Demand for and Supply of Veterinarians in the U.S. to 2032

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Abstract

Previous studies have offered conflicting results regarding the ability of veterinary medical colleges to meet the demand for veterinarians in coming years. This is a critical question because it impacts the need for the expansion of veterinary program capacity. An inadequate supply of veterinarians endangers the long-term wellbeing of patients, while an excess supply increases veterinarian unemployment and wastes the resources expended on program expansion. Lloyd (2023) found a significant shortfall of companion animal veterinarians by 2030. In a critique of Lloyd (2023), the American Veterinary Medical Association (AVMA, 2023) projected a larger supply of veterinarians and a smaller need, leading to declining veterinarian revenues and salaries. Both studies employed incomplete proxies for demand. It is also important to consider the market for veterinarians outside of companion animal care.

U.S. veterinary medical colleges constitute the primary source of supply of veterinarians along with a smaller number supplied by foreign programs. Consequently, both Lloyd (2023) and the AVMA (2023) focused on projecting the total number of graduates. This study uses a recent projection of graduates developed by the American Association of Veterinary Medical Colleges (AAVMC).

Two demographic shifts may decrease the average working hours of veterinarians, thereby decreasing the effective supply. The profession is undergoing a shift toward an increasing number of female veterinarians, and retiring Baby Boomers are gradually being replaced by members of the Millennial generation and Generation Z. Female veterinarians average 4.6% fewer hours than men, partly because a greater share of women work parttime. The implications of the generation shift are less clear, but at least some Millennials place a high value on work-life balance and may thus prefer to work fewer hours than the Baby Boomers whom they are replacing. Generation Z members are the first digital natives, which could make them well-equipped to accommodate the increasing use of technology in veterinary medicine.

Substantial evidence exists that burnout is a serious problem among veterinarians. Recent studies have found that more than 40% of veterinarians were considering leaving the profession prior to retirement. Burnout decreases the effective supply of veterinarians as practicing professionals leave the profession through early retirement or moving to another career.

Rather than the previous studies' demand estimation approaches based on demand drivers, this study uses an approach beginning with the broad economy and based on 10-year projections of occupational growth and turnover from the U.S. Bureau of Labor Statistics. The results are that the projected total growth and turnover need through 2032 is 70,092 new veterinarians. The 52,926 projected veterinary graduates will meet only about 76% of that need. This shortfall will not be evenly distributed geographically; it may be impacted by personal preferences and the need to satisfy college debt.

The supply shortfall can be addressed by reducing veterinarian turnover, improving efficiency, and increasing the supply of graduates. Recommendations include prioritizing veterinarian mental health to combat burnout, expanding the use of technology to improve efficiency, and increased utilization of veterinary technicians and nurses. There is a likely need for veterinary program expansion as well. Our projections imply a need for at least 1,600 new seats by the early 2030s, including the currently planned expansions that will provide new seats in coming years. However, the difference between projected and actual veterinarian employment in recent years implies that the profession will need to monitor growth and turnover needs in coming years as the demand for veterinarians evolves.

Introduction

This study was commissioned by the American Association of Veterinary Medical Colleges (AAVMC) to contribute an answer to an important question: Will the supply of veterinarians over the next decade be sufficient to meet the demand? If the supply of veterinarians is insufficient, pet owners will be unable to access timely, economical care for their companion animals, especially in more remote areas. Farmers will be unable to receive care for their livestock, with risks to the nation's food supply. Conversely, an oversupply of veterinarians will lead to declining revenues and salaries for these professionals, along with excess, unfunded capacity in the nation's 33 current and the additional planned veterinary medical colleges.

This paper begins with an overview of three previous studies addressing this question, and then presents an analysis of those studies. Following this is an analysis of the demand for veterinarians through 2032 and the supply available to meet that demand. A discussion of ways to increase the supply of veterinarians and more effectively meet demand growth, along with other recommendations for the veterinary profession, concludes the paper.

Previous Analyses

Three studies have offered conflicting answers to the question of supply of and demand for veterinarians, but only in the companion animal segment. Lloyd (2021) projected a shortage of 15,000 companion animal veterinarians by 2030. Based on a 2018 American Veterinary Medical Association (AVMA) study, around 4,000 veterinarians graduated annually from United States and international colleges of veterinary medicine and entered the U.S. workforce; 59.8% of these entered companion animal practice. This implied that about 2,400 new companion animal veterinarians would be added to the labor force each year through 2030. With three new veterinary medicine schools scheduled to open and some existing programs scheduled to expand, Lloyd (2021) calculated a total inflow of 26,000 companion animal veterinarians from 2021 to 2030. Given projections of industry growth, the fact that 39% of veterinarians were older than 55 and likely to retire by 2030, and that veterinarians currently practicing reported substantial burnout and wanted to reduce their hours, Lloyd (2021) estimated a need for nearly 41,000 additional companion animal veterinarians and consequently a shortage of 15,000 (16%) companion animal veterinarians by 2030.

In a follow-up study, Lloyd (2023) incorporated into his projections the finding of Zhang, House, and Salois (2023) that mean expenditures per household on veterinary services increased at a compound annual rate of 2.95% between 1980 and 2021. Using new estimates of workforce entry, again including program expansions, Lloyd (2023) projected slightly more than 29,000 new graduates and 1,700 veterinarians trained outside the U.S. entering the field by 2030. This coupled with retirements, death, and disability led to a projected shortfall of 14,000 to 24,000 companion animal veterinarians by 2030. Attrition from the field driven by pre-retirement burnout is a significant factor as well and is discussed in detail later in this article. Burnout impacts were not included by Lloyd (2023), implying that the shortfall could be greater than his estimates suggest.[1]

[1] The idea of inequality between demand and supply over a period of years is contrary to the principle from economics that markets clear to reach equilibrium. Rather than considering the finding of a shortfall as a disequilibrium, it should be looked upon as an insufficient number of veterinarians to maintain service levels and patient health.

In contrast, a brief report from the AVMA (2023) argued that Lloyd (2021 and 2023) "may substantially underestimate the supply of veterinarians and overestimate the demand for veterinary services and risks steering the profession in an unsustainable direction." Three new veterinary programs have opened and will shortly graduate their first class. Further, the report pointed to 12 additional schools in various stages of development. AVMA (2023) also found fault with the Lloyd (2023) assumption of 3% to 4% compound annual growth in the market, arguing that a more accurate proxy for the demand for veterinary services is the 2% compound annual growth of the pet population. Finally, while the AVMA agreed that their own surveys found a desire by veterinarians to work fewer hours, they have actually worked more hours recently. Veterinarians on average worked 44.3 hours in 2022 versus 41.9 hours in 2019. Median working hours were consistently around 40 hours until 2020 but increased to 45 hours through 2022. The report also hypothesized that greater efficiencies and the shift to service provision by non-veterinarian staff will also reduce the demand for veterinarians. As a result, the AVMA (2023) forecast a surplus of 8,200 companion animal veterinarians by 2030.

Analysis of the Previous Studies

Lloyd's (2021, 2023) reliance on household expenditures for veterinary services as a proxy for demand for veterinarians is a limitation in his analysis. Expenditures in the veterinary services industry includes not only the services of the veterinarian but also the services of veterinary technicians and the clerical staff supporting the practice. As a result, if veterinary technicians undertake some of the work previously performed by veterinarians, the increase in expenditures would be reflected in veterinary services but would not imply a commensurate increase in demand for veterinarians. Other changes in the market, including the growth of higher cost specialized veterinary services and nonprofit animal clinics, which may create higher demand for veterinarians and their services, are other factors making the projected growth in expenditures for veterinary services an inadequate proxy for veterinarian demand. The AVMA (2023) study also cited this problem in the context of contributions to revenue. If one veterinary visit earns $100 in revenue and involves one veterinarian, it does not follow that a $500 visit necessarily requires five veterinarians.

However, the same criticism of an imperfect proxy for veterinarian demand applies to the AVMA's (2023) reliance on the growth of the pet population – like Lloyd (2021, 2023), this was a bottom-up approach in which the pet population was seen as a driver of the demand for veterinarians. Lloyd (2021) cited AVMA estimates that one in six dogs and almost half of cats are never seen by a veterinarian. If marketing and access efforts to reach some of these companion animals were successful, the 2% growth rate of the pet population would understate the need for veterinarians to serve the additional patients. Estimation based on growth in the pet population also fails to reflect shifts in care from veterinarians to veterinary nurses and technicians – a trend analogous to that occurring in human healthcare.

Both Lloyd (2021, 2023) and the AVMA (2023) have a stated focus on veterinarians engaged in companion animal care. As is shown below, this sector employs around three-quarters of veterinarians in either companion animal or mixed practices. However, many of the remaining veterinarians work outside of the veterinary services industry. Veterinary medical programs must prepare their graduates for all of the opportunities open to them.

Despite these limitations, Lloyd (2021) made valid arguments regarding a future shortage: in 2019 there were already 2,000 more veterinarian jobs than the number of veterinarians available to fill them. Further, the mismatch between the desire of veterinarians to work fewer hours and the AVMA's (2023)

observation that veterinarians have recently been working more hours does not negate the importance of burnout and its eventual impact on the field. First, note that the increase in hours occurred during the pandemic, when all labor markets experienced substantial distortion. This increase in hours is thus likely unsustainable and may have been the very thing driving the feelings of burnout. This is a phenomenon with far-reaching consequences that are discussed in more detail below.

Supply of Veterinarians

The key question of this study is whether the supply of veterinarians in coming years will be sufficient to meet the demand. The vast majority of veterinarians entering the field emerge from U.S. veterinary colleges, with a smaller number graduating from foreign programs. That should thus be the focus of estimating the supply, as it was in the previous studies. These studies differ in their assumptions regarding the growth of seats through 2030. Both studies, however, consider only veterinarians entering companion animal practice. As argued above, a focus on the entire market for veterinarians is necessary to assess the supply shortfall or surplus, so the total graduate count should be included.

The AVMA's (2023) projected supply of veterinarians was substantially higher than that of Lloyd (2023). The justification of these higher projections is brief, but it included 2.7% historic year-over-year growth applied to graduate estimates beginning in 2027, international students not considered by Lloyd (2023), 2% year-over-year growth applied to certificates of these graduates, 1% year-over-year growth of the companion animal market, and expansion of programs at Lincoln Memorial University and Louisiana State University beginning in 2027. The result is a projected supply of 39,854 new companion animal veterinarians versus 30,700 in Lloyd (2023).

One objection to the AVMA (2023) projection is that the growth components listed above are treated as additive. Specifically, the inclusion of both the 2.7% historical growth of program graduates and the expansion of the two university programs may have introduced double counting. The historical growth is likely to have included previous program expansions. Further, including the 1% growth in the companion animal segment in the projection includes a factor that is likely driving the growth in the number of graduates, again raising the possibility of double counting. Further, treating the growth in the pet population as a factor ignores the physical and operating constraints in veterinary programs, implicitly assuming that they can expand in lockstep with the demand for veterinary services. This assumes away the problem.

The AVMA (2023) analysis also cites expansion of existing programs and 12 new veterinary programs in development. Andrew Maccabe (personal communication, November 18, 2023), Chief Executive Officer of the AAVMC, provided additional details. The three new programs are at the University of Arizona, Long Island University and Texas Tech University. These programs are provisionally accredited and have enrolled students. Arizona graduated their first cohort in August 2023; Long Island University will graduate their first cohort in May 2024 and Texas Tech University will follow in 2025. Twelve additional schools have announced their intention to develop veterinary programs; of these, five have begun the pre-accreditation process, which includes a consultative site visit and a comprehensive site visit. After these steps, a developing school may receive a Letter of Reasonable Assurance (LRA), at which time they can admit students. The University of Ana G. Mendez in Puerto Rico received an LRA in January 2024 and is expected to admit a cohort in August 2024. Rowan University, the next school likely to receive an LRA, would not be able to admit a cohort before 2025; the remaining developing schools could be even later. As a result, the increases projected by the AVMA (2023) might be too high.

According to Maccabe (personal communication, November 18, 2023), it takes minimum of two to three years before a school can receive an LRA. There has never been a non-accredited program operating in the United States or Canada since the early 1900s. Further, any program attempting to operate without accreditation (even if it could attract students) would be ineligible for accreditation in the future.

The AAVMC has revised its supply projections to respond to the concerns raised by the AVMA, including foreign graduates, planned growth, and new programs. An additional consideration is the loss from students dropping out from veterinary medical programs. Maccabe (personal communication, December 7, 2023) pointed out that the seats vacated though student dropout remain with the cohort and represent a permanent loss from the program. The net attrition rate applying to first-year students has been a stable 2.6% for many years. The AAVMC estimates second-year attrition to be 1.3%, half of the first-year rate, and half of that rate, 0.6%, in the third year. There is assumed to be zero attrition among fourth-year students.

The AAVMC in April released updated projections of veterinary school graduates including new and expanded programs. Graduates from existing programs before attrition are expected to increase from 3,560 in 2023 to 4,256, including cohorts at the University of Arizona, Long Island University, Texas Tech University, and Lincoln Memorial University. U.S. graduates from international programs are projected to increase to 918 in 2025 and stabilize at 900 in the long term.

Expansions will lead to the following additional enrollment in existing programs and additional graduates three years later:

- 2024: Tufts University: 25.
- 2025: Oregon State University, 15, University of Illinois Urbana-Champaign: 10. University of Tennessee, 35. Louisiana State University, 70. North Carolina State University: 12, Colorado State University: 10. Total new seats: 152; total projected seats: 177.
- 2026: University of Arizona: 10. Colorado State University: 10. Total new seats: 20; total projected seats: 197.
- 2027: Colorado State University: 10. Total new seats: 10; total projected seats: 207.
- 2028: Colorado State University: 10. Total new seats: 10; total projected seats: 217.

The new programs and their projected enrollment are as follows:

- 2024: University of Ana G. Mendez, 60.
- 2025: Rowan University, 70. Utah State University, 80. Lincoln Memorial University–Orange Park, 100. Lyon College, 100. Ana G. Mendez, 10 additional. Total new seats: 360; total projected seats: 420.
- 2026: Clemson University, 80. Arkansas State University, 120. Rocky Vista University, 80. University of Maryland–Eastern Shore, 80. Chamberlain University, 80. Ana G. Mendez, 10 additional. Total new seats: 450; total projected seats: 870.
- 2027: Hanover University: 80. Midwestern University–Downers Grove: 100. Total new seats: 180; total projected seats: 1,050.
- 2030: Utah State University, 20 additional. Total projected seats: 1,070.

The AAVMC analysis is in Table 1. The graduates from new U.S. colleges are the above new seats lagged three years. The projections extend to 2035, but the demand projections continue only through 2032. Also included are the projections through 2030 to permit comparisons between these results and those

from Lloyd (2023) and the AVMA (2023). The result is 40,424 total graduates entering the labor force through 2030, a total of 52,926 through 2032, and 71,733 through 2035.

Table 1: Revised Projection of Veterinary Graduates, 2023-2035

Academic Year	Expected graduates from US colleges based on existing enrollments (before attrition)	Expected US graduates from international colleges based on existing enrollments (before attrition)	Additional expected graduates due to planned growth at US colleges (before attrition)	Additional expected graduates due to enrollment at new US colleges (before attrition)	Total expected graduates based on existing enrollment plus planned growth plus new US schools (before attrition)	Attrition rate	Total expected graduates based on existing class size plus planned growth plus new US schools, less attrition
2023	3,560	779			4,339	0.0%	**4,339**
2024	3,724	759			4,483	0.0%	**4,483**
2025	3,935	918			4,853	0.6%	**4,824**
2026	4,156	896			5,052	1.3%	**4,986**
2027	4,256	900			5,156	2.6%	**5,022**
2028	4,256	900	25	60	5,241	2.6%	**5,105**
2029	4,256	900	177	420	5,753	2.6%	**5,603**
2030	4,256	900	197	870	6,223	2.6%	**6,061**
2031	4,256	900	207	1,050	6,413	2.6%	**6,246**
2032	4,256	900	217	1,050	6,423	2.6%	**6,256**
2033	4,256	900	217	1,050	6,423	2.6%	**6,256**
2034	4,256	900	217	1,070	6,443	2.6%	**6,275**
2035	4,256	900	217	1,070	6,443	2.6%	**6,275**
Total through 2030	32,399	6,952	399	1,350	41,100		**40,424**
Total through 2032	40,911	8,752	823	3,450	53,936		**52,926**
Total through 2035	53,679	11,452	1,474	6,640	73,245		**71,733**

Source: AAVMC Internal Data Reports (April 26, 2024).

Impacts of Demographic Shifts on Veterinarian Supply

Two demographic shifts may decrease the average working hours of veterinarians, thereby decreasing the effective supply. An exploration of these shifts may offer clues for more effective retention. These shifts are the increasing share of female veterinarians and the replacement of retiring Baby Boomers with members of the Millennial generation.

The profession is experiencing an ongoing shift toward female veterinarians. The U.S. Bureau of Labor Statistics (2023a) estimated that 69.8% of employed and self-employed veterinarians in 2022 were women[2], up from 56% in 2010 (U.S. Bureau of Labor Statistics, 2011). This trend will continue as more than 80% of students in DVM programs in the 2022-2023 academic year identified as female (American Association of Veterinary Medical Colleges, 2023). These graduates will replace older retirees who are more likely to be male.[3] To the extent that the increasing number of female veterinarians individually work fewer hours the need for headcount will increase.

Using data from the 2016 and 2017 Census of Veterinarians, Neill et al. (2021) found that men in the sample worked an average 45.01 hours per week, while women worked an average of 42.92 hours per week, 4.6% less. Part of this disparity can be explained by the finding that 10.4% of male veterinarians worked part-time, compared to 14.1% of women. As women will make up a larger share of the veterinary profession in the coming years and are more likely than men to work part-time and work fewer hours on average, the result could be a reduction in the number of hours of service from any given number of veterinarians.

Generational shifts in the veterinarian population may also increase the need for headcount and will likely change the structure of work for veterinarians and other animal care workers. Mannheim (1953) argued that significant events and experiences during individuals' formative years affect their attitudes, priorities, and behaviors in the workplace and elsewhere. The assumption that all individuals born during a certain period will behave in the same way is clearly false and further, there may be systemic differences between individuals who become veterinarians and those who do not. Still, generational differences have been widely explored as a way of understanding individuals' attitudes toward work, their colleagues, and their employer.

Although Baby Boomers (born between 1946 and 1964) are staying in the workforce longer than members of previous generations (Fry, 2019), they will gradually be replaced by Millennials, born between 1981 and 1996, and by Generation Z, born between 1997 and 2010. If the conventional wisdom that Millennials have a lower level of loyalty to their current employer, change jobs frequently and prefer to work fewer hours than Baby Boomers this would imply that additional headcount will be needed to maintain the same level of services and that retention will become more difficult if working hours are not reduced.[4]

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[2] Bain et al. (2023) reported a slightly lower 56% share of female veterinarians in 2022.

[3] Another finding of the Current Population Survey (U.S. Bureau of Labor Statistics, 2022) is a troubling lack of diversity in the profession. Among employed veterinarians, 91.4% are White, versus 77% of workers economy wide. This share is not significantly different from that in 2010, but diversity may increase in the future. White students comprise approximately 80% of those enrolled in veterinary medical programs (American Association of Veterinary Medical Colleges, 2023). This is still a lower percentage of persons of color than are present in the workforce as a whole.

[4] Becton et al. (2014) cited findings that Baby Boomers tend to focus on achievement and power, are self-reliant, and are more focused on work than younger generations. Baby Boomers also tend to value a stable working

However, the truth regarding the emerging Millennial generation may be more complex than the stereotype, and there may be differences between Millennials in general and those choosing to become veterinarians. Leslie et al. (2021) identified three primary Millennial archetypes. The first archetype, Social Investors, care about the quality of their work, personal development, and social relationships at work. But their first priority is their home, family, and work-life balance. They care about the impact of their work and their employer's impact on society at large. The second archetype, Chill Worker Bees, value job security and physical and emotional safety. They want clear communication and instructions from their superiors so that they do not make mistakes. The third archetype, Go Getters, prioritize professional development, opportunities for growth, and regular feedback. Like the Social Investors, the Go Getters place a high priority on the ethics and morality of their work and its impact on society. Both of these forces, the gender shift and the generational shift, may lead to a decline in the hours that individual veterinarians work and an increase in the total number of veterinarians needed.

The youngest generation currently entering the workforce is Generation Z. Born between 1997[5] and 2010, the oldest members of this generation are on the verge of graduating from veterinary medical programs. These individuals were shaped by the climate crisis and the pandemic (Grénman et al., 2024). They are digital natives, with smartphones, social media, and the widespread use of the internet a fact of life for them from their early childhood. According to Burawat (2023), this is a generation concerned far more than previous generations about social and environmental issues and prioritizing individuality, creativity, and diversity. They are self-directed and will leave an organization whose values are not aligned with their own. This generation's comfort with technology makes them well suited to accommodate the infusion of technology and social media engagement into veterinary practice. Once again, though, these general characteristics of these generations are a generalization.

Burnout Impacts

Burnout is another factor that decreases veterinarian supply in the marketplace. Substantial evidence exists that this is a severe problem among veterinarians. For example, Ouedraogo (2021) highlighted the finding that more than 40% of veterinarians who graduated in the past 10 years were considering leaving the profession. Burnout can cause individuals to leave the profession before typical retirement age – decreasing the supply of veterinarians and increasing the likelihood of a shortage. Burnout can also result in inefficient service delivery and suboptimal patient care. This is an important aspect of the supply of veterinarians. As discussed below, the evidence suggests that burnout could potentially lead to the loss of tens of thousands of veterinarians in coming years.

Ouedraogo et al. (2021) explored the prevalence of compassion fatigue among veterinarians in practice and elsewhere. Compassion fatigue consists of both burnout and secondary traumatic stress. Burnout arises gradually and gives rise to hopelessness, frustration, a lack of focus, and consequently difficulties in performing one's job and providing adequate patient care. Secondary traumatic stress arises from fear and ongoing exposure to traumatic events such as euthanizing companion animals and comforting their owners. Ouedraogo et al. (2021) undertook a large study of AVMA members before the pandemic and found a high level of compassion fatigue, with 35.5% of the multi-year sample having low

environment and to remain loyal to their employer (Wong et al., 2008). This suggests that job-hopping and attrition should be greater among Millennials than among Baby Boomers.

[5] According to some sources, 1995 or 1996.

compassion satisfaction scores and only 21.5% with high scores. Half of the sample had high levels of burnout, and more than half (58.9%) had high levels of secondary traumatic stress.

The eventual result of burnout and secondary traumatic stress may be increased turnover as veterinarians leave direct animal care for less onerous jobs in other industries or change their career entirely. A presentation by Ouedraogo drawing from the 2021 AVMA Veterinarian and Practice Owners Survey was summarized by Nolen (2021a). Results were that 44% of veterinarians in private practice were considering leaving the profession before retirement. The percentages varied somewhat by age: 43% of Baby Boomers (born 1946 to 1964), 47% of Generation X (born 1965 to 1980), and 43% of Millennials (born 1981 to 1995). Mental health and work-life balance were the primary reasons; these were cited by 33% and 27% of the total sample, respectively. If only half of all veterinarians in private act on the desire to leave early, that would create a replacement need for more than 22,000 veterinarians in coming years.[6]

Burnout, including the inconsistency between the wish for fewer hours and the observation of more hours points out a threat to the profession and could lead to a reduction in the service hours of veterinarians. Neill et al. (2022) estimated the cost of burnout in the veterinary profession to be $1 billion to $2 billion annually. One method to reduce the problem of burnout suggested by Neill et al. (2022) is to lengthen primary care visit times. This too, though, would reduce the supply of services by veterinarians.

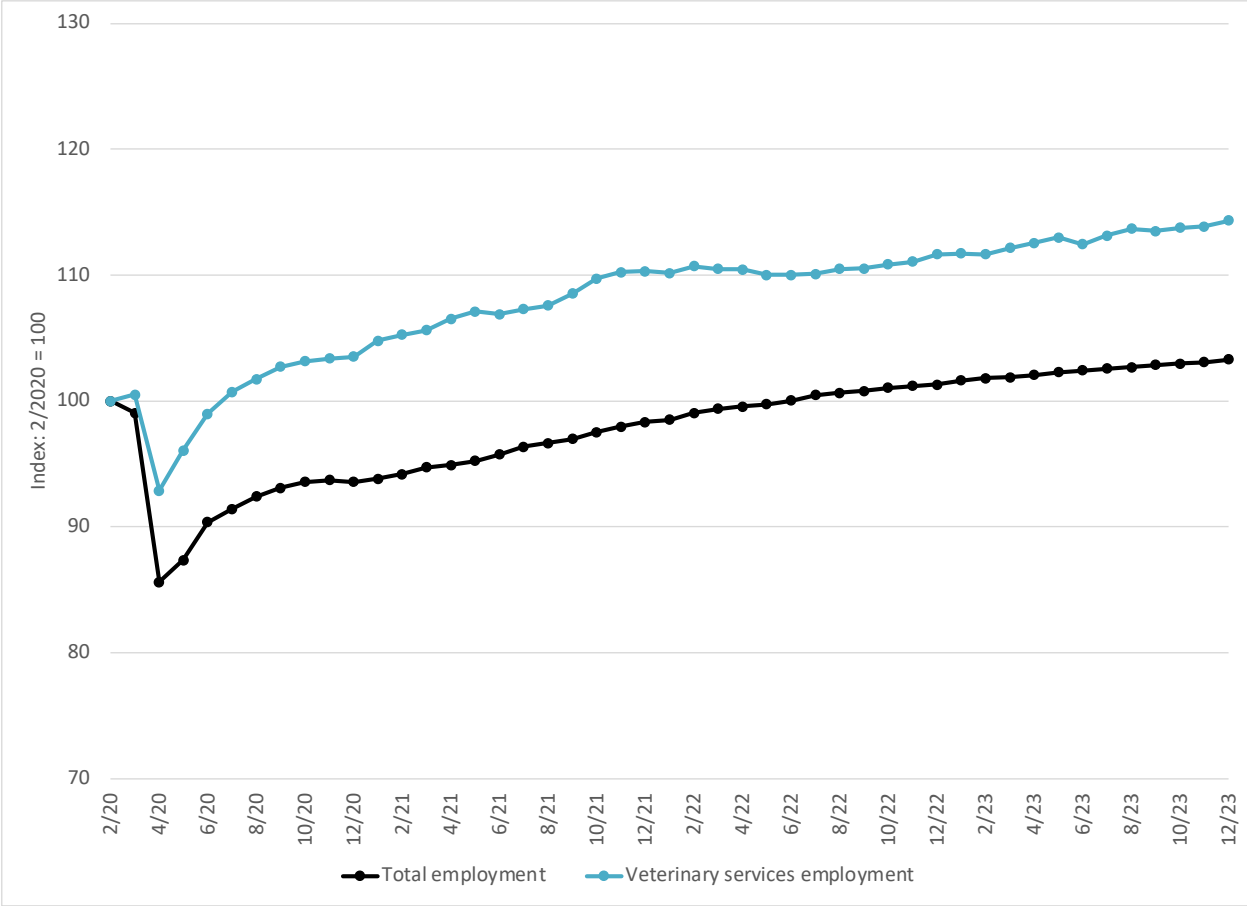
Pandemic Impacts

The onset of the COVID-19 pandemic at the beginning of 2020 had staggering impacts on the economy and employment. Estimates of gross domestic product (GDP) from the U.S. Bureau of Economic Analysis show a decline of 7.9%, or 28% on an annualized basis, during the second quarter of 2020, likely the largest quarterly decline since record-keeping began in 1929. Impacts on employment were just as consequential. Employment declined 14.4% during March and April, also an unprecedented decline in such a brief period.

As Figure 1 reveals, the impact on veterinary services employment was much less than average. Veterinary services employment declined only in April and only 7.6% – little more than half the total decline. The industry recovered all of its lost jobs in July, three months later. Total employment did not recover all of its losses until June 2022, 26 months later. Veterinary services as of December 2023 stood 14.3% greater than its February 2020 level; total employment was 3.3% greater.

[6] From Bain et al. (2023, p. 17) approximately 101,376 veterinarians (80.8% of the total) were engaged in private practice in 2022. If 22% of these resign from the profession (half of those wishing to do so), the loss would be 22,303 veterinarians. This does not include losses from the remaining 19.2% of the profession.

Figure 1: Total and Veterinary Services Payroll Employment, February 2020-December 2023
Seasonally adjusted



Source: U.S. Bureau of Labor Statistics (2024a).

The pandemic's greatest effect on the veterinary profession and veterinarians was less tangible. Health for Animals (2020) cited three impacts. At the start of the pandemic, more than one-quarter of pet owners delayed or skipped veterinary visits out of concerns around leaving their household bubble,. This affected practice income and potentially long-term animal health. Second, there was a large uptick in telehealth adoption – a point that is discussed in more detail below. Third, veterinarians assisted human healthcare professionals by diverting equipment and medicines to human patients and carrying out COVID tests. Zoonotic researchers also participated in the development of the vaccines.

Veterinarians were not immune from the widespread stress and isolation resulting the pandemic. This had markedly negative impacts on veterinarians' mental health. Volk et al. (2022) summarized the results of the wave of the 2021 Merck Animal Health Veterinarian Wellbeing Study conducted during the pandemic. The wellbeing and mental health of veterinarians declined during the pandemic, and burnout remained at a high level. Younger veterinarians (under age 55) had lower levels of wellbeing than older ones, and veterinarians in companion animal and mixed practices had lower wellbeing than those in food animals and equine practices. Working conditions during the pandemic were an additional source of stress with 51% of veterinarians working longer hours than they would have otherwise, and 78% reporting being shorthanded due to increased employee absences. Consistent with these findings, 39% were dissatisfied with their amount of free time and 51% reported working more hours than they would like. Also in line with previous waves of this study, only 47% of veterinarians would recommend the

profession to a friend or family member, and in response to a new question, nearly one in five regretted even becoming a veterinarian. In short, the wellbeing and mental health of veterinarians declined during the pandemic, and burnout remained at a high level.

Demand for Veterinarians

As previously noted, although the veterinary services industry employs the overwhelming majority of veterinarians, many other industries also include veterinarian positions. As part of its annual Employment Projections, the Bureau of Labor Statistics (BLS) issues estimates of industry employment within occupations (and occupational employment within industries) both currently and 10 years in the future. The most recent release provides 2022 actual employment totals and 2032 projections.

The industry employment distributions for veterinarians by industry in 2022 and projected for 2032 are shown in Table 2. The column headed NAICS indicates the North American Industry Classification System code. NAICS is a hierarchical system in which the broadest classification, the sector, is identified with a two-digit code. Successively narrower subsectors (three digits), industry groups (four digits), and industries (five to six digits) are classified within sectors. Most employment in Table 2 is presented at the broad sector level. In cases where the sector's employment of veterinarians is a larger share of total employment, more detailed classifications are presented. Industries other than veterinary services employed at least 7.2% of all veterinarians in 2022 and are projected to employ a marginally higher share in 2032 (assuming that all self-employed workers work in veterinary services). Because these other industries also have needs for veterinarians, they must be included in the demand assessment.

Table 2: Employment of Veterinarians by Industry Sector/Industry, 2022 and 2032

Sector/industry	NAICS	Share of total		Employment	
		2022	2032	2022	2032
Total employment	**00**	**100.0%**	**100.0%**	**89,500**	**107,200**
Self-employed workers	00	10.1%	9.4%	9,000	10,100
Manufacturing	31-33	0.1%	0.1%	100	100
Wholesale trade	42	0.3%	0.3%	300	300
Retail trade	44-45	0.1%	0.1%	100	100
Professional, scientific, and technical services	**54**				
Research and development in the physical, engineering, and life sciences	54171	0.5%	0.4%	400	400
Veterinary services	54194	82.7%	84.3%	74,000	90,400
Other professional, scientific, and technical services	541xx	0.1%	0.2%	100	200
Educational services: state, local, and private	61	0.9%	0.8%	800	900
Healthcare and social assistance	62	0.1%	0.1%	100	100
Arts, entertainment, and recreation	71	0.3%	0.3%	300	300
Other services (except public administration)	**81**				
Other personal services	8129	0.9%	0.8%	800	900
Social advocacy organizations	8133	1.4%	1.2%	1,300	1,300
All other services	81xx	0.0%	0.1%	0	100
Government	**90**				
Federal government, excluding postal service	9991	1.3%	1.1%	1,200	1,200
State government, excluding education and hospitals	9992	0.7%	0.6%	600	600
Local government, excluding education and hospitals	9993	0.4%	0.4%	400	400

Note: Indented industries are components of the boldface sector above. Line items may not add to the total because of rounding.
Source: U.S. Bureau of Labor Statistics (2023b).

The bottom-up approach of Lloyd (2021, 2023) in quantifying the demand for veterinarians has the significant benefit of explicitly identifying factors driving that demand, including reduced full-time equivalent totals resulting from overworked and burned-out veterinarians leaving the profession. However, as discussed above, the proxies selected by Lloyd (2023) and the AVMA (2023) to measure veterinarian demand failed to capture the scope of the need. There seems to be no proxy driver for future veterinarian demand that is above criticism.

The estimation problems inherent in a bottom-up approach suggest that a top-down approach – moving from the aggregate economy to demand for veterinarians – is necessary. This can be accomplished by drawing from the BLS Employment Projections (U.S. Bureau of Labor Statistics, 2023b) that are the source for the employment distributions in Table 2. It should be emphasized that the Employment Projections are not a forecast. A forecast considers actual current and anticipated economic conditions to predict outcomes and can reasonably be developed only a year or two in advance. In contrast, a projection does not attempt to consider the unknowable future expansions and contractions of the economy but makes an array of assumptions to determine long-term underlying trends (Byun et al., 2015). Even with the most carefully crafted assumptions, there is always the likelihood that unanticipated economic shocks (such as the COVID-19 pandemic) will change the trajectory of output and employment growth. Thus, long-term projections are inherently uncertain. The historic reliability of the projections of veterinarian employment is examined below.

The BLS *Handbook of Methods* provides a detailed discussion of the derivation of Employment Projections, including the underlying assumptions. These assumptions include (U.S. Bureau of Labor Statistics, 2023c):

- No significant change in broad social and demographic trends.
- No new major armed conflicts.
- No major natural disasters, including pandemics.
- No significant changes in laws, policies, and regulations that would impact economic trends.
- No unforeseen disruptive technologies.
- The U.S. economy will be at approximately full employment/potential output in the projection year.

The concepts of full employment and potential output require additional discussion. According to Dubina (2017), in a full-employment economy, unemployment is low enough to use all available resources, but not so low that inflation accelerates. An economy above full employment is overheating: demand exceeds the economy's ability to produce goods and services and inflation accelerates. An example is the rapidly accelerating demand for goods and services as the economy was reopening from the pandemic lockdowns in late 2020 and 2021 and consumers were eager to spend their stimulus checks. Producers and the supply chain were not equipped to accommodate these greatly increased demands and prices rose. This situation is unsustainable over the long run. In contrast, an economy below full employment is in recession or recovering from one. Unemployment is high and resources are operating below capacity. At any given time, the economy can be below, at, or above full employment.

There is no way to measure the level of full employment directly, as Dubina (2017) explained. Full employment does not mean zero unemployment. Some level of unemployment always occurs as workers move to jobs better suited to their skills or their desired career path or develop new skills to meet the evolving needs of employers. These actions eventually lead to greater economic efficiency. In full employment, capacity utilization is high, prices and wages are stable, and unemployment is low.

As discussed in U.S. Bureau of Labor Statistics (2023c), derivation of the projections is a six-step process. The first step is a projection of the future size and composition of the labor force in the target year. The labor force is the subset of the civilian population 16 years and older – with no upper bound – who are either working or actively looking for work. Projecting the labor force includes projecting the future population by age, including births, deaths, and migration to and from the U.S. (the most difficult component), and from this the share of the population in the labor force.

The second step is to project the growth of the aggregate economy from its current state and the level of GDP in the target year necessary to achieve full employment. The third step is to allocate the target year's projected total output among individual groups of goods and services using the relationship between final goods and the goods needed to produce them. The fourth step is to translate the list of goods and services comprising total target year GDP into output of each industry and the industry employment necessary to produce that output.

The fifth step is to use the staffing pattern within individual industries to translate total industry employment into occupational employment within that industry. Table 2 is a less detailed version of this result for veterinarians. The projected demand for veterinary services in 2032 implies a need for 90,400

veterinarians employed in veterinary services in that year.[7] In the sixth and final step, the occupational results are combined with the projected number of separations due to retirements, promotions, career changes, and other factors to project average annual openings within an occupation over the 10-year period.

A reliable projection of demand for veterinarians requires an accurate baseline. As shown in Table 2, the estimate of 2022 employment in the BLS Employment Projections is 89,500, only 71% of the 125,465 veterinarians estimated in Bain et al. (2023, p. 17). Although estimation error attaches to the employment projections, the primary cause of the difference is the way in which the BLS defines occupations in the Standard Occupation Classification (SOC) system. The primary difference in this case is a veterinarian whose primary job is teaching in a college or university veterinary medical or animal care program. BLS classifies this individual not as a veterinarian but as a "health specialties teacher, postsecondary." This occupation employs an estimated 207,700 but is a broad category including teachers specializing in either animal or human medicine. Some veterinarians performing or leading research in government or private industry might be classified as animal scientists or natural science managers, or they may be undertaking this research as self-employed workers.

Bain et al. (2023, p. 17) provided a percentage distribution of veterinarian employment from the 2022 Census of Veterinarians that is more specific in veterinary services but less specific elsewhere. This distribution, combined with the total estimated number of veterinarians yields the number by practice and sector in Table 3. Table 4 compares these estimates to the BLS distribution from Table 2. It is assumed that Bain et al.'s (2023) 125,465 total is an accurate count of veterinarians nationwide, whether BLS classifies them as such or not.

Table 3: AVMA Estimated Number of Veterinarians by Specialty and Sector, 2022

Sector	Percentage	Number
Total	**100.0%**	**125,465**
Private practice (veterinary services)	**80.8%**	**101,376**
Food animal	1.8%	2,258
Companion animal	69.3%	86,947
Mixed animal	4.9%	6,148
Equine	4.4%	5,520
Other private practice	0.4%	502
College or university	6.2%	7,779
State, local, or federal government	0.8%	1,004
Uniformed services	0.4%	502
Industry/commercial	3.9%	4,893
Other public practice	7.9%	9,912

Source: Calculated from Bain et al. (2023).

[7] Note in Table 2 that self-employed workers are included as a separate category. Many of these will likely be owners of veterinary practices. The 90,400 total for veterinary services in 2032 consists of veterinarians employed in practices owned by someone else.

Table 4: Comparison of BLS and AVMA Estimates of Total and Sector Distribution of Veterinarians

Sector	BLS	AVMA
Total	**89,500**	**125,465**
Veterinary services	83,000	101,376
College or university	800	7,779
Government	2,200	1,506
Industry/commercial and other public practice	3,500	14,805

Source: U.S. Bureau of Labor Statistics (2023b) and Bain et al. (2023).

There are two primary components of the demand for labor in an occupation. The growth demand is generated by an increase in the number of positions. The turnover demand arises from the need to fill existing positions as workers are promoted, move, retire, or leave their position for other reasons. Turnover can further be categorized as what might be called external turnover and internal turnover. An external turnover need results from a veterinarian retiring or otherwise leaving the profession. This creates a net replacement need which must be ultimately satisfied by a new entrant. An internal turnover need occurs when a worker leaves one veterinary practice for another practice with an existing opening. This requires the practice losing the veterinarian to find another, but it does not increase the net need across the entire profession. Turnover needs, particularly external ones, are typically much greater than growth needs – especially in recent years as the retirement of Baby Boomers continues to grow and create openings in existing positions. The AVMA (2023) asserted that Lloyd's (2023) conclusion that the need for 45,000 to 55,000 workers represented an "astounding 40% increase in slightly more than six years." This incorrectly conflated the growth and turnover needs and designated the entire need as growth.

The approach to estimate the growth and turnover need through 2030 is to use the BLS (2023b) 2022-2032 percentage growth projection for veterinarians (19.8%), applying this growth to the 125,465 total from Bain et al. (2023). Another element of the BLS (2023b) occupational projections is average annual openings. These encompass both growth and external turnover. The BLS estimate of average annual openings for veterinarians between 2022 and 2032 is 5,000 per year.

The annual openings used here are 5,000 times the ratio of current employment from Bain et al. (2023) to that from BLS (2023b), or roughly 7,000. Total openings include both growth and turnover, so they constitute the total annual demand. This is a suboptimal approach because it projects the turnover among those classified as veterinarians in the SOC system to those operating in different work contexts, such as veterinary medical colleges. The optimal approach would be to apply the openings throughout the profession to the initial 125,465 veterinarian total. The AVMA would be the logical source of annual openings throughout the profession, but they do not make publicly available any estimate they may have.

A test of the reasonableness of projecting occupational turnover of veterinarians to the rest of the profession is to compare the implicit turnover rate for veterinarians projected by BLS to that of other occupations that may include veterinarians – health specialties teachers, postsecondary, and animal scientists. This is shown in Table 5. The difference between 2022 and 2032 employment is the number of projected openings over the 10 years due to occupational growth. The difference between this total and the total 10-year openings as given by BLS is the total number of openings driven by turnover within the occupation. The turnover rate is calculated as the calculated openings from turnover divided by the average of 2022 and 2032 employment. The resulting turnover rate for veterinarians is 33%. The rate for the other two occupations is much higher: 78% for health specialties teachers and 67% for animal

scientists. This implies that the assumed average of 7,000 openings per year is more likely than not to be an understatement of the actual unavailable number of openings.

It might seem that the results in Table 5 could be combined with the sector distribution of veterinarians in Table 3 to produce a larger estimate of annual openings, but this would introduce irrelevant factors into the estimation. The difference between the 262,800 estimate of health specialties teachers and the 7,779 veterinarians in colleges and universities as reported in Table 3 suggests that the vast majority of these teachers are in medical colleges, dentistry colleges, pharmacy colleges, and other human health programs where conditions driving turnover could be significantly different from those in veterinary medical colleges. A similar argument can be made for veterinarians within the animal scientist occupation.

Table 5: Projected Turnover Rates, Veterinarians and Other Relevant BLS Occupations

Occupation	2022 actual	2032 projected	Change	Pct. change	10-year openings	Turnover*	Turnover rate**
Veterinarians	89,500	107,200	17,700	19.8%	50,000	32,300	32.8%
Health specialties teachers, postsec.	262,800	313,000	50,200	19.1%	274,000	223,800	77.7%
Animal scientists	2,800	2,900	100	3.6%	2,000	1,900	66.7%

*Total 10-year openings less openings due to change in number of occupations.
**Turnover divided by average of 2022 and 2032 employment totals.
Source: Calculated from BLS (2023b).

The results of the analysis are in Table 6. The total need is derived from the 7,000 average annual openings and the turnover need is thus the difference between the total need and the need driven by market growth.[8] The results imply that the graduates entering the veterinary field over the coming eight years will satisfy only about 73% of the total need through 2030 and 76% through 2032. This finding is consistent with the 2,000 open veterinary positions in 2019 cited by Lloyd (2021) and the very low unemployment rate among veterinarians. Veterinarian unemployment in 2021 was 1.8% in 2021, according to the AVMA Census of Veterinarians (Nolen, 2021b). While this rate was up from the 0.7% in 2020, it was still far lower than the 2021 population average of 5.3% as reported by BLS (2023a).[9] The implication is that these shortages are likely to worsen. The ex-post accuracy of BLS employment projections for veterinarians is analyzed below. This analysis suggests that although it is likely that significant program expansions are necessary, the profession will need to monitor growth and turnover needs as they evolve in coming years.

[8] The BLS (2023b) total 10-year growth projection is 19.8%, so each year's employment is calculated as that for the previous year times $1.198^{0.1}$. The growth need is the current year's total minus the total for the previous year. Average annual openings include both growth and turnover, so these are total needs. The total need for all 10 years (roughly 70,000) is distributed proportionally to the distribution of the growth need. The turnover need is the difference between the total need and the growth need.

[9] The veterinarian and population unemployment rates are not strictly comparable. The veterinarian unemployment rate includes as unemployed those working outside of veterinary medicine (Nolen, 2021b). BLS counts as unemployed only those who did not work at all during the reference period. If the population unemployment rate included those working outside their desired profession, it would be even higher.

Table 6: Veterinarian Growth and Turnover Needs

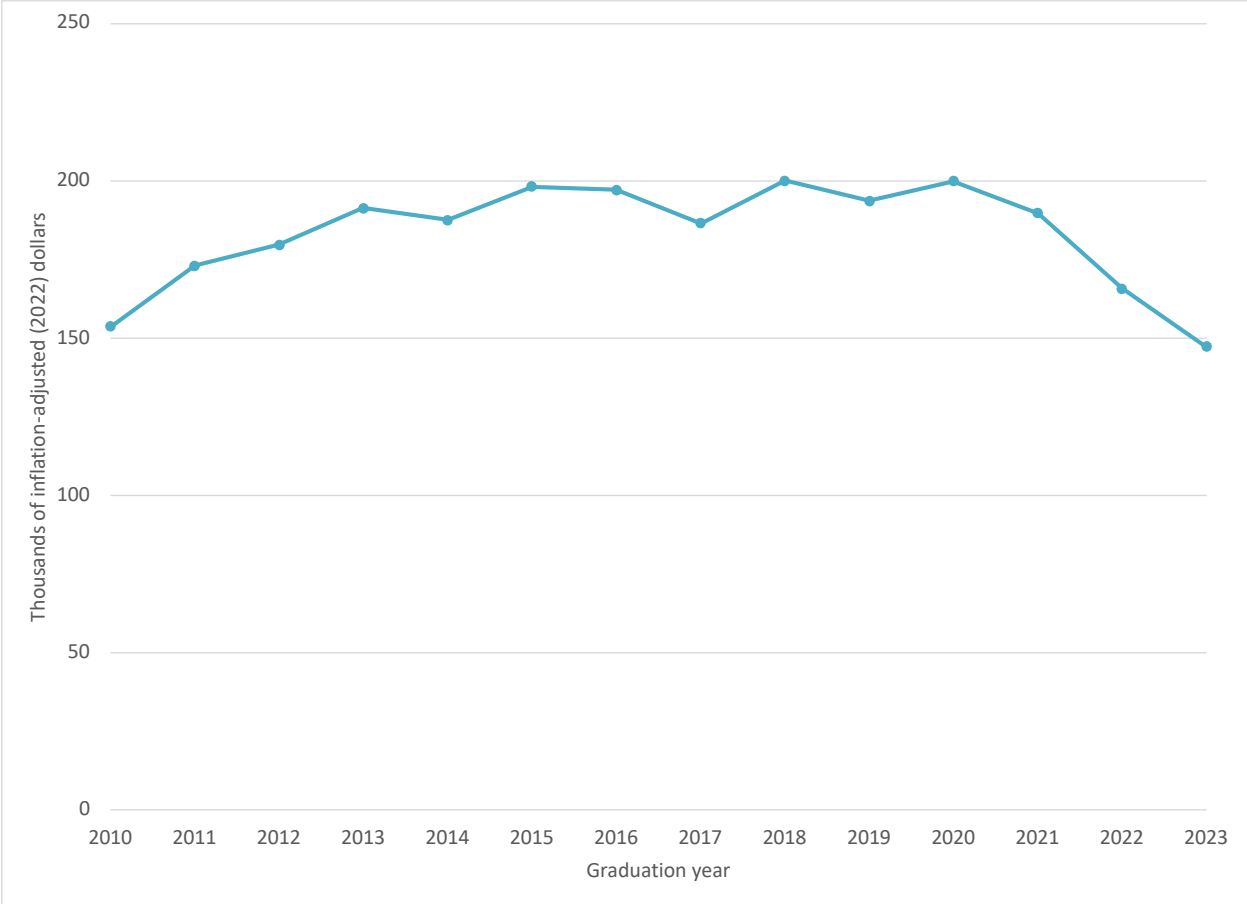
Year	Employment	Growth need	Turnover need	Total need	Graduates*	Shortfall
2022	125,465					
2023	127,750	2,285	4,169	6,454	4,339	2,115
2024	130,076	2,326	4,245	6,571	4,483	2,088
2025	132,445	2,369	4,322	6,691	4,824	1,867
2026	134,856	2,412	4,401	6,813	4,986	1,827
2027	137,312	2,456	4,481	6,937	5,022	1,915
2028	139,812	2,500	4,563	7,063	5,105	1,959
2029	142,358	2,546	4,646	7,192	5,603	1,588
2030	144,951	2,592	4,731	7,323	6,061	1,262
2031	147,590	2,639	4,817	7,456	6,246	1,210
2032	150,278	2,688	4,904	7,592	6,256	1,336
Total through 2030		**19,486**	**35,558**	**55,044**	**40,424**	**14,621**
Total through 2032		**24,813**	**45,280**	**70,092**	**52,926**	**17,166**

*From Table 1.

The shortfall in Table 6 is a national average. Veterinarians serve a local market, and there can be wide disparities in the availability of services among individual communities. LaFayette (2022) found that most small metropolitan and rural areas in Ohio were much less well served by veterinarians than larger urban areas. Normally, veterinarians in overserved markets would be expected to move to underserved markets to maximize their earnings, but additional factors are likely in play. Personal tastes and a preference for urban living could be one, as could a preference for work with house pets.

But the most significant factor could be a need to satisfy debt obligations. Based on AVMA data this need, though still great, could be easing somewhat. Figure 2 graphs the average debt of veterinary school graduates upon graduation since 2010 as reported by the AVMA and adjusted for inflation by the authors. Although still high, the $147,258 average debt of 2023 graduates has declined more than 26% from its 2018 peak. On an inflation-adjusted basis, the 2023 average is the lowest over the entire period. That said, the higher burden faced by graduates in earlier years is still a factor in their choice of location and emphasis. It may also create a barrier to establishing their own practice.

Figure 2: Mean Debt of New Veterinary Graduates, 2010-2023
Adjusted for inflation



Source: AVMA, U.S. Bureau of Labor Statistics (2024b).

Reliability of the BLS Projections

How reliable is the projection of veterinarian employment in 2032 from which the employment totals in Table 6 are drawn? If the actual economic conditions in 2032 turn out to be significantly different from the assumed full employment/potential output, the projections will be inaccurate. Byun et al. (2015) demonstrated this by distinguishing between the projections made for 2006, 2008, and 2010 and the much lower actual employment during the severe 2007-2009 recession.

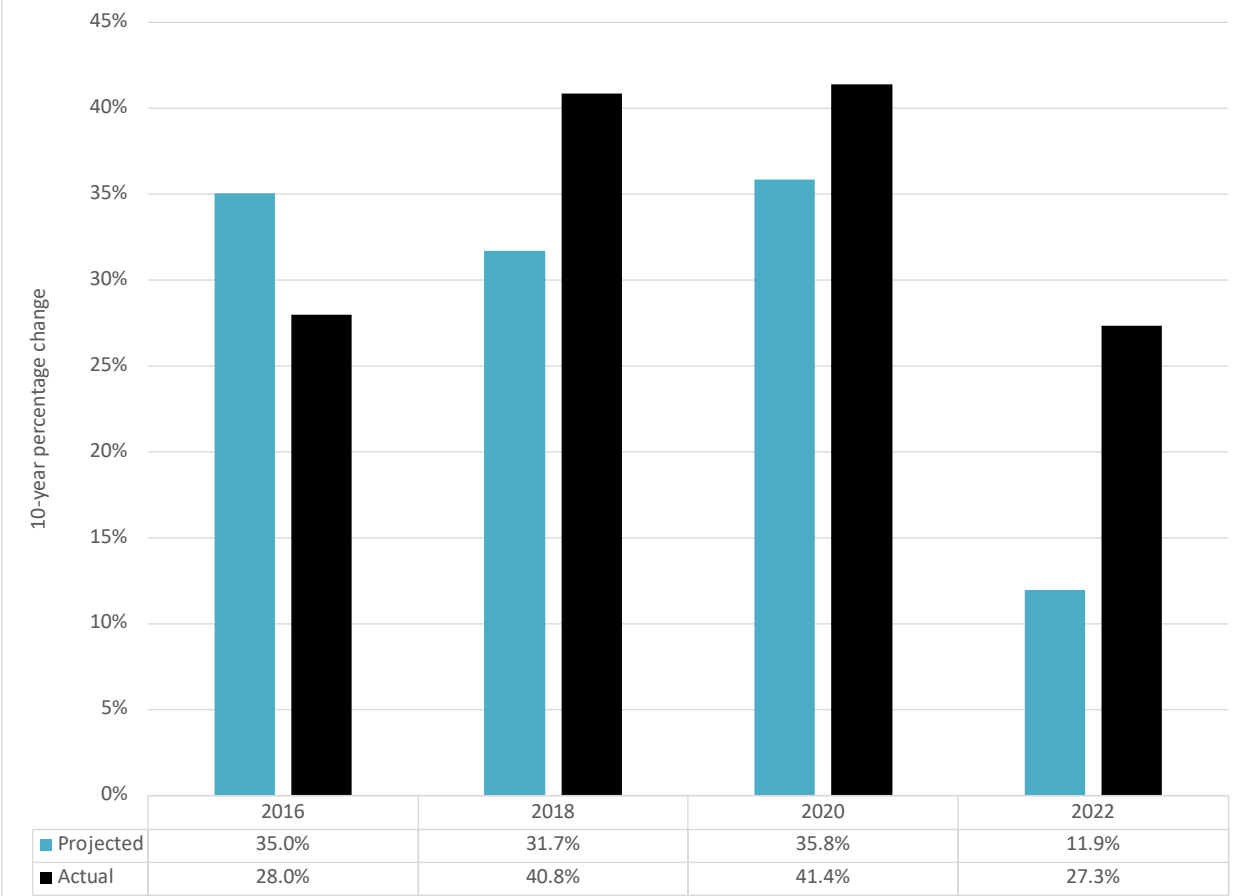
Conversely, the unusually low unemployment rates seen recently have caused occupational projections to understate actual results. The BLS (2024c) evaluation of the 2012-2022 projections found that the actual occupational growth rate over that period was 13.2%, versus a projected rate of 10.8%. The difference was due to faster growth in the labor force and a lower 2022 unemployment rate. However, the predictions of occupational growth or decline in the 2012-2022 projections were correct 77% of the time.

The assumptions enumerated earlier underlying the BLS projections suggest some additional reasons why the achieved employment total in 2032 could differ from the projection. The most direct difference would arise from the economy being either above or below. Additionally, a significant change in immigration in coming years would make the labor force and occupational demand greater or less than

the projection. A new pandemic, war, or social unrest could disrupt growth, but based on the impacts from COVID-19, the employment impact of a pandemic on veterinarian demand could be much less than the impact on other occupations. Some new technologies – or a more widespread deployment of telemedicine – could moderate the growth of veterinarian demand. It will be important for the AAVMC to keep track of employment growth in coming years.

To illustrate potential differences between projected and actual employment, Figure 3 compares veterinarian employment in 2016, 2018, 2020, and 2022 with the projections made 10 years previously (BLS, 2007, 2009, 2011b, and 2013).[10] The 2006-2016 employment growth was 25% higher than actual growth, but more recent projections have been lower than the actuals. The 2018 projected growth was 20% lower than the actual, the 2020 projection was 12% lower, and the 2022 projection was 54% lower. It is surprising that the projection that came closest to the actual employment was during the height of the COVID-19 pandemic and recession in 2020. These understated projections do not imply that the 2022 projections used in this study are likely to understate the 2032 veterinarian employment. The ex-post accuracy of the estimate depends on the actual economic conditions between 2022 and 2032 versus the assumptions made in deriving the projections. It will be important for the profession to monitor the growth of the field in coming years. Some later veterinary program expansions may not be needed, or these may not be sufficient to satisfy demand as it grows.

Figure 3: Projected versus Actual Veterinarian Employment, 2016-2022



	2016	2018	2020	2022
Projected	35.0%	31.7%	35.8%	11.9%
Actual	28.0%	40.8%	41.4%	27.3%

Source: BLS (2007, 2009, 2011b, and 2013).

[10] Previous years' projections are no longer available online. These are drawn from the author's personal archive.

Recommendations

The larger implication of the results in Table 5 is that there will be a severe and growing unmet need for veterinarians in coming years – one that upcoming program expansions and additions will be insufficient to meet. Thus, it is critical that the profession takes steps to reduce the growth and replacement needs and consequently the large number of graduates needed to meet those needs. It is likewise critical that program seats increase. Given the current constraints in the number of program seats available, addressing the growth need should probably come first.

The greatest need is addressing burnout, especially the tragedy of suicide. The profession should continue to work with mental health professionals to develop a better understanding of the causes of burnout and suicides, address the results openly, and publicize available resources such as the 988 suicide and crisis hotline. Part of the messaging should involve reducing the stigma surrounding asking for help. A peer support network could address milder cases of burnout before they lead to attrition.

Another way to address the veterinarian demand constraint – in addition to easing the strain on veterinarians that can lead to burnout – is to continue to infuse technology into animal care. The increased adoption of telemedicine is one possibility in cases where it is appropriate. As reported by Bishop et al. (2021), telemedicine gained ground in animal medicine during the pandemic, thanks in part to the U.S. Food and Drug Administration's Center for Veterinary Medicine relaxing restrictions on telemedicine in veterinary care. Bishop et al. (2021) found that veterinarians found telemedicine platforms relatively easy to use and these consultations often took less time than an in-person consultation. However, many veterinarians had a harder time fostering relationships in virtual visits than in in-person ones, and most veterinarians offered the service at substantially reduced or no cost. Both of these concerns may limit the adoption of telehealth. Pet owners generally seem to be satisfied with the service, though, and are willing to pay for it (Bishop et al., 2021). Veterinarians who have had success in integrating telehealth into their practice could provide best practices for relationship building. Telemedicine could be of particular value in rural areas, where veterinary services could be less available. A robust network of telehealth providers could make it easier for pet owners in underserved communities to access veterinary services, improving the health of their companion animals and reducing the stress of veterinarians serving in these areas.

Another technological tool that could ease the burden on veterinarians while improving diagnosis and treatment is artificial intelligence (AI). In two companion articles, Appleby and Basran (2022) and Basran and Appleby (2022) introduced AI and explored its potential in veterinary diagnostic medical imaging. As in human medicine, AI can assist in identifying abnormalities and detecting, predicting, and classifying diseases. This can reduce veterinary practice workloads and help to relieve veterinarian stress.

It is also important to call attention to the lack of racial and ethnic diversity among veterinarians. As veterinary programs expand and new programs are created, the profession should make a conscientious effort to attract people of color. Doing so will broaden the pool of talent from which veterinary programs can draw and foster a profession that more closely resembles the client population. In all cases, veterinary and pre-veterinary programs should provide their students with an accurate view of life as a veterinarian, including its stresses and disappointments. This may better prepare graduates to succeed in the field and reduce attrition.

Ultimately, the effectiveness of the profession and its ability to treat patients requires that demand and supply be brought into balance. Table 5 implies that the number of graduates entering the field in 2023

was 33% less than that year's projected growth need. Although this proportion is projected to decline over time, it remains at 20% in 2032. Depending on the success of the efforts outlined above, the projections imply a need for at least 1,600 additional seats by early in the next decade, including the planned program expansions that will come online through 2032. Veterinary medical programs should continue to expand in future years in line with the ongoing expansion of the market. It would not be wise to expand to address the entire shortfall in Table 5, however. This would eventually result in excess supply as all of the overhanging demand is met.

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