vital services by caring for the health and welfare of horses. The economic downturn has most negatively affected equine medicine with declines in the racing industry (which

had already been facing declines), horse ownership in general and the demand for associated veterinary services. Notwithstanding these trends, there have been increases in the “sporting” or “recreational” sectors (e.g., dressage, pleasure riding, etc.) in the past two decades due to greater disposable income for some. It is interesting to note that although associates in equine medicine have the lowest starting salaries (and experience more stress, risk of injury and emergency work) among private-sector practitioners, experienced equine practitioners earn higher salaries than those in other private practice (e.g., average of \$160,240 for practitioners over 60 years of age). Because clinics have not developed in equine practice, veterinarians who work in this industry are often “on call” and generally need to be available to clients at all hours. Historically, practitioners have been predominately men, but women are increasingly entering this sector of practice. The equine practitioner workforce as a group seems to be aging, and is a result of an insufficient number of young veterinarians choosing to enter the equine workforce.

### Unmet Needs in Food Animal Practice

Food animal veterinarians oversee the safety and security of the nation’s food supply from animal sources, and work to prevent and control disease outbreaks on the nation’s farm lands. The number of livestock farms in the U.S. has decreased, and there has been a consolidation of food animal production and a concurrent increase in herd sizes. The majority of U.S. poultry, feedlot beef and pork production activities now occur in large, intensive animal feeding operations. With declining food prices, demands for veterinarians in the livestock, poultry and swine industries are changing – with primary animal care provided by a veterinarian increasingly viewed as too expensive relative to what the animal product can be sold for. There is a growing trend, however, for small livestock operations such as organic farms for meat and milk production, driven by a consumer movement for locally produced foods and concerns about animal welfare and the safety of food produced in concentrated animal operations.

Despite these trends, however, the numbers of veterinarians in this sector are not growing and the number of food animal-predominant veterinarians has declined, causing these veterinarians to expand their practices to include the

treatment of companion animals and horses. These types of veterinarians may need new skill sets (e.g., experience dealing with epidemiology and health of animal herds, rather than individual animals, and understanding complex challenges of “production medicine”). According to the NAS report, large dairies routinely use consultants to advise on issues such as housing, communication, nutrition and environmental regulations – matters seen as “outside the realms of veterinary medicine.” Since food safety is of critical importance, it would be extremely problematic if the veterinary profession lost its presence in food animal production and care. The veterinarian-producer (i.e., farmer) relationship is thus essential for the health and welfare of livestock populations.

### Needs in Academia

The academic faculty for the U.S. veterinary colleges has broad responsibility to prepare students to be “practice ready” to enter the workforce, as well as to conduct research and participate in postgraduate training including masters/doctoral degree programs and internships/residencies. According to AVMA statistics, there are an estimated 6,425 veterinarians employed by U.S. colleges and universities. Of these, approximately 4,000 comprise the academic faculty for the AVMA-accredited colleges and schools of veterinary medicine. Given challenges related to significant declines in state support for schools, faculty are increasingly required to seek extramural grant support to cover a portion of salaries, as well as to purchase laboratory equipment and help provide stipends for graduate students. Veterinary colleges require trained graduates for faculty positions in numerous fields such as physiology, pathology, virology and microbiology, as well as clinical faculty with expertise in certain specialties where board certification or a Ph.D. would be needed. The expectation is that there will be growing shortages of D.V.M.s with advanced training entering academia.

### Growth in Private Industry

The majority of private sector positions for veterinarians (outside of private practice and working for a corporation) are in the pharmaceutical, biotechnology, diagnostics, contract research, animal feeds and agrochemical industries. The highest paying jobs for veterinarians are



in these fields, which in 2009 paid an average annual salary of \$167,415. In 2010, the AVMA estimated that 3,200 veterinarians in the U.S. worked in private industry. Trends affecting private industry suggest that hiring of veterinarians is likely to grow. However, despite its attractiveness primarily for salary and benefits, only 0.1 percent of recent D.V.M. graduates selected a position in industry. This is in part due to the need for additional advanced training (e.g., Ph.D.), which is necessary for many positions.

In California, the AVMA estimates that there is “excess capacity” in food animal practices by 12 percent; small animal practices by 15 percent; equine practices by 20 percent; and mixed practices by 11 percent, compared to national excess capacity in the same categories of 15 percent, 18 percent, 23 percent and 13 percent, respectively. In this 2013 study, “excess capacity” referred “to the ability to provide services in excess of the quantity demanded at a price that consumers are willing pay. Excess capacity means that veterinarians in a particular geographic area and/or employment sector are underutilized. This underutilization can take the form of unemployment, but more often takes the form of reduced productivity because either (1) the veterinarian does not have sufficient demand for services to keep busy, or (2) the veterinarian is keeping busy by providing services that could be provided by a technician or other staff member with less training.” There is some debate as to what this phrase means in terms of the current number of graduates (i.e., reflecting too many?) versus how they practice (i.e., graduates’ decisions regarding what practice types to pursue; or that the market may not need as many small-companion animal veterinarians).

## FACTORS DRIVING WORKFORCE DEMAND

### Changing economic conditions (including the recession)

The economy affects pet owners as well as veterinarians. The AVMA recently reported that several small animal practices have reported a drop in patient visits and only moderate increases in transaction charges. According to findings from the National Commission on Veterinary Economic Issues (NCVEI) and a study by Brakke Consulting, pet owners report spending less on veterinary services, some practice owners have had to lay off at least one veterinarian and/or

staff, and up to 44 percent of veterinarians have canceled or postponed major purchases, such as veterinary equipment.

The CVMA states that 74 percent of clients with insurance are more likely to authorize testing and procedures. However, according to the North American Pet Health Insurance Association, only 0.65 percent of U.S. dog and cat owners had insurance in 2012. The American Pet Products Association (APPA) estimates that number to be only slightly higher and in the range of 1-3 percent. With stretched finances, pet owners may decide to postpone or forego recommended diagnostics, procedures or medical treatments to minimize costs, and most do not pay for pet insurance. Since expenditures for pets are closely tied to household income, it is anticipated that when economic conditions improve, spending on pets also will increase.

**Increasing Population Growth** Population growth – including the aging of the population – is among factors contributing to the need for more veterinarians. By the year 2050, the world will need to double food production to feed a global population estimated to be 9.1 billion. Ensuring a sustainable global food supply is critical to keep the world’s population well-nourished and healthy. Essential to meeting this goal will be the use of best practices that prevent diseases, and the ability to effectively treat sick animals and control disease outbreaks.

Already the most populous state in the nation with an estimated 38.7 million residents, California’s population is expected to grow to 42.4 million by the year 2025. The population aged 65 years and older is expected to grow significantly faster than younger citizens, and will nearly double in the next 20 years.

A 2013 U.S. News and World Report article states, “Americans age 55 to 64 spent the most on their pets of any age group, at \$636 per year, in 2011. In addition, homeowners spent \$653 on average, compared to renters, at \$221. With baby boomers entering retirement and a housing recovery in place, that may mean the population willing to spend big on their animals is about to grow.”

### Increasing Rates of Pet Ownership and Caring for Animals

Pet ownership in the U.S. is common. Sixty-five percent of American households in 2014 owned a pet. This

translates to an estimated 79.7 million households with pets in 2014.

Food is one of the highest annual expenditures for owners of all species of pets. Trips to the veterinarian (for emergency, sick, surgical or routine care) also are identified as top expenses, particularly among dog, cat and bird owners. In 2012, U.S. households spent \$13.67 billion for veterinary services, with an estimated \$14.21 billion expected in 2013.

As previously noted, in contrast to health insurance coverage for humans, as well as in comparison to other countries, a low percentage of U.S. pet owners opt to purchase pet insurance. For example, in many European countries, the figure for pet insurance coverage rises to more than 20 percent, including considerably higher levels in the United Kingdom (40 percent) and in Sweden (70 percent). Pet insurance in the U.S. is expected to increase in 2013. Evidence exists that the tighter the perception of the bond between an owner and a pet (i.e., seen as a family member), the higher the level of veterinary service expenditures, when financial means are available. However, even when resources are not readily available, some owners choose to go into debt to provide veterinary care for their pets.

**Advancing understanding of One Health** While the term One Health may be familiar to many veterinarians, it has only recently emerged in the public's consciousness – gaining momentum in the past decade. The concept behind One Health, however, has long been recognized nationally and globally. As noted in a 2014 JAVMA News article, the One Health concept is broad in that it “unites veterinarians, physicians and other scientific health and environmental professionals in a collaborative approach that recognizes the vast interrelationships between human, animal, and environmental health.” One Health reflects the understanding that humans are part of a larger ecosystem, and disease problems can more effectively be addressed through improved communication and collaboration across disciplines and organizations. Approximately 70 percent of the diseases known to affect humans are zoonotic — meaning they can be transmitted between animals and humans. The actions of people substantially influence how diseases move within a community, region and the world.

Veterinarians are increasingly needed to work across disciplines to help deal with zoonotic pathogens significant to the public's health, as well as disease threats to wildlife and domestic animals. Current examples involving human illness include bovine spongiform encephalopathy, West Nile virus and foodborne illnesses. One Health also is ever more important given concerns related to increasing use of antibiotics in farm animals and the national focus on addressing antibacterial resistance in both humans and wildlife.

The 2014 AAVMC annual conference had a theme of “One Health in Veterinary Medical Education,” to highlight work in this area. Topics addressed included: controlling zoonotic infectious diseases, conducting research that enhances the health of both animals and people, discussing disparities in access to healthcare, partnerships in action, teaching methodologies and developing academic programs to advance One Health. The UC Davis School of Veterinary Medicine has a One Health Institute, which is active all over the world.

### **Impacts of climate change and wildlife conservation**

Humans and animals all inhabit the earth. Thus, understanding the ecosystem and changing climate is critical, given its impact on the health of humans, pets, livestock and wildlife. In 2007, the Intergovernmental Panel on Climate Change – a scientific body under the auspices of the United Nations – projected that “unprecedented rates of climate change will result in increasing average global temperatures; rising sea levels; changing global precipitation patterns ...; and increasing midcontinental summer droughts. Increasing temperatures, combined with changes in rainfall and humidity, may have significant impacts on wildlife, domestic animal, and human health and diseases.” Such changes could result in increased demand for water, accelerated damage to habitats and increased opportunities for the transmission of diseases between animals and humans. In addition, the introduction of invasive species, urbanization/development and environmental toxins all impact the well-being of ecosystems and populations.

**Regulations on product safety** Regulatory requirements related to product safety drive the need for D.V.M.s in industry, government, academia and other sectors, with specialized training in food safety, laboratory



animal studies, pharmacokinetics and toxicology. The complexity of products introduced into the food and companion-animal marketplace is increasing. The need for a veterinary workforce with special expertise is driven by the increasing use of pharmacokinetics in the discovery and development of drugs. With regulatory standards in the product development and registration process increasing, it drives the increased standards and practices when conducting studies involving the use of animals.

Several federal agencies, including the United States Department of Agriculture, Food and Drug Administration, National Institutes of Health, and Centers for Disease Control and Prevention, have critical roles in keeping Americans safe through such activities as the management of national animal health (primarily livestock) programs, as well as the prevention of animal disease, research and approval of veterinary biologics. For example, the Food Safety and Inspection Service (FSIS) is the public health agency in the USDA responsible for “ensuring the nation’s commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged.” Outside of companion animal practice, FSIS is the largest employer of veterinarians in the U.S. Veterinarians employed in other government organizations work as epidemiologists, pathologists, auditors, risk analysts and biosecurity experts. It is likely that demand for veterinarians to fill these vital roles will increase.

### **FACTORS AFFECTING WORKFORCE SUPPLY**

The size of the active veterinary workforce is primarily driven by work participation (i.e., the number of veterinarians who enter/re-enter and exit the workforce). Other factors influencing the supply of veterinarians include the capacity of schools of veterinary medicine to train new veterinarians, changing demographics of the veterinarian workforce, changes in workforce participation, and the role and utilization of veterinary technicians.

**Educational Capacity** Supply of the veterinary workforce depends in part on the number of students enrolled in veterinary schools and the resulting number of new graduates entering practice (See Section III). Since only

27 states in the U.S. offer veterinary education to fulfill the veterinary healthcare needs of the nation, individual institutional responsibilities extend beyond state and regional boundaries. Despite little evidence of widespread workforce shortages, some veterinary colleges have increased enrollment in recent years. The AVMA also has accredited new veterinary schools, including schools outside of the United States, which will further increase the supply of veterinarians. Because there have been a greater number of individuals taking the North American Veterinary Licensing Exam (NAVLE) than the number of graduates of U.S. colleges of veterinary medicine in 2013, it is likely that foreign-trained veterinarians are entering the U.S. workforce and increasing the total supply. Graduates of some off-shore veterinary schools in the Caribbean (i.e., Ross University in St. Kitts and St. George’s University in Grenada) may, under certain conditions, practice in the U.S., thereby potentially annually adding several hundred D.V.M.s to the U.S. supply in the coming years.

**Financial Determinants** High costs of training and increasing debt loads, together with the significant costs of maintaining a veterinary practice and frequent lack of insurance coverage for many pets, are among the major factors influencing decisions by new graduates about practice types and locations. Increasing student debt (See Section III) also can undermine the interests of graduates in pursuing research training, academic careers or jobs in public practice, which frequently offer lower compensation than other employment settings.

**Workforce Demographics** The demographics of the veterinary medicine workforce also are changing. Today, the proportion of veterinarians who are women is roughly half. This growth is expected to increase as most new graduates are female, while the majority of veterinarians approaching retirement are male. By 2030, 71 percent of the workforce is projected to be female. Veterinarians also are aging, with many expected to retire in the coming years, although some data suggest that veterinarians tend to retire later than the average worker. In fact, the American Association of Retired Veterinarians (established in 1987) changed its name in 2009 to the American Association of Senior Veterinarians, largely because the organization observed that more veterinarians were not retiring at traditional ages.

The AVMA does not track veterinarians' retirement age, but an estimated 10 percent of its practicing members are age 65 or older, compared to approximately 5 percent of workers in all industries. Retirements of practicing veterinarians will affect the supply of professionals available to meet workforce needs.

**Changes in Workforce Participation** Female veterinarians tend to work fewer hours than their male counterparts of the same age. Women also are mainly in companion-animal-exclusive practices, representing approximately 56 percent of the workforce in that sector in 2010. They also are more likely in parts of their career to work part-time, work fewer hours and leave the workplace temporarily for family obligations. More women are associates in businesses rather than practice owners, which allows them to have greater work schedule flexibility, but subsequently results in lower income. According to a 2013 CVMA report, even when controlling for factors such as experience, practice type and location, male owners earned one-third more than female owners. On average, male owners made \$50,000 more than their female counterparts. According to the same study, there is a strong generational difference when it comes to attitudes about dedication and work/life balance. Newer D.V.M. grads are more likely to agree that the field “can and should make room for veterinarians who want to balance work and family.” The CVMA study also found that compared to recent national surveys, California veterinarians report working shorter hours (as owners and associates) in small animal/food animal/equine specialties. Older California veterinarian respondents (i.e., those who graduated before 1998) had higher job satisfaction, compared to younger veterinarians.

**Aging of Veterinary Faculty** The contributions of veterinary medical school faculty extend beyond their role in training veterinarians and are critical for the future success of the profession. In 2015, there were approximately 4,171 faculty at U.S. colleges of veterinary medicine. It is difficult to determine what percentage of veterinary school graduates choose to pursue a career in academia, but the number of veterinarian faculty represent only a small percentage of the practicing workforce (less than 5 percent). Of respondents in the UC Davis School of Veterinary Medicine's class of 2014 exit survey, given

to graduating students, zero individuals picked “academia” as their first choice of the type of employment sought; one individual had it as his or her second choice, and three individuals listed it as their third choice. Similar results were seen in past years' exit surveys, where only a handful of individuals expressed their intent to pursue employment as faculty or staff in an academic setting. It is possible, however, that graduates who indicated they were pursuing advanced training through internships, residencies or other advanced degrees would be a pool of individuals that might pursue a future faculty position at a later time. This choice may be due in large part to the differential between faculty salaries and private practice income, rising levels of student indebtedness and increasing pressures on faculty to generate clinical income and meet the scholarly expectations of an academic career. Declining state support for faculty positions also has meant budgetary cutbacks that have reduced hiring and caused layoffs, with resulting implications on the supply of faculty. Respondents to a National Academy of Sciences survey estimated that by 2016, approximately 10.5 percent (446 positions) of faculty positions would be vacant due to retirements.

**Veterinary Technicians** Registered Veterinary Technicians (RVTs) assist veterinarians with a wide variety of tasks. The establishment of formal training programs is leading to an increasingly qualified workforce of ancillary professionals. According to the Bureau of Labor Statistics, employment of veterinary technicians is expected to increase nationally by approximately 25,000 or 30 percent (much faster than average) between 2012 and 2022. In California, the number of veterinary technicians registered each year has increased, largely driven by the proliferation of private, for-profit veterinarian technology training programs across the state. Additionally, the California Veterinary Medicine Practice Act includes a variety of eligibility categories for the RVT examination, and an “alternate route” may be available to individuals with a combination of set hours of specific education and at least 4,416 hours of practical, directed clinical experience. Median annual salary in 2012 of veterinary technologists and technicians in California was \$34,876, compared to an average national veterinary technician salary of \$29,549 (2011 data). In the future, veterinary technicians may become even more valuable



resources for helping expand a practice's range to underserved areas, adding to the currently offered services, and increasing the earnings of a D.V.M. by more fully employing D.V.M.s in tasks that require their expertise. The 2012 National Academy of Sciences workforce report notes that there are rural areas where primary veterinary care is needed, but where there are too few farms to support full-time veterinarians. A system of animal health care that involves rigorously trained technicians working under the supervision of veterinarians could be developed and fill a clear need. Of note, a National Association of Veterinary Technicians in America (NAVTA) survey in 2008 identified a key concern for individuals in this profession. Nearly 80 percent surveyed felt "that veterinary technicians were so underpaid that the feasibility of staying in the profession was declining. Only 43 percent reported being satisfied and definitely planned to stay in the profession." This may be due, in part, to some credentialed technicians believing that their education is not adequately compensated, particularly when compared to unlicensed assistants hired by veterinarians.

**Technological Advances** Technology is increasingly changing the way humans live and work, including the way veterinarians do business. In recent decades, advances in medicine and science have greatly improved the quality of pet health. Many of these advances have been adapted from techniques and technologies designed for use in human medicine. With the increased specialization of veterinarians, what is possible for humans is increasingly available for the diagnosis and treatment of pets. The latest innovations in imaging and treatment technology have led to less invasive, more accurate and faster diagnoses of disease, which improves outcomes for pets. For example, Magnetic Resonance Imaging (MRI) is being used, although it carries a relatively high cost and requires the use of anesthesia. Ultrasound technology, familiar for many pregnant women in the assessment of fetal development, also has dramatically improved, allowing for 3-D or 4-D imaging options for humans and animals. As technology becomes more affordable and accessible to veterinarians, the ability to integrate these new tools into practice will become more routine and will potentially improve the quality of life for pets.

In addition, use of technology is changing how veterinarians run their practices and communicate with current and prospective clients. Use of social media such as Facebook, YouTube or Instagram is increasingly popular and valuable to veterinarians as a cost-effective and efficient way to raise awareness about pet health issues, as well as to position their businesses as resources that pet owners can turn to for information.

A person wearing a white lab coat is shown from the side, standing outdoors. The background is a soft-focus view of green trees and foliage, with sunlight filtering through the leaves, creating a bokeh effect. The person's arm is visible, and they appear to be holding something, though it is not clearly identifiable.

**VETERINARY  
MEDICAL  
EDUCATION IS  
ADAPTING WITH  
SOCIETY'S NEEDS**





### III. VETERINARY MEDICAL EDUCATION

Significant changes in the educational requirements for veterinary medicine have occurred over the years, with additional changes anticipated as the profession seeks new ways to ensure that veterinary medical education evolves to meet society's needs in the 21st century. Influencing these changes have been major advances in veterinary science and technology; growing societal expectations regarding the quality and efficacy of veterinary services; a significant decline in state support for veterinary medical education and federal funding for advanced research; the increasing need for public practice veterinarians to ensure healthy food from healthy animals and protect against bioterrorism/agroterrorism and other emerging diseases that affect human health; and the desire to protect the ecosystem balance and environmental health.

Currently, there are 28 fully accredited schools of veterinary medicine (with two schools in review with "reasonable assurance of accreditation") in the U.S. graduating about 2,700 students per year, with nearly 11,500 students enrolled across a four-year educational program. Upon graduation, students acquire a Doctor of Veterinary Medicine (D.V.M.) degree.

#### APPLICANT AND ENROLLMENT TRENDS

In 2014, more than 6,700 people applied to fill approximately 4,000 first-year positions in AVMA-accredited schools in the U.S., Canada, and abroad. The recent expansion of enrollment at veterinary schools across the U.S. and the opening of two new schools in 2014 – Midwestern University in Arizona and Lincoln Memorial University in Tennessee – has highlighted the significant demand for a veterinary medical education. The rate of annual growth in D.V.M. enrollments has increased by 2 percent resulting in a 34 percent increase in the number of D.V.M. graduates over the last decade. It is also important to note that the number of U.S. citizens enrolled in AVMA-accredited international programs located in Australia (4), France, England, Ireland, Mexico, The Netherlands, New Zealand, Scotland (2) and the West Indies (2) has increased by 113.8 percent over the last six years. This growth, however, has resulted in a decline in the applicant to seat ratio to less than 2:1, which could jeopardize the future viability and quality of schools if this ratio continues to fall. Although there is currently

little evidence of veterinary workforce shortages in most fields nationally, there are shortages in some states and regions of the country and new schools are continuing to seek accreditation (e.g., University of Arizona at Tucson with plans to enroll a new class in fall 2016) while the number of American students studying at international schools shows a trend of continued growth.

The AAVMC expects 4,460 veterinary graduates to enter the U.S. workforce in 2017. This includes roughly 1,150 American graduates of schools outside of the U.S. A 2013 national workforce study prepared for the AVMA estimated that 3,457 graduates from accredited and non-accredited colleges of veterinary medicine completed their education in 2012. The AAVMC indicates that 2,781 students graduated from U.S. colleges of veterinary medicine in 2014, further suggesting that foreign trained veterinarians are currently entering the U.S. workforce.

#### POSTDOCTORAL TRAINING

Postdoctoral veterinary training is not required before earning a license and beginning to practice. However, many internships and residency programs are available as an increasing number of new veterinarians are interested in improving their clinical skills, achieving advanced qualifications or gaining specialty certification. Veterinarians who seek specialty board certification in one of the 22 specialty organizations and possibly one of the 23 subspecialties must complete two- to five-year residency programs and pass a board certification examination. Residency programs currently exist at nearly every accredited veterinary college in the U.S. and Canada. Student and employer interest in specialty training has grown significantly. For example, from 2006 to 2010, the number of AVMA members who were board-certified specialists in veterinary medicine increased by 20 percent in just four years (8,500 to 10,200). While demand for specialty services has increased, there has been little growth in the capacity of programs to train veterinary specialists.

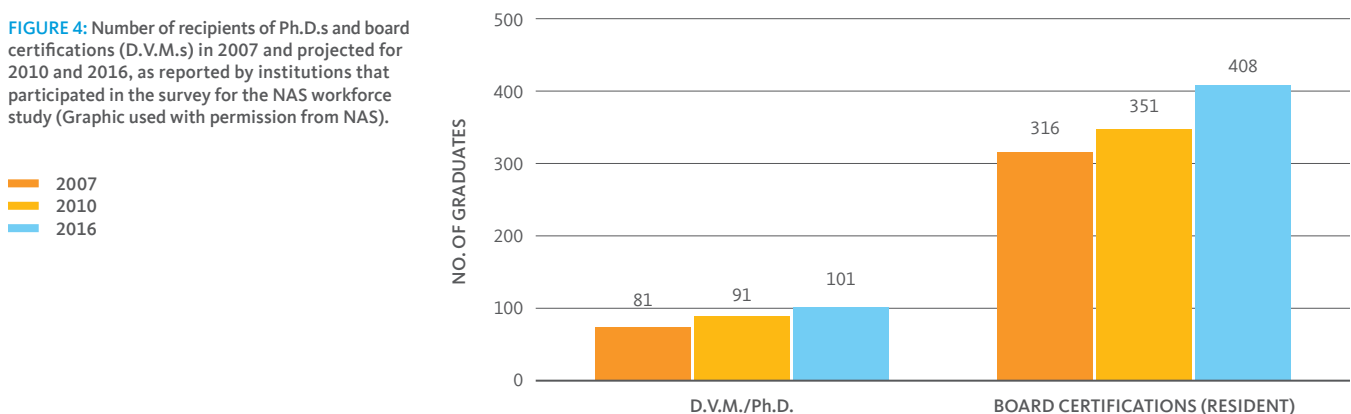
**Internship and Residency Selection** The American Association of Veterinary Clinicians (AAVC) sponsors a web-based Veterinary Internship and Residency Matching Program (VIRMP) to expedite the selection of interns and

residents for participating veterinary colleges and private veterinary practices. Although this program is voluntary, most internships and residencies participate in the VIRMP. The website clearly states that the AAVC is dedicated to promoting postgraduate clinical education, and thus provides this inventory of training programs, but does not evaluate, regulate or certify listed VIRMP programs. Of note, veterinary internships and residencies are funded by the organizations sponsoring the intern or resident, and unlike the medical and dentistry professions, there is no federal Medicare funding available to help support costs. Forty-five percent of UC Davis' graduating class of 2013 that had set plans at the time of survey were pursuing an internship following graduation. In comparison, an estimated 5 percent of all new U.S. veterinary school graduates in 1980 completed internships. Given the high percentage of recent graduates participating in postgraduate training programs, there have been concerns raised about their consistency and quality (i.e., the educational value of veterinary internships has been highly variable). Moreover, internships have been under scrutiny as supply and demand continues to increase despite relatively lower pay, fueling claims that individuals in postgraduate training were being used as a source of cheap labor. According to a 2013 Journal of the American Veterinary Medical Association (JAVMA) news article, the national mean for a veterinary intern salary in 2012 was \$25,756. By contrast, the national mean starting salary for all veterinary employment types in 2012 (excluding advanced education) was \$65,404.

In response to such concerns, some have proposed establishing a veterinary counterpart to the Accreditation Council for Graduate Medical Education (ACGME) which oversees postgraduate medical training programs. In May 2009, the AVMA Executive Board created a joint task force (with the AAVMC) to assess the status of veterinary internships, identify areas that need improvement and develop a plan to address identified needs. The task force's work culminated in a final report in spring 2011. The report included a revised internship definition indicating that internships should provide mentorship, direct supervision and didactic experiences, including rounds, seminars and formal presentations; internship disclosure guidelines; and accompanying model AVMA Internship Guidelines. All have been adopted as official AVMA policy.

**Advanced Research Training** Graduate academic programs that lead to masters (M.S.) and/or doctoral (Ph.D.) degrees also are available to prepare individuals primarily for careers in academia (teaching and research), public practice and private industry. Veterinary medical research is critical to human health, ecosystem maintenance, building the academic workforce and to the future of the profession. Yet, declining state and federal resources continue to prevent schools from strengthening their scholarly base, adding relevant new topics to curricula to respond to societal needs, and cultivating student interest in careers in academia and research. Interest in specialty training is growing while interest in advanced research training appears to be decreasing.

**FIGURE 4:** Number of recipients of Ph.D.s and board certifications (D.V.M.s) in 2007 and projected for 2010 and 2016, as reported by institutions that participated in the survey for the NAS workforce study (Graphic used with permission from NAS).





**LICENSURE**

Veterinarians must acquire a license issued by the state they plan to work in before they can engage in clinical practice. A license is granted only to veterinarians who pass a state's licensing examination. Licensure of California veterinarians is administered by the Veterinary Medical Board of California (Board) under the auspices of the Department of Consumer Affairs. To acquire a California license, the Board requires that an applicant graduate from an AVMA-accredited veterinary college or school and pass three examinations – the North American Veterinary Licensing Examination (NAVLE), the California Veterinary State Board (CSB) and, if an applicant is a graduate of a school outside of California, he or she must pass the Veterinary Law Exam (VLE). A California veterinary license allows the holder to practice veterinary medicine on any species of animal, as long as that activity meets the community standard of care. Typically, the Board issues new licenses to approximately 600 veterinarians annually.

**VETERINARY MEDICAL EDUCATION IN CALIFORNIA**

As California's population continues to grow, the limited opportunities for a veterinary education have become increasingly competitive. There are two schools of veterinary medicine in California: UC Davis and the Western University of Health Sciences (WUHS), which admitted its first class

in Fall 2003. There are approximately 950 D.V.M. students enrolled in these programs.

In California, the UC Davis School of Veterinary Medicine and the WUHS College of Veterinary Medicine both receive nearly 900 applications to their D.V.M. programs each year. Davis enrolls 138 and Western enrolls 105 new first-year students, making admission to both schools very competitive.

**UC Davis** Under the California Master Plan for Higher Education, the University of California is delegated exclusive responsibility in public higher education for the training of Doctors of Veterinary Medicine in California. UC Davis is home to the only School of Veterinary Medicine (SVM) in the UC system. Established in 1948, the UC Davis SVM is recognized around the world for its training and research programs in animal health, comparative medicine and veterinary science. Ranked first in the world, the SVM plays a central role in meeting California's veterinary workforce needs, with an estimated 70 percent of its graduates electing to practice or continue their education in the state. The professional curriculum offered by the UC Davis SVM is a rigorous and intensive four-year program of study that prepares the student to pursue diverse career opportunities in veterinary medicine.

**Western University of Health Sciences** The College of Veterinary Medicine at Western University of Health Sciences (WUHS) was established in 1998. At that time,

**FIGURE 5:** Enrollment by degree for California schools

Schools	Total Enrollment by Degree Program 2014-15				
	D.V.M.	M.S.	Ph.D.	Master of Preventive Vet. Med.	M.P.H.
UC Davis	546	28	137	20	0
Western University of Health Sciences	423	0	0	0	20

it was the first new U.S. college of veterinary medicine established in more than twenty years. On March 3, 2010, the AVMA granted the college full accreditation.

WUHS' four-year D.V.M. curriculum uses a problem-based learning (PBL) approach where the educational program includes wellness care and primary and tertiary care, as well as client communication, collegial exchange and business training. Working in small groups, students use case studies to learn basic science and clinical concepts.

In the first two years, students focus primarily on the basic sciences and their application to the clinical sciences. They spend most of their time on campus working closely with faculty and peers. In year three, students begin to apply what they have learned in years one and two in various clinical environments under the supervision of WUHS faculty and clinical preceptors. The fourth and final year is taught using a distributed clinical program where students spend all of their time in off-campus clinical environments mostly of their own choosing that best meet their unique learning needs and goals.

In the clinical years learners continue to apply the principles of PBL to clinical cases seen at rotations that include private, public and non-profit institutions and practice settings. Faculty guide and mentor learners throughout the four-year curriculum using technology that allows students to rotate in clinical settings around the world, depending on their unique learning needs and career goals.

### UC Davis Curriculum

Beginning with the class of 2015, the SVM implemented a new curriculum on the semester system, aligning UC Davis with most other North American veterinary schools. The curriculum is comparative across species, integrates material vertically and horizontally, is centered on body systems rather than disciplines and is taught using problems, cases, lectures, small group discussions and laboratories. Students learn normal and abnormal together so that learning takes place in the context of how students will use the material. The curriculum is learner-centered rather than teacher-centered and designed with less contact time in the classroom to allow students to work in small groups researching information and problem solving. Starting

in the first year, students spend one day every three weeks working with senior students in the Veterinary Medical Teaching Hospital (VMTH), so they can put into practice what they are learning in the classroom.

### Framework

The first two years of the curriculum are core for all students and feature a comparative approach. The first year starts with a prologue block where students will be introduced to what it means to be a veterinarian. They participate in exercises that emphasize team building, leadership and communication skills as well as ethics and professionalism. The next block provides foundational material common to years one and two. Blocks for each body system follow for the next two years – anatomy, physiology, pharmacology, pathology, clinical pathology and imaging – integrating normal and abnormal form and function. The second year finishes with blocks covering oncology, immunology and infectious disease and population health, and clinical foundations as an introduction to the third year.

For the third and fourth years, all students take a comparative track and select one of two tracks: small animal or large animal. Within the large animal stream, all students initially study core material but will select an emphasis in equine, livestock or zoologic for the remainder of the stream. Students electing to study two streams, such as small animal and large animal (core), accomplish this by doing one stream in the third year and the other in the fourth year. Having completed these streams, students then move into the clinical portion of their training undertaken mostly in the VMTH but with opportunities for externships.

### Outcomes

The new curriculum is outcome-based in that it emphasizes and tracks what a Doctor of Veterinary Medicine from UC Davis needs to know and do at graduation. The curriculum was designed taking into consideration D.V.M. learning outcomes and core competencies established by the faculty with input from stakeholders. These learning outcomes and competencies guide the curriculum content and ensure that each student masters the core material irrespective of species emphasis. The clinical competencies have been designed specific to career areas of emphasis.



**CALIFORNIA HAS  
TWO SCHOOLS  
OF VETERINARY  
MEDICINE:**

UC Davis and the  
Western University  
of Health Sciences.  
The UC Davis School  
of Veterinary Medicine  
is ranked No. 1 in the  
nation and in the world.



### UC Davis Enrollment Capacity

In September 1998, the SVM received a permanent annual budget augmentation of \$2.5 million, beginning in fiscal year 1998-1999, which was used to fund a modest level of enrollment expansion. This augmentation was used to support an increase in the enrollment of both D.V.M. students and residents. It also was used to fund administrative and technical needs to establish a veterinary presence in southern California through the establishment of the UC Veterinary Medical Center – San Diego in 1999. The center includes both a clinical program in Sorrento Valley, a comparative medicine research program at UC San Diego in concert with the UC San Diego School of Medicine and a resident training program with the Zoological Society of San Diego (Zoo, Wild Animal Park and Sea World).

Given its current size and capacity, the expansion of new veterinary schools across the U.S. and abroad and recent evidence that the supply of veterinarians in the workforce appears to be aligned with the demand for services, the SVM at UC Davis does not have plans to expand enrollment at this time.

### STRENGTHS OF THE UC DAVIS SCHOOL OF VETERINARY MEDICINE

The UC Davis School of Veterinary Medicine has influenced the transformation of veterinary medicine from a primarily livestock-oriented health profession to one that encompasses stewardship of all animal species. This has been accomplished in large part through the vision, leadership and collegiality of the school's faculty. Together they continue to improve the health of animals, people and the environment – through excellent teaching, groundbreaking research, implementing One Health projects and developing innovative clinical treatments.

For almost 70 years, the school has encouraged growth and exploration of new areas, capitalizing on individual and collective faculty interests to develop pragmatic solutions for critical problems facing animal and human health and welfare. A strong leader in veterinary medical education, UC Davis ranks first in the nation by the 2015 U.S. News

and World Report. More than 170 graduate students pursue advanced science training at the school, which has the largest residency program of any veterinary school in the country. Through an extensive teaching hospital in Davis and satellite clinics in Tulare and San Diego, the school provides services throughout the state to more than 50,000 animal patients annually in 34 specialties.

Research is critical for the development of new knowledge, and UC Davis' faculty set the trend in veterinary medicine by generating new information and technology for the profession as part of its \$74 million research program – 30 percent of which is funded by the National Institutes of Health. Practitioners and public health professionals rely on this new information and its application directly to improve animal health and protect human health. The school's animal, human and environmental programs span the state; serve as an essential component of California's health workforce; and share knowledge with communities worldwide. The following are major areas where the school continues to make a significant impact.

**Animal Health and Care** As the primary animal health resource for the state of California, the school's responsibilities to protect animal health and improve animal care are paramount. Animals are woven into the fabric of people's lives as pets, food, economic livelihood, recreation and wildlife appreciation. The role of pets, including the human-animal bond, has dramatically increased. In the U.S., 65 percent of households have pets and 63 percent of pet owners consider their pets important family members. The public demand for readily accessible, high quality veterinary care increases each year.

**Food Safety and Public Health** Food-borne illnesses affect 1.5 billion people annually and cause over 2 million deaths worldwide. Veterinary medicine is the only profession that spans the food chain from farm-to-fork and links agriculture and human health. The SVM is the main source of information and health services for animals in production units, the inspectors in processing plants and the public health officials for inspection of food preparation operations in California. In the event of a food-borne disease outbreak, veterinarians are critical to tracing the source and working with state and federal officials to control or contain it. Veterinarians in the field and in

the school's research laboratory are the state's experts in protecting the safety of food products.

**Environmental Health** All humans and animals depend upon a healthy environment. Humans must serve as stewards of the environment as humans have had the greatest impact on changing the delicate balance of our ecosystems. Veterinarians and UC Davis faculty bridge the human, animal and environmental arenas. They understand the impacts of encroaching human populations on wildlife, the transmission of current and emerging diseases from animals to humans, the contamination of human and animal waste on land and water resources, the impact of chemicals used for agricultural pest control and the effect of diminishing air quality from emissions associated from livestock production units and vehicles. Human medical personnel, wildlife conservationists and stewards of public lands require veterinary expertise to provide the comprehensive health assessment, solutions and future management strategies to preserve environmental health.

**Future Veterinary and Human Health Research** Research on animal and human health issues provides an important pathway to improved health, including new treatments, new pharmaceutical options, new nutritional regimens, new surgical techniques, etc. Although research endeavors benefit both animals and humans, veterinary research is dependent upon the advanced training of veterinarians in research principles. UC is dedicated to the advancement of research and graduate student education. The UC Davis School of Veterinary Medicine has the largest graduate academic program among all of the veterinary schools and colleges nationwide and consistently ranks at the top of U.S. veterinary schools training future faculty. To meet this academic demand, efforts are needed to increase the number of veterinary graduate academic students in the educational pipeline.

**Global Health** The UC Davis School of Veterinary Medicine is active all over the world, working at the interface of animals, people and the environment to solve complex problems that impact health and conservation. Program examples include:

- One Health Institute – the institute's PREDICT program, working in 30 countries, is building global

surveillance to detect and prevent spillover of pathogens of pandemic potential that can move between wildlife and people.

- California Animal Health and Food Safety Laboratory System – providing diagnostic support to safeguard livestock/poultry health and public health; connected nationally and internationally; part of National Animal Health Laboratory Network, designed to meld federal and state resources for rapid response to foreign animal disease; part of Food Emergency Response Network prepared to respond to terrorist events should the nation's food supply be threatened with radiation, infectious agents and/or chemicals; CDC's Laboratory Response Network to respond to threat agents.
- Western Institute for Food Safety and Security – serving as a collaborative institute for identifying the causes of foodborne disease and working to prevent future outbreaks by reducing the risk factors leading to contamination of raw agricultural products and reducing the pathogens associated with animal products. Information exchange and training programs occurs with Nanjing Agricultural University in China.
- HALI Project – Health for Animals and Livelihood Improvement in Tanzania – providing collaborative research and capacity-building activities for assessing the effects of zoonotic disease and water management on health and livelihoods in the Ruaha ecosystem of Tanzania.
- Oiled Wildlife Care Network – serving as the recognized international leader in oil spill response, rescue, rehabilitation and research.
- Gorilla Doctors – providing hands-on medical care to sick and injured mountain gorillas living in the national parks of Rwanda, Uganda and the Democratic Republic of Congo.
- Wildlife Health Center's Latin American Program – addressing a variety of issues in South America, including the population health of the southern right whale and the effects of lead ammunition on waterfowl.
- Center for Continuing Professional Education – providing continuing veterinary education including

international educational efforts in China and Costa Rica. Future plans include new programs in Italy and in Germany.

- Center for Companion Animal Health – hosting Israel faculty/student exchange with Koret School of Veterinary Medicine.

### CHALLENGES FOR THE UC DAVIS SCHOOL OF VETERINARY MEDICINE

**Veterinary Educational Costs and Student Debt** As state support for higher education has steadily declined, tuition increases have resulted in rapid increases in student debt for D.V.M. students. In 2011, new D.V.M.s graduated with an average debt load of \$142,613. However, this amount is substantively greater for those graduating from offshore schools in the Caribbean and abroad.

Although the cost of education has skyrocketed, salaries for veterinarians remain low. The average starting salary for a veterinarian in the U.S. was approximately, \$65,404 per year in 2012, which is far lower than other health professions that require the same level of education and training (Figure 7). The additional years of training do not provide an adequate “rate of return” for the educational investment made. This imbalance is unsustainable and also deters graduates from pursuing advanced training (e.g., Ph.D. programs that would prepare them for careers in academia or public practice).

The erosion of state support has had the same impact at UC Davis. Although, the School of Veterinary Medicine has enhanced their endowment to raise additional funds for scholarships, which covers, on average, 40 percent of the cost of attendance for students, the average debt of \$131,000 in 2013 was still higher than the average starting salary of \$68,000 for their graduates.

If the cost of education continues to outpace salaries, the profession could be at risk for providing access only to those who have the financial resources to pay the tuition; limiting the ability of graduates to purchase practices; producing alumni who are incapable of financially supporting the schools; and making it impossible for veterinarians to repay their debt.

**Demand for Specialty Services is Increasing** UC Davis is the largest producer of specialists in the country – training 102 residents each year. The residency program spans 34 different specialties and includes resident positions at the Veterinary Medical Teaching and Research Center in Tulare and at the UC Veterinary Medical Center at San Diego. Nationally, there are only approximately 400 resident positions, one-third of which graduate each year, to meet the increasing demand for veterinary specialists. Although the number of resident positions has nearly doubled in the last ten years, specialists still represent a small fraction of the profession. In California, only 15 percent of veterinarians are trained as specialists as compared to 12 percent nationally.

**FIGURE 6:** Tuition and fees as reported in the AAVMC's annual Comparative Data Report for 2014-15. Note: Ross and St. George's University are located in the Caribbean but are included given their high enrollment of California and U.S. students.

Veterinary Schools	Annual Tuition & Fees		Est. Total Tuition & Fees Over All Years — Class of 2015		Other Annual Related Educational Costs	
	RESIDENT	NON-RESIDENT	RESIDENT	NON-RESIDENT	RESIDENT	NON-RESIDENT
UC Davis	\$30,813	\$43,058	\$131,673	\$180,653	\$25,559	\$25,559
Western University	\$49,635	\$49,635	\$186,225	\$186,225	\$27,594	\$27,594
Ross University	\$35,498	\$35,498	\$190,933	\$190,933	\$12,702	\$12,702
St. George's University	\$36,440	\$36,440	\$150,582	\$150,582	\$26,000	\$26,000
U.S. Average	\$26,934	\$46,744	\$102,490	\$178,289	\$29,142	\$30,398



Although the demand for specialists is growing, schools lack adequate resources and infrastructure to build and maintain these programs. From this pool, industry and biotech enterprises draw experts and the public draws veterinary specialists. New investments and partnerships with private industry and government will thus be necessary for meeting the workforce needs of these sectors.

**Recruitment of Faculty and Researchers is Difficult**

The veterinary profession is growing into new areas and disciplines at the same time that a significant proportion of the veterinary faculty nationwide is expected to retire (i.e., within the next 10 years). Of the nearly 6,400 veterinarians employed by colleges and universities, 4,000 faculty are responsible for preparing the U.S. veterinary workforce, conducting cutting-edge research and teaching post-graduate students and residents. Declining state support and federal funding for research have kept faculty salaries very low, caused reductions in hiring, and resulted in the elimination of programs. By 2016, approximately 10.5 percent of faculty positions will be vacant nationally. Trends suggest that the academic community will not meet its own needs, let alone those of state labs, federal research and regulatory agencies or the pharmaceutical and biotech industries.

Of the approximately 100,000 veterinary professionals in the United States, fewer than 10 percent have received advanced training in disciplinary fields such as nutrition,

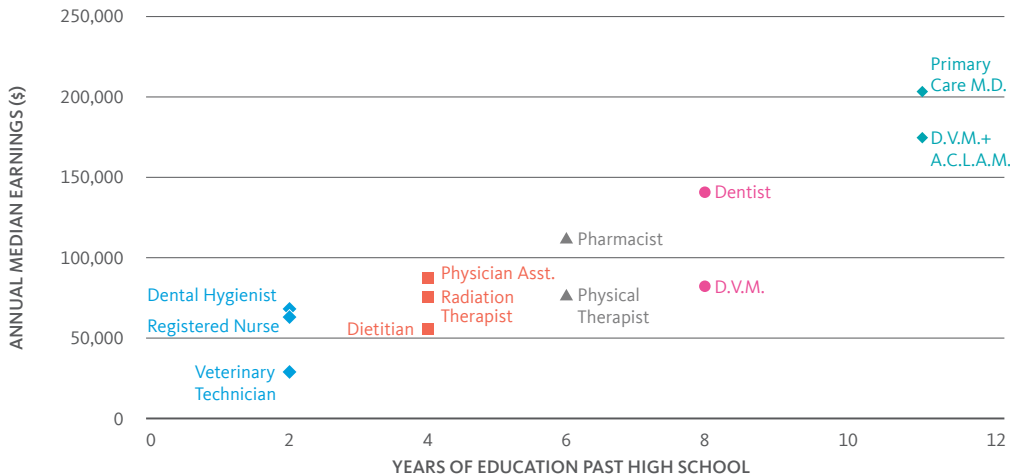
toxicology, epidemiology, microbiology, parasitology, comparative pathology and laboratory animal medicine. Among members of the AVMA, 15 percent have acquired a graduate degree in addition to their D.V.M. degree, but fewer than 5 percent have completed a Ph.D.

Although UC Davis has the largest faculty of any U.S. veterinary school, the challenges noted above hamper their ability to meet the demand for new faculty and researchers in the areas of public health, environmental health, food safety, genomics, epidemiology, bioinformatics and many of the clinical and basic sciences. For the school to continue to successfully compete for new faculty and to maintain its leadership position within the profession, more funding for graduate academic training positions for veterinarians is needed.

**Student and Faculty Diversity is Inadequate**

The veterinary profession as a whole lacks the diversity desired to reflect the ethnic and cultural groups of California's population. While efforts are being made to address this issue, progress has been slow. The AAVMC reported that in 2012-13, approximately 82 percent of students enrolled in U.S. veterinary colleges were white; 4 percent were Asian; 4 percent Latino; and 2 percent were African American. Nevertheless, California's two schools were among the most diverse in the country. In 2014-15, 36.2 percent of the D.V.M. students at Western University of Health Sciences and 29.5 percent of those at UC Davis were racially and ethnically underrepresented

**FIGURE 7:** Median career earnings in the health professions according to the Bureau of Labor Statistics 2011. Note: ACLAM refers to a Diplomate, American College of Laboratory Animal Medicine (Graphic used with permission from the NAS).



students (compared to the 14.6 percent U.S. total and 12.8 percent U.S. median). Only Tuskegee University's School of Veterinary Medicine had a higher percentage of underrepresented students enrolled in their student body (77.1 percent).

Greater diversity has been accomplished through the continued recruitment and encouragement of students from all ethnic and cultural backgrounds. For example, UC Davis students and faculty are leading efforts to promote diversity within their student population by targeting their outreach efforts to diverse populations and developing pipeline programs to increase the number of underrepresented students and fostering a supportive and inclusive learning environment. The School of Veterinary Medicine also collaborates with other health professional schools on campus to increase high school and undergraduate student interest in science, math and health careers. The recruitment and retention of a diverse student body also is cited as one of the major priorities of the WUHS. While the majority of first-year veterinary students across the country are now women, more ethnic and cultural diversity among students is still needed. One impediment to this goal is the lack of role models in veterinary practice and among the faculty to encourage students to pursue veterinary medicine as a career.

A woman with long brown hair, wearing a white cardigan over a dark top, is smiling and petting a light brown dog. The dog is lying down, and the woman's hand is visible on its side. The background is a blurred park scene with trees and other people. The text "THE ONE HEALTH MOVEMENT IS GAINING MOMENTUM" is overlaid in blue capital letters on a white background.

**THE ONE HEALTH  
MOVEMENT  
IS GAINING  
MOMENTUM**





## IV. SUMMARY OF FINDINGS

1. **Nationally there is little evidence of veterinary workforce shortages in most fields, but there may be unmet demand for veterinary services in certain sectors and regions in California as a result of maldistribution.** Projections from 2005 suggested workforce shortages in veterinary medicine. But since then, a national assessment of the veterinary workforce prepared by the National Academy of Sciences indicates that there is little evidence of shortages in most practice types. Factors that have contributed to the increased supply of the nation's veterinarians include changes in workforce participation, the economy, changing demographics and accreditation of more schools of veterinary medicine globally. However, there are still unmet needs for veterinarians in certain sectors, such as public practice, academia and industry.
2. **Veterinary educational costs and student debt have rapidly increased, yet salaries for veterinarians remain relatively low.** The number of veterinarians, average salaries and educational cost are important factors in understanding workforce changes and their impact on meeting workforce needs. As salaries remain significantly lower than other health professions requiring the same level of education, the willingness of students to pay for a veterinary education could decline, thus causing a decrease in the supply of high quality D.V.M. graduates. The "return on investment" for the D.V.M. degree is diminishing and the high cost is at a crisis point for the profession.
3. **The One Health movement is gaining momentum, with increasing needs in public sector practice.** While the term One Health may be familiar to many veterinarians, it has only recently emerged in the public's consciousness – gaining momentum in the past decade. The concept behind One Health, however, has long been recognized nationally and globally. The One Health concept is broad in that it "unites veterinarians, physicians and other scientific health and environmental professionals in a collaborative approach that recognizes the vast interrelationships between human, animal and environmental health." One Health reflects the understanding that humans are part of a larger ecosystem, and disease problems can more effectively be addressed through improved communication and collaboration across disciplines and organizations. Veterinarians are increasingly needed to help deal with zoonotic pathogens significant to the public's health, as well as disease threats to wildlife and domestic animals.
4. **Opportunities to obtain a veterinary education in California are severely limited. Many California residents attend veterinary schools out of state, or outside of the U.S.** Under the state's Master Plan for Higher Education, the University of California is delegated exclusive responsibility in public higher education for training Doctors of Veterinary Medicine in California. The UC Davis School of Veterinary Medicine is ranked first in the world and in the nation and recognized as the nation's premier clinical, research and training programs in veterinary science. However, opportunities for a veterinary education in California, even with the addition of the College of Veterinary Medicine at Western University of Health Sciences in 2003, are among the lowest in the nation. Of the new veterinary licensees in California each year, roughly 40 percent come from other states.
5. **Recruitment of faculty is increasingly difficult.** Within academic veterinary medicine, the demand for veterinarians with advanced training for educational and research purposes is far outpacing the supply. The NAS study projects that nearly 600 faculty positions will be vacant by 2016 (new positions and replacements for retirees). However, there is little evidence that institutions will be able to meet their own needs by training and recruiting sufficient numbers of graduates with advanced training, particularly those with Ph.D.s who are willing to join the academy given competing private sector employment opportunities. The continuous erosion of state and federal funding for education and research will jeopardize the profession's capacity to educate future veterinarians and to serve societal needs for addressing foodborne illnesses and emerging diseases that affect agricultural production, human health and animal welfare.

6. **An increasing number of veterinarians are pursuing specialty training.** More than 11,000 veterinarians have been awarded diplomate status in the U.S., or 12 percent of the profession. In 2010, about half of veterinary graduates pursued advanced study (including internships) in some specialty. By comparison, in 1980, an estimated 5 percent of all new graduates completed internships. Explanations for this recent trend include increased demand for specialization (e.g., pets are living longer, and may have more complex health needs), higher earning potential of specialists coupled with graduates with higher debt burdens, and intellectual interest in the specialty fields.
7. **The veterinary workforce, students and faculty do not reflect the ethnic diversity of California.** The need for increased diversity in the veterinary workforce continues to grow as the state's population becomes increasingly diverse. Greater diversity is critical not only from the perspective of educational opportunity but also relative to food safety and public health. The prevalence of food-borne illnesses associated with culturally prepared foods and practices is growing, making cultural competence among veterinary professionals and faculty a necessity. In addition, the changing economic status of diverse populations impacts the need for a diverse veterinary workforce as the population of pet owners is becoming more ethnically diverse in California.



## V. RECOMMENDATIONS

1. **Work with educational leaders, associations and public and private industry to develop a national strategy to address the impact of rising student debt on career choice and future workforce needs.**

The mean cost of veterinary education in the U.S. has increased by nearly 250 percent over the last 15 years and is expected to outpace compensation. These trends could result in a decrease in demand for a veterinary education all while demographic changes such as increases in the size, age and diversity of the population suggest continuous growth in the number of pet owners. The impact of rising debt is especially damaging to efforts to recruit more underrepresented students into veterinary medicine, research and academia. Innovative, cross-disciplinary strategies should be developed to decrease the cost of educating veterinarians. Best practices for helping students become economically successful after graduating should be shared often with prospective and current veterinary students as well as new graduates (e.g., debt management education, financial literacy education, financial aid counseling). Schools should enhance their fundraising capacity for securing additional funding for scholarships and advocate for inclusion in loan forgiveness programs available for other health professions.

2. **Expand the graduate academic education program, contingent on resource availability and partnerships with industry and the biomedical research sector, in recognition of the more than 300 zoonotic diseases and new emerging diseases that threaten animal and human health.** Veterinarians trained in research practices and involved in research investigations are vital to the identification and control of these diseases. Collaborations with medical and public health personnel are often not publicly recognized

but are key to the future health and well-being of populations in the face of disease outbreaks. Training these individuals for public service careers should be a priority for the University of California. The UC Davis School of Veterinary Medicine could examine opportunities for development of new joint training programs and/or expanding research training with the UC San Diego's School of Medicine and School of Pharmacy's training program. New and innovative partnerships between academe and industrial employers of veterinarians would expose students to corporate practice and potentially result in cost-sharing for the education of veterinarians with advanced research training. Additional UC postgraduate training opportunities would increase access to advanced training for UC Davis School of Veterinary Medicine graduates, and individuals with this training would help expand the recruitment pools to fill the faculty ranks of the future and the anticipated vacancies due to impending retirements.

3. **Develop and implement strategies to improve the recruitment and retention of faculty.** The education of future veterinarians is essential for meeting state needs. Recruitment strategies to inspire veterinary medical students to pursue post-graduate studies and to build the faculty pipeline are critical to the quality and viability of the profession (e.g., post-doctoral research fellowships, formal mentorship programs, development of more D.V.M./Ph.D. programs). Professional development strategies to recruit and retain outstanding faculty (e.g., National Institutes of Health's T35 program), adopting incentives to recruit junior faculty and identifying opportunities for collaboration and resource sharing among training programs, across disciplines and public and non-profit institutions should be considered.

4. **Increase the diversity and cultural competence of the faculty and students.** Although there has been steady progress achieved with regard to student diversity, veterinary students and faculty do not reflect the overall diversity of the state. Continuous review of best practices in outreach, targeted recruitment, education and faculty retention is needed. Examples of model programs that could be adapted to diversify veterinary schools include the Latino Center for Medical Education and Research's Doctors Academy in Fresno, UC Programs in Medical Education (PRIME), UC Diversity Pipeline Initiative and the President's Postdoctoral Fellowship Program. Increasing public awareness of the potential benefits of animal ownership and the use of veterinary services in general among culturally diverse groups, and promoting efforts to develop skills relevant to multiculturalism and cultural competence should be prioritized.
5. **Contribute to increasing the number of veterinarians practicing in sectors with workforce shortages (e.g., research and public practice).** Given unmet needs for veterinarians in specific sectors of practice, targeted outreach and recruitment of students with an interest in jobs that align with meeting societal needs will be an important strategy. Schools of veterinary medicine nationwide also should continue to pursue public-private partnerships and develop new education, training and innovative business models to increase the pipeline to research and public sector jobs.
6. **Expand capacity to promote the One Health concept to address complex, global health problems.** One Health is not new, but is gaining momentum worldwide for its importance and relevance for society. It is vital to expand interdisciplinary collaborations and communications as the health of humans is intricately connected to the health of animals and the environment in which they all live. UC should invest in fostering more collaboration across its ten-campus system, especially within its health sciences programs, and other disciplines such as agricultural and environmental sciences, social sciences and engineering. Increased awareness by the public and in the broader UC community of the current contributions of UC Davis School of Veterinary Medicine faculty and trainees to global health, public health, biomedical research and environmental/agricultural sciences is essential. UC Davis' One Health Institute is at the forefront, doing work that is global in nature, comprehensive, holistic, collaborative and transdisciplinary. UC should continue its work with other veterinary schools and organizations, and across professions to define competencies that can be integrated within curricula and research that addresses food and water safety and security. A new cadre of leaders trained in the One Health approach will be critical in the 21st century to advance the health of animals, people and the environment.

## VI. ACKNOWLEDGMENTS

The University of California Office of the President's Division of UC Health regularly convenes meetings and discussions with the leadership of the UC health professions community, including the deans and faculty of UC's 17 health professional schools. In view of recent trends in health professions education and in light of increasing demands for health services as a result of health reform, UC Health took a closer look at recent changes that are relevant for many of California's health professions programs. A previous UC report entitled "A New Era of Growth: A Closer Look at Recent Trends in Health Professions Education" was issued in May 2013. This report builds on that work with a focus on trends relevant for California's veterinary medical education programs and practice in this state, and follows a February 2014 report pertaining to the pharmacy profession.

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A close-up, low-angle shot of a person's legs and feet. They are wearing light-colored khaki pants and dark brown, worn-in leather boots. They are standing on a dry, dusty, brown dirt surface. To the right, the lower leg and hoof of a white horse are visible. The text is overlaid in the center-left of the image.

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