

Essential veterinary education: equipping students with an understanding of the need for research in global veterinary public health

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Summary

Research is the foundation of health advancement; therefore, it is imperative that all health professionals are well versed in its importance during their formal training. Since veterinary education in most countries is now focused on preparing clinicians rather than public health practitioners or research scientists, educators should recognise the importance of research by emphasising the principles and key methodologies that are generic in the life sciences. This exposure will provide a baseline understanding for all students, may encourage some to complete research projects and research-focused externships during school, and will ultimately inspire others to pursue research training after graduation. All aspects of veterinary research would benefit from this approach, including veterinary public health. This paper discusses the essential understanding of research that should be gained through veterinary education, particularly within the evolving nature of veterinary public health education.

Keywords

Doctor of Veterinary Medicine – Master of Public Health – One Health – Public health – Research – Veterinary education.

Educational challenges facing veterinary public health

The World Health Organization (WHO) defines veterinary public health as ‘the sum of all contributions to the physical, mental and social well-being of humans through an understanding and application of veterinary science’. Some argue that ‘veterinary’ is not required and the term public health is adequate, but throughout this article the WHO definition will be retained.

Before considering the extent to which the graduating veterinarian should appreciate the importance of research in advancing global veterinary public health, one first needs to address the limited content of public health education in the veterinary curriculum of most colleges. Upon graduation each new veterinarian in the United States of America (USA) swears, as part of the veterinary oath, to promote public health and advance medical

knowledge. Public health is correctly seen as an important responsibility of the veterinary profession worldwide. In response to the One Health Initiative (a strategy for expanding interdisciplinary collaborations in all aspects of health care for human and animal health), many within the profession argue that the veterinary curriculum should contain a larger percentage of courses related to public health. The WHO report ‘Future Trends in Veterinary Public Health’ (6) projected that veterinary public health would be one of the major activities of the veterinary profession in the forthcoming decades, with traditional courses in food safety and security, zoonoses, and environmental health being supplemented with courses on disaster preparedness for events such as hurricanes, floods, drought and intentionally caused epidemics. The WHO document, now nearly 10 years old (the study group met in 1999, but the report was published in 2002), remains an excellent road map for recognising the breadth of veterinary public health and defines both core and emerging veterinary public health domains (Box 1).

Box 1**Core and emerging domains of veterinary public health****Core domains**

- 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
- Production and control of biological products and medical devices
- Management of domestic and wild animal populations
- Protection of drinking water and the environment
- Management of public health emergencies

Emerging domains

- Investigation, epidemiology and control of non-zoonotic, communicable diseases
- Social, behavioural and mental aspects of human–animal relationships (including animal-facilitated therapy and development of animal welfare standards)
- Epidemiology and prevention of non-infectious diseases (including the promotion of healthy lifestyles)
- Leadership, management and administration of public health and environmental agencies, including government institutions, private sector organisations and academic institutions
- Risk analysis, health economics, cost-benefit analysis, cost analysis, effectiveness analysis and other methods of evaluating health service delivery and public health programmes
- The social context of delivery of veterinary public health services, especially to women in rural areas who have traditionally been underserved by Veterinary Services, yet who have great potential for preventing zoonotic diseases and diseases of animal origin

Source: World Health Organization (6)

Undoubtedly, veterinary public health will remain a major responsibility for the profession in all countries. It is important for all students to receive training in public health because all veterinarians, regardless of their career path, are confronted by public health issues on a regular basis. That said, it is difficult (particularly in countries, such as the USA, where companion animal practice is highly developed) to see how the present educational structure could be changed to enable all students to attain a level of competency in public health that would be sufficient to make them competitive for appointments in this area without undertaking further training after graduation.

Veterinarians have a long and distinguished history of contributing to the maintenance and promotion of public health. How, then, has a situation developed in which the training of veterinarians needs to be supplemented before

they are competitive for careers in public health? In the last 25 years there have been many changes in the demographics of the profession, and in its role in serving society. In the developed nations, the majority of the profession is now employed in small animal practice and is predominantly female (a similar trend is emerging in the developing nations of the world). The curriculum has been adapted to this change in focus: the percentage of time spent on food animal practice, and more specifically on public health concerns, has declined. In some colleges students can now choose to follow courses along a specialised track before receiving their veterinary degree, and this has exacerbated the problem. Without new efforts in recruitment (e.g. recruitment of individuals with an expressed interest in food animal medicine or veterinary public health), and changes in the curriculum in veterinary colleges, this distribution is likely to worsen.

This trend away from extensive training in food animal production and public health has occurred at a time when more veterinarians are needed in these fields. The WHO 'Future Trends in Veterinary Public Health' report (6) concluded that multiple global challenges face health professionals, and solutions will require extensive collaboration between traditionally distinct disciplines. Gibbs (3), reviewing the responses to these challenges, pointed out the historical neglect of public health in the late 20th Century, the recent record of poor interdisciplinary collaboration, and the deficiencies in education. There is now serious concern worldwide among those involved in the One Health Initiative that the veterinary profession has not been sufficiently pro-active in adequately educating veterinary students in matters of public health. Certainly there has been a recent flourish of activity to address the problem in many countries. Most schools recognise that they must recruit more students interested in food production and that they must increase the training opportunities for those interested in public health, but the lure of other specialised areas in the profession is strong. Many graduating students are interested solely in clinical veterinary medicine, particularly in small animal and equine medicine, and enter into internships and residencies to further hone their skills before taking their first appointment in practice. The training programmes bring with them the opportunity for the individual to become 'boarded' (i.e. he or she will become a member through examination of a specialty board, such as internal medicine, surgery, etc.). There is an established pathway for these students to follow, and the financial reward upon completing the training is attractive. In contrast, until recently there has been an inadequate career structure for graduating students who wish to pursue a career in veterinary public health.

The topic of this paper, namely the education of students in the importance of research in global veterinary public health, must therefore be placed in context as just one part

of the greater educational challenge of engaging veterinary students in public health.

Cultivating an appreciation for the importance of research within the scope of global veterinary public health

Research is a mission of most veterinary schools around the world, and its benefits to animal and human health are well recognised. Meeting the veterinary public health challenges of the 21st Century requires major reliance upon science, coupled, in some cases, with significant changes in social behaviour. Ultimately, science advances through research. Nolan *et al.* (5) remarked, when discussing the current needs of society and the recruitment of veterinarians into research in general, that the impact of veterinarians in public health and on social well-being is often underrated, given the inextricable link between animals and people (Fig. 1). Thus, it is axiomatic that every veterinary student needs to develop, during his or her training, a strong appreciation of the history of research and the continuing need for high-quality research in all specialisations of veterinary medicine.

Research can be defined as ‘scientific or critical investigation aimed at discovering and interpreting facts’. More specifically, ‘scientific research relies on the application of the scientific method, a harnessing of curiosity’ (1). As an illustration, two of the cornerstones of public health, vaccination and epidemiology, evolved from curiosity and application of the scientific method in the 18th and 19th Centuries respectively (see Box 2 on Edward Jenner and John Snow).

Although definitions provide a generic understanding of research, the reality is that research means different things

to different professions, and even to different individuals. Our personal and professional background and interests inherently bias our definition, understanding, and appreciation of research. The spectrum of research that provides the underpinning for advances within the domains of veterinary public health is inevitably wide in scope. As the WHO report points out, the spectrum ranges from ‘diagnosis, surveillance, epidemiology, control, prevention and elimination of zoonoses’ to ‘the social context of delivery of veterinary public health services’ (6) (Box 1). Accordingly, with so little time available in the curriculum, students training to be veterinarians need to appreciate the importance of research across medicine rather than specifically within public health. At a bare minimum, students need to know the concepts of the scientific method, how to search the literature, how to formulate and address a hypothesis, how to use general research methodologies, and from whom they should seek advice. Involvement with research, as the next important stage in the educational process, is most easily accommodated subsequent to, or in parallel with, the veterinary degree, as will be discussed later.

The need for student awareness of the importance of research within the One Health Initiative

The One Health Initiative has been established to address many of the challenges described above. But the One Health Initiative will only be successful if there is both interdisciplinary co-operation and a strong foundation of research activities across the spectrum of issues. For many scientists there is now a convergence of scientific skills and language that promotes interdisciplinary collaboration. This is most apparent within the control of infectious disease, which is an area in which veterinarians are very much involved. The power of modern research techniques

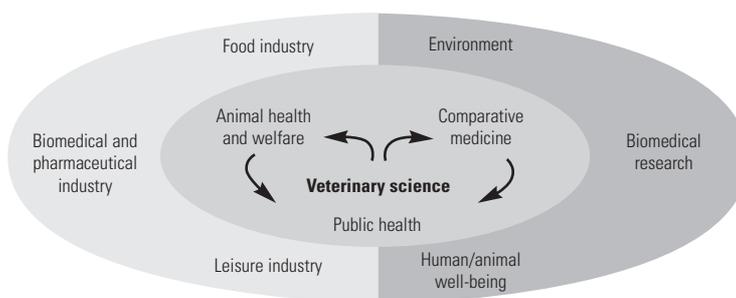


Fig. 1
Illustration of the pivotal relationship between public health and veterinary science

Source: Nolan *et al.* (5)

Box 2**The contributions of research to global public health: a historical perspective**

Anyone questioning the importance of educating today's veterinary student in the importance of global public health research should be directed to the discoveries of Edward Jenner and John Snow. Isaac Newton (using a phrase attributable to the philosopher Bernard of Chartres) remarked that his scientific discoveries were only possible because he was able to see further as he was able to stand on the shoulders of giants. Likewise, the modern discipline of public health is founded upon the research discoveries of Jenner and Snow in the 18th and 19th Centuries.

Jenner's discovery that cowpox can be used**to protect from smallpox: the birth of vaccination**

The period which many historians of science call the Scientific Revolution can be roughly dated as having begun in 1543, the year in which Nicolaus Copernicus (1473-1543) published his theories displacing Earth as the centre of the Universe. Subsequently, in England, the writings of Francis Bacon (1561-1626) and later John Locke (1632-1704) advanced the Scientific Revolution by introducing empiricism upon which the scientific method (and thus scientific research as we understand it today) was founded. The scientific method gained momentum in England and we know that it influenced the thinking of Edward Jenner, the physician whose studies on smallpox, once the scourge of mankind, led to the disease being globally eradicated in 1980.

Jenner's work developed from the common observation that milkmaids did not generally get smallpox. Indeed there is even a nursery rhyme that confirms this. Jenner theorised that prior exposure to cowpox protected the milkmaids. (A popular rhyme sung at that time illustrates the observation upon which Jenner based his experiments: 'Where are you going to, my pretty maid?' 'I'm going a-milking, sir', she said. 'What is your fortune, my pretty maid?' 'My face is my fortune, sir', she said.) Unquestionably, Benjamin Jesty, a farmer who lived about 50 miles from Jenner, had recognised this about 30 years earlier and had even protected his family by inoculating pustulous material from cows. But Jenner was the first to apply the scientific method of experimentation and thus it was to Jenner that the honour of discovering vaccination was given by Pasteur nearly a century later. (It was in honour of both Jenner and the role of the cow [Latin: *vacca*] that Louis Pasteur adopted the term vaccination.)

The research of Jenner introduced the concept of preventing diseases through vaccination. The research of Snow and Farr led to communities throughout the world placing great priority on the supply of safe drinking water. Complemented by the later discoveries of Louis Pasteur and Robert Koch and the establishment of the science of microbiology, these two examples of research, both based on the scientific method, have promoted, more than any other, human and animal health throughout the world.

By today's standards, Jenner's experiments were neither ethical nor adequately controlled. On 14 May 1796, Jenner tested his theory by first inoculating James Phipps, a young boy of 8 years old, with material from pustules on the hand of Sarah Nelmes, a milkmaid who had caught cowpox from a cow. Later, and most importantly, he challenged Phipps' immunity by attempting to infect him with smallpox. As history knows, Phipps resisted this challenge.

John Snow and the discovery that cholera is spread by water

The investigations of John Snow (1813-1858), as supported by the work of William Farr (1807-1883), into the cholera outbreaks in London, particularly the Broad Street epidemic in 1854, are now generally regarded as the founding event for the science of epidemiology and the discipline of public health as we recognise it today.

Snow's research is all the more remarkable because it was conducted (as indeed were Jenner's studies on smallpox some 50 years earlier) at a time when the microbial cause of disease had yet to be established. Disease was believed by many to be caused by noxious air and other influences collectively known as miasmas. The germ theory of disease had not been accepted.

By using maps to record the cases and by questioning the citizens in the area, Snow and Farr recognised, through observation linked to statistical analysis, that the cases of cholera could be linked to a specific pump from which most of those affected had drunk water. The evidence was sufficiently persuasive for the local council to remove the handle from the pump thereby forcing the inhabitants to draw water from a different source. Controversy still lingers as to the true circumstances of the epidemic, but the research by Snow and Farr was epochal.

is truly amazing and new technology is being applied to epidemiology and disease diagnosis with rapidly increasing sophistication and speed. The combined application of the polymerase chain reaction (PCR) to detect infectious agents and the sequencing of the genome of microbes has revolutionised diagnostics. The parallel sequencing of the genomes of many mammals and arthropod vectors opens up the opportunity to relate the classic epidemiological triangle of host, agent, and environment in ways hitherto never even imagined. The molecular revolution was heralded by Francis Crick and James Watson and introduced a common language of base pairing. This language unites many disciplines and professions. Discoveries in one field can be quickly applied in

apparently unrelated fields. Today's veterinary student must have an appreciation of this 'core science' and how it is applicable in veterinary medicine, including veterinary public health.

Diagnostic techniques are critical to the control of disease, but epidemiological knowledge is also critical. Epidemiology is at the apex of the many disciplines within science and social behaviour that contribute to One Health. Unfortunately, epidemiology does not have a common language akin to that of molecular science, but the introduction of the use of personal computers for modelling disease has arguably united epidemiologists across a wide range of study. Additionally, epidemiology

has advanced rapidly by linking modelling to the modern armoury of molecular diagnostics to trace the origins and spread of infectious agents. The global tracing of the spread of H5N1 highly pathogenic avian influenza and its molecular evolution is a classic example, employing the powerful synergy of these technologies. A recent technical consultation of the Food and Agriculture Organization (FAO), the World Organisation for Animal Health (OIE) and the WHO on avian influenza at the human–animal interface highlights the breadth of research – from basic field epidemiology to high-powered molecular investigation – involved in global public health (2). An appreciation of how research provides the bedrock for disease tracing and risk assessment, for example, is critical for all veterinarians and especially those intent upon a career in public health.

The way forward: specialised training in public health

In the last five years, many veterinary schools in the USA and around the world have recognised the need for a renaissance in veterinary public health education. There is also recognition that any attempt to drastically change the core veterinary curriculum to include more required courses on public health (as opposed to elective courses) is unrealistic.

The most common approach to redress the situation in North American veterinary schools has been to offer a Master of Public Health (MPH) degree with the veterinary degree to students interested in public health. These combined degrees are structured so that students can complete the MPH while in veterinary school or shortly thereafter. For example, at the University of Florida the students start their MPH degree the summer before entering the Doctor of Veterinary Medicine (DVM) curriculum in the autumn. By allowing common credit for several courses, the students can graduate with a DVM degree and an MPH degree in the same semester. Mechanisms vary from university to university, and details of other degree programmes have been recently published by Hueston (4). The majority of veterinary schools in the USA have established, or are developing, such joint degree programmes.

Although the MPH is not a ‘research’ degree, students are usually expected to complete an internship and/or research project, which provides greater exposure to research methods and tools. Residency training leading to board certification from the American College of Veterinary Preventive Medicine also leads to an appreciation of the importance of research in public health. Currently,

however, only one veterinary public health residency is available in the USA (at the University of Minnesota). Finally, veterinarians with a strong interest in research can pursue PhD-level graduate training either in a veterinary school, a school of public health or similar institution.

Conclusion

It is the opinion of the authors that the veterinary curriculum (prior to any post-graduate study) should emphasise the issues outlined below so that each student acquires a basic appreciation of research within the context of veterinary public health.

- a) All students should receive instruction and guidance in:
 - research and the scientific method
 - general research methods and tools (‘core science’ concepts should be discussed throughout the curriculum)
 - research needs within the veterinary profession (pertinent to both animal and human health)
 - additional educational opportunities that can be completed during or after veterinary school.
- b) All students should recognise the five disciplines of public health (biostatistics, environmental health, epidemiology, public health administration, social and behavioural sciences) and appreciate the roles of veterinarians in the public health workforce (WHO core and emerging veterinary public health domains [Box 1]).
- c) All students should understand their social responsibilities and where they fit into the bigger picture of health protection and promotion (One Health), particularly within the context of their chosen career paths.
- d) Students should appreciate that research opportunities are vast; however, they will most likely need to specialise or focus their attention on a subset of issues about which they are most passionate. This will often require additional graduate training (Master of Science, MPH, PhD, etc.). If students are interested in veterinary public health research they should seek out mentors that can best guide them, network with researchers and other students, and ideally travel in order to gain a more global perspective.
- e) Students must appreciate that global public health challenges are multifaceted, they will require extensive collaboration to solve or mitigate, and advances are contingent upon an underpinning of research.

While all veterinarians should possess a strong appreciation of public health fundamentals, the growth of specialisation within the veterinary profession in many

nations of the world now parallels that of the medical profession. It is therefore unrealistic to expect all veterinarians to have extensive knowledge of public health issues and research at the time of graduation. The goal should be that each graduate understands the core concepts of research and veterinary public health, how their career interests overlap with these fields, and

ultimately their social responsibilities to public health and the advancement of medical knowledge. The emergence of more public health and research training opportunities, whether during school or after graduation, is an encouraging development for those students who wish to pursue veterinary public health and/or research as their career path. ■

Les fondamentaux de l'enseignement vétérinaire : sensibiliser les étudiants à la nécessité de la recherche dans le domaine de la santé publique vétérinaire mondiale

E.P.J. Gibbs & T.C. Anderson

Résumé

La recherche est la base du progrès sanitaire ; par conséquent, il est impératif que les professionnels de la santé prennent toute la mesure de son importance durant leur formation initiale. Étant donné que dans la plupart des pays, les systèmes d'enseignement vétérinaire visent en priorité à former des cliniciens plutôt que des praticiens de la santé publique ou des chercheurs, il serait utile que les enseignants reconnaissent l'importance de la recherche et exposent les principes et les méthodologies qui sont communes aux sciences biologiques. Cette initiation permettrait aux étudiants d'acquérir de bonnes connaissances de départ, encouragerait certains d'entre eux à effectuer des projets et des stages de recherche durant leur formation, voire à se lancer dans une spécialisation de recherche après l'obtention de leur diplôme. Une telle approche serait bénéfique pour tous les aspects de la recherche vétérinaire, y compris la santé publique vétérinaire. Les auteurs examinent les composantes essentielles de la recherche auxquelles les étudiants doivent être versés, en particulier dans le contexte d'un enseignement de la santé publique vétérinaire en pleine évolution.

Mots-clés

Docteur en médecine vétérinaire – Enseignement vétérinaire – Master en santé publique – Recherche – Santé publique – Une seule santé. ■

Enseñanza veterinaria básica para que los estudiantes entiendan la necesidad de la investigación en salud pública veterinaria mundial

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Resumen

La investigación es el fundamento de los avances sanitarios. Por ello es absolutamente necesario hacer entender su importancia a los profesionales de la salud desde el momento mismo en que cursan sus estudios oficiales. Toda vez que en la mayoría de los países la enseñanza universitaria apunta sobre todo a preparar a veterinarios clínicos, y no tanto a profesionales de la salud pública o a investigadores, el cuerpo docente debería reconocer y subrayar la importancia de la investigación haciendo hincapié en los principios y métodos fundamentales que son comunes a todas las ciencias de la vida. Ello dotaría a los alumnos de elementos de referencia para entender la relevancia del tema, y quizá alentaría a algunos de ellos a llevar adelante proyectos de investigación o realizar prácticas extrauniversitarias ligadas a la investigación durante sus años de estudios, y a la larga induciría a otros a seguir una formación de postgrado orientada a la investigación. Tal planteamiento resultaría beneficioso en todos los planos de la investigación en la materia, comprendida la salud pública veterinaria. Los autores examinan los aspectos básicos que conviene transmitir en la enseñanza veterinaria para que los alumnos entiendan la importancia de la investigación, sobre todo teniendo en cuenta que la enseñanza de la salud pública veterinaria está, por su propia naturaleza, en constante evolución.

Palabras clave

Doctorado en medicina veterinaria – Enseñanza veterinaria – Investigación – Maestría en salud pública – Salud pública – Una sola salud.



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