

ADDRESSING CURRICULUM DEFICIENCIES IN VETERINARY PUBLIC HEALTH:
A COMPARISON OF OTHER HEALTH PROFESSIONS' EXPERIENCES

by

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Abstract

The history of veterinary medicine is intimately intertwined with duties to public health. This has remained true over centuries, and is becoming even more important with recent significant threats to public health. Despite this, the veterinary profession is failing to meet increasing needs for veterinarians trained in population medicine and public health, nationally and internationally.

Current accreditation requirements for veterinary schools and colleges are vague with regard to public health education, leaving each college or school of veterinary medicine to implement its own perception of veterinary public health education. Is the public health education in veterinary curricula adequate among U.S. veterinary colleges and schools? Our inventory of the veterinary curricula in the 28 U.S. veterinary schools and colleges revealed inadequacies in veterinary public health education delivery. We found that most colleges and schools are lacking in the major veterinary public health subjects as recommended by the American College of Veterinary Preventive Medicine and the World Health Organization.

The issue of inadequacies, even deficiencies, within health professional curricula is not unique to the veterinary profession. What have other health professions proposed to correct their own perceived deficiencies within their educational curricula? We identified deficiencies and proposed solutions from three health professions and discussed their solutions as potential approaches to remedy the inconsistency in public health delivery in veterinary curricula. The dental profession addressed lack of faculty effectiveness with faculty development programs. The medical profession identified an outdated and irrelevant pre-medical curriculum and is currently considering reforming it. The

chiropractic profession identified a lack of public health education in its curriculum and organized a standardized public health course.

Health professions are similar in content of curricula and length of professional program. In addition, the health professions have similar pre-requisites. They also share similar challenges: faculty shortages, high student debt loads, and rising educational costs. Because of these similarities, solutions to perceived curricular deficiencies proposed in one health profession can be used to address deficiencies in other health professions. Therefore, the dental, medical, and chiropractic professions have proposed solutions that should be considered in addressing the veterinary profession's curricular deficiency of inadequacy in public health education.

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Dedication

This work is dedicated to my two children, Olivia and Brock. Thank you for making me take time to play and laugh. You reveal the true essence of life and the love of Our Father.

Thank you also to my husband, Brian. Your support and encouragement goes beyond words. The completion of this thesis and the recent completion of your graduate program mark the end of a challenging season in our lives. It has been a privilege to endure with you during this season, and I am blessed to be at your side as we enter another.

Isaiah 26:3

CHAPTER 1 - The Importance of Veterinary Public Health

Where We've Been

The history of veterinary medicine displays the profession's continual devotion to public health. Relationships between human and animal disease were observed in civilizations of ancient Babylon, China, and the Nile Valley. Hippocrates described evidence of this relationship, as did the biblical book of Leviticus. It was realized in the Middle Ages that rats were the carriers of the deadly plague that claimed millions of lives across Europe [1]. Sanitary conditions, or lack thereof, and the resulting impact on animal and human disease became a focus, and helped to usher in a new era of awakening and the formation of veterinary schools and civilian veterinary services [2]. The importation of livestock in the seventeenth century and the increasing need for food-producing animals in the New World precipitated the emergence of food borne diseases. Recognizing the link between ill animals and food safety in the 1700s and 1800s, public health pioneers voiced the need for more professionals trained in veterinary medicine and public health, a theme still heard today. The United States colonies also witnessed their first recorded zoonosis—rabies—in 1753 [3]. This disease's spread across the country and its microbiological relationship with humans and animals occurred during a revolution of microbiology that fathered the formation of laboratory practices [2]. Milk hygiene, meat inspection services, quarantine practices, and other contributions from veterinary public health dramatically decreased the incidence of morbidity and mortality worldwide [3]. Public health in the 1800s was acknowledged with the formation of several key organizations, such as the American Public Health Association

in 1872, the National Board of Health in 1879 , and the Bureau of Animal Industry in 1884 [3].

The concept of veterinary public health, as understood today, was nurtured in the 1940s in the “Communicable Disease Centers” of the U.S. Public Health Service (USPHS). This is what is now known as the Centers for Disease Control and Prevention. In post-World War II America, public health veterinarians helped to develop the modern concept and science of epidemiology. Careers for these veterinarians included food safety, comparative pathology/medicine, pathogenic microbiology, environmental science, and epidemiology [2], similar to those that are available today [4].

In 1999, the World Health Organization (WHO) defined veterinary public health (VPH) as “the sum of all contributions to the physical, mental and social well-being of humans through an understanding and application of veterinary science” [5]. WHO identifies “core domains” of VPH: “diagnosis, surveillance, epidemiology, control, prevention and elimination of zoonoses; food protection; management of health aspects of laboratory animal facilities and diagnostic laboratories; biomedical research; health education and extension; and production and control of biological products and medical devices.” Other core responsibilities are the management of wild and domestic animal populations, protection of the environment and drinking water sources, and public health emergency management [5].

The above responsibilities of VPH are intimately intertwined with the assigned and pledged responsibilities of any veterinarian. Upon entrance into the profession, veterinarians swear an oath; part of this oath states that he/she will “use my scientific knowledge and skills for the *benefit of society* through the protection of animal health, the relief of animal suffering, the conservation of animal resources, the *promotion of public*

health, and the advancement of medical knowledge” [6], (italics added). In 2000, Peter Koolmees published a book chapter concerning current food hygiene and veterinary inspection. He wrote, “Veterinary public health may be defined as the interactions between animals and animal products on the one side and human health on the other” [7], page 53. Considering the contents of Koolmees’ definition, the Veterinarian’s Oath, and the WHO definition, the role of veterinary public health is clear. It is not to be viewed as a subset of the veterinary profession, but as its central role [8].

Where We Are

Today, the need for public health veterinarians is larger than the profession’s answer to the call. In February 2009, the United States Government Accountability Office published the results of a study evaluating the sufficiency of the veterinary workforce in federal agencies. Current shortages of veterinary personnel are being experienced by the Department of Defense (DOD) and the Department of Agriculture (USDA). Specific organizations within the USDA affected include the Agricultural Research Service (ARS) and Food Safety and Inspection Service (FSIS). Adding to the shortage, twenty-seven percent of the positions held by veterinarians will be open within the next three years due to retirement of professionals in the USDA-FSIS, the US Army Veterinary Corps, and the USPHS [9].

Production animal veterinarians in private practice serve small, rural and large, corporate operations. These individuals are increasingly needed as first-line observers and responders to potential acts of agroterrorism that could impact the safety of the nation’s and world’s food supplies. These veterinarians have direct influence on the production of food

for consumption in the U.S. and abroad. Food systems veterinarians—ones not only well-versed in food production systems, but also familiar with political and economic realities—are needed to guard the economic health of the world’s food supply [10]. Prince et al. described a study conducted concerning the projected demand for production animal veterinarians. Prince et al. used the Delphi method; the Delphi method utilizes expert judgments to forecast and allows latitude for the changes inevitable in the profession of production animal veterinary medicine. The Delphi method predicted that the demand for production animal veterinarians will increase [11]. These results contradicted a KPMG LLP study which did not forecast an increased need for production animal veterinarians in the years 1997 to 2015. KPMG LLP made linear extrapolation models based on historical trends [11]. (KPMG LLP is a tax, audit, and advisory firm that provides services globally [12].)

The National Research Council repeatedly outlined the increasing need for and shortage of veterinarians in biomedical research, with one report stating, “Research in veterinary science is critical for the health and well-being of animals, including humans” [13], abstract. The Council identified food safety, emerging infectious diseases, the development of new therapies, and bioterrorism as examples of issues involving veterinary medicine that impact human as well as animal health [13]. In a series of papers published in 2004 and 2005, the Council identified an “unfulfilled need” for veterinarians in biomedical research [14].

Because of changing societal demands on the veterinary profession, academic programs are continuously revised. The American Veterinary Medical Association (AVMA) accredits U.S. veterinary schools, as well as some foreign veterinary programs. Relative to public health curriculum standards, the Accreditation Policies and Procedures of the AVMA Council on Education (COE) state that an accredited veterinary college shall provide

“instruction in the principles of epidemiology, zoonoses, food safety, the interrelationship of animals and the environment, and the contribution of the veterinarian to the overall public and professional healthcare teams” [15]. However, the AVMA COE does not provide specific guidance in structuring of public health education in veterinary curricula.

About 60% of new veterinary graduates will enter clinical practice [16]. It drives the perceived necessity for a clinically-centered curriculum. The North American Veterinary Licensing Exam (NAVLE) is the exam required for licensure to practice the profession of veterinary medicine in North American jurisdictions [17]. This exam is weighted heavily in clinical application. Nine of the three hundred NAVLE exam questions (i.e., 3% of the questions) are specific to veterinary public health. Additional questions involve subjects of importance to public health, such as anthrax, parasitism, and dermatophytosis, but these questions are not specific to their impacts on public health [18]. As discussed later in this thesis, heavy clinical emphasis does not excuse the lack of comprehensive public health education in the curriculum, preparing graduates for their societal responsibilities.

Zoonotic disease has traditionally been the center of the small animal practitioner’s role in public health. Rabies vaccination, vaccination documentation, sample submission for testing and reporting, and public education have contributed to a dramatic decrease of the disease’s incidence since the 1700s. Small animal practitioners also help control zoonoses such as intestinal parasitism, dermatophytosis, enteric bacterial infections, and tick borne diseases. Concerning bioterrorism and zoonotic disease emergence, small animal practitioners are poised on the “front lines” of identifying suspicious clinical syndromes that may need to be reported and consequentially investigated by state or federal agencies. Practitioners also may be asked to assist the same agencies in outbreak and disaster management, whether the disasters are naturally occurring or manmade. Small animal

veterinarians are societal educators for such topics as dog and cat bite/scratch prevention, avian influenza, and zoonoses in immunocompromised individuals [19]. Due to an increase in the number of immunocompromised persons, the latter is a growing issue. A large percentage of the U.S. population is currently immunocompromised for one of several reasons, and certain populations within this group are growing, such as the elderly and persons receiving immunosuppressive therapies [20]. Pet ownership is increasing [21]. Emotional benefits from pet ownership have been noted, especially for those suffering from immunocompromising health conditions [22], [23]. However, people with such health conditions are at an increased risk for contracting a zoonotic disease from a pet [22]. Small animal veterinarians are an integral part of service animal programs for disabled persons; the physical and behavioral health of the service animals is vital for the disabled person's well-being. Small animal practitioners have responsibilities and knowledge about proper storage, use, and waste management for medical supplies and pharmaceuticals [19].

Food and fiber animal veterinarians traditionally have and will continue to answer vital societal needs in the control of zoonotic diseases, safe food production practices, vigilance in monitoring biosecurity, and environmental awareness [11]. The reduction in zoonotic diseases such as tuberculosis and brucellosis are examples where the roles food and fiber animal veterinarians are essential for disease monitoring, testing, and removing of diseased animals from the food chain [24]. While attending the clinical needs of their patients, food and fiber animal veterinarians utilize supplies and pharmaceuticals that must be used in a prudent manner. Widely known and hotly debated is the role of antimicrobials in food and fiber animal production. Food and fiber animal veterinarians are in the middle between the producer's desire and need to profit and the consumer's demand for drug-free animal products. In addition, food and fiber veterinarians serve as meat and poultry

inspectors that guard our nation's food supply [25]. As society is changing, the societal responsibilities of food and fiber animal veterinarians are also changing. Individual animal medicine has been replaced with a concentration on population medicine, or "herd health," as the size of the production system has grown. This growth in the production system has created an added strain on the environment. Food and fiber animal veterinarians need to help solve environmental problems created by large animal production systems [26]. An increasingly globalized food market has driven changes in food demand, production, marketing, and animal welfare. Globalization has also precipitated concerns about protecting animal and public health from foreign and emerging animal diseases, as well as bioterrorism [11]. Most practicing food and fiber animal veterinarians in the U.S. are nationally accredited by the USDA [27]. These individuals examine importing and exporting animals for evidence of disease—foreign and domestic—and are on the "front lines" of identifying reportable diseases. Based on the inspected animals' disease status, accredited veterinarians determine animal transport within the U.S. and internationally to and from the U.S. Because these accredited veterinarians are thought to be uniformly trained and thereby nationally registered, they are assumed by the government to be competent to assist in the event of a foreign animal disease emergency [28].

Clearly, veterinarians in clinical practice have substantial public health responsibilities. How prepared are veterinary school graduates for these responsibilities? In 1984, the USDA published a specific list of objectives necessary for accredited veterinarians. These objectives focused on foreign animal disease. In 1992, all veterinary schools and colleges agreed to integrate these objectives in their curricula. A review study in 2003 evaluated all veterinary schools at that time for their level of inclusion of these objectives in their curricula. The review demonstrated all schools and colleges of veterinary

medicine had foreign animal disease information in their respective curricula, but only 7 institutions required a core class in foreign animal disease [28]. All schools and colleges incorporated information about the most important animal diseases, as defined by the World Organization for Animal Health, but not in a manner to emphasize disease recognition and control. Most veterinary schools and colleges lacked instruction of essential regulatory practices [28].

The remainder of this chapter seeks to answer the first research question defined in this thesis:

“Is the public health education in veterinary curricula adequate among U.S. veterinary colleges and schools?”

Method and Results

Is the public health education in veterinary curricula adequate among U.S. veterinary colleges and schools? To answer this question, a methodology similar to the 2003 Wenzel review study, described above, was utilized. Wenzel conducted a review of curricula from all the U.S. veterinary schools and colleges to determine inclusion of specific objectives. These inclusions were inventoried and conclusions were made regarding these results [28]. This methodology was also used in a 2001 study by Stoskopf et al, which examined the curricular offerings in the area of zoologic medicine at 31 North American colleges and schools of veterinary medicine [29].

To answer the first question posed in this thesis, curricula from all 28 accredited veterinary colleges and schools in the U.S. were reviewed and observations were made about the specific courses listed within the curricula [30-56]. Information concerning the

curricula was obtained by internet search of online listings of individual professional veterinary curricula. When the veterinary curriculum was not available online, individual colleges or schools of veterinary medicine were contacted by phone or e-mail, requesting a printed copy of the current curriculum. It is acknowledged that subject titles do not capture the entire content of the specific course, but they do reflect curricular intent. An inventory of courses with titles specific to subjects related to public health was compiled. This list of subjects evaluated was based on a proposal to enhance public health education in the veterinary curriculum prepared by the American College of Veterinary Preventive Medicine (ACVPM) [57]. The subjects were Epidemiology (Epi), Food Safety, Zoonoses, Foreign Animal Disease (FAD), Environmental Health (E Health), Community Health (C Health), and Biostatistics (Biostats). When available, the number of credit hours was recorded; when the number of credit hours for a particular subject was not available, the number of weeks the course was taught, or a “Y,” was recorded instead. When a course included more than one subject, all were documented. Comments about elective course opportunities related to public health also were noted. This information was arranged by school and public health subject in spreadsheet format (Table 1).

The number of subject appearances in each school’s curriculum was also evaluated. This is represented by the Total Subjects column in the spreadsheet. For example, Auburn University required 1 of the 7 specific subjects in the veterinary curriculum, a community health course. Auburn’s Total Subject score is 1. Comparatively, Tufts University requires 4 of the 7 subjects, and the Total Subjects score is 4. Four is the maximum score that any veterinary school received. As indicated in Figure 1, 25% of the U.S. veterinary schools require 1 of the 7 subjects in the curriculum; 29% require 2 subjects; 32% require 3 subjects; 7% require 4 subjects.

The frequency of specific subjects within veterinary curricula was also noted. Figure 2 shows that of all the subjects related to public health required in the curricula, 39% of these were epidemiology courses; 32% were community health courses; 12% were food safety courses; 7% were foreign animal disease courses; 7% were zoonoses courses, 3% were biostatistics courses; 0% were environmental health courses.

Discussion

Realizing again that some courses will be more inclusive than their titles indicate, some topics covered will not be reflected and accounted for in this inventory. However, the subject title does reflect curricular intent. Of the recommended subject matters, epidemiology was the most common; almost 79% of the veterinary colleges required the course. A community health course was required in 64% of veterinary colleges. Only 25% of U.S. veterinary colleges require a food safety course, 14% require a zoonoses course, 14% require a foreign animal disease course, 11% require a biostatistics course, and there are not any veterinary colleges requiring environmental health in their curricula.

Review of this inventory suggests that U.S. veterinary school curricula vary in public health education. Veterinary colleges and schools differ widely in what public health subjects are included in the individual curriculum and the amount of course hours within the curriculum devoted to these subjects. This variability could result in considerable inconsistencies across the country in regards to the delivery of veterinary public health education to future veterinarians.

Globally, the WHO serves to disseminate advice that is objective and reliable. In 2002, a WHO study group published a report, *Future Trends in Veterinary Public Health*.

Section 7 of this report comments specifically about the professional development of veterinary students with regards to public health, stating “VPH should be taught in all veterinary schools” on page 37 [58]. It suggests that courses, not merely lectures, should be included in the veterinary program. These courses are food safety, zoonoses, and environmental health [58]. The study group commented that all veterinary graduates, no matter their career path, should have this basic foundation of knowledge. If the graduate seeks further training in a VPH-specific career, that training should take place outside of the veterinary curricula [58].

Certain subjects—biostatistics, epidemiology, immunology, microbiology, parasitology, and pathology—require “reinforcement” in VPH curricula [58]. As the inventory conducted for this thesis revealed, most of the veterinary colleges in the U.S. have incorporated epidemiology into their respective curricula. The WHO study group recognized this effort, but states that other areas of VPH, such as food hygiene, have been “neglected” in several educational institutions [58]. This is also reinforced by the inventory reported herein.

WHO stated that a veterinary program should include courses in food safety, zoonoses, and environmental health. Results from the inventory revealed only 25% of U.S. veterinary colleges and schools require a food safety class, 14% require a zoonoses course, and 0% require a environmental health course in their curricula. With regards to WHO recommendations, U.S. veterinary curricula are inadequate in veterinary public health education.

The WHO study group also recommends that each veterinary school have its own VPH department, staffed with faculty experienced in public health. This recommendation implies that each veterinary campus should have, at a minimum, a faculty member prepared

to deliver quality education in the subject matters that were previously identified (i.e., food safety, zoonoses, and environmental health).

In April 2007, a collaborative meeting between the AAVMC and Association of Schools of Public Health (ASPH) was held in Atlanta, GA. James Wenzel presented an oral session entitled, “Model public health curricula and shortfalls in U.S. veterinary professional curricula which must be supplemented by post-graduate, dual-degree, or just-in-time-training” [59]. The title encompasses the content of the session. Clearly, public health deficiencies in veterinary education are recognized by the AAVMC and ASPH. Should the responsibility and additional financial burden of correcting these educational deficiencies fall on veterinary graduates? The possible solutions this thesis will present provide a way for veterinary schools and colleges to address the deficiency without burdening the student with additional time and financial commitment.

It is recognized that curricular deficiencies are not unique to the veterinary profession. Particularly within the health professions, similar challenges are seen in education, these challenges include expanding amounts of information, high educational costs to the colleges and schools as well as the student, and faculty shortages. It was prudent, then, to ask the second question to be answered in this thesis:

“What have other health professions proposed to correct a perceived curricular deficiency?”

Method

Because this second research question is a comparative one, it was fitting that a comparative approach be adopted. Although this seems intuitive, given the lack of actual

quantitative data available, some research was warranted to grasp the intentions and limitations of a comparative approach. Comparative studies are common in the literature, particularly in the social sciences. Two examples of comparative studies were found. One involved the health sciences and compared the healthcare organizations of Denmark and the United Kingdom [60]. The second is a comparison of evaluation methods used in middle school curricula [61].

The comparative method is one of four methods of investigation to establish empirical relationships between variables. It is a general and broad method. This contrasts with the other three methods—experimental, statistical, and case study—commonly seen in the biological sciences [62]. Generally, these three methods have an endpoint of scientific explanation by controlling variables. The experimental method compares results from two groups—one group is exposed to a stimulus, the other is not. The statistical method mathematically manipulates the information obtained from experimental methods to uncover relationships between variables. The comparative method is representative of the statistical method, except it uses a smaller number of cases, or N's [62]. Case studies and studies using the comparative method are similar, but with one fundamental difference: the case study method focuses on a single case, while the comparative method focuses on at least two cases [62].

Small number of cases and many variables are the main weaknesses of the comparative method, thus the statistical or experimental methods should be used whenever possible [62]. When temporal, financial, and energy resources are too great to achieve quality results from these methods, the comparative method offers an opportunity to form a hypothesis for later analysis by the statistical, and eventually, the experimental methods [62].

Two general comments should be made concerning comparative studies. The first is that care should be taken to avoid selecting cases for a comparative study that fit a hypothesis; all cases should have systematic selection [62]. The second is if a negative result is found in a case, it does not mean that the hypothesis should be rejected [62]. With these comments in mind, a few suggestions were offered by Lijphart to combat the weaknesses mentioned above. The first of these suggestions was to increase the number of cases, if resources allow. If the sample number cannot be increased, the second suggestion was to combine variables that already express similar characteristics. Using comparable cases was the third suggestion, which means that the cases are similar in a number of important characteristics. Lastly, the analysis should focus on only the key variables [62].

As indicated by the above suggestion, the cases selected for comparison in this thesis met certain criteria. This thesis explores curricular deficiencies and the resulting responses of other health care professions. Therefore, three criteria existed in case selection: 1) the cases must each be about one of the health professions, 2) the cases must each have an identifiable curricular deficiency, and 3) the cases must each have an identifiable response from the profession's educational body. In regards to the first criteria, veterinary medicine is considered to be a health profession, and selecting cases from other health professions made them comparable to the veterinary profession. The second criterion was used to compare all cases with the identified curricular deficiency in veterinary medical education, which is the inadequacy of public health education in the veterinary curriculum. The third criterion provided examples of solutions to the identified curricular deficiencies. These examples allowed for discussion about possible solutions to the identified curricular deficiency in veterinary medical education.

Curricula from the health professions, specifically, are similar in regard to important characteristics. They are also similar to veterinary medicine curricula. The health professions featured in this thesis are veterinary, dental, medical, and chiropractic. In their professional educational programs, content of curricula and the length of programs are quite comparable. Their pre-professional college requirements are also similar. Since all four professions share similar characteristics, their individual curricular deficiencies and proposed solutions have reasonable application to any of the four.

The remainder of this thesis will explore three different health professions' perceptions of a curricular deficiency and their proposals to address their perceived deficiencies. Each of the next three chapters will open with an introduction to the circumstances within a particular health profession that lead to a perceived curricular deficiency. In a narrative method, the deficiency will be described. Each chapter will then describe what was done or proposed to correct the deficiency.

This type of descriptive research is seen in many other areas of science and is used to evaluate variables without hypothetical testing [63]. In this thesis, descriptive research is employed to narrate how certain health professions addressed specific curricular problems or deficiencies. An example of this type of descriptive case research is seen in a Master's report describing three cases of architectural renovation of historical buildings. The author highlighted unique problems that each of the three cases illuminated and the creative solutions used to address these problems. At the end of the report, the author offered suggestions for a successful completion of similar projects [64]. The same approach is being applied within this thesis.

Chapter 5 of the thesis will discuss each of the potential solutions as it applies to public health education within the veterinary curriculum. This descriptive method may

produce (inductively) testable hypotheses, regarding proposed prescriptions, for the lack of consistency in public health education within veterinary curricula.

CHAPTER 2 - Dental Profession (2001-present)

Similar to the veterinary profession, the human dental profession has identified areas of deficiency in dental education that may diminish the profession's effectiveness. In 2001, Dr. Kathleen Roth identified "symptoms of a looming crisis in dental education" [65], page 983. These symptoms, which she described as previously identified challenges faced by dental schools and colleges, included rising educational costs in the face of declining financial support, high student debt loads, an outdated curriculum, a frustrating clinical teaching environment, and faculty shortages [65].

Regarding the dental curriculum and educational environment, Roth explains that the majority of current dental practitioners remember their dental educational experience as "highly frustrating" [65], page 984. Course content and assignments were outdated, irrelevant, and not placed into appropriate clinical context. There appeared to be a mismatch between curricular requirements and what was necessary in practice. Faculty did not appear to know how to teach or test students. Graduated dentists also felt that the dental school faculty sometimes used intimidating instructional methods; this method of instruction was indicated as a negative educational experience by past students [65].

Roth noted that dental practitioners were more likely to employ practice methods emulated from clinical instructors and experts in the lecture circuits rather than what the recent literature was promoting. As dental students, they suffered from a lack of experiences and abilities to assess the validity and applicability of clinical research. This weakness persisted when they became practitioners, resulting in the avoidance of current

research and its clinical application. Research faculty in dental educational institutions have the responsibility to develop abilities to share discoveries and clinical implications with students, encouraging the reliance upon research as an aid to making practice decisions. This reliance will help students adapt to changing methods and technology during their practice careers, using research evidence to guide them. Roth encouraged dental schools to embrace a more evidence-based approach to the curricula, as opposed to faculty promoting their own recommendations [65], thus requiring a change in how faculty deliver the curricula.

Identified Deficiency: Lack of faculty effectiveness

Hendricson et al. described faculty development as the “essential ingredient” in dental professional curricular reform [66], page 1515. The purpose of this article commissioned by the American Dental Education Association Commission of Change and Innovation in Dental Education, or ADEA CCI, was to provide dental schools with insights and information about faculty development. Due to the apparent lack of forward movement in dental schools with educational reform implementation, Hendricson et al. made recommendations concerning faculty development. In this enlightening publication, the authors pose and address several questions:

- What is faculty development?
- How is faculty development accomplished?
- Why is faculty development particularly important in dental education?

- What happens when faculty development does not accompany educational reform?
- Why are teaching attitudes and behaviors so difficult to change?
- What outcomes can be expected from faculty development?
- What does the available evidence tell us about the design of faculty development programs [66]?

The authors cited several quotes from thought leaders in health profession education in defining **faculty development** as:

“...a tool for improving the educational vitality of our institutions through **attention to the competencies** needed by individual teachers and to the institutional policies required to promote academic excellence.” -Wilkerson and Irby [66], page 1515.

“...the broad range of activities that institutions use to **renew or assist faculty** in their roles.” -Centra [66], page 1517.

“...**planned program** to prepare institutions and faculty members for their academic roles including teaching, research, administration, writing/scholarship, and career management.” -Bland et al. [66], page 1517.

“...**manage change by enhancing individual strengths and abilities** as well as organizational capacities and the overall culture.” -Bligh [66], page 1517.

“...**needed at all levels of faculty life**, from novice instructor through the administrator to address the various levels in the educational enterprise.” -O’Neill and Taylor [66], page 1517.

The author of this thesis used bolding on type for emphasis.

Hendricson et al. reviewed literature concerning methods of faculty development, and concluded that most development strategies are encompassed in a hierarchial system published by Ullian and Stritter [66]. This system encompasses seven development activities, described in the next paragraph.

The hierarchy begins with self-directed activities. Faculty members can engage in reading, self-assessment and reflection, viewing videos, and reviewing evaluations completed by students. The second tier in the hierarchy involves faculty shadowing more experienced teachers. The third tier describes the faculty member being videotaped and/or observed when performing teaching duties and getting feedback. The fourth tier is the faculty member’s participation in short lectures, journal clubs, or other peer-directed discussion groups. Workshops and brief seminar participation of three to six hours is the fifth tier. In the sixth tier, the time commitment is expanded to several weeks in skills fellowships or teaching enhancement courses. The seventh and final tier describes organizational support such as formalized mentoring programs, sabbaticals for observations at other schools, and provision for faculty to engage in advanced degree and/or leadership programs [66].

To illustrate the need for faculty development in dental education, Hendricson et al. explained that there is an aging dental faculty, and that younger faculty are often easily

drawn away from academia to enter private practice. Many of the replacements for these faculty members are older dental professionals who are seeking positions in academia as a second career. These older professionals have little experience or knowledge of contemporary academic environment and policy and may be reluctant to embrace the challenges of a changing curriculum. Thus, faculty development is needed to help retain the younger faculty and retrain the older faculty recruits [66].

Four reform proposals advocated in health professional education (in addition to dental schools) are problem-based learning (PBL), e-curricula, integrated and team-taught curricula, and evidence-based practice. In a review of the literature, Hendricson et al. concluded that all proposed reforms have met resistance in acceptance and use by faculty, and that the major barrier encountered is the lack of awareness and capacity within the faculty to implement such changes [66]. For successful curricular change, faculty development programs must be well-designed, implemented, and supported by the educational institution [67]; they should be at the very center of the complex issue of planning and implementing educational reform [66].

Literature describing outcomes of faculty development programs are scarce. To discuss outcome assessments, Hendricson et al. deferred to “the most comprehensive source of information” [66], page 1526. This source is a summary report by the Best Evidence in Medical Education Collaborative (BEME). The report was published as Guide No. 8 in *Medical Teacher’s* June 2006 issue [66].

BEME is an internationally collaborative group of individuals and institutions that is involved with the movement from “opinion-based education to evidence-based education” in medical education. Its main purposes are to collect and review studies of medical

education research, to disseminate the conclusions world-wide, and to foster a culture of best-evidence medical education among stakeholders [68].

The objective of the BEME report was to assess the effects of faculty development programs on faculty members as individual teachers and the resulting impact on their respective educational institutions. The BEME report addressed specific points: features of effective faculty development, if faculty development makes a difference, and the effects on the individual teachers and institutions. An international group of individuals gathered to refine this review, develop a framework for study review, and define inclusion and exclusion criteria for research study articles. Literature searches of Medline and ERIC provided articles that were used in the review. Data extraction and analysis were performed, based on the following criteria:

- Expected learning outcomes
- Context of the intervention
- Description and impact of the intervention
- Evaluation methods
- Study quality and strength of findings
- Suggestions for future research
- New insights and implications for faculty development [68].

Admitting limitations in methodology, the BEME determined outcomes for faculty development programs from 53 research study articles discussing individual programs. Faculty program participants were generally satisfied with programs, and they also reported an improved attitude in teaching and faculty development as a result of their program. In

addition, the participants felt they grew in knowledge about teaching concepts, strategies, and skills. They also reported increased involvement in different educational activities and new networks of colleagues as a result of the faculty development program [68].

Hendricson et al. felt that the BEME review offered much to faculty program development and encouraged dental educators to place this document in their “must read” pile [66], page 1526. Hendricson et al. referred to several studies, with special reference to the BEME review, that suggest the effectiveness of a faculty development program is influenced by 6 criteria: 1) the inclusion of experiential learning, 2) feedback to the participants, 3) opportunities to apply what has been learned, 4) contact with peers modeling exemplary teaching styles, 5) diversity in learning experiences, and 6) post-program assessment [66]. Licari simplified these criteria into 3 main stages: help faculty focus on the curricular change and the need for change, prepare the faculty to teach the new or changed curriculum, and help the faculty assess learning with the new changes [67].

At the University of Missouri Kansas City (UMKC) School of Dentistry, a determined effort in faculty development has been in place for two years. Dr. Cindy Amyot directs faculty development at the school. Dr. Amyot has a BS in dental hygiene, MS in dental hygiene education, and doctorate degree in education. She is also a member of the ADEA CCI [69]. During a telephone interview, Dr. Amyot provided a brief description of such activities, which are summarized in the following paragraph.

Recognizing that most dental school faculty were not trained educators, faculty development programs focus on pedagogy and using technology in the classroom and clinical setting. In a single semester, a faculty member has the opportunity to attend two to three lunchtime educational sessions a month. These sessions may include subjects such as mentoring or technology in teaching. In the semester, one or two faculty in-services are also

conducted. These are a half to a full day in length and cover a variety of topics and often involve outside expertise. Recently, the faculty were surveyed to determine what subjects would be beneficial to review, and those suggestions were then implemented. Faculty are also able to apply for funding to support faculty development sessions off campus [69].

Admitting that outcome studies need to be conducted to fully evaluate the effectiveness of the implemented faculty development programs, Dr. Amyot did have anecdotal evidence that the programs were successful. She reported faculty that have been teaching at UMKC for forty years feel that they now “have the best teaching group” [69].

Proposed solution: Faculty development programs

Earlier this decade, dental educators realized that faculty ineffectiveness was one of many symptoms of a crisis in the profession’s educational structure. Current dental practitioners were using outdated practice methods and avoided current research literature. Dental educators believed this to be the result of lack of faculty development. Clinical and didactic instructors needed to update the information they were teaching and use more effective teaching strategies. Research faculty needed to learn how to teach the material that they were discovering in their laboratories, keeping the students current on developing practice methods. Since then, faculty development programs have been advocated, planned, and executed. Although limited researched evidence exists demonstrating the effectiveness of these programs, preliminary reports indicate that the programs are successful.

CHAPTER 3 - Medical Profession (1910-present)

In the year 1910, a document was published that had unprecedented effects on medical education in the United States. It was received by the medical community with very polarized reviews. It was described as “epoch making,” “fearless,” and “specific” by those who embraced its recommendations to improve the quality of medical education. It was concurrently criticized as being “contentious and unnecessarily irritating,” and as an “animus against smaller institutions” by those who were threatened by its proclamations and direct suggestions [70], page 106. Regardless, its influence on medical education proved to be the most dramatic, then or since, of any document concerning medical education. It revolutionized medical education in the United States, and medical educators today are requesting an encore [71, 72].

Bulletin Number Four of the Carnegie Foundation for the Advancement of Teaching, now known as the *Flexner Report*, was written by a scholar and educator. However, the author, Abraham Flexner, was not a physician. This seemed inconsequential to Mr. Flexner’s persistence in medical educational reform [70]. Flexner, discouraged by medical practice being viewed as a status symbol and money maker, voiced his concern about public health welfare.

“Such exploitation of medical education is strangely inconsistent with the social aspects of medical practice. The overwhelming importance of preventive

medicine, sanitation, and public health indicates that in modern life the medical profession is an organ differentiated by society for its highest purposes, not a business to be exploited” [73], page 2140.

Flexner discussed standardization of medical school curricula, with 2 years of classroom and laboratory education and 2 years of clinical education. He also alluded to the focus of the previous chapter, faculty development, stating that medical schools have no place for “the scientifically dead practitioner whose knowledge has long since come to a standstill and whose lectures, composed when he first took his chair, like pebbles rolling in a brook, get smoother and smoother as the stream of time rolls over them” [70], page 108.

Specifications of teaching hospitals were also recommended. Flexner discussed their organization, size, and function. He specified that individual states should partially fund the operations of their own teaching hospitals. The total number of schools was to be reduced and those surviving schools were to be associated with colleges or universities [70].

Flexner advocated a government supported licensing organization, such as a Boards of Registration of Medicine. In his opinion, students should have standardized licensure, whether they were to practice in progressive, urban areas or smaller, rural areas [70].

Two years after he published *Bulletin Number Four*, Flexner sat on the General Education Board, which was funded by Rockefeller, with medical education reform at the top of the agenda. While he sat on the Board, he was able to secure \$50 million from Rockefeller. This money was added to funds collected from other philanthropists and used to implement the recommendations he made in his report. Between 1919 and 1928, Flexner sought to improve clinical teaching facilities and to establish full time faculty in medical schools. Even after his retirement from the Board in 1928, progress in medical education

continued. Most proprietary schools were eliminated, reducing total schools from over 160 to 76. Curricula and entrance requirements were, due to his efforts, standardized between schools [70].

Despite his emphasis on the natural sciences, Flexner admitted that the profession was “fast becoming social and preventive” [70], page 107. Therefore, Flexner advocated a liberal pre-medical college experience, with heavy emphasis on chemistry, physics, and biology. At the time, students were being accepted into medical schools with varying educational experiences: some with a college degree and some without a high school diploma. Before the effects of his report were seen, some medical colleges required a list of certain preparatory courses, while others required simply the money to pay for tuition. His recommendation of requiring a high school diploma and at least 2 years of college for entrance into medical school became standard prerequisites [70].

Today, entrance into medical school is weighted upon completion and grades in undergraduate pre-medical classes (biology, chemistry, and physics), activity in extra-curricular and volunteer organizations, and standardized test scores (Medical College Admission Test, or MCAT) [74]. Some educators believe that pre-medical educational requirements have become too scientific and rigid, even irrelevant. Others fear that humanity in the medical profession has been lost by training “concrete” thinkers that simply memorize facts [74].

As Flexner noted in his time, medicine is social and preventative. Today, a great emphasis on preventative medicine exists in the medical profession. Health insurance premiums are lower if the insured does not use tobacco products. Reduced-cost immunization clinics are common. More and more general screening tests (i.e., mammograms, well-checks, colonoscopies) are covered by insurance companies, because it

has been recognized that prevention or early detection of a disease is less costly than treatment.

The social influence in disease and health is also recognized today, perhaps even more than in Flexner's time. In the 1930's social medicine began as noninfectious disease epidemiology, focusing on cancer [63]. Since then, social medicine has identified itself with increasing knowledge in the vast numbers of infectious disease, such as HIV-AIDS, sexually transmitted diseases, and parasitic infections. Social medicine also involves researching and educating the public about other behavioral-linked diseases, such as smoking and cardiovascular disease [63]. Clearly, social and preventative medicine is, even more today, a vital component of the practice of medicine. Society requires that today's physician be more than a natural scientist.

Identified deficiency: Outdated, irrelevant pre-medical curriculum

Emanuel identified specific courses as irrelevant: organic chemistry, physics, and calculus. In his 2006 article, he questions:

“Many premed requirements are irrelevant to future medical education and practice. Does knowing how to integrate $\sin\theta$ have anything to do with caring for a patient or elucidating the role of TERC in aplastic anemia? Do any physicians, even researchers, have to know about Diels-Alder adducts? Is calculating the angular momentum of a spinning top relevant to any medical practice? Most of what is contained in one year of calculus, organic chemistry, and physics is irrelevant to medical practitioners, researchers, and administrators” [71], page 1129.

Emanuel believes that pre-medical courses in organic chemistry, physics, and calculus serve only to “weed out” students [71], page 1129. He, along with other advocates, believes that these courses could be replaced by more relevant subjects. By eliminating calculus, organic chemistry, and physics, six semester hours become available for more relevant classes [71].

Emanuel makes four simple arguments for these proposed changes. First, he claims that the mathematics needed most by medical professionals is statistics. Statistics are essential in understanding literature in medical research as well as the experimental design and execution of the research. Emanuel advocates adding a semester of statistics to the pre-medical curriculum [71].

Second, most of the material covered in organic chemistry and physics is irrelevant to the medical professional. What is relevant could be covered in a couple weeks, contained in more relevant classes. These more relevant classes include a semester each of genetics and molecular biology and one year of biochemistry [71].

Third, Emanuel recommends the addition of a one-semester ethics class in the pre-medical studies. He claims that this class would help students gain “the ability to distinguish ethical issues from communications, economic issues, or aesthetic issues, to make ethical arguments, and to give ethical reasons that justify their decisions” [71], page 1129.

Lastly, Emanuel suggests adding a one-semester psychology course designed to educate students how to enhance interactions with staff, colleagues, patients, and their own families [71]. Revisiting Flexner’s prediction of social medicine, other educators also suggest more pre-medical classes in the humanities and social sciences [74].

But is simply changing the required classwork enough? Does the entire pre-medical experience depend on the classes one takes? Some feel that the significance of the premed curricula is not only defined by the classwork, but also the atmosphere and extracurricular experiences that truly shape the minds and attitudes of tomorrow's physicians [74]. Further, the over-emphasis of performance in pre-medical curricula creates a certain set of values and norms, called the "premed syndrome" [74]. This is characterized by excessive competitiveness, lack of social skills, and an extreme preoccupation with grades. Thus, students are learning far more than what is taught in the classroom; should they be learning more than how to succeed in admission to medical school?

Gross et al. surveyed ten first and second year medical students, four medical school admission committee members, and nine pre-medical advisors about the pre-medical experience. Their responses were quite different. The advisors and committee members described the premed experience as an illuminating journey that helped students shape their attitudes about their fit into the medical profession as well as the "characteristics" of different medical schools [74]. Students described it as a competitive group of obstacles in their path of achieving admission to medical school. They strategically enrolled in classes that were required and those that helped to boost their GPA, not in those classes that may have augmented the social and humanistic development of a prospective physician. Their clinical and research experience in the pre-medical years was tempered by what would look best on their medical school application. The desire to gain positive recommendation letters for application to medical schools encouraged them to grow relationships with their professors [74]. Thus, the students had a very egocentric pre-medical education in a career path to be members in a profession of whose sole responsibility is the medical care of another human.

Gross et al. proposed changes to address the atmosphere and attitudes that shape the very character of young medical professionals inside and outside of the classroom. The researchers admitted that little exploration of such changes exists. Most of the focus is changing the prerequisite classes for entrance into medical school. By the time students enter medical school, it is too late to shape their attitudes and character [74].

Proposed solution: Modernize and humanize the pre-medical curriculum to be more current and socially relevant

At the beginning of the last century, science was becoming more influential in the medical profession. Abraham Flexner realized that medical professional education needed to change from a profession depending on anecdotal evidence to one relying on the laws of science. This revolutionized the delivery and content of pre-medical and medical curricula, and thereby drastically improved the quality of medicine in the United States. Flexner himself also realized the impact social science had on the effectiveness of medical education and practice. This impact is being recognized more today. Some educators desire to again restructure the pre-medical curriculum to allow for development of social awareness and responsibility in tomorrow's physicians.

CHAPTER 4 - Chiropractic profession (1995-2007)

Members of the health professions are trained to provide high quality care. In addition, they also serve as public health educators to society during their practice careers. Health promotion and disease prevention are specific public health concerns that health professionals are poised to address with their patients. Health promotion is the application and modification of behaviors to reduce risk factors for disease. Disease prevention measures, or clinical preventative services, are offered to disease-free individuals to prevent disease occurrence. Clinical services are offered to people that may have risk factors for certain diseases and are intended to prevent disease occurrence or diagnose the disease in an earlier, more treatable stage [75].

Public health education for the health professional is a growing need driven by many factors including: changing patterns of diseases, the influence of behavior in disease, social and economic changes, aging populations, and increasing global travel [76]. Influential entities such as the United States Surgeon General, Pew Health Commission, and Healthy People 2010 strongly support and encourage efforts to improve education in health promotion and disease prevention for the health professions [77], [76].

In 1995, a paper published in the *Journal of Chiropractic Education* illuminated the disparities of public health education among chiropractic colleges [78]. In 2001, the same journal published a collective list of courses related to public health that were being taught in chiropractic colleges. The authors stated that the courses were appropriate, but not

particularly useful in the context of public health education. Relevant public health topics were absent from most curricula. Furthermore, when relevant topics were present, they were often scattered throughout the curriculum, out of context and disjointed from clinical application [75].

In 2001, Green conducted a survey asking current chiropractic students and practicing chiropractors about the public health education in their professional education. These stakeholders' responses were consistent; a stronger integration of clinical preventative medicine and health promotion would be beneficial in chiropractic practice [75].

In 2000, Hawk discussed discrepancies between public health education in chiropractic school and health promotion in clinical practice. Specific issues were identified:

- Over emphasis on the disease model and singular cause with emphasis on biological science and absence of the biopsychosocial model,
- Lack of teaching chiropractic students how to engage patients in active self-care and taking charge of their own health, and
- Missing emphasis that public health requires interdisciplinary collaboration and need exists to form alliances with public health departments [79].

Identified deficiency: Inconsistencies in public health education

As a first step to address this curricular deficiency, authors of the above articles encouraged discussion among the public health representatives and administrators in the chiropractic colleges to assess and change public health educational delivery in the chiropractic curriculum [75], [78], [79]. In September 2000, The Model Course project began with a baseline assessment of chiropractic students, public health faculty, and field practitioners regarding their current attitudes, beliefs, and behaviors concerning public health. Project members organized into working teams in the core areas of public health. These core areas included epidemiology and biostatistics, health policy and management, behavioral studies, environmental health sciences, health education, infectious and non-infectious diseases, occupational health, and preventative services. Using feedback from the baseline assessment, the project members then created learning objectives specific to these core areas. Feedback was gathered from members in other core public health areas and a public health-chiropractic advisory group. Additional feedback from chiropractic public health faculty contributed to the evaluation of the proposed learning objectives [77].

In March 2001, the project members organized an educational event highlighting the importance of public health in chiropractics. A public health workshop was held at the Association of Chiropractic Colleges (ACC) annual meeting. The workshop included presentations, paper presentation sessions, and group discussions concerning certain areas of public health [77].

The project concluded in early 2002 with the production of *A Model Course in Public Health Education in Chiropractic Colleges-User's Guide*. Michael Perillo was the Chiropractic Project Director and wrote this about the *User's Guide*:

“This manual is a collection of the background, educational tools, assessment results and recommendation for educational content generated during the project. It should serve as a useful reference for future chiropractic educators and researchers. These recommendations are a work in progress, not a final product. They represent a phase in the evolution of public health education in chiropractic, and will no doubt be the subject of future evaluation and modification.” Forward, [77].

The user’s guide provided explicit description of the overall program goals. The following are these exact goals stated in section VI of the *User’s Guide*:

- To teach public health to chiropractic students emphasizing relevance to clinical chiropractic practice.
- To train chiropractic students to understand and appreciate the basic public health systems that exist in the United States.
- To familiarize students with traditional public health methods, philosophy and vocabulary as described in commonly accepted definitions of public health and public health initiatives.
- To provide introductory training in the scope of public health, including the following specific subject areas:
 - Environmental sciences
 - Epidemiology
 - Health policy and management
 - Health Promotion and Clinical preventive health services
 - Infectious Diseases and Immunology

- Non-communicable diseases
- Occupational health
- To familiarize students with methods to access and evaluate reliable, relevant sources of public health information.
- To enable students to formulate an impression of their own role and the chiropractic profession's role in public health.
- To provide the public health information necessary for students to pass licensure examinations and meet accrediting bodies' requirements [77], page 27.

Section VII, Subject Specific Learning Objectives, is an elaborate, twenty-four page list of learning objectives specific to core areas of public health. This is the main thrust of the document, and the contents are intended to be included in the chiropractic curricula [77].

The Canadian Memorial Chiropractic College (CMCC) has been implementing, in phases, a new curriculum since 1999. The previous curriculum was based on a traditional medical model, with three years of basic and clinical studies and a final year of a mixture of didactic and practical experiences. Since 1999, the college has implemented a more integrated, outcome-based curricular program [76].

Although the previous curriculum included a public health course, it was not well-attended or appreciated by students. Student surveys indicated that they were disappointed with the course and its lack of practical applicability. Administrators and curriculum committee members felt that the public health course required major revisions in content and delivery [76].

The *Model Course for Public Health Education in Chiropractic Colleges* was the framework that helped to revise the public health course at CMCC. However, it was felt that the document was too “cumbersome” to be contained in a short public health course. CMCC reviewed the subject-specific learning objectives and modified the list to fit within the college’s time and resource restrictions. The seven major subject areas, environmental sciences, epidemiology, health policy and management, infectious diseases and immunology, noncommunicable diseases, health promotion and clinical preventive services, and occupational health were included in the organization of the new course. The content was delivered by representatives of public health including: field practitioners, external and internal faculty, and persons from local public health departments [76].

A follow-up student survey published by Borody and Till demonstrated that CMCC students were more satisfied with the changes in the public health course. The authors admitted that they cautiously interpreted the results as they were based entirely on student questionnaire responses. However, they did feel that it was successful in the short-term [76].

Proposed solution: Reformed public health course

Over the past decade, the chiropractic educational stakeholders have identified a weak and inconsistent delivery of public health education in the sixteen chiropractic colleges in the United States. Administrators and faculty combined information from a collaboration of chiropractic faculty, practitioners, students, and public health representatives to reform the content and delivery of a public health class. The efforts to

make the course material more clinically practical appeared to have a positive effect on student perceptions.

CHAPTER 5 - Discussion and conclusion

While the veterinary, dental, medical, and chiropractic professional schools are different in educational content, they are quite similar in many areas. Their curricular structures are comparable in that they all have didactic and clinical components. The lengths of the programs are similar, ranging from 3-5 years, to acquire the professional degree. Health professional programs are rigorous and have a heavy emphasis on the biological sciences. Prerequisite studies are undergraduate courses in biology, chemistry, physics, and composition, minimally. All four professional programs need to prepare the student for a national licensing exam. This, in effect, drives standardization within each profession's curricula. Due to these similarities, comparisons in perceived curricular deficiencies and solutions of the dental, medical, and chiropractic professions could provide a way to address veterinary curricular deficiencies.

In these next sections, deficiencies within the veterinary curricula are compared to those identified in the dental, medical, or chiropractic curricula. Next, the proposed solutions to these deficiencies are discussed in their relevance to the veterinary curricula. A brief summary of these previously identified deficiencies and solutions are reviewed in Table 2.1 below.

Table 2: 1: Summary of curricular deficiencies and proposed solutions in four health professions

<i>Health profession</i>	<i>Perceived deficiency</i>	<i>Proposed solution</i>
Veterinary	Inadequacy in public health education	?
Dental	Lack of faculty effectiveness	Faculty development programs
Medical	Outdated, irrelevant pre-medical curriculum	Modernize/humanize standard pre-medical curriculum
Chiropractic	Inconsistencies in public health education	Reformed public health course

From the Dental Profession

As mentioned in Chapter 2 of this thesis, Roth identified several “symptoms of a looming crisis in dental education.” These symptoms included rising educational costs with declining financial support, soaring student debt loads, outdated curricula, a frustrating clinical teaching environment, and faculty shortages [65]. Similar symptoms are found in the veterinary educational system [80].

In 2007, *The Foresight Report* was published by the Association of American Veterinary Medical Colleges (AAVMC). This report was a long-range planning project to determine the perceived needs of the profession within the next 20-25 years. This report identified issues in veterinary education that are similar to those identified by Roth in the

dental profession [80]. The report addressed veterinary student debt as something that “...impedes progress by the profession.” [80], page 13. Additionally, the report discussed the need to increase educational funding, because the current financial support was inadequate to supply societal demands for veterinarians [80]. A section of this report discussed curricular changes to include subjects outside of the natural sciences, such as communications, public relations, and conflict resolution [80]. In 2005, the *Journal of Veterinary Medical Education (JVME)* published an article discussing the factors affecting veterinary faculty shortages [81]. The same issue of this journal included another article that revealed potential reasons for faculty dissatisfaction and why those veterinary faculty members eventually left academia [82].

In the latter article, Freeman discussed the many factors that contribute to satisfaction of clinical faculty members, particularly with regards to research. These factors included clearly identifiable goals, leadership in research, a productive and positive working group, and access to resources—including human resources [82]. Freeman states on page 333, “There is an urgent need to develop and implement multi-faceted faculty mentoring programs at our veterinary colleges.”

Chapter 2 of this thesis contained a bullet list of different definitions for “faculty development.” These definitions were provided by thought leaders in dental education. To briefly summarize the wisdom of these dentistry education thought leaders, a combined definition for faculty development could be the following: Needed at all levels of faculty life, faculty development is a planned program meant to renew and assist faculty by giving attention to competencies in order to manage change by enhancing individual strengths and abilities.

In the veterinary curricula, classes related to public health are sometimes taught by instructors who have primary interest in subjects other than public health. These instructors are not incompetent, but their training and interest may not prepare them to teach a course related to public health. Assumedly, this may contribute to inconsistencies in public health education in the veterinary curricula.

As discussed earlier in this thesis, the American Veterinary Medical Association Council on Education (AVMA COE) does not identify specific public health objectives to be taught in veterinary colleges. The AVMA COE also does not require veterinary colleges to have a faculty member trained in public health [15]. These observations are not intended to criticize the leadership of the accrediting agency. However, the lack of specific requirements results in the lack in needed framework to avoid significant curricular inconsistencies in public health education. If faculty members trained in public health are not available to instruct related courses, faculty responsible for these courses may benefit from a development program specific for instructors of veterinary public health. Even if colleges have faculty trained in public health, these faculty members could benefit from a development program. This program could help structure public health courses with relevant and clinically applicable material. Veterinary colleges could collectively contribute to the construction of such a program, providing more consistency in the delivery of public health education in their individual curricula.

In 2006, Steinert and Mann published an article, “Faculty Development: Principles and Practices” in *JVME*. The authors—who happen to also be the first two listed authors in the BEME report—examined faculty development programs in the medical profession and made suggestions for faculty development programs in veterinary education [83]. Faculty development programs are intended to target individual and organizational levels. At the

individual level, attitudes and beliefs of the individual are addressed. Support for the faculty members as a group is the goal of the organizational level. An example of development at the organizational level is creating environments that support learning and development, interprofessionally and intraprofessionally. Previously, the authors commented that less attention has been given to organizational development [83].

Steinert and Mann discussed challenges frequently encountered in faculty development programs, warning that “faculty development programs cannot be designed or delivered in isolation” [83], page 320. They identified specific factors that could be contributive or destructive: individual desires, organizational agendas, institutional support and resources. More common challenges included the following:

- Clear identification of program goals and priorities
- Harmonizing organizational and individual needs
- Faculty motivation in participation
- Support of the institution
- Promotion of a change in traditional mindsets toward teaching and learning
- Limitations in financial and human resources [83]

Steinert and Mann expressed particular concerns about faculty motivation in development initiatives. They explained that some faculty members may feel threatened when asked to change what they perceive to be successful teaching methods. Time for learning was also emphasized as being vital to faculty development success. Even the most motivated teachers are disadvantaged when they are not allocated time to learn and revise their instructional methods. If the institution is not supportive of the value in faculty

development programs by allocating time and other resources for them, faculty motivation to continue the program will suffer [83].

Abundant evidence in health professions' literature declaring the effects of faculty development is lacking. Very few studies exist that evaluate faculty development programs with control groups and adequate sample sizes; lacking control groups and adequate sample size diminishes the value of the assessment [83]. Future study of faculty development programs will present great opportunities to enhance and improve teaching effectiveness and support curricular changes that are necessary across all the health professions [66]. The evidence of the effectiveness of faculty development programs as reported in the BEME report, however, presents a strong argument for the design and implementation of programs to help the faculty succeed with new curricular implementations. It is beyond the scope of this thesis to offer a faculty development program plan for public health education in the veterinary curriculum. However, it is suggested for exploration as a possible solution to curricular deficiency, as experienced in the dental educational system.

From the Medical Profession

Pre-medical admission requirements are very similar to pre-veterinary requirements. Both require completion of a list of courses in the natural sciences. Grade point average is weighted heavily in the application process. Medical and veterinary colleges also consider the applicant's professional experience. Both programs will evaluate the applicant on participation in pre-professional organizations and other related activities. These requirements and recommendations for acceptance into a professional program will shape the attitudes and culture of students in pre-professional curricula. As previously

mentioned in Chapter 3, Gross et al. discussed that this “checklist to success” ultimately encourages students to be more concerned about what grades they receive and the desired experiences than the quality of education and experiences. This results in students who are excessively competitive, lacking in social skills, and preoccupied with grades [74].

Specifically examining course requirements, the comparative table is provided below to illustrate the similarities between pre-professional admission requirements of a veterinary school (Kansas State University College of Veterinary Medicine—KSU CVM) and a medical school (University of Kansas School of Medicine—KU SOM) [84], [85].

Table 2: 2: Comparison of prerequisites for application to a veterinary college and a medical school

KSU CVM		KU SOM	
Course	Semester hours	Course	Semesters
General Biology or Zoology	4	General Biology	2
General Organic Chemistry	5	General Organic Chemistry	2
General Inorganic Chemistry	8	General Inorganic Chemistry	2
Physics	8	Physics	2
Expository Writing	6	English composition	2
Public Speaking	2	Oral communications	Suggested
General Biochemistry	3	Biochemistry	strongly suggested
Genetics	3	Genetics	strongly suggested
Social Sciences/Humanities	12	Social Sciences/Humanities	Suggested
Microbiology	4	Upper-level biology	Suggested
		Mathematics	1

Realizing that minor differences among all respective professional schools exist, the admission requirements of these two schools will be used to generally represent other

professional schools. There are several reasons to support this assumption. One reason is that both the veterinary and medical professions utilize a universal application that can be used to apply to multiple schools in one application. For this to be effective, pre-professional requirements need to be generally similar. (KSU CVM requires submission of the Association of American Veterinary Medical Colleges application [86], and KU SOM requires the American Medical College Application Service [84].) Another reason is that students applying for admission to veterinary or medical programs are required to take an admissions exam. This is a standardized test that was written with the expectation that all students would have been exposed to similar information within their pre-professional programs. (KSU CVM requires the Graduate Records Exam [86], and KU SOM requires the Medical College Admissions Test [87].)

In Chapter 3, four arguments for changing pre-medical requirements Emanuel proposed were discussed. To review, they are:

- Statistics is the mathematics course needed by medical professionals
- Most material in organic chemistry and physics is irrelevant
- Ethics is a course recommended in the pre-professional curriculum
- Psychology is recommended in the pre-professional curriculum [71]

If Emanuel's arguments are applied to the pre-professional course requirements for the two schools above, several observations can be made. Neither school requires statistics. Significant amounts of the pre-professional requirements of both schools are in organic chemistry and physics. Neither school specifically requires ethics or psychology. Additionally, KSU CVM has more course requirements. The CVM requires coursework in

General Biochemistry, Genetics, and Microbiology, Public Speaking, Social Sciences/Humanities. KU SOM lists these as “suggested” or “strongly suggested” for application.

Sandra McCurdy, the Associate Dean of Admissions at KU SOM, made a similar observation. She indicated that the requirements for admission to medical schools were less academically rigid than those required for admission to veterinary schools. She verified that medical schools desired reformation in the pre-medical requirements, but a consensus has not been reached among medical school administrators on the specific changes to be made. An example of a specific change that Ms. McCurdy mentioned included less emphasis on the natural sciences in the pre-medical curriculum. Another desired change was a greater global perspective in the pre-medical curriculum. Ms. McCurdy indicated that the rare applicant to KU SOM has this broad awareness; most are just focused on being accepted into the professional program [88]. The author of this thesis has witnessed similar attitudes in applicants to veterinary school.

Susan Watt, the pre-medical advisor for KSU, feels that increasing the amounts of social sciences and humanities and in the pre-medical curriculum is important for the professional success of future students. However, she described a precarious situation. Simply increasing the required number of semesters of social sciences and humanities does not address the issue. Specific courses in the broad subjects of social sciences and humanities are highly encouraged in the pre-medical curriculum by pre-medical advisors to broaden the student’s global perspective. An example is a course in medical ethics. It would benefit pre-medical students if this course was required for application. Not all colleges and universities have the resources to offer this specific course. By requiring this class for

application, it would essentially exclude students attending institutions that did not offer the required class [89].

Changing pre-veterinary required courses could provide opportunities to gain education in areas of public health. Students could have exposure to general principles of epidemiology, biostatistics, community health, environmental health, zoonotic disease, foreign animal disease, and food safety in the pre-veterinary curriculum. This would create a more global perspective for students and a foundation to build upon in the professional education. Building upon principles may require less time in the professional curriculum than having to introduce them first. If students had been exposed to these subject areas earlier in their academic careers, they may have a greater appreciation for them in their professional training.

Addressing pre-veterinary course requirements would necessitate a consensus among administrators in all accredited institutions and governing bodies. These individuals would need to collaborate and make specific changes to pre-veterinary requirements standard to all programs. This is a significant challenge, but a crucial factor. If these individuals could not agree on specific changes, the same deadlock would occur in changing pre-professional requirements as seen in the medical profession.

From the Chiropractic Profession

Based on a traditional medical curriculum and immersed in the biological sciences, the chiropractic curriculum is similar to the veterinary curriculum. Similar challenges emerge when trying to add more information to the curriculum; it is difficult to decide what information can be sacrificed to make room for additional subjects. However, the

chiropractic profession's solution to address deficiencies in public health education suggests a realistic approach to addressing similar deficiencies in public health education in the veterinary curricula.

The veterinary profession has a document that is comparable to the *Model Course for Public Health Education in Chiropractic Colleges*. The document, *Proposed Model Veterinary Public Health/Preventive Medicine Curriculum*, is a list of public health and preventive medicine courses recommended to be included in veterinary curricula. This document was prepared by the American College of Veterinary Preventive Medicine in 2000 and was referenced at the beginning of this thesis [57].

When the CCMC evaluated the *Model Course for Public Health Education in Chiropractic College*, administrators and faculty found that the volume of recommendations contained in the document was “too cumbersome” to be incorporated into a single public health class. A similar situation exists when reviewing the *Proposed Model Veterinary Public Health/Preventive Medicine Curriculum*. In its entirety, this document would require 163.5 lecture/lab hours in veterinary public health, with another 49 optional hours [57]. This is also “too cumbersome” to completely implement into the veterinary curriculum. The CCMC's solution was to use the *Model Course for Public Health Education in Chiropractic College* as a guideline to construct a single public health course. A similar approach could be used by the veterinary profession.

The leadership and guidance of administrators, faculty, and governing educational bodies in the veterinary profession should investigate societal needs in public health that veterinarians are expected to address. These educational leaders could then identify specific learning objectives necessary for graduating veterinarians. Using the *Proposed Model*

Veterinary Public Health/Preventive Medicine Curriculum as a framework, a standardized public health course could be generated for implementation in all veterinary schools.

Societal needs have already been identified on a global scale. On October 12-14, 2009, deans and directors of veterinary training programs throughout the world organized and collectively proclaimed recommendations for veterinary education. This meeting was titled “Evolving veterinary education for a safer world” [90]. Over several days, recommendations were made concerning various areas of veterinary medical education. One such area was titled “Basic global needs for veterinary education” and included a session, “Global Day One Competencies,” presented by Jorna [91]. Below is the brief abstract for that presentation:

“The Day One Competencies are the combination of knowledge and skills that the young graduate needs to possess for a safe start as a veterinarian entering the profession. World-wide we have to realistically define what are the Day One Competencies for new veterinary graduates and the World Veterinary Association (WVA) has to take the lead. The level of the global Day One Competencies is depending (on) the veterinary education offered by the veterinary faculties/schools, and we all know that all over the world some schools do not meet the minimum requirements of veterinary education to exercise the veterinary profession as it needs to be practised. Veterinary education is a very important topic for the profession in controlling animal health, animal welfare and public health. The great mobility of people and animals and the trade of animals and products of animal origin require a high standard of veterinary education to prevent outbreaks of animal diseases, to prevent zoonoses and to certify that animals are healthy and products of animal

origin are safe. Even to investigate and to diagnose diseases and to cure animals requires a high standard of basic veterinary training. In the context of 'Evolving Veterinary Education for a safer world' WVA has to pay attention to three main issues: the minimum requirements the schools have to fulfill in veterinary education; what may the veterinary profession expect of the education by the schools and what may the society expect of veterinary education. Not fulfilling the minimum requirements at a global level can be a disaster for the profession and the society because of the mobility of people, animals and products of animal origin which need the guarantee of a high standard of veterinary certification. People need to have confidence in this aspect of the profession. WVA has adopted new minimum requirements for Veterinary Education" [91].

Despite the general recommendations by Jorna, there are global public health roles that veterinarians are expected to address upon entering their professional careers. In the United States, veterinary educational leaders should answer this call by identifying specific learning objectives in public health to be adopted by veterinary colleges. Incorporating these objectives in a standardized public health class would be a solution to the inconsistencies in public health education delivery.

Conclusion

This thesis has examined deficiencies and proposed solutions for other health professions in order to gain insight into potential solutions as the veterinary profession

seeks to solve inadequacies regarding public health education. Tables 2.2 and 2.3 provide a summary of curricular deficiencies and solutions identified by three health professions. The dental profession addressed faculty ineffectiveness by organizing faculty development programs. The medical profession is currently considering reform in the pre-medical curricula to rectify irrelevance in certain areas. The chiropractic profession formed a standardized public health course to remedy the lack of effective public health education. These solutions should be considered as possible frameworks for addressing inconsistencies in public health education in veterinary curricula.

Organizing a standardized public health course offers the most direct approach in improving consistencies among veterinary schools and colleges. A committee of veterinary educational leaders would need to decide on specific learning objectives for a standardized public health course, as was done in the chiropractic profession. The *Proposed Model Veterinary Public Health/Preventive Medicine Curriculum* provides a list of recommended subjects that could serve as a framework. This course template would be available to all U.S. veterinary schools and colleges for implementation.

Before implementation, faculty would need development programs to effectively instruct the standardized public health course. As discussed previously, classes related to public health may be taught by instructors who have primary interest in subjects other than public health. Even if colleges have faculty trained in public health, these faculty members would benefit from a development program. This program could help faculty facilitate a standardized public health course with relevant and clinically applicable material. Veterinary colleges could collectively contribute to the construction of such a program, providing more consistency in the delivery of public health education in their individual curricula.

Reformation of pre-veterinary curricular requirements appears to be as necessary as the need for reform in the medical profession. This pre-veterinary reform would affect more than just veterinary colleges and schools. All educational institutions with pre-veterinary programs would be affected. Effects could be minimized with smaller changes to the pre-veterinary curriculum. Several questions would need to be addressed. Could some required coursework, such as organic chemistry and physics, be replaced? Research is needed to evaluate the educational value of organic chemistry and physics to a veterinary graduate. Are several semesters of these courses necessary? Could they be replaced by something more relevant, such as biostatistics? Even while these specific questions remain unanswered, it is time to start the process of changing pre-veterinary requirements.

These specific proposed solutions will be challenging to implement. Other health professions embraced similar challenges and made difficult decisions to overcome identified deficiencies in their curricula. The veterinary profession will need to do the same.

Table 2: 3: Summary of curricular deficiencies and proposed solutions in four health professions

<i>Health profession</i>	<i>Perceived deficiency</i>	<i>Proposed solution</i>
Veterinary	Inadequacies in public health education	Standardized public health course Create faculty development programs for instructors, perhaps in standardized public health course. Change pre-veterinary curricula to introduce public health principles and allow more time to build upon them in the standardized public health course or other public health courses.
Dental	Lack of faculty effectiveness	Faculty development programs
Medical	Outdated, irrelevant pre-medical curriculum	Modernize/humanize standard pre-medical curriculum
Chiropractic	Inconsistencies in public health education	Reformed public health course

Figures and Tables

Table 1: This table shows the individual veterinary schools/colleges and public health related subjects taught within their respective curriculum [31-57].

College/School of Veterinary Medicine	Epi	Food Safety	Zoonoses	FAD	E health	C health	Biostats	Total subjects
Auburn University						4		1
Colorado State University								
Cornell University								
Iowa State University						4		1
Kansas State University	2		3					2
Louisiana State University	1.5					1.5		2
Michigan State University	3					2		2
Mississippi State University	2							1
North Carolina State University	1	1	1			1		4
Oklahoma State University	1	1				1		3
Oregon State University	Y					Y		2
Purdue University	1					2		2
Texas A&M University						1		1
The Ohio State University	4							1
Tufts University	Y			Y		Y	Y	4
Tuskegee University	2					2		2
University of California-Davis	Y	Y	Y					3
University of Florida	Y							1
University of Georgia	2.7							1
University of Illinois	2	1				1		3
University of Minnesota	2			1		2		3
University of Missouri	1					2	1	3
University of Pennsylvania	Y						Y	2
University of Tennessee	2	1	1					3
University of Wisconsin-Madison	2	1				1		3
Virginia Tech	Y					Y		2
Washington State University	Y			Y		Y		3
Western University of Health Sciences		2 weeks		2 weeks		2 weeks		3

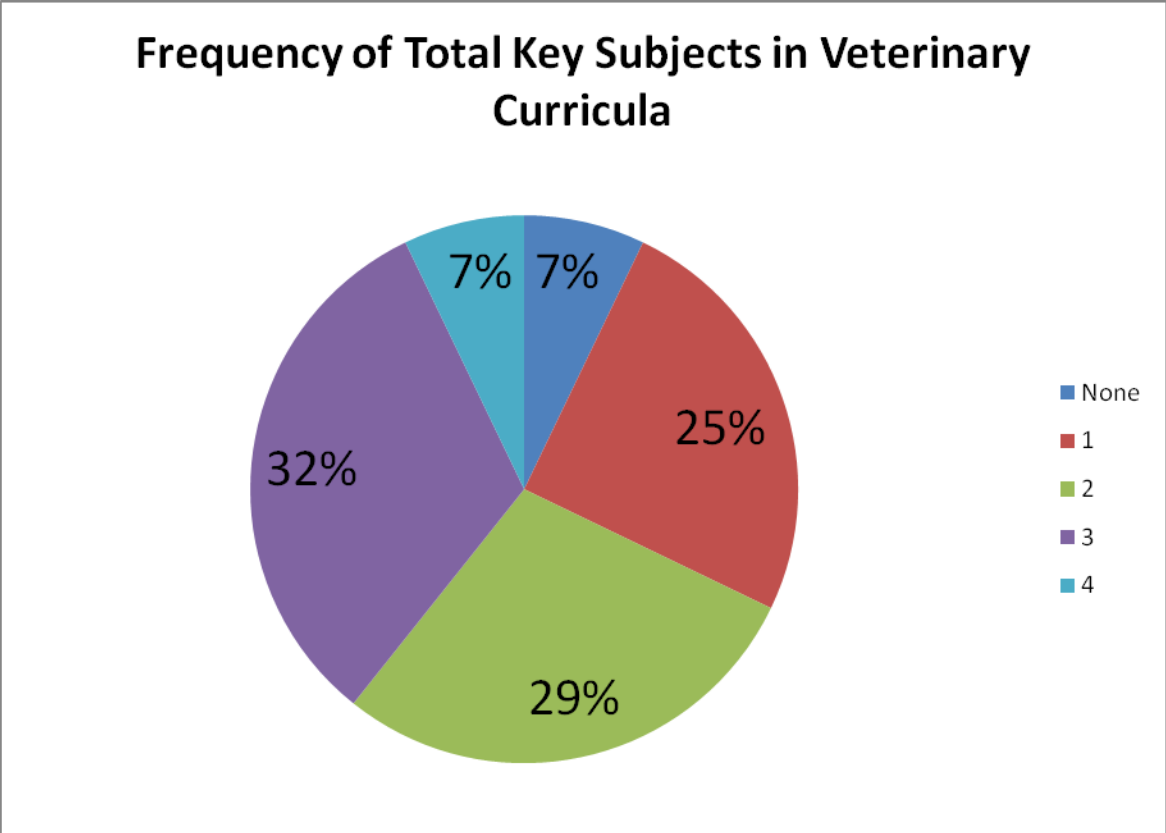


Figure 1: Frequency of key public health subject matters in U.S. veterinary curricula.

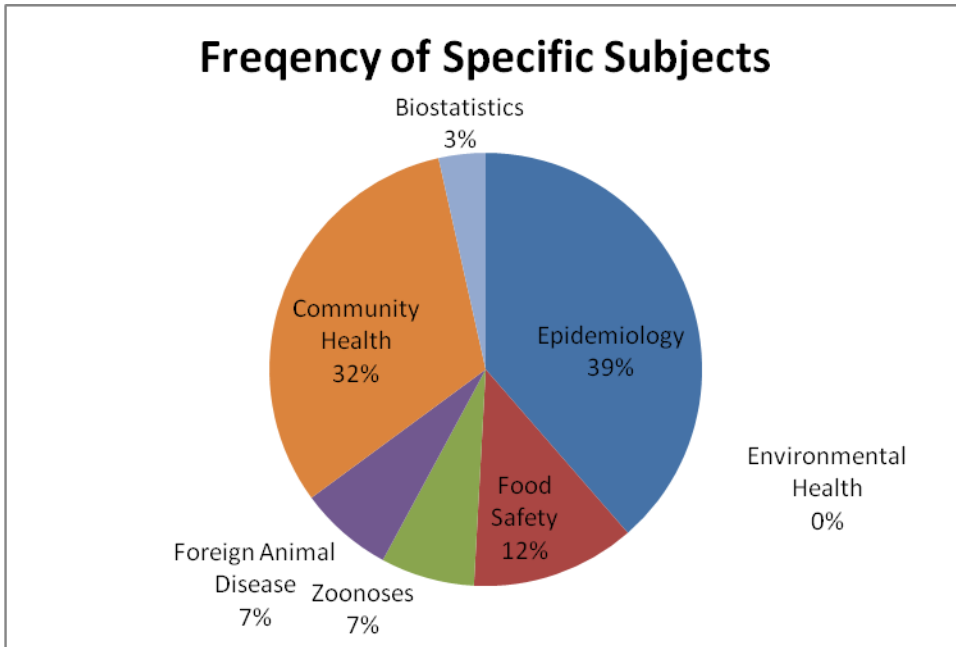


Figure 2: Frequency of subject appearance in U.S. veterinary college/school curricula.

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