

Opening the window on public health to veterinary students

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Summary

Veterinary public health is defined by the World Health Organization as: 'the sum of all contributions to the physical, mental, and social well-being of humans through an understanding and application of veterinary science'. The role of animals and wildlife as sources of human diseases continues to increase. As demand for public health veterinarians will similarly continue to increase, the veterinary profession must make a concentrated effort to encourage veterinary students to pursue careers in this field, and increase the opportunities for training and experience in this area for both veterinary students and graduates. In this paper, the authors describe the existing opportunities for training in or practising as a public health veterinarian, with a particular focus on the United States of America.

Keywords

Career – Curriculum – Outreach – Public health – United States of America – Veterinary medicine – Veterinary public health.

Introduction

Promoting public health is part of the oath that all veterinarians in the United States of America (USA) take at graduation. Veterinarians working with companion animals, food animals and wildlife, whether they realise it or not, are all on the front lines of veterinary public health. In 1999, a veterinary pathologist in New York was responsible for recognising the link between disease in humans and animals that eventually led to the discovery of West Nile virus in the Western Hemisphere (13). The patients of veterinarians may act as sentinels and/or sources of the diseases that eventually cause outbreaks in the human population. In addition, veterinarians often deal with animal patients with zoonotic diseases that require client education and consult with physicians on zoonotic issues that may affect human patients.

Veterinary public health is defined by the World Health Organization as: 'the sum of all contributions to the physical, mental, and social well-being of humans through an understanding and application of veterinary science' (30). It may not be fully understood by many in the public or in the medical field, but the comprehensive nature of a

veterinary medical doctoral education uniquely prepares veterinarians to work at the forefront of public health. The veterinary curriculum includes education about infectious diseases (including how these diseases might affect human clients and the veterinarian), and training in the health and clinical management of multiple species. A fundamentally population-based approach to problem-solving also makes veterinarians uniquely qualified for the field of public health (20). Veterinarians can provide particular expertise in zoonotic diseases, vector-borne diseases and antimicrobial resistance as they apply to public health, but their knowledge and expertise are not limited to these areas (30). At the Centers for Disease Control and Prevention (CDC), veterinarians work not only on zoonoses, but also on:

- environmental health
- chronic diseases
- human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS)
- injury
- immunisations
- migration and quarantine
- health education (16).

Veterinarians in public health can work at state and local agencies, along with federal agencies, such as:

- a) those within the Department of Health and Human Services (HHS), including:
 - the CDC
 - the Food and Drug Administration
 - the National Institutes of Health
- b) agencies within the US Department of Agriculture (USDA), including:
 - the Animal and Plant Health Inspection Service
 - the Food Safety Inspection Service (FSIS)
- c) the Environmental Protection Agency
- d) the Department of Defense and the military branches of the uniformed services
- e) a myriad of other federal agencies in various roles.

Some federal veterinarians are also commissioned officers in the US Public Health Service Commissioned Corps (www.usphs.gov). Corps officers are employed in a variety of positions throughout the HHS and certain non-HHS federal agencies and programmes, in the areas of disease control and prevention and other health-related fields.

Currently, 4.1% of the almost 84,000 veterinarians in the USA work for local, state or federal agencies or the uniformed services, with about 90 of those veterinarians working at CDC (1, 16). As of 2007, it was estimated that there was a shortage of approximately 1,500 veterinarians in public health, and that, in the next 20 years, this shortage could rise to 15,000 (29). Although the percentage of graduating veterinary students entering public health practice (in local, state and federal government and the uniformed services) doubled between 1984 and 2007, this has still only been an increase from 0.9% to 1.8% of all graduates (24, 28). The demand for veterinarians entering the public health sector will only increase; therefore the veterinary profession must make a concentrated effort to encourage students to pursue careers in this field.

Current public health education for veterinary students

Veterinary students can be exposed to public health through their core and elective courses and through externships at outside locations. Many of the required courses in the veterinary curriculum tend to focus on issues that veterinarians will face when diagnosing and treating zoonotic diseases and educating their clients about protecting themselves from zoonotic disease risks. The

current curricula do not necessarily cover potential career paths for students interested in public health (based on a sample of available syllabi that the authors reviewed).

Although the experience of the lead author, when she was a veterinary student, demonstrates that students who are interested in public health careers will search out information on the topic from various sources, many students may not achieve a career pathway in public health until some years after graduation. Many veterinary schools have a variety of dual degree programmes that include public health training and allow for the pursuit of a veterinary degree along with a graduate degree, for example (but not limited to) an advanced degree in microbiology, epidemiology or public health. Some dual degree programmes include financial assistance. Opportunities for veterinary students after graduation can occur either through studying for additional degrees or involvement in fellowship or training programmes. Training programmes and careers in public health tend to follow one of three main paths:

- laboratory research
- epidemiology
- the development, implementation and evaluation of disease prevention and control programmes.

Education through the core curriculum

The authors obtained information about courses in the core curriculum that were directly or indirectly related to public health through the following methods:

- making direct enquiries with faculty staff at veterinary schools
- accessing information on the websites of veterinary schools (accessed on 3 July 2008)
- gathering previously published information (22) from veterinary schools.

At present, all veterinary schools have required courses in the curriculum which emphasise public health or related topics, such as epidemiology, preventive medicine, zoonoses and food safety (Table I). In addition to academic courses, the University of Minnesota has a required veterinary public health rotation and an elective externship in public health practice. Michigan State University has an elective veterinary public health field experience or research clerkship. As recommended in a symposium sponsored by the American Veterinary Medical Association, 'Public health in a new millennium', veterinary schools should have a separate public health course for educating students on issues not addressed in

Table 1

Schools and colleges of veterinary medicine in the United States of America that include a public health or related course as part of the required curriculum

School	Required course in public health (PH) or related topic (RT) ^(a)	Source of information ^(b)
Auburn University	PH	website
Colorado State University	RT	website
Cornell University	PH	personal communication
Iowa State University	PH	website
Kansas State University	RT	personal communication
Louisiana State University	PH	personal communication
Michigan State University	PH	website
Mississippi State University	RT	website
North Carolina State University	PH	personal communication
Ohio State University	PH	Riddle <i>et al.</i> (22)
Oklahoma State University	PH	personal communication
Oregon State University	PH	personal communication
Purdue University	PH	personal communication
Texas A & M University	PH	personal communication
Tufts University	PH	school website
Tuskegee University	PH	Riddle <i>et al.</i> (22)
University of California, Davis	PH	school website
University of Florida	RT	school website
University of Georgia	RT	personal communication
University of Illinois, Urbana	PH	school website
University of Minnesota	PH	personal communication
University of Missouri	PH	school website
University of Pennsylvania	PH	school website
University of Tennessee	RT	school website
University of Wisconsin, Madison	PH	personal communication
Virginia-Maryland Regional College	PH	school website
Washington State University	PH	school website
Western University of Health Sciences	PH	personal communication

a/ 'Related' courses are considered to be those courses that have public health implications but the term 'public health' is not specified in the course title. Examples would be: epidemiology, preventive medicine, zoonoses and food safety. Some schools above listed as 'PH' also have related courses in the required curriculum

b/ Information obtained from the school websites was accessed on 2 July 2008. Personal communication is defined as information gained from direct contact with a staff or faculty member at the school or college of veterinary medicine.

other courses (10). The University of Florida does have a required course on careers for veterinarians and the University of Minnesota has courses in 'Public health issues' and 'Veterinary medicine opportunities'.

Education through external experiences

The authors identified only a few organised programmes for veterinary students or recent graduates who are interested in careers in public health. The following are key examples of these kinds of programmes, which are

available at both national and local agencies in the USA; others may exist. Students are encouraged to contact agencies that do not have formalised programmes if they are interested in potential public health careers with those agencies.

The O.C. Hubert Student Fellowship in International Health is available through the CDC Foundation to third- and fourth-year veterinary students (www.cdcfoundation.org/fellowships/ochubert/index.aspx). This programme encourages students to think about public health from a global perspective by working on a priority health problem with CDC staff in a developing country for 6 to 12 weeks. The CDC also offers an epidemiology elective programme

for senior veterinary and medical students (www.cdc.gov/epielective). This rotation must be at least six weeks long and occur some time between September and June.

The USDA FSIS has a volunteer student programme for veterinary students (www.fsis.usda.gov/Careers/Volunteer_Student_Program/index.asp). This programme has established a formalised relationship with 15 veterinary schools in the USA, but also allows participation from other students affiliated with other veterinary colleges.

The Los Angeles County Veterinary Public Health Unit also offers a veterinary student externship (<http://publichealth.lacounty.gov/vet/externship/main.htm>). This rotation is available to third- and fourth-year veterinary students and focuses mainly on veterinary public health, rabies and bioterrorism.

Post-veterinary school opportunities

After graduating from veterinary school, students can pursue further degrees, such as a Master of Public Health (MPH), Master of Preventive Veterinary Medicine (MPVM), Master of Veterinary Public Health (MVPH), or doctorate (PhD) and/or training or fellowship programmes. A graduate student undertaking a PhD could focus on, but would not be limited to, such areas as:

- public health
- epidemiology
- infectious diseases
- microbiology
- bioterrorism
- immunology.

Training experiences after veterinary school generally centre on either epidemiology or laboratory research. The Epidemiologic Investigation Services at the California Department of Health Services (Cal-EIS) ([www.cdph.ca.gov/programs/Pages/CaliforniaEpidemiologicInvestigationService\(Cal-EIS\).aspx](http://www.cdph.ca.gov/programs/Pages/CaliforniaEpidemiologicInvestigationService(Cal-EIS).aspx)) or at the Epidemic Intelligence Service (EIS) at CDC (www.cdc.gov/eis/index.html) are two programmes that concentrate on training in epidemiology in the public health setting.

The Cal-EIS is a one-year fellowship for training medical professionals who have at least a Master's degree. The goal of the programme is to train epidemiologists for public health leadership positions in California. Veterinarians can apply if they have taken epidemiology and biostatistics courses at the graduate level. At present, the salary is better than most veterinary internship or residency salaries in the USA.

The Epidemic Intelligence Service (EIS) programme at CDC is a two-year, post-graduate, 'on the job' training programme for health professionals who are interested in applied public health epidemiology (www.cdc.gov/eis/index.html) (20). Veterinarians who wish to apply are encouraged to have an MPH or equivalent, such as an MPVM, or are required, as a minimum, to have applicable public health experience. Salaries for EIS officers at CDC are comparable to or higher than average salaries of new graduates. In addition, CDC veterinarians, both during their EIS programme and later, as they pursue careers in the US government, can elect to be commissioned officers in the US Public Health Service Commissioned Corps or members of the Civil Service.

There are few fellowships for laboratory workers to gain experience in public health laboratories; although that does not mean that a motivated student could not make their own opportunities for research projects at public health institutions. Recent veterinary graduates can pursue the Emerging Infectious Disease (EID) Laboratory Fellowship Program through the American Public Health Laboratories and CDC (www.aphl.org/profdev/fellowships/eid/Pages/default.aspx), as well as the American Society for Microbiology/CDC Program in Infectious Disease and Public Health Microbiology (www.asm.org/asm/?option=com_content&view=article&id=15497&Itemid=338). Both of these programmes offer two years of post-doctorate experience, with a salary that is better than that of a graduate student but less than the average practising veterinarian. However, they do offer health insurance, relocation costs and some financial support for professional development. Other potential laboratory research programmes at CDC can be found at www.cdc.gov/phtrain/applied_lab_research.html.

Expanding the opportunities for veterinary students

Riddle *et al.* (22) stated that veterinary schools need to offer students 'educational opportunities that will enable them to think beyond traditional clinical roles and geopolitical boundaries'. Expanding educational opportunities is essential for veterinary students who may be interested in non-traditional career paths, such as public health practice. It is also important that veterinary schools offer courses, such as the programme at the University of Florida, that have a primary focus on the different career paths for veterinarians. These courses encourage students to realise that they have career opportunities beyond those of private practitioner, academician or state veterinarian.

Outreach from veterinarians working in public health and faculty members interested in public health could also be

very influential for students. Over the years, CDC veterinarians have attempted, when travelling to areas in the vicinity of a veterinary school for their official duties, to arrange to speak to the veterinary students. Seminars about the jobs that public health veterinarians perform can also be very educational and inspiring for veterinary students. Furthermore, the CDC started a 'CDC Veterinary Student Day' in 2005, and more than 350 students and faculty staff attended the most recent event in 2008 (5).

Reaching out to veterinary students in this way and pointing out the many opportunities in the field of public health will help to open a window that they may not even have realised existed. Moreover, it will assist in meeting the future demand for the valuable knowledge that veterinarians possess.

Pathways to public health that have worked

Traditional pathways to a public health career (Dr M. Kathleen Glynn)

Many veterinarians currently working in public health, including myself, have followed a classic pathway to prepare for public health careers through the academic or other training programmes outlined above. My pathway to public health came through the acquisition of a Master's degree in Preventive Veterinary Medicine, followed by applied training in Cal-EIS and the EIS programme at CDC, which ultimately led to a public health career with CDC, as discussed in Pappaioanou *et al.* (20). Since completing my training, my public health experience at CDC has included conducting public health surveillance for nationally notifiable, potential bioterrorism-associated diseases and HIV/AIDS, and leadership in epidemiology and laboratory programmes for bacterial zoonoses.

Veterinarians who have acquired similar training and followed this traditional path have entered into public health at the local, state or federal level in a variety of ways. Conventional routes of employment, such as identifying available positions and applying for them, remain a standard. These types of positions can include those found within state or local health departments that co-ordinate such veterinary public health activities as disease prevention programmes against rabies or vector-borne diseases. In these cases, veterinary training may be either a job requirement or a strong benefit. Alternatively, veterinarians can also successfully compete for positions that are more generally classified as suitable for epidemiologists or other health scientists, and that do not require a veterinary doctoral degree.

Another common career entry route for veterinarians is to build upon collaborative work that occurred as part of

their training, i.e. turning this academic or other training collaboration into career opportunities with local, state or federal public health agencies. For example, of the 118 veterinarians that participated in the CDC EIS programme between 1977 and 2000, 80% went on to careers in local, state or federal public health (20).

Non-traditional pathways to a public health career (Dr Robyn Stoddard)

As a somewhat recent graduate from veterinary school (University of California, Davis, 2000), I never imagined that I would be working in the field of public health. My career goals since college were focused on wildlife research. My interest in infectious diseases did not develop until I began taking courses in microbiology during veterinary school. Upon completing veterinary school, my graduate research focused on the use of antimicrobial drugs at the Marine Mammal Center, a marine mammal rehabilitation facility. After beginning the project, we quickly realised the potential for using data on pathogenic and antimicrobial-resistant faecal bacteria (26) in northern elephant seals (*Mirounga angustirostris*) for risk factor analysis on the exposure of these seals to faecal pollution in the marine environment (25). Although it was not my original intention, I found my research had implications for public health and the great majority of my funding came from the National Ocean and Atmospheric Administration Oceans and Human Health Initiative, whose goal is to identify crucial areas of concern in the connection between the oceans and public health.

As I neared the end of my schooling, I then began looking to the next step and applied for the EID Laboratory Fellowship, along with several other programmes. I was invited for an interview for this fellowship. During the interview process, I met with several scientists in the Bacterial Zoonoses Branch (BZB) at CDC who were interested in working with me. Although I did not receive the EID fellowship, BZB identified alternate funding to employ me as a post-doctoral fellow, which has since led to a permanent position as a microbiologist. Through my training as a veterinarian and my graduate experience, which included course work, research and teaching veterinary students in microbiology, I found that I had the perfect framework for a career as a veterinarian in public health.

The influx of veterinarians into public health jobs

In the past two decades, there have been three major areas that have specifically attracted and successfully recruited

veterinarians into public health work. Each has been in the infectious disease area. They are: HIV/AIDS, bioterrorism and emerging infectious diseases. For the first of these, HIV/AIDS, veterinarians have been able to provide specific skills for population-based surveillance and the study and prevention of epidemics at the population level. In particular, veterinarians have found public health opportunities by applying their knowledge of opportunistic infections that may be associated with companion animal/pet ownership (7, 8, 9).

A second infectious disease area in which veterinarians have successfully identified public health career opportunities is in the public health response to bioterrorism. Most of the identified bioterrorism threat agents are zoonotic pathogens (23), and have been classified as priority agents because they can have substantial effects (morbidity and/or mortality) on both human and animal populations. As well as being invaluable sources of information on zoonotic diseases, veterinarians have been able to contribute to public health by working with animal health partners, such as local and national humane associations or agricultural extension and education programmes, to recognise sentinel events in animal populations as early indicators of potential bioterrorism (2, 19, 21).

Emerging and re-emerging diseases are increasingly being linked with zoonotic disease issues. Some 60% to 70% of emerging infection events in the past half-century have had a zoonotic component (12). Many of the recent global epidemics have involved zoonotic agents (4, 11), and control of these epidemics increasingly relies on interventions in the animal population or at the animal-human interface (18). This recognition of the crucial role of zoonotic diseases in public health led to the establishment of the CDC National Center for Zoonotic, Vector-borne, and Enteric Diseases in 2007, and to the continued call for collaborations between veterinary and human medicine to combat these emerging threats (3, 13, 15, 17).

More recently, a specific emerging infectious disease – the epizootic of the highly pathogenic avian influenza (HPAI) H5N1, with its potential for virus mutation and development into a human pandemic – has further highlighted the crucial role of veterinarians in public health (27). Most recently, the emergence of pandemic H1N1 2009 influenza virus among people, and the potential for spread from humans into swine populations, again called upon veterinary experts. Veterinarians have found new opportunities in public health, serving as leaders to identify and implement crucial control measures to prevent further transmission among bird populations, and to discover the factors at the animal-human interface that support bird-to-human transmission (14). Issues such

as influenza and other emerging zoonotic diseases will continue to highlight the need for more veterinarians in public health. It will be the responsibility of the veterinary community to appropriately educate and recruit veterinarians to public health careers.

Conclusion

The role of animals and wildlife in human diseases continues to increase, which correspondingly increases the demand for veterinarians working in public health. The authors have reviewed the current status of veterinary education and training opportunities in public health in the USA, described ways in which veterinary students can be made aware of careers in public health and explored the avenues in which they can pursue such careers, if interested. These opportunities, along with the new 'One World, One Health' curriculum at the University of Calgary, described elsewhere in this issue (6), are certainly steps in the right direction. A very major question arises, however, and that is whether enough veterinary students are pursuing public health careers to meet the national and global demands. All the evidence at hand seems to suggest that this is not the case. The veterinary community is charged with the challenge of expanding these educational and training opportunities and ensuring the consistent integration of public health practice and concepts into the veterinary curriculum. The future success of all combined public health efforts against zoonotic disease is dependent upon well-trained and motivated veterinarians entering public health service, and more must be done by and for the veterinary profession to meet its obligation to society in this very crucial area.

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Ouvert aux futurs vétérinaires des passerelles vers la santé publique

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Résumé

L'Organisation mondiale de la santé définit la santé publique vétérinaire comme « la contribution de la connaissance et de l'application de la science vétérinaire au bien-être physique, mental et social de l'homme ». Le rôle joué par les animaux et la faune sauvage en tant que sources des maladies affectant l'homme ne cesse de croître. La nécessité de recourir à des vétérinaires de santé publique augmentera en parallèle, de sorte que la profession vétérinaire doit se mobiliser pour encourager les étudiants en médecine vétérinaire à s'orienter vers cette filière, en multipliant les possibilités de formations et de stages destinées aussi bien aux étudiants qu'aux vétérinaires diplômés. Les auteurs décrivent quelques possibilités de formation dans le domaine de la santé publique vétérinaire et de voies d'accès à cette profession, en particulier aux États-Unis d'Amérique.

Mots-clés

Carrière – États-Unis d'Amérique – Médecine vétérinaire – Programme d'enseignement – Santé publique – Santé publique vétérinaire – Sensibilisation des étudiants.



Abrir el horizonte profesional de los estudiantes de veterinaria a las cuestiones de salud pública

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Resumen

La Organización Mundial de la Salud define la salud pública veterinaria como 'la suma de todas las contribuciones al bienestar físico, mental y social de los seres humanos mediante la comprensión y aplicación de la ciencia veterinaria'. Los animales y la fauna salvaje tienen un papel cada vez más importante como origen de enfermedades que afectan al hombre. Ello inducirá un constante aumento de la demanda de veterinarios especializados en salud pública y exigirá que la profesión redoble esfuerzos para alentar a los estudiantes a hacer carrera en este ámbito y mejore su oferta de formación y experiencia en la materia dirigida tanto a estudiantes como a titulados en veterinaria. Los autores describen las posibilidades de formación o de ejercicio de la salud pública veterinaria hoy por hoy existentes, centrándose especialmente en los Estados Unidos de América.

Palabras clave

Carrera – Estados Unidos de América – Información para estudiantes – Medicina veterinaria – Plan de estudios – Proyección – Salud pública – Salud pública veterinaria.



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