

Global health: setting the agenda for veterinary medical education to enable veterinarians to meet their responsibilities in the field

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Summary

We regard the set of papers in this issue (OIE *Rev. sci. tech. Off. int. Epiz.*, 28 [2]) as a blueprint for an agenda to bridge the divides within the global scope of the veterinary profession, so that it will meet its responsibilities to the world as it develops in the coming decades. It defines the areas with which all veterinary students should be knowledgeable, provides emphasis on the need to expand the education of all veterinary students in terms of their global health responsibilities, and then provides insights into the educational approaches that can result in the inclusion of global health issues within the veterinary curriculum.

Keywords

Global health – Global veterinary public health – Veterinary medical education – Veterinary profession.

Global health: defining, creating and setting the agenda for veterinary medical education

In 1986 I (LS) presented my Wooldridge Memorial Lecture entitled 'New horizons for veterinary medicine: can the educators respond?' (40). I identified several issues which were of topical concern at the time, including genetic modification of crops and animals, use of animals to produce pharmacological substances, embryo transfer and the use of genetically engineered growth hormone to increase milk yield in dairy cows, to mention a few.

These were the burning issues of some 20 years ago and they focused on cumulative events in veterinary medicine over several decades. Now the issues are quite different. We are now living in a post-Malthusian age and the contributions to this volume recognise the need for the veterinary profession, and thereby veterinary education, to respond to the challenges posed by the coming urgencies. Expert population predictions are accepted as fairly reliable and the issues that come with them are global in nature and urgently need attention. By 2050 it is estimated that nine billion people will inhabit our planet amid global warming, environmental degradation, water shortages and possibly social unrest (24). A vital issue will be the feeding of these nine billion, who will increasingly demand animal protein and will increasingly live in urban communities

(24). In China, for example, it is projected that by 2020 900 million people will live in cities. Such burgeoning populations will demand new approaches to food production and food security as well as to the control of disease; especially that derived from animals. Already the majority of new disease entities are zoonoses and as population densities grow the incidence of animal-derived disease in the human population will also grow. Three recent examples of a zoonotic infection appearing in an opportunistic manner are the outbreaks of avian influenza and severe acute respiratory syndrome and the appearance of influenza A/H1N1 in Mexico, which has now been recognised as a global pandemic by the World Health Organization.

A recurrent theme in all these issues, whether they are related to climate, food, or disease surveillance and control, is the need for rapid action. But as rapid as we would wish this action to be it does take several years of research before new technology can become a practical reality that is ready for field use. The average lead time required to translate new technologies into commercial products (e.g. vaccines) is at least 10 years, so there is an urgent need to ensure high quality research now to find the solutions to provide food security for the future.

An important question in this global scenario is 'Does the veterinary profession have a role to play?' The various contributions to this volume express the wholehearted opinion that it does. If this is so, is the profession prepared to address the global issues and how? Unfortunately, while at present there may be a willingness to do so it is problematic that there is the urgency and the means to design new and innovative programmes in veterinary schools and colleges to address the many issues that will encompass the global scene. As has been emphasised by King in this set of publications (25), the veterinary global community must work in unison; this volume identifies courses of action that must be taken if we, the veterinary profession, are to play an important role in the issues that not only will be upon us in a few decades time, but are already placing animal and human health and welfare under threat. So when in my Wooldridge Lecture I posed the question 'Can the educators respond?' perhaps the question should have been 'Must the educators respond?' and the answer to this is undoubtedly 'Yes!' But there will need to be a radical change of emphasis in the educational programmes of veterinary schools and it is hoped that this volume will be the blueprint for that future emphasis.

The world already looks to human medicine to play a critical role in these global issues, but there is little recognition of the world role that could and should be played by the veterinary profession. Is this a failure on the part of the veterinary profession and its leadership to recognise and embrace the challenges posed by these global issues? To engage with these issues would be

consistent with the 'global health' concept of 'One World, One Health' proposed by Osburn, Scott and Gibbs (34), who describe it as an integrated approach to animal, human and environmental health, an interdependence that has never been more important or urgent than now. In the coming decades, as emphasised by Kelly (24), the need to produce more food and provide greater security from plagues will involve close cooperation between the medical and veterinary professions, i.e. 'one medicine'. Halliwell (21), in discussing the responsibilities of veterinary educators in responding to the emerging needs of veterinary medicine, identifies the responsibility of national and international organisations as that of providing foresight and vision, and he gives the Foresight Project initiative of the American Association of Veterinary Medical Colleges (55) as an example of a project that envisions a number of scenarios for veterinary education in the years ahead. A 'bold and imaginative' (21) report emerged from the Foresight Project, but Halliwell accepts that change is a long-term process and that any impact upon curriculum developments has yet to appear.

The concept of 'one medicine' was mooted as early as the 19th Century by Virchow, a German physician and pathologist who stated, 'Between animal and human medicine there is no dividing line, nor should there be'. Various other authors have put forward the concept of 'one medicine', for example William Osler (35) and Calvin Schwabe (38). In the examination of this concept both medical and veterinary education came under critical scrutiny in the early 20th Century on both sides of the Atlantic. The Flexner Report (17) to the Carnegie Foundation in 1910 lambasted medical education in the United States of America (USA): 'medical schools were private money-making ventures, bickering and feuding were standard means of faculty communication'.

The Flexner Report revolutionised medical thinking in North America, sweeping away the apprenticeship system and establishing the concept that research and teaching go hand in hand. This produced an emphasis on science rather than manipulative skills. Veterinary education in both the USA and Europe felt the blast of the Flexner Report and in the United Kingdom (UK) the Second Loveday Report in 1944 (29) recommended that veterinary colleges, hitherto independent, should become part of universities. 'Nothing short of this will give veterinary education the standing and the opportunities for development ... which the national economy deserves and requires'. The introduction of comparative medicine (or 'one medicine') into university thought in the UK may be attributed to Sir Clifford Allbut, Regius Professor of Physik in Cambridge, who in 1919 advocated that Cambridge University should set up a Central Institute of Comparative Pathology, saying 'We cannot tell how bright the cross lights which ... will be thrown upon the fields of several pathologies of all kinds of life'. In response to Allbut's

recommendation the Institute of Animal Pathology was established in the mid-1920s and was later incorporated into the Cambridge Veterinary School in 1949.

It is of interest, in passing, that together with the Potsdam Institute for Climate Impact Research and the support of industry, the Programme for Sustainability Leadership at the University of Cambridge has gathered together more than 20 Nobel Laureates and some of the world's leading scientists, politicians and global business figures, to discuss the future of the planet. The aim is to ignite debate around the world and to set the clock ticking for the crucial United Nations Climate Conference in Copenhagen in December 2009. This should be an opportunity for the veterinary profession to make an important contribution to global medicine and one health. Indeed Osburn *et al.* (34) have stated that veterinarians have pivotal obligations, opportunities and contributions to make in the advancement of public health as part of the global medicine concept. As stated by King (25) in his article 'One world of veterinary medicine', 'Today, the veterinary profession sits on the cusp of the greatest period of challenges and opportunities in its history'. These challenges include recognising and responding to zoonotic disease transmission and vector-borne diseases, maintaining food and water quality and promoting wildlife and ecosystem health (2, 3, 11, 20, 36, 49). All of these are natural components of the veterinary domain. Osburn *et al.* (34) give examples where the 'one medicine' concept has elucidated new disease entities hitherto unrecognised by either the medical or veterinary professions. On the production animal side examples include bovine spongiform encephalopathy (BSE) and *Escherichia coli* O157:H7 contamination of leafy greens. BSE is a degenerative neurological disease of cattle similar to scrapie in sheep and Creutzfeldt-Jakob (CJD) in humans. The BSE epidemic in cattle in the UK is believed to have resulted from feeding to cattle rations containing protein and calcium derived from meat and bone meal. The origin of infection with CJD was traced to the consumption of tissue of cattle infected with the prions of BSE. Since 1996, 180,000 cattle have been destroyed and there have been more than 200 human fatalities. Though most prevalent in the UK, cases in cattle and humans have been reported from other countries.

The elucidation of *E. coli* O157:H7 infection associated with leafy greens originally identified cattle as the hosts for outbreaks of human diseases. But the fields where the produce (leafy greens) was grown had no direct link to cattle; the role of feral pigs was then examined and they were identified as a source of contamination. After mingling with cattle in pastures some quarter of a mile away the pigs moved into these leafy green fields and defecated there, mechanised harvesters with vacuum pick-up systems picked up leafy greens and debris, including pig faeces, all of which was transferred to washing

containers where a cooling process placed the *E. coli* in contact with the internal and external surfaces of the leafy greens.

In the field of companion animals it is now recognised that the study of the restricted genomes of many breeds of companion animals offers an outstanding opportunity to provide a joined up approach to research on human and animal diseases in which veterinary schools can provide leadership ('one medicine').

Examples of comparative medical issues or 'one medicine' are combined immuno-deficiency in Arab horses, canine leucocyte adhesion deficiency in Irish Setters, syringomyelia in Cavalier King Charles Spaniels and brachycephalia in Pekinese and Bulldogs.

An area which must command increased attention in any veterinary school curriculum and research programme is public health and zoonoses. Of the 1,461 infectious diseases of man, 875 are of animal origin and this ratio is increasing. This is a matter of growing concern, as is the resurgence in antimicrobial medications for food producing animals and the concomitant increase of antibiotic resistance. Of particular note is the recognition that antibiotic-resistant genes are circulating in the environment via commensal organisms. Since the veterinary profession has been accused of causing a substantial proportion of antibiotic resistance problems there is the need to have the prudent use of antimicrobial agents more clearly enunciated throughout the curriculum.

The development of antimicrobials is ranked among the most important advances in medicine. Many life-threatening infections have been controlled while minor infectious morbidity is readily treated. Antibiotic prophylates have made many surgical procedures, transplantation medicine and cancer therapy much safer. The therapeutic effectiveness of antimicrobials differs from other drugs since they target microorganisms as opposed to host-derived pathologies. Unlike other drugs the therapeutic effectiveness is continually threatened by the emergence and spread of resistant organisms. Antibiotic resistance must be viewed as a serious threat to public health.

Fanning *et al.* (15) maintain that current veterinary education programmes do not provide the means to enhance an undergraduate student's understanding of this situation. As a first step they maintain that a modern education programme should provide students with a holistic view of the ecology of resistance and how it can emerge.

The importance of food animal veterinary education is examined by Bravo *et al.* (8) who identify the need for the curriculum to be adapted to the individual circumstances

of a country or region. In Europe, for example, in 2010, curricula must be adapted to the guidelines of the European Space for Higher Education and Bravo *et al.* maintain that it is now time to specify how the veterinary curricula can be most adequately oriented to adapt them to these new requirements. These authors recognise that there is increasing demand for food of animal origin globally, which has highlighted the lack of farm veterinarians in some Western countries, and they note that an increasingly 'urban' mentality is developing in the profession and in veterinary education. In a strongly argued contribution these authors identify that one of the tasks that veterinary professionals are most frequently asked to perform is to guarantee the safety of food production for the consumer, thereby safeguarding human health, without neglecting animal health and welfare.

When a country is heavily dependent on meat and livestock exports, as for example Australia or New Zealand are, the veterinary authorities carry an important burden of responsibility for the examination and certification of exported products. Therefore it would be expected that the veterinary curriculum would have a strong public health component. As pointed out by Abbott (1), Craven (12), and Fenwick and Wilks (16, 54), as Australia is the largest exporter of red meat and animals in the world it needs to have a veterinary curriculum appropriately rich and broad in these areas to produce graduates who are able to address challenges in related areas of veterinary public health throughout the world. To this end a Public Health University Network in Australia has been established to harmonise the veterinary public health curricula at the various veterinary schools and to develop the Australian veterinary public health philosophy. The global implications of veterinary public health teaching in Australia are great and teachers in educational establishments recognise that the veterinary profession is a truly global profession and it is integral to the success of the 'One Health' concept. Similarly, Swan *et al.* (43) emphasise that education in countries in which endemic exotic diseases exist must be tailored to an understanding of the surveillance and control needs, not only for that region, e.g. sub-Saharan Africa, but globally as well. To advance this concept in southeast Asian countries a meeting of the Asian Association of Veterinary Schools has recommended that graduates of veterinary schools in Asia should have extensive training in population health, preventative medicine and zoonotic diseases (57). In some universities veterinary public health is taken further by Master of Science courses, thereby supplementing the undergraduate courses.

In South America, Berruecos and Zarco (6) describe the integration of issues of global animal and public health into the veterinary education curriculum. Historically, in most Latin American countries the development of veterinary

education followed that of Mexico, with a practical transition from a curriculum oriented towards equine medicine to one that balances animal health, animal production and public health. Concomitant with this development there was a marked increase in the number of veterinary colleges in South America; there are now more than 200, with 160 of them being in Brazil alone.

Under the auspices of the Panamerican Association of Veterinary Sciences, the Pan American Federation of Veterinary Schools (PFVS) was created to 'promote modification of veterinary curricula to deliver basic veterinary education according to the political, social, economic, sanitary and environmental realities of the region and to orient veterinary education towards higher emphasis on animal health, quality and efficiency of veterinary services and ethical and environmental consciousness'. This has resulted in curricular harmonisation, with a basic curriculum for veterinary education in Latin America and the recommendation that every veterinary college in the region, regardless of educational methodology or species emphasis, makes sure that its curriculum covers specified areas, two of which are public health, and ethics and social responsibility (Berruecos and Zarco, 6). This international harmonisation of the veterinary curriculum is a major step forward, as reported by Zarco (58), and could well be adopted by other countries. Craven (1) has addressed the issue of matching veterinary school accreditation to the global needs of the profession and of global society.

Projections of problems for the coming decades (e.g. global warming, environmental degradation and food shortages) also include warnings about water and its role in disease transmission, zoonoses and agricultural cultivations. The need for water in food production, in both horticulture and livestock undertakings is obvious and its shortage may well lead to famine, as indeed it already has in some parts of the world. However, waterborne transmission of infectious diseases is of importance to the veterinarian, and Bowman (7) believes that the veterinary curriculum should contain a component on understanding water and sewage treatment processes such as flocculation, sedimentation, filtration and divitrification. Waterborne transmission of disease was identified by John Snow (1813-1858), who observed that a cholera epidemic in 1848 was spread by the water supply and recommended the removal of the handle of the Broad Street (London) pump to control it. He published his views in 'On the mode of communication of cholera' in 1849. He is commemorated by the Pump Handle Society of the London School of Tropical Medicine and Hygiene. Bowman (7) gives an excellent account of the wide range of infectious diseases, including zoonoses, where water plays an important role. The western world may well be relatively free of these major infections but they are still serious concerns in the developing world.

Any discussion of waterborne diseases would not be complete without mention of fish diseases. Weber *et al.* (52) emphasise the need for these to be an essential component of veterinary education. Apart from being the most numerous of companion animals, they serve as vital indicators for marine and freshwater ecosystems and, importantly, as the source of high quality food in many parts of the world. In general, fish production, health and welfare are not as widely taught as they should be and are often relegated to postgraduate programmes such as those at the University of Stirling and the Norwegian School of Veterinary Science. In their contribution to this volume Lipman and van Knapen (28) discuss the need for a different kind of veterinarian, and most certainly there is a growing agreement globally that the curricula hitherto espoused by veterinary schools no longer adequately prepare students to respond to the span of responsibilities that the veterinarian may be called upon to deal with. Lipman and van Knapen (28) give an interesting account of how the veterinary faculty at the University of Utrecht (Netherlands) has responded to the challenge, and this could serve as a blueprint for curricular development for the future.

If we are to accomplish the changes proposed by the various authors of this volume and prepare students for work in a globalised world then we must retool the educational programmes worldwide (9). De Lamballerie (14) urges the case for an understanding of molecular tools and molecular biology to appreciate epidemiological aspects of disease genetic susceptibility. Stoddard and Glynn (42), Windsor (56) and Malone *et al.* (32) give a breadth of examples of opening the window on public health to veterinary students. These include 'extern'-ships in various agencies of which there are several willing to take on students. Such opportunities, along with the new curriculum at the University of Calgary, Canada (13), which is based on the 'One World, One Health' concept, are moves in the right direction. Stoddard and Glynn (42) state that within the next 20 years the shortage of veterinary graduates entering public health practice could be as great as 15,000.

Capua (10), and Wilks and Fenwick (54) call for a greater understanding of viruses, viral diseases, the epidemiology of their pathology and control options, particularly as they relate to domestic wild animals and birds. Coupled with this is the need for a greater understanding and knowledge of the tools available for diagnoses and control. This also requires new graduates to have an understanding of research and the need for it (19). In particular, new graduates need to know and appreciate the scientific method, how to search the literature, how to formulate and address hypotheses and how to get the information to the appropriate ears. The involvement in research in parallel with the veterinary degree (dual degree programmes) is increasingly seen in some countries.

Inclusion of conservation medicine and ecosystem health in the veterinary curriculum worldwide is recommended by Aguirre and Gomez (2, 3) as a means of preparing veterinarians to fulfil critical roles in sustaining global health. Bellemain and Coppalle (5) describe the public health governance issues that must be included in the veterinary curriculum and emphasise that they must be taught in the context of the actual situation in a specific country.

An aspect of veterinary education not touched upon in sufficient detail is that of animal welfare. Veterinarians have a special responsibility for the welfare of animals in general and particularly for those under their care. Whether acting as clinicians or policy advisors veterinarians have a special role to play as 'animal advocates' while taking into account the considerations of owners, animal industries and governments (Main *et al.*, 31). Welfare science is essentially an understanding of animal behaviour. Molento and Calderon (33) conclude that it is not possible to work as a veterinarian and make a good quality contribution unless the main concepts and issues of animal welfare are understood and incorporated into practice. Madigan and Dacre (30) have especially emphasised the breadth of responsibilities that a veterinarian has. To enable veterinary professionals to meet the demands of working in global veterinary medicine in an evolving world it is essential that veterinary education include opportunities for students to develop skills in communication and cultural sensitivity, as is emphasised by Kurtz and Adams (27). It is critical that all veterinary students gain an awareness of and a capability for communication, both within their own cultural environment and, more importantly, across cultures. The veterinary profession cannot meet its global responsibilities without having an intrinsic appreciation of such skills.

Achieving the needed results

The authors of this volume of papers clearly strongly subscribe to the need for veterinary graduates to be well cognisant of the breadth of global issues and problems that they have discussed. This especially includes an understanding of the role that the profession must play in meeting the United Nations declared Millennium Goals for feeding the world's population (39) and the issues that must be handled in protecting and preserving the planet's ecosystem (3, 41). Veterinarians must receive training that enables them to make an effective contribution to these issues, and the papers in this volume cover the broad range of subject areas that should be included in that training. Critically, it is not just the veterinarians who will be directly working within these areas who need this training, but all veterinarians, since all must be spokespersons for the veterinary profession and must understand the role of

veterinarians at global level. To accomplish this critical task they need to have a solid foundation in the range of key areas. Veterinarians in practices must serve as the knowledgeable link to the local communities that they serve.

How can these goals be brought about and global public health served by the veterinary community? What clearly would seem absolutely necessary is a significant change in the curriculum in most, if not all, veterinary schools. But to accomplish this is a major problem since many in veterinary education would conclude that even the current curricula are already unacceptably stretched beyond a reasonable educational load and overcrowded with the broad range of subjects that must be taught. The solution, however, cannot be to ignore the issue. Major curricula changes are unfortunately usually very difficult to achieve and indeed, as Turnwald *et al.* (46) have noted, the difficulties involved in introducing these changes have been compared to the difficulties of moving a cemetery. An added conundrum is that with some teachers there is a cult of complete coverage and an unwillingness to cut back on the hours they devote to their subject, and hence to open up space for new or additional subjects.

One particular difficulty for veterinary schools is that most woefully lack staff with expertise in education that can manage major curriculum reform. This was the same issue that medical schools faced during much of the last half of the 20th Century, but during the last decade and a half, especially with the leadership of the Association of American Medical Colleges (AAMC) in the USA and the Association of Medical Educators in Europe (AMEE) this has dramatically changed. Now most medical schools, especially in the progressive countries, have a cadre of staff members with extensive understanding of adult education, its structures, and the strategies for success and effective learning. Veterinary medicine needs to follow suit and incorporate in their faculty structure experts in education who can help guide major change. Some notable veterinary school exceptions with solid expertise in education (all of whom have been kind enough to make contributions to this set of papers) include the Royal Veterinary College, London; the Faculty of Veterinary Medicine, Utrecht University; the Royal (Dick) School of Veterinary Studies, Edinburgh; the Faculty of Veterinary Science, Sydney; the Virginia Maryland Regional College of Veterinary Medicine, Blacksburg, Virginia; and the Faculty of Life Sciences, University of Copenhagen.

It is usually very well recognised that an expert in one area of veterinary medicine is not necessarily an expert in other areas of veterinary medicine, but unfortunately that principle is often forgotten when choosing someone to lead a critical evolution in the educational programme. When major change in a veterinary curriculum is deemed essential, the leadership of this effort most often falls to a

faculty member, who is probably a well recognised teacher, but mostly so as an expert in teaching in his/her own subject. Quite often this leader has but minimum expertise in the breadth of educational domains that are critically essential to understand in directing a major change in a school's curriculum. The problems in achieving curriculum reform are then confounded. Furthermore, even once a change has been implemented there is most often little follow up of a hard-core scientific nature to determine whether or not that change had the desired effect. This is akin to 'creating a new antibiotic to fight a major disease but then not then determining if it is effective'!

We have been fortunate, however, to have some excellent veterinary educators contribute to this volume. The paper by Turnwald *et al.* (46) provides an exceptional discussion of how to structure a curriculum revision. Turnwald *et al.* make a very important point about the need to have good leadership, especially at the highest level within the school. Perhaps rather than just a leader, what is needed most is a champion, someone who is at the forefront encouraging progress. In fairly recent times Dan Tosteson is certainly the prime example of the crucial role a champion can play in effecting educational change. For the two years prior to his joining the Harvard Medical School as Dean, the school was wrestling over curriculum with difficulty. Upon Tosteson's arrival the entire mood changed leading to a curriculum that many schools then emulated (51). The Turnwald *et al.* article (46) provides excellent guidance on how to proceed to accomplish curricular reform.

The next step in the creation of a curriculum is to define the outcomes that the curriculum is to achieve, as is emphasised by the papers by Welsh *et al.* from the Royal Veterinary College, London (53); Taylor from the Faculty of Veterinary Science, University of Sydney (45); and Jaarsma *et al.* from the Faculty of Veterinary Medicine at Utrecht University (22) (Utrecht University have produced detailed programme outcomes for the veterinary curriculum [47]). Programme outcomes must be specific, extensive, and verifiable (i.e. students must be able to assess whether or not they have developed the skills described in each outcome). For effective change to occur, it is absolutely essential to define the destination before considering how to get there. This is the difference in defining curriculum from the top down versus the bottom up. What is absolutely essential in effecting curriculum change, especially with a set of complex issues to resolve, is to define what outcomes one wishes to achieve and what skills, knowledge and understanding each student must have achieved by the day of graduation. Taylor (45) has done this in the paper entitled 'Defining, constructing and assessing learning outcomes', as have Welsh *et al.* (53) in their paper 'Approaches to defining day-one competency: a framework for learning veterinary skills' and van Beukelen *et al.* in their detailed brochure entitled 'Programme outcomes of the veterinary curriculum' (47). Each of these

provides a mode of very specifically defining what the curriculum needs to achieve and crucially set the balance between areas. 'One can't build a car or a train if one does not know what a car or a train is expected to achieve and how each has a different mission'. The same principle equally applies to building a curriculum. Unfortunately, currently, very often veterinary school faculty start defining changes in a curriculum without having very carefully defined what they want to achieve. Such an approach has a high failure rate. There are thus three stages in accomplishing desirable curriculum change:

- firstly, define the goal one wants to achieve
- secondly, create a curriculum that would appear to achieve the desired goal
- thirdly, evaluate whether the new curriculum is in fact achieving its intended goal.

The papers in this compendium have provided an excellent insight into the areas of global animal and public health that must be provided in the veterinary curriculum, directing attention to many specific components. Global public health, and the variety of associated and essential topics that have been well documented in the sequence of papers in this compendium, is critically important. It is absolutely essential, therefore, that they be well defined as part of the outcomes that each veterinary curriculum is designed to achieve. These sets of topics MUST be part of the defined outcomes if that school wishes to ensure that they are indeed part of the total curriculum that is to be implemented. The full product will probably vary from school to school. It is key, therefore, that each school define the end product that they wish their curriculum to achieve. Equally important is that each school recognises its responsibility to educate all of its students within this essential framework of global public health. The paper by Welsh *et al.* (53) provides the means to accomplish this by describing the approach adopted by the Royal Veterinary College London (37). A two-year project resulted in the publication of a day-one skills handbook which was introduced to staff and students in 2007. This is now a standard feature throughout the veterinary course. The authors report that the project produced a framework for day-one skills that related to practice in the UK or Northern Europe, but accept that there would be some very different components to such a framework in other parts of the world. Also defined by the Royal College of Veterinary Surgeons (RCVS) are year-one skills, recognising that education does not end upon graduation, all that has been achieved is the start of the process.

Only after the desired outcomes have been defined is it appropriate to start examining the curriculum in its individual steps and in doing so reach a curriculum that meets the full objectives of the school. It is critical to consider not only what topics should be covered, but how. Jensen (23) addresses the issues of preparing students for

future veterinary professional life-long learning and Jaarsma *et al.* (22) advocate a change from conventional teacher-centred veterinary education to one of student-centred learning environments and generic competency development. Jensen (23) has pointed out that in universities and establishments of higher education there are many resources available to enable advances to be made in veterinary education and teaching. An example of this is the marked development of information technology (IT) and the strong probability that IT could provide a solution to the provision of educational information for which there is insufficient space or time in a curriculum. Frydenberg (18) gives an account of the possibilities for distance education, maintaining that students expect to be able to take it with them wherever they go. Mobile devices are becoming more and more powerful and can be used for access to programmes almost anywhere in the world. What is demanded here is not only that access to speciality courses be offered electronically but also, importantly, that such 'electronic courses' be produced by experts in the field of (veterinary) knowledge and as with the written word be reviewed independently as to content and accuracy. Frydenberg (18) concludes that content of distance education can be 'misused, misunderstood and misapplied' and that 'experts (professors) will be in more demand than ever' and she explores new approaches such as Open Educational Resources (OER), which means an institution or a professor may make available open, free of charge material so long as proper attribution to the creator is made. The first in this field of OER was Massachusetts Institute of Technology (MIT), which now offers over 1,800 courses freely over the Web. Such an approach may well be the answer to the multiple topic areas that veterinary education and the resulting graduates should have access to. Frydenberg (18) identifies OER and the Open Courseware Consortium as revolutionary propositions to make educationally organised knowledge freely available to anyone, anywhere.

Another important issue of curriculum change is emphasised by the two papers comparing the two major types of veterinary curriculum currently in effect (26, 50). These two types of curriculum either provide students during their last year of training with an experience with a broad range of species (often defined as omni/general clinical competence), or to just one or a very few species, usually termed 'tracking'. These two types of curriculum are quite distinct, especially in at least the last year of training. With the tracking curriculum the student's attention is very specifically directed to the areas/species of veterinary medicine they want to pursue following graduation. With the omni/general clinical competence approach the students have a broad multi-species experience during veterinary school and do not undertake specialist veterinary training in a particular area until after graduation (or even later). The impetus for 'tracking' is often the fact that students recognise, or are informed, that

employment opportunities are poor in a given field, e.g. farm animals, and hence they may concentrate on a track which is more likely to result in employment and an income with which to pay off a student loan. An alternative approach is the 'core-elective' system, where basic essential information is provided and is supplemented by opportunities for the student to focus interest and explore topics not included in the 'core' of the course. There are many examples of students who have elected a topic in an exploratory way and have eventually taken employment in that field, e.g. wildlife medicine. The two papers that examine this issue (26, 50) describe what was the very first study of the tracking approach (and did so some 30 years after it had been introduced!!). It provides an example of the type of detailed study of a curriculum change that is essential with the generation of statistically reliable conclusions. This study is an example of the third of the three stages needed in accomplishing desirable curriculum change itemised above (i.e. evaluate the effectiveness of the new curriculum – is it achieving the intended goal?).

One criticism of the tracking approach that has been made is that should a graduate wish to change his/her emphasis to another species or topic area then s/he would be at a disadvantage in not having been exposed to the up-to-date information in the new area. However, evidence presented by comparisons between the veterinary school programmes at Ohio State University and the University of California, Davis, has concluded that provided the basic disciplinary courses are good, then a change in veterinary career direction can be managed well and graduates are 'up to speed' in their new area within a month or less, with many being comfortable with the change in just a few days (Klosterman *et al.*, 26). Clearly the quality of this preclinical teaching is critical in preparing a graduate for a range of options.

It might have been expected that the outcome of these two approaches to veterinary education would be quite different in terms of the future careers that students select. It is perhaps surprising to note, however, that this was not so and the data indicated that the percentage of students who selected the various areas of practice was identical, within statistical variation, with these two distinct approaches to curriculum. Thus, this opens up the critical question of to what extent does curriculum define the veterinary careers that students choose.

An important message from these data is that with two quite different curricula the graduates choose virtually the same proportion of different career tracks. If the curriculum does not particularly influence the veterinary career that a student subsequently chooses then what does? Thus, will a curriculum that has a substantial

amount of global public health incorporated into it, in fact make any difference in the number of students choosing to work in this area? Clearly, without such a change graduating students will be grossly insufficient in their knowledge of global public health and therefore such a change in curriculum must happen. But even with a change in curriculum it would appear that not enough students will subsequently choose a career in global public health. A change in curriculum alone will probably not be sufficient to result in more veterinarians entering into a life-long practice in global public health? If not, then what can accomplish the needed change? A key question is when do most veterinary students choose their career track? Is it during veterinary school or before they enter veterinary school? If it is before, then the most important means of encouraging veterinarians to choose a career in global health is to educate them about the possibilities while they are still at high school. The paper by Andrews (4) describes an activity that attempts to address this issue. She describes the ambitious enterprise of the RCVS, the governing body of veterinarians in the UK, to provide the vast majority of 14-16-year-old students in the UK with an understanding of the variety of careers available to a veterinarian, including careers in public health. Perhaps this approach will do more to influence career choice than any curriculum emphasis. Perhaps it will result in a substantial increase in the number of veterinary students entering into global public health. If it does it should be modelled around the world. But this must occur with a simultaneous vast improvement in the extent of global public health education within the veterinary school curricula worldwide.

We will not know if the RCVS project has been a success for some years, but clearly a vigorous effort must be put into immediately trying to compensate for the considerable shortage of veterinarians in the critical area of global public health. The issues are urgent and profound and veterinary education must by all means possible deliberately direct students' career aspirations to those of global health. Furthermore, all veterinarians must be able to speak with authority and understanding of global health issues; there is currently a shortage of veterinarians with the level of knowledge to do this and it is clear that finding an immediate solution to this problem is of the utmost importance. A vigorous effort must be mounted to deal with this shortage

This volume of papers is a blueprint for the way ahead for veterinary education. If acted upon, then the answer to my (LS) rhetorical question as posed in the Wooldridge Lecture (31) – 'Can the educators respond?' – is surely 'YES'.

■

Déterminer les priorités de l'enseignement de la médecine vétérinaire : permettre aux vétérinaires d'assumer leurs responsabilités dans le domaine de la santé mondiale

L. Soulsby & D.A. Walsh

Résumé

La série d'articles réunis dans ce numéro (*Rev. sci. tech. Off. int. Epiz.*, 28 [2]) peut être considérée comme une tentative de mise en ordre des priorités permettant de dépasser les clivages de la profession vétérinaire au plan mondial, dans le but que celle-ci puisse assumer ses responsabilités dans le monde tel qu'il évoluera dans les prochaines décennies. Cet ouvrage commence par définir les domaines de compétences que doivent maîtriser tous les étudiants vétérinaires ; il met ensuite l'accent sur la nécessité de doter les étudiants vétérinaires d'un socle plus large de connaissances afin qu'ils puissent assumer leurs responsabilités en termes de santé mondiale ; enfin, il fournit un aperçu des approches pédagogiques susceptibles d'intégrer les problématiques de la santé mondiale dans les programmes d'enseignement vétérinaire.

Mots-clés

Enseignement de la médecine vétérinaire – Profession vétérinaire – Santé mondiale – Santé publique vétérinaire mondiale.



Líneas de trabajo de la enseñanza de la veterinaria, o cómo preparar al profesional para afrontar los problemas sanitarios mundiales

L. Soulsby & D.A. Walsh

Resumen

Los autores consideran que el conjunto de artículos que forman este número (28 [2]) de la *Revista científica y técnica* de la OIE sienta las bases de un plan de trabajo para colmar las lagunas que a escala mundial presenta la profesión veterinaria, un plan que en los próximos decenios sirva a la profesión para desarrollarse y asumir sus responsabilidades ante al mundo. Tras delimitar los ámbitos que deberían abarcar los conocimientos de todo estudiante de veterinaria, los autores hacen hincapié en la necesidad de ampliar la enseñanza veterinaria para dar cabida en ella a las responsabilidades sanitarias mundiales de los futuros profesionales y, por último, ofrecen pistas sobre los métodos didácticos que pueden facilitar la inclusión en los planes de estudios de una serie de temas sanitarios de dimensión mundial.

Palabras clave

Enseñanza de la medicina veterinaria – Profesión veterinaria – Salud mundial – Salud pública veterinaria mundial.



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