Evaluation of veterinary public practice education programs

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Objective—To describe the number and types of veterinary professional degree and certificate programs providing education in the area of public practice to veterinarians and determine the availability of these programs via distance learning.

Procedures—Web-based internet searches were performed for programs for veterinary public practice or public health, population medicine, or Master’s degree in Epidemiology. The information reviewed was derived from individual school and program websites and from personal e-mail correspondence with school administrators.

Results—17 professional degree and 4 certificate programs were available to provide education and training in the areas of public practice and population medicine to veterinarians. Twelve of these programs have begun since 1998. Of the 17 professional degree programs, 7 are located in the United States and 10 are located in other countries. Nine of the professional degree programs provide education through traditional teaching methods, and 8 provide education and training through distance learning.

Conclusions—During the preceding 5 years, the number of programs available to educate and train veterinarians in the areas of public practice and population medicine has increased. Distance learning is being used to increase capacity and reach a broader audience of veterinarians. With the increase in programs has come an increase in capacity to educate and train veterinarians in the fields of population medicine and public practice. The impact and sustainability of this increased capacity have not been evaluated. (J Am Vet Med Assoc 2006;228:529–536)

Historically, one of the principal roles of veterinary medicine was to support agriculture and the production of a healthy, wholesome food supply. By serving those public needs, veterinarians also took an active role in the management of broader public health issues. Under the concept of “one medicine” espoused by Calvin Schwabe, veterinarians, physicians, and other health care providers and scientists work together under 1 umbrella of public health.1 In this concept, veterinarians support food and water safety, treat and prevent zoonotic diseases, intervene in epidemic disease outbreaks, participate in disease eradication efforts, contribute to health research, and improve the health and maintenance of agricultural animals. Historically, veterinarians were uniquely qualified to participate in these activities because of the multidisciplinary and herd-level training they received, which included an emphasis on population medicine. However, in recent decades, there has been a shift in the veterinary curriculum away from population-based training to a focus on the individual animal.2,3 As a result of the increased emphasis on individual animal care, there has been a vital loss of veterinarians in the fields of public practice (the use of veterinary skills in public health, population medicine, regulatory medicine, extension, and support of products and services provided to veterinarians working in food animal production) who are trained with the necessary skills to participate in, and be an integral member of, the public health team.

With the release of the PEW report in 1989,2 veterinary medical education attempted to redefine itself to address broader societal needs beyond animal health care. However, subsequent reports6–8 indicate that within the current structure of veterinary medical training, there is still a continued deficiency of training and educational opportunities for veterinarians in the fields of public practice and population medicine. Documented in all 3 of these reports is a trend in veterinary graduate career choices away from public practice and in the direction of private practice. Career demographics suggest that fewer than 5% of new veterinary graduates enter into the arena of public practice.9 At the same time it is estimated that 20% of new graduates, or 300 of 2,500 graduating veterinarians in the United States, are required annually to satisfy newly created positions and replace those veterinarians retiring from population health and public practice.10 As a consequence, opportunities are being lost to the veterinary profession when these positions are filled by professionals.

| MPVM | Master’s degree in Preventative Veterinary Medicine |
| MVPH | Master’s degree in Veterinary Public Health |
| MPH  | Master’s degree in Public Health |
from other disciplines because qualified veterinarians are not available. The veterinary profession is thus failing to realize all of the potential in the public arena.

The shortage of qualified veterinarians to fill these positions is heightened by an increased awareness and interest in the fields of bioterrorism, agroterrorism, and biodefense as well as a profound interest to protect public and animal health from these threats. In addition, the ever-widening global economy that promotes international access to markets and borders has coincided with the emergence of global disease pandemics that have veterinary implications. The need for trained veterinarians in the fields of public practice is exemplified by the recent outbreaks of severe acute respiratory syndrome, West Nile virus, avian influenza, and exotic Newcastle disease and the discovery of a case of bovine spongiform encephalopathy in the United States. The anticipated shortfall of veterinarians trained to work in public practice is critical and points to a need for postdoctoral training in the disciplines of population health.

In the summer of 2003, a series of articles titled “Agenda for Action” was published. These articles addressed the nature of the biological threats facing the United States, the roles and responsibilities of the veterinary profession, and the roles and responsibilities of academic veterinary medicine.1-7 These articles and others2-8 resulted in a call to action for the veterinary profession and veterinary academic institutions to create new and innovative programs to meet a critical need of a shortage of veterinarians trained in the areas of population health and public practice.

In the current environments for training veterinarians, veterinary students are exposed to most of the information needed to practice in the public sector; however, the opportunity to develop skills in these areas during veterinary school is extremely limited. Furthermore, the veterinary degree is not widely recognized as a valid credential for public health work, despite the fact that the veterinary curriculum has considerable public health components9 and the veterinary oath taken by graduates in the United States includes a pledge “to promote public health.”10 At this point, many veterinarians find that the only way for them to acquire competency in the knowledge and skills needed for public veterinary practice is the completion of an additional professional degree (such as an MPVM, MVPH, or MPH), academic degree (master’s or PhD), certificate program, or postgraduate fellowship.

The purpose of the study reported here was to describe the number and types of veterinary professional degrees and certificate programs providing education and training in the area of public practice to veterinarians and determine the availability of these programs via distance learning.

Materials and Methods
A literature review describing the association between veterinarians and public health provided the background and initial description of educational programs. Web-based Internet searches were performed from February 1, 2004, to April 1, 2004, to identify national and international programs that provide training and education to veterinarians in the areas of public practice, public health, and population medicine. Information found on program or school Web sites was clarified through conversations with program administrators via telephone and e-mail.

The search was limited to programs specifically designed for veterinarians. Further, the review was focused on veterinary professional degree and certificate programs. Professional degrees were defined as those available to veterinarians (or veterinary students in the case of dual degree opportunities), with limited or no research requirement, and conferring a degree such as MPH or MPVM. Certificate programs were defined as those programs of typically short duration (≤ 6 weeks) in which a certificate of completion but no degree was awarded at the end of the program.

Graduate academic programs designed to provide postdoctorate research training and a degree such as a Master of Science or PhD were not included in the review. We also excluded postgraduate research fellowships from the review because they tended to be limited in the number of available training opportunities. Also, although there are many MPVM programs available to veterinarians in the United States, only those that were explicitly paired with a DVM or VMD education or targeted at veterinarians were included in the review.

The Web site for the Association for Veterinary Epidemiology and Preventive Medicine, Programs of Graduate Study,11 provided the initial data for identifying professional degree programs. In addition, 6 Web-based search engines were used to search on the key words veterinary public practice, veterinary public health, population medicine, and Master’s degree in Epidemiology. Information describing the programs was derived from that provided on individual school and program Web sites as well as from personal e-mail correspondence with school administrators.

The review focused on the educational elements of the programs. These included the history of individual programs, the length of the program, the number of units required to complete the degree, the number of students enrolled in the program, and program delivery methods.

Results
Seventeen professional degree and 4 certificate programs designed to educate and train veterinarians in the areas of public practice were included in the review. These programs were sponsored by schools or colleges of veterinary medicine. Programs were further divided into general epidemiology programs, MPH dual-degree programs, and specialty training programs.

General epidemiology programs focused on principles of epidemiology and data analyses to provide veterinarians a strong foundation in epidemiology and biostatistics and broadly prepare them for public practice and population medicine. The MPH programs focused on education and training of veterinarians to work in the area of human public health. The specialty training programs emphasized specific areas related to public practice, such as food safety.

Professional degree programs in the United States—
Presently, there are 7 professional degree programs in public practice for veterinarians in the United States (Table 1). Five of these programs were implemented from 2002 to 2004. Four universities (University of California,22 Tufts University,23 Iowa State University,51 and University of Minnesota24) offer the professional degree as a dual-degree program (ie, the schools offer veterinary students the option to pursue an education in public practice concurrently with their veterinary medical education [DVM/MPH or DVM/MPVM]). Graduate veterinarians
may also take programs at the University of California, Iowa State University, and the University of Minnesota. The other 3 programs (North Carolina State University, Michigan State University, and Iowa State University's non-MPH program) are intended to be taken after receiving a DVM degree.

Programs at the University of California (MPVM), North Carolina State University (MVPH), and Iowa State University (MVPM) are generalized epidemiology programs that focus on providing an education in applied epidemiology and biostatistics to veterinarians. Areas of emphasis include epidemiologic principles, epidemiologic study design (including clinical trials), outbreak investigations, statistical analyses, and critical thinking in the review of research papers. Graduates from these programs are prepared to work in animal and public health fields at state, national, and international agencies.

The MPH dual-degree programs (University of Minnesota, Iowa State University, and Tufts University) prepare graduates for careers specifically in human public health agencies. These programs are designed to be taken concurrently with the DVM program. The program at Tufts University collaborates with the Tufts School of Medicine; the program at Iowa State University collaborates with the University of Iowa, College of Public Health; and the University of Minnesota program collaborates with the University of Minnesota, School of Public Health. The program at the University of Minnesota was designed to be accessible to veterinary students from any AVMA-accredited college or school of veterinary medicine and presently has students enrolled from Kansas State University and Purdue University as well as the University of Minnesota.

The professional Master of Science in Food Safety degree is offered jointly by the College of Veterinary Medicine and the National Food Safety and Toxicology Center at Michigan State University. The program is open to anyone interested and qualified (ie, it is not exclusive to veterinarians). The program solely focuses on food safety and the impact food safety has on public health. This program was included in the review because many veterinarians work in food safety.

International professional degree programs—Ten international professional degree programs providing education to veterinarians in the fields of epidemiology and public practice were reviewed (Table 2). Of these, 7 have been developed since 1998. Compared with the programs in the United States, the international programs tend to be designed as part-time programs that offer students a great deal of flexibility regarding the time required to complete the degree or certificate.

Programs at Massey University in New Zealand, the Royal Veterinary College (Veterinary Epidemiology and Public Health program) in the United Kingdom, the Royal Veterinary and Agriculture University (MVPH) in Denmark, Pretoria University in South Africa, the University of Sydney in Australia, and Utrecht University in the Netherlands all provide training in applied epidemiology and statistics. Emphasis varies among schools, but they all include the fundamentals of epidemiology, including study design and outbreak investigations as well as data analyses. Programs at the Royal Veterinary College, the Royal Veterinary and Agriculture University, Pretoria University, and Utrecht University also include animal...
health economics in the curriculum.30-32,34 The program at the University of Sydney uniquely offers leadership training and techniques for project management.33 Graduates of these programs are prepared for careers in public practice, veterinary public health, and population medicine at the state, national, and international level.

Murdoch University in Australia has 2 specialty programs; 1 focuses on conservation medicine35 and the other on veterinary surveillance.36 The Conservation Medicine program prepares veterinarians to work on environmental conservation projects in governmental and nongovernmental agencies. The Veterinary Surveillance program specifically trains and prepares veterinarians to address the issues of monitoring health and disease in populations.

The Royal Veterinary College’s Livestock Health and Production program37 is aimed specifically at veterinarians working in livestock health and production practice. The program prepares veterinarians to work in public or private practice on issues involving livestock health, production, and economics. In addition, epidemiology and public health issues as they relate to livestock are included in the topics covered.37 Finally, as with the program given by Michigan State University, the Royal Veterinary Agriculture University’s Master’s degree in Food Quality and Safety program38 specifically prepares students to work in food safety.

Certificate programs—Several certificate programs are available to veterinarians interested in further training in public practice (Table 3). Two of those at the University of Minnesota, School of Public Health, Core Concepts in Public Health46 and Food Safety and Biosecurity,49 are especially applicable to veterinarians interested in public practice. The program in Core Concepts in Public Health includes training in epidemiology, biostatistics, and public health. The program in Food Safety and Biosecurity includes training in biosecurity, food safety, infectious diseases, and surveillance. The postgraduate certificate program at Murdoch University in Veterinary Conservation Medicine41 is a shortened version of the master’s degree program and provides veterinarians knowledge to improve their skills in working with wildlife and in conservation medicine.

In addition, a fellowship in Science, Politics, and Animal Health Policy42 has historically been available through the combined efforts of Michigan State University and the University of Minnesota, College of Veterinary Medicine. This program aims to provide

<table>
<thead>
<tr>
<th>School</th>
<th>Program</th>
<th>Country</th>
<th>Start date</th>
<th>Duration of program</th>
<th>No. (maximum capacity) of students</th>
<th>Program requirements*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massey University</td>
<td>Master of Veterinary Studies, Epidemiology</td>
<td>New Zealand</td>
<td>1995</td>
<td>2–6 y</td>
<td>25–30</td>
<td>200 points</td>
</tr>
<tr>
<td>Murdoch University</td>
<td>Master of Veterinary Studies, Conservation Medicine</td>
<td>Australia</td>
<td>2004</td>
<td>1 y</td>
<td>NA</td>
<td>24 units</td>
</tr>
<tr>
<td></td>
<td>Master in Veterinary Studies, Veterinary Surveillance</td>
<td>Australia</td>
<td>2004</td>
<td>1 y</td>
<td>NA</td>
<td>4 units</td>
</tr>
<tr>
<td>Royal Veterinary College</td>
<td>Livestock Health and Production</td>
<td>United Kingdom</td>
<td>1999</td>
<td>2–5 y</td>
<td>46 (no max)</td>
<td>7 courses</td>
</tr>
<tr>
<td>Royal Veterinary and Agriculture University</td>
<td>MVPH</td>
<td>Denmark</td>
<td>2002</td>
<td>2–6 y</td>
<td>10 (25)</td>
<td>5 modules</td>
</tr>
<tr>
<td>Pretoria University</td>
<td>Master in Food Quality and Safety (Danish)</td>
<td>Denmark</td>
<td>2004</td>
<td>2–6 y</td>
<td>NA</td>
<td>7 modules</td>
</tr>
<tr>
<td>University of Sydney</td>
<td>Master of Science, Veterinary Epidemiology, and Economics</td>
<td>South Africa</td>
<td>NA</td>
<td>2–4 y</td>
<td>NA</td>
<td>4 modules</td>
</tr>
<tr>
<td>Pretoria University</td>
<td>Veterinary Public Health Management Postgraduate Program</td>
<td>Australia</td>
<td>2004</td>
<td>2–3 y</td>
<td>20</td>
<td>18 or 24 units</td>
</tr>
<tr>
<td>Utrecht University</td>
<td>Master of Science, Veterinary Epidemiology and Economics</td>
<td>Netherlands</td>
<td>1992</td>
<td>1.5 y</td>
<td>10–15 (20)</td>
<td>4 modules</td>
</tr>
</tbody>
</table>

*Programs from international universities use various systems for program requirements. The reader is referred to the individual programs for explanation of unit, point, course, and module. NA = Not available. Information could not be found on the Web site, and program administrators could not be reached. See Table 1 for remainder of key.
practical lessons in state, national, and international policy and political issues associated with animal health. Topics covered in this fellowship include leadership; strategic planning; state, national, and international policy; media training; and negotiation skills. The program has been suspended since 2001 but may be offered again in future years.

Distance learning opportunities—Of the programs reviewed, 8 use some form of distance learning to deliver their curriculum (Table 4). The mode of distance learning used varied from school to school. Programs in the United Kingdom operate on a correspondence course model. In these programs, materials are mailed to the student in January with courses beginning in February. Learning support is available via e-mail correspondence with course administrators and through local networks of students, which the student must initiate and facilitate. Students turn in assignments regularly and sit for examinations in October. Examinations are held around the world at various predetermined sites.

In contrast, programs at the University of Sydney, the University of Minnesota, and Michigan State

### Table 3—Comparison of certificate programs training veterinarians in the areas of public practice.

<table>
<thead>
<tr>
<th>University and Program</th>
<th>Country</th>
<th>Start date</th>
<th>Duration of program</th>
<th>Program requirements*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michigan State University</td>
<td>USA</td>
<td>1998</td>
<td>12 d</td>
<td>3 modules†</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td>USA</td>
<td>2004</td>
<td>2–4 y</td>
<td>15 units</td>
</tr>
<tr>
<td>Murdoch University</td>
<td>Australia</td>
<td>2004</td>
<td>6 mo</td>
<td>12 units</td>
</tr>
</tbody>
</table>

†Each module is a 4-day session focusing on state, national, or international health policy. See Table 2 for remainder of key.

### Table 4—Distance learning opportunities in veterinary professional degree programs training veterinarians in the areas of public practice.

<table>
<thead>
<tr>
<th>School</th>
<th>Country</th>
<th>Program</th>
<th>Timing of courses</th>
<th>Medium of delivery</th>
<th>Required on-site time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michigan State University</td>
<td>USA</td>
<td>Professional Master of Science in Food Safety</td>
<td>School calendar; Start in summer</td>
<td>Posted lectures, internet research, Web talk, and video</td>
<td>2 wk</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td>USA</td>
<td>Veterinary Public Health Program</td>
<td>Summers during veterinary school and rotations during the fourth year</td>
<td>Web-based, online classroom chats and posting and lectures</td>
<td>Two 3-wk blocks</td>
</tr>
<tr>
<td>Massey University</td>
<td>New Zealand</td>
<td>Master of Veterinary Studies, Epidemiology</td>
<td>Annual calendar</td>
<td>Three 3-wk residential blocks (modules) followed by projects and assignments via internet and e-mail</td>
<td>Three 3-wk residential blocks</td>
</tr>
<tr>
<td>Murdoch University</td>
<td>Australia</td>
<td>Master of Veterinary Studies, Conservation Medicine</td>
<td>Regular semester</td>
<td>NA</td>
<td>None</td>
</tr>
<tr>
<td>Royal Veterinary College</td>
<td>England</td>
<td>Livestock Health and Production</td>
<td>Start in February; final examinations in October</td>
<td>Published (and mailed) notes and readings (from textbooks and journals)</td>
<td>None</td>
</tr>
<tr>
<td>Pretoria University</td>
<td>South Africa</td>
<td>MSc Veterinary Epidemiology and Economics</td>
<td>NA</td>
<td>Only some classes available</td>
<td>NA</td>
</tr>
<tr>
<td>University of Sydney</td>
<td>Australia</td>
<td>Veterinary Public Health Management Postgraduate Program</td>
<td>Regular semester</td>
<td>Interactive Web-based, online classrooms, message boards, and chat rooms</td>
<td>3 blocks, 3–5 d each</td>
</tr>
</tbody>
</table>

See Table 2 for key.
University have an interactive Web-based style. In these programs, students interact with one another and with faculty and administrators via message boards and chat rooms. Materials are delivered via Web-based classrooms. These programs all have at least 1 mandatory on-campus initiation or intensive workshop. During the initial visit, students are oriented to the school, the computer systems, and the available resources. Often this time also includes networking, team building, and where applicable, leadership development workshops for students.32,27,33

The program at Massey University is structured in a modular design. Each year of the program consists of three, 3-week residential modules of structured class time followed by structured, asynchronous learning away from the university. Between the residential modules, students work on projects and assignments on their own; however, peer and faculty support is available via e-mail.29

Discussion

In the past 5 years, there has been a notable increase in the number of professional degree and certificate programs available to provide education to veterinarians in the fields of public practice and population medicine. These programs have some similarity in content, yet offer slightly different teaching emphases and approaches to deliver the material. The general epidemiology training programs provide veterinarians with a background in epidemiology and biostatistics and thus prepare veterinarians to work in various careers in public and private veterinary practice. The MPH, specialty degree programs, and certificate programs train veterinarians to work in specific fields of public practice, mainly in public health, food safety, and areas such as conservation medicine.

Many of the new public practice education programs are designed to permit students flexibility for completing course work. In particular, most of the recently developed programs are offered primarily as distance education programs. The educational designs of these programs involve minimal on-site time for the student with most of the education provided via asynchronous, self-directed learning materials. A common model consists of students meeting at the sponsoring institution for an initial intensive, on-site classroom experience, which is followed by at-home studying by use of interactive Web-based materials. These programs are attempting to reach a wide audience of veterinarians through flexible, part-time scheduling and the ability to enroll and learn from home. As such, these programs are directed at the many veterinarians that are unable or unwilling to take the time away from practice or work to enroll in a full-time, residential training program.34

The use of high-quality distance learning modalities is especially attractive to many in the veterinary profession given the time and financial constraints of returning to full-time, in-residence classroom presentations. In addition to the types of programs reviewed in this study, veterinarians are also able to acquire the skills needed to enter into public practice through academic degrees such as a master's or PhD or through postgraduate fellowships. Many universities in the United States and internationally offer such programs. The academic degree programs are more focused on research than those reviewed by this study and often contain an extensive research project as part of the required curriculum. Other opportunities for veterinarians, which were not reviewed in our study, are through postgraduate fellowships. Both Iowa State University and the University of Minnesota Center for Animal Health and Food Safety offer fellowships in public health. These programs recruit graduate veterinarians to work part time while pursuing an MPH degree and provide hands-on experience with current veterinary public health issues.

Additional public practice educational programs are under development at several veterinary colleges. Examples include veterinary public health programs at the Ohio State University and the University of Wisconsin. In Canada, an initiative to develop Schools of Public Health has been developed and proposes partnerships with Canadian veterinary colleges with the intent of increasing the number of veterinarians applying for public health credentials. Finally, veterinary public health certificate programs are being evaluated as a means for recognizing a concentration area undertaken by veterinary students during their 4-year undergraduate veterinary curriculum, similar to the international veterinary medicine certificate now available at several veterinary colleges. A complete listing of the programs under consideration and development was not attempted because of the uncertainty of the final program structure and offerings.

During our review, many references were found to programs that were inactive or no longer in existence. This was most common when researching certificate courses but also applied to professional degree programs. This observation raises 2 questions: how sustainable are public practice programs, and can (or will) the veterinary profession support the recent surge of public practice educational programs? Sustainability is a complex combination of student enrollment, faculty investment, and administrative support. Clearly, maintaining student enrollment is essential for survival of these programs, but this is not a simple problem of developing an exciting and accessible curriculum and delivery method. In all likelihood, students in these programs will be returning to school as established professionals. It is well known that adult learners are a heterogeneous group with various learning styles that differ from the traditional student in professional school.45

To effectively recruit, train, and educate professionals for these areas of public practice, these programs need to establish diverse educational offerings that appeal to various adult learning styles. It is also clear that student interest and demand will only exist if attractive job opportunities exist for graduates of these programs.

Sustainability also relies on faculty investment and involvement. Many of these programs rely on key faculty members for not only initiation and operation of the program but also for promotion. When these faculty members retire or move on to other positions, the program may experience a time of quiescence or be discontinued altogether. Certificate programs in the United States are examples of faculty-driven programs.
that are often self-funded as external nonacademic programs and rely entirely on faculty energy and interest to sustain the programs. For these programs to be sustainable, there must also be administrative support for infrastructure beyond the faculty investment. The administration needs to provide the environment in which these programs are determined to be an essential component to veterinary education. Without this support, continuation and sustainability of these programs becomes difficult. Professional degree programs, while not usually under the same funding constraints as certificate programs, experience the same student, faculty, and administration support issues. Given the projected need for veterinarians trained in public practice principles, understanding the dynamics of program sustainability is a fundamental issue as veterinary schools develop public practice training programs.

Related to sustaining these programs, but perhaps a bigger challenge facing veterinary educational institutions, is evaluating the success of these initiatives in training a veterinary workforce for public practice. Two currently operating programs (University of California and Utrecht University) have existed for more than 10 years, and 3 other programs (Tufts University, Massey University [New Zealand], and the Royal Veterinary College [United Kingdom]) have existed for more than 5 years. Yet, despite the longevity of these programs, to the authors' knowledge, published data evaluating these programs are not available, and as a consequence, little is known about the likelihood of graduates of these programs entering the fields of public practice. Even less is known about the impact graduates of these programs have on issues related to public practice and how prepared they were to enter public practice. Program impact and evaluation should be required for all public practice programs.

As the awareness of potential bioterrorism, agroterrorism, and biodefense threats increases and as new and reemerging zoonotic diseases are identified, trained veterinarians will be needed in the areas of public practice. The veterinary profession is once again faced with a unique opportunity to engage in these areas and provide leadership in animal health policy. As the various programs currently in existence mature and determine the necessary educational outcomes, the profession will successfully educate and train veterinarians to work on public practice issues facing society in the 21st century. With the fulfillment of this potential and opportunity for meeting societal needs, the veterinary voice and knowledge will not disappear from the public practice arena and the vision of “one medicine” will have another chance to crystallize.

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