Proceedings of the First OIE Global Conference on Evolving Veterinary Education for a Safer World

12–14 October 2009

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Preface

‘Evolving Veterinary Education for a Safer World’, Paris, 12–14 October 2009

Address at the opening ceremony by Dr Bernard Vallat, Director General of the OIE

Representatives of governments or administrations of OIE Member Countries, deans and representatives of deans of veterinary education institutions, distinguished guests,

On behalf of the conference organisers and of the Steering and Scientific Committees, I wish to extend my thanks for having travelled – most of you a long way – to join us at this conference on veterinary education, in spite of the economic crisis that we are all experiencing. Indeed, the admission charges that you have kindly paid were crucial in enabling us to stage this event, for which I am profoundly grateful.

The World Organisation for Animal Health (OIE) decided to organise this first-ever global conference on veterinary education because our organisation’s mandate is to improve animal health and welfare worldwide, and we all know that this is illusory without competent veterinarians, which means they must be well trained, in terms of both initial and continuing training. As all of you are global players in veterinary education, we wish to engage you in dialogue throughout these three conference days so that together we can help veterinary education to evolve.

Veterinary education is not a tradable or commercial good like any other. Veterinarians are entrusted with the task of preventing and controlling the major biological risks threatening society in our globalised world. We therefore wish to reaffirm that:

- Veterinary education is a global public good eligible for government funding, in addition to private sector funding, everywhere in the world;
- In return, veterinarians have a duty of excellence. All veterinarians must have the general and scientific knowledge to enable them to understand the complexity of our world and to find solutions to difficult and highly diverse issues. That is the price they must pay for receiving increased recognition from society as a whole. During the coming three days, we shall discuss the minimum instructional content that should figure in the training curriculum of anyone aspiring to the title of veterinarian anywhere in the world;
- We shall also discuss possible mechanisms that can be used to encourage all veterinary education institutions to evolve and to gear themselves to society’s new requirements, whilst complying with key principles;
- Veterinary statutory bodies may play a crucial role in this, and we shall be discussing them too, as well as the benefit of tackling all these issues at regional and global levels, in particular through federations or associations of veterinary education institutions.

Nor should we forget the duty of solidarity with the poorest countries. All the world’s veterinarians have the right to excellence. There is no doubt that the richer countries have an interest in helping the poorer countries to rid themselves of the animal diseases threatening countries that have already become disease free. The OIE is able to propose models of effective and recognised mechanisms for achieving this, including policies for twinning institutions, which we are already implementing successfully in the case of OIE Reference Laboratories, thanks to the OIE World Animal Health and Welfare Fund.

It is also possible to create, and subsequently implement on a strictly voluntary basis, a set of minimum criteria to be presented to OIE Members, first for debate and then adoption. These criteria would enable voluntary, independent evaluations of requesting veterinary education institutions to be conducted, in order to determine, on a harmonised basis, the key needs of any institutions requesting technical or financial support, either from their own government or administration or, if necessary, from international donors, under the auspices of the OIE. Each institution would, of course, be autonomous after complying with the basic minimum.
Preface

As regards veterinary statutory bodies, the 176 Member Countries of the OIE have already adopted international quality standards, which are recognised by the World Trade Organization. The voluntary and independent evaluation of veterinary statutory bodies has already been integrated into the OIE PVS tool for the evaluation of Performance of Veterinary Services, which has been used by around 100 OIE Member Countries to date. The quality of initial and continuing training is already being evaluated as a key element of the performance of Veterinary Services. A further possibility is for the veterinary statutory bodies in developing countries in need of support to use the mechanism of North–South or South–South twinning between veterinary statutory bodies from different countries and regions.

As you see, we really have our work cut out, with only two-and-a-half days to endeavour to build and adopt consensus on all these aspects.

I shall conclude by thanking Mr Vernon Hill, from Philadelphia in the United States of America, who has earmarked part of his fortune to create the annual Penn Vet World Leadership Award, in recognition of a veterinarian’s service to the community. The award is a sort of Nobel Prize for veterinarians. The 2009 award winner is with us today. He is a teacher, researcher and former dean of a veterinary university. The award will be formally presented to him here, in your presence, at 14.00 hours tomorrow.

I wish you all a pleasant stay in Paris and a stimulating conference that will, I am certain, help veterinary education to evolve in the right direction.

Thank you for your attention.
Introduction du Dr Bernard Vallat, Directeur général de l'OIE à la séance inaugurale

Mesdames et Messieurs les Représentants des gouvernements ou des administrations des Pays Membres de l'OIE
Mesdames et Messieurs les Doyens et Représentants des Doyens des établissements d’enseignement vétérinaire

Honorables invités,

Au nom des organisateurs de cette Conférence, du Comité de pilotage et du Comité scientifique, je voudrais vous remercier chaleureusement d’avoir fait pour la plupart d’entre vous un long voyage pour vous joindre à nous pour cette Conférence sur l’enseignement vétérinaire, malgré la crise économique que nous subissons tous. Les droits d’entrée que vous avez bien voulu acquitter ont d’ailleurs été déterminants pour que cet événement ait pu avoir lieu, ce pourquoi je vous exprime toute ma reconnaissance.

L’OIE a décidé d’organiser cette Conférence, qui est une première mondiale, car notre mandat est d’améliorer la santé et le bien-être animal dans le monde et nous savons tous que ceci est illusoire sans vétérinaires compétents, donc bien formés, tant au niveau de leur formation initiale que de leur formation continue. Vous êtes tous des acteurs mondiaux de la formation vétérinaire et nous souhaitons dialoguer avec vous pendant ces trois jours pour faire bouger les choses ensemble.

La formation vétérinaire n’est pas un bien marchand ou commercial comme un autre. Les vétérinaires ont des missions de prévention et de contrôle de risques biologiques majeurs, qui menacent la société dans notre monde globalisé. Ainsi, nous voulons réaffirmer que :

- la formation vétérinaire est un Bien Public mondial éligible à des financements publics se rajoutant aux financements privés partout dans le monde ;
- en contrepartie les vétérinaires ont une obligation d’excellence. Ils doivent tous disposer d’une culture générale et scientifique leur permettant de comprendre la complexité de notre monde et de trouver des solutions face à des situations difficiles et très diverses. C’est le prix à payer pour obtenir une meilleure reconnaissance par la société dans son ensemble. Nous discuterons pendant ces trois jours du contenu pédagogique minimum qui devrait figurer dans les programmes de formation de toute personne revendiquant le titre de vétérinaire dans le monde ;
- nous discuterons également des mécanismes possibles utilisables pour inciter tous les établissements d’enseignement vétérinaire à évoluer et à s’adapter aux nouvelles demandes sociétales tout en respectant des principes essentiels ;
- le rôle des Ordres des vétérinaires (Veterinary Statutory Bodies) peut être fondamental en la matière et nous en parlerons également, ainsi que de l’intérêt d’aborder toutes ces questions aux niveaux régional et global notamment grâce aux Fédérations ou Associations d’établissements de formation vétérinaire.

N’oublions pas non plus le devoir de solidarité envers les pays les plus pauvres. Tous les vétérinaires du monde ont droit à l’excellence. Il est aisé de démontrer que les pays les plus riches ont intérêt à aider les pays pauvres à se débarrasser des maladies animales qui menacent les pays devenus indemnes l’OIE peut proposer pour cela des modèles de mécanismes efficaces et reconnus, comme les politiques de jumelage entre établissements, que nous pratiquons déjà avec succès pour les Laboratoires de Référence de l’OIE grâce au Fonds Mondial de l’OIE pour la santé et bien-être animal.

Il est également possible de créer puis de mettre en œuvre sur une base strictement volontaire une batterie de critères minimaux à présenter d’abord pour débat et adoption aux Membres de l’OIE et destinés à réaliser
Préface

ensuite des évaluations volontaires indépendantes d’établissements d’enseignement vétérinaire demandeurs afin de déterminer, sur une base harmonisée, les besoins essentiels des établissements qui demanderaient un appui technique ou financier soit de la part de leur propre gouvernement ou administration, soit si nécessaire de la part de bailleurs de fonds internationaux, sous les auspices de l’OIE.

Chaque établissement serait bien entendu souverain au-delà du socle minimal à respecter.

En ce qui concerne les Ordres Vétérinaires, des normes internationales de qualité ont déjà été adoptées par les 176 Pays Membres de L’OIE et sont reconnues par l’Organisation mondiale du commerce. Leur évaluation, volontaire et indépendante est déjà intégrée dans les évaluations des Services vétérinaires réalisées par l’OIE grâce à l’instrument appelé PVS, qui a déjà été utilisé à ce jour par près de 100 Pays Membres de l’OIE et qui a déjà intégré la qualité de la formation initiale et continue comme un élément essentiel de l’efficacité des Services vétérinaires. Par ailleurs, il pourrait être envisagé que les Ordres des pays en développement ayant besoin d’un appui puissent également utiliser le mécanisme de jumelage Nord-Sud ou Sud-Sud entre Ordres Vétérinaires de différents pays et régions.

Vous voyez qu’il y a beaucoup de pain sur la planche et que deux jours et demi ne seront pas de trop pour tenter de bâtir et adopter des consensus sur tous ces aspects.

Je terminerai en remerciant Mr Vernon Hill de Philadelphie aux Etats-Unis qui a décidé de consacrer une partie de sa fortune pour créer un Prix récompensant chaque année un vétérinaire pour son œuvre au profit de la collectivité. C’est en quelque sorte le prix Nobel des vétérinaires. Le lauréat pour 2009 est parmi nous. Il est enseignant, chercheur et ex-Doyen d’une Université vétérinaire. Le Prix lui sera remis solennellement ici-même demain à 14 heures en votre présence.

Je vous souhaitez à toutes et à tous un bon séjour à Paris et une Conférence stimulante qui fera j’en suis sûr bouger les choses dans le bon sens.

Merci pour votre attention.
Opening Ceremony

A global veterinary education to cope with societal needs
P.-P. Pastoret & B. Vallat

How to improve animal health worldwide
B. Vallat & P.-P. Pastoret
A global veterinary education to cope with societal needs

P.-P. Pastoret & B. Vallat
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Summary

In a rapidly changing world, veterinary education must face new challenges and continually evolve to meet societal demands in the field of prevention and control of diseases, food security, food safety, public health and animal welfare. Appropriate education and training have a direct effect on the quality and performance of public and private components of Veterinary Services; therefore, the World Organisation for Animal Health (OIE) is considering the issue of initial and continuous veterinary education as part of its commitment to encouraging its Members to strengthen the animal health policies and activities of their national Veterinary Services. Well-educated public and private veterinarians who have received appropriate training will help the OIE to fulfil its global mission: ‘improve animal health worldwide’, and be prepared for the implementation of the new concept ‘One World, One Health’, giving leadership to veterinarians in the field of risk management of zoonoses at their animal source.

Keywords: Animal welfare – Food safety – Food security – Infectious diseases – ‘One World, One Health’.

Introduction

The World Organisation for Animal Health

The World Organisation for Animal Health, created in 1924 under the initial name ‘Office International des Epizooties’ has conserved its historic acronym (OIE).

It is one of the oldest and, with its 176 Members (in 2011, 178 Members), one of the most representative of all intergovernmental organisations.

Present on all five continents through its network of more than 230 Regional and Sub-regional Representations, Collaborating Centres and Reference Laboratories, the OIE manages the world animal health and alert system and plays a key role in scientific research and information. Operating at the interface between animal health, human health and the environment, the OIE acts upstream and alongside agencies supporting and financing the fight against animal diseases, and helps its members to prevent, control and even eradicate these diseases. In its capacity as the international reference organisation for animal health, with its unique global reference for animal welfare, the OIE elaborates animal health and welfare standards in order to ensure safety of the food supply and the world trade in animals and animal products within the frame of the World Trade Organization (WTO) Sanitary and PhytoSanitary measures (SPS) Agreement.

Firmly committed to international cooperation and solidarity, the OIE provides support for the world’s national Veterinary Services, now recognised as a global public good, and supports strengthening their capacities as a priority for public investment.

The mandates of the World Organisation for Animal Health

The OIE was primarily created with the aim of controlling the international spread of infectious animal diseases. Over and above this historic mission, its new mandate is now ‘to improve animal health worldwide’. This has considerably broadened its responsibilities, since not only does it require from its 176 Members that they all share the same political will, but new institutional and technical mechanisms will have to be developed at national, regional and worldwide level. To succeed, the OIE must provide policy makers with the right information, arguments and tools for this political will to be exercised effectively in a sustainable manner. These arguments must first and foremost be founded on a qualitative and quantitative evaluation of the political, social and economic benefits to be gained by investing more in new national, regional and worldwide animal health systems.

The Veterinary Services, including both their public and private sector components, are in the front line when it comes to improving animal health.
Increasing their effectiveness depends on the mobilisation of adequate human and financial resources, and on the application of the methods of good governance described in the OIE Terrestrial Animal Health Code (15) and Aquatic Animal Health Code (14) (the Codes), adopted democratically in the form of international standards by its Members.

In order to improve animal health by making the Veterinary Services more effective, the OIE needs to be able to demonstrate that this field of activities is a ‘global public good’. Moreover it requires well-educated veterinarians worldwide.

The World Organisation for Animal Health listed diseases

Even if the OIE has broadened its mandate, infectious diseases are still at the heart of the OIE activities.

There are 92 listed infectious diseases (including diseases of birds and bees) in the Terrestrial Animal Health Code (15), and 30 (diseases of fish, molluscs, crustaceans and amphibians) in the Aquatic Animal Health Code (14). According to their relative importance, the diseases were previously divided in two categories, A (the most important ones) and B (the less important ones). Since 2005 these categories have been abandoned and a single list is used now. At present special emphasis is put on wildlife, on zoonoses and on emerging infections.

According to the definitions of the Codes a zoonosis is any disease or infection which is naturally transmissible from animals to humans. An emerging disease means a new infection resulting from the evolution or change of an existing pathogenic agent, a known infection spreading to a new geographic area or population, or a previously unrecognised pathogenic agent or disease diagnosed for the first time and that has a significant impact on animal or public health. A transboundary disease is any disease that can spread easily at regional or global level. At national level, a zone/region means a clearly defined part of a territory containing an animal sub-population with a distinct health status with respect to a specific disease, for which required surveillance, control and biosecurity measures have been applied for the purpose of international trade.

The OIE criteria for listing a disease have been democratically adopted by all OIE Members and are as follows:

- international spread
- zoonotic potential
- significant spread within naïve populations
- emerging diseases.

According to these basic criteria, parameters are also defined. At least one ‘yes’ means that the criterion has been met.

- International spread: has international spread been proven on three or more occasions? OR are more than three countries with populations of susceptible animals free of the disease or facing impending freedom (based on the relevant provisions of the Codes)? OR do OIE annual reports indicate that a significant number of countries with susceptible populations have reported absence of the disease for several consecutive years?

- Zoonotic potential: has transmission to humans been proven (with the exception of artificial circumstances), AND is human infection associated with severe consequences (death or prolonged illness)?

- Significant spread within naïve populations: does the disease exhibit significant mortality at the level of a country or a zone, OR does the disease exhibit significant morbidity at the level of a country or a zone?

- Emerging diseases: are there apparent zoonotic properties or is there a rapid spread?

As a result of the implementation of the decision tree above, the current list of OIE diseases shows that food-producing animal diseases and zoonoses (including food-borne zoonoses) are in the front line.

The list of diseases is updated annually by the general assembly of national delegates. Interestingly, swine flu does not belong to the OIE listed diseases.

In April 2009, cases of human illness caused by a novel strain of pandemic influenza A/H1N1 were reported in Mexico and the United States of America (USA). Very quickly, and in a context of an enhanced
worldwide surveillance, cases of human infection with this virus were notified in all continents, leading the World Health Organization (WHO) to declare a global influenza pandemic.

While pandemic influenza has spread worldwide among the human population, to date there is no evidence that animals are playing any role in the spread of this virus. The virus contains some gene sequences that have been identified as influenza virus sequences from swine. To date there is no information as to the specific origin of this pandemic virus, which continues to spread from person to person just like a classical human influenza virus. As of today, no link between an animal and the first human cases has been established (12).

The reverse is not true, since, in Alberta (Canada) for the first time, a pig herd has been contaminated by an infected man. The pig is susceptible to this new virus, now named ‘pandemic H1N1/2009’, as has been observed and demonstrated, but only shows mild clinical signs after infection. Since swine influenza is not an OIE listed disease, this first contamination of a herd was notified by Canada as an ‘emerging’ disease.

Zoonosis and emerging infections

Zoonoses, either food-borne or non food-borne, are particularly important in the context of emerging infectious diseases of humans, as the majority of these are of zoonotic origin. A comprehensive review made at the beginning of this century (1, 10) identified 1,415 species of infectious organisms known to be pathogenic to humans, including 217 viruses and prions, 538 bacteria and rickettsia, 307 fungi, 66 protozoa and 287 helminths. Out of these, 868 (61%) were classified as zoonotic and 175 pathogenic species were considered to be associated with emerging diseases. Of 175 emerging pathogens in this group, 132 (75%) were zoonotic, the vast majority of which came from wildlife. Wildlife obviously constitutes an important potential source of new pathogenic agents for human and domestic animals.

Future research activities should focus on solutions to these problems arising at the interface between animals and humans (8).

A four-fold classification of emerging zoonoses was proposed (examples of each type are given in brackets):

- Type 1: from wild animals to humans (Hanta)
- Type 1 plus: from wild animals to humans with further human-to-human transmission (AIDS)
- Type 2: from wild animals to domestic animals to humans (avian flu)
- Type 2 plus: from wild animals to domestic animals to humans, with further human-to-human transmission (severe acute respiratory syndrome, SARS).

The resulting holistic approach to emerging infections links microbiology, veterinary medicine, human medicine, ecology, public health and epidemiology.

As emerging ‘new’ respiratory viruses are identified in many wild and domestic animals, issues of interspecies transmission have become of increasing concern. The development of safe and effective human and veterinary vaccines is a priority. For example the spread of different influenza viruses has stimulated influenza vaccine development, just as the spread of Ebola and Marburg viruses has led to new approaches to filovirus vaccines. Interdisciplinary collaboration has become essential because of the convergence of human disease, animal disease and a common approach to biosecurity.

An updated veterinary curriculum is essential to empower future graduates to work in an international environment, applying international standards for disease surveillance, veterinary public health, food safety and animal welfare.

The detection of zoonoses at the animal source must be clearly under the leadership of well-trained veterinarians able to cooperate later in that topic with public health specialists and authorities.

Biodiversity and emerging infections

The changes following globalisation, climate change, and the opening-up of previously closed ecosystems, have considerably modified the pattern of endemic (or enzootic) infections/diseases and contributed to the emergence of new agents that are pathogenic for humans and domestic animals.
Biodiversity of bacteria and viruses

Nowadays, the estimated number of known bacterial species is roughly 4,700, but the real number of existing bacteria could well exceed 40,000 species. Therefore, the proportion of known to all species would be only 12%.

The number of viruses identified is approximately 5,000 species (5), but the likely number could exceed 130,000 according to the first estimates. Even this number is most probably an underestimate (e.g. human beings harbour at least eight different Herpes viruses, and five different Herpes viruses have already been identified in cattle (Bos Taurus), but if we take into account the estimated number of 130,000, only 4% of viruses are already identified. This does not take into account the extreme variability of viruses, particularly RNA viruses, leading to populations of quasi-species. Considering that there are 5,416 recognised mammal species and that, for instance, Herpes viruses have been isolated from all classes of vertebrates and even from oysters. It must be acknowledged that the world of viruses is huge.

Biodiversity of mammals

The inventory of mammalian species was first established in 1982, when only 4,170 species were recognised; the same inventory established in 1993 contained 4,629 different species. In 2005, the complete list of mammal species consisted of 5,416 species (13). The estimate is that at present 99% of mammal species have already been identified.

This progressive increase in number seems to be paradoxical and even contradictory if the extinction of some species during the same period of time is taken into account. This increase in number can be accounted for when we consider that each phenotype of newly discovered species is listed separately and, more importantly, that the advent of modern molecular technology allows for the discrimination of species according to their genotypes and increasingly detailed comparisons of species limits and evolutionary relationships (taxonomic revision).

Among mammals, there are 2,277 species of rodents pertaining to 481 genera. Since 1993, 128 new rodent species have been recognised. The rodents therefore compose 42% of recognised mammal species. This number is particularly important if the fact is taken into account that the order of rodents harbours, and is the reservoir of, numerous zoonotic infections. Among the most spectacular are Hanta viruses (4); some African Sciuridae species (Funisciurus spp.; Heliosciurus spp.), are the reservoir of monkeypox. Recently, the introduction of one of these species into the USA nearly provoked an ecological disaster because of the transmission of the virus to indigenous rodent species (prairie dogs).

To date, the order of Chiroptera contains 1,116 species, pertaining to 202 genera; 49 new species have been identified since 1993. Bats make up therefore 20.6% of the total number of mammal species. This is very worrying, since bats have been the source of many emerging diseases, many of them previously unrecognised. For instance, insectivorous and frugivorous bats are the reservoir of the Archeolyssa viruses from which all Lyssavirus strains derive, even the strains responsible for terrestrial rabies. Frugivorous bats are the reservoir of new previously unknown viruses such as Nipah and Hendra (Henipa virus), responsible for numerous human fatalities, of the Coronavirus responsible for the epidemics of SARS, and most probably of Filoviridae such as the virus responsible for Ebola in Africa. Bats are flying mammals, and therefore may transport pathogens over long distances in a short time.

Biodiversity of birds

There are approximately 10,000 species of birds. In 1990, 9,672 species were recognised, pertaining to 2,058 genera (11), 5,712 of which are passerines (1,162 genera) and 3,960 non-passerines (896 genera).

Birds, previously dinobirds, arose from dinosaurs and are therefore further removed from us than mammals on the evolutionary tree, but they are nevertheless reservoirs of zoonotic infections, as exemplified by the recent epidemics of West Nile virus infection in the Americas, or by the epizootics/epidemics of highly pathogenic avian influenza with virus H5N1. It should also be mentioned that most of the birds are migratory, often over long distances.
Biodiversity of domestic animals

Through selection, humans have created a number of different breeds of domestic animals, e.g. there are approximately 700 recognised cattle breeds worldwide (6), but many of these are on the verge of extinction (less than 100 breeding cows) (7). There is therefore currently a swift erosion of genetic variability in cattle, which is really worrying.

Conclusion

It is noteworthy that wildlife biodiversity hotspots are found mainly in tropical and sub-tropical zones, such as sub-Saharan Africa, Indonesia and South America.

It is also noteworthy that wildlife populations interplay more and more with domestic animals and with invasive species (becoming often the dominant ones), and that this is responsible for an erosion of biodiversity.

Globalisation and climate change

Humankind is currently facing many different challenges that will require global solutions. As already mentioned, one of these challenges is the spread of infectious diseases that emerge or re-emerge at the interfaces between animals, humans and the ecosystems in which they live. This situation is the result of several factors, including the exponential growth in human and livestock populations, rapid urbanisation, changing farming systems, closer interaction between livestock and wildlife, forest encroachment, changes in ecosystems, globalisation of trade in animals and animal products, and a huge increase in transport and global tourism.

The main role played directly by human beings can be summarised by the five Ts:

- trade
- transport
- travel
- tourism
- terrorism.

Nevertheless the most important factor is still the dramatic increase in the world’s population, which is expected to reach 8 billion by 2025, mainly in Asia, Africa and Latin America, where most of the world’s poor live.

At the same time, some in-transition Asian countries are currently experiencing strong economic growth, with rapid urbanisation and greater demand for food, particularly of animal origin. This phenomenon, termed the ‘livestock revolution’ by Delgado (3), is leading to rapid change in farming systems. In 2008, over 21 billion food animals were produced to help feed a population of over 6 billion people. By 2020, this demand is expected to increase by 50%. The loss of animal productivity as a result of diseases is estimated to be 20% at global level.

The increase in the human population is also putting pressure on land use, with further encroachment on natural forests and their rich and diverse fauna, thereby exposing humans and domestic animals to new pathogens.

The competition for land use and water supply will also create numerous social and political tensions. The available land will be used to produce the four Fs:

- food
- feed
- forage
- and fuel.

Another detrimental factor will be climate change, which also will impact on the epidemiology and control of animal diseases and the potential for arthropod vectors to colonise new territories (2). Ruminants have been accused of contributing to global warming, by certain authors, through their emissions of methane (a greenhouse gas).
Animal welfare and protection of the environment

Welfare

Animal welfare (9) means how an animal is coping with the conditions in which it lives. An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well-nourished, safe, able to express innate behaviour, and is not suffering from unpleasant states such as pain, fear and distress. Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter/killing. Animal welfare (as well as well-being) refers to the state of the animal; the treatment that an animal receives is covered by other terms such as animal care, animal husbandry, and humane treatment.

There are five internationally recognised freedoms for the animal which provide valuable guidance in animal welfare:

- freedom from hunger, thirst and malnutrition
- freedom from fear and distress
- freedom from physical and thermal discomfort
- freedom from pain, injury and disease
- freedom to express normal patterns of behaviour.

There are also three internationally recognised rules (the three Rs) which provide valuable guidance for the use of animals in science:

- reduction in numbers of animals to be used
- refinement of experimental methods
- replacement of animals with techniques that do not use animals.

The concepts of ‘animal health’ and ‘animal welfare’ are closely linked through their common scientific, ethical, economic and political dimensions. Today, animal welfare is a topical issue, due to a very wide public interest in animal protection and the need for more countries to gain access to international markets while respecting consumers’ demands in this field. Despite their cultural and religious diversity, the Members of the OIE wished to have guidelines and recommendations on this topic, even though it does not fall within the scope of the SPS Agreement. The OIE’s initial work in this field gave priority to the welfare of animals used in agriculture and aquaculture, and more specifically to questions relating to their transport and slaughter, and their killing for disease control purposes.

In animal health, the alternatives to control diseases are either to vaccinate the animals in order to prevent the disease or to attempt to eliminate the infection through strict application of animal health measures such as the slaughtering of infected and in-contact animals. For diseases for which vaccines do not exist (e.g. African swine fever), and particularly for dramatic zoonoses such as Nipah virus infection of pigs, the systematic slaughtering of animals is at present the only available solution.

Systematic slaughtering of animals is nevertheless increasingly unpopular in developed countries, and often unworkable in developing ones.

One of the most recent dramatic example of mass slaughtering has been the complete destruction of the pig populations in some countries, without the appropriate equipment, and without any benefit to animal health or public health.

The general public in developed countries is increasingly in favour of the policy of ‘vaccination for life’. Unfortunately serological methods do not generally distinguish between the humoral immune responses resulting from an infection and a vaccination.

Fortunately this problem can nowadays often be overcome by the use of marker vaccines and their companion diagnostic tests (the DIVA strategy, Differentiating Infected from Vaccinated Animals) (16).

Recent discoveries of the genetic mutations that underlie the human inability to perceive pain may soon be coupled with the increased ability to manipulate the rodent genome in order to create mice that are essentially ‘pain-free’ or, at least, have a highly diminished capacity to perceive pain. Rare nonsense mutations in SCN9A have recently been characterised in several families in Pakistan. People who carry a mutation in this gene lack the ability to perceive any form of pain, but are otherwise physiologically normal.
Given the findings on human genetic foundations of pain perception, genetic manipulations of the nociceptive genes in mice will certainly continue, possibly with the introduction and testing of the ‘humanised’ mutations observed in people with a congenital inability to feel pain. At first sight, the use of pain-free animals could potentially counter many of the arguments that are made for the restriction and prohibition of animal experimentation, especially those based on utilitarian ethics. Nevertheless, pain is part of a highly significant and necessary physiological process. Animals must keep the right to feel pain, but humans must do whatever they can to avoid imposing it.

Environment and biodiversity

Veterinarians must take into account the consequences of their practices on the environment and biodiversity. For instance the prudent use of antibiotics or anthelmintics is recommended in order to avoid the emergence of resistances. Prudent use of some anthelmintics is also recommended to avoid non-specific killing of arthropods living in the vicinity of domestic animals.

The mass disposal of dead animals associated with an animal disease outbreak is often subject to intense public and media scrutiny, obligating the Veterinary Authority to not only conduct disposal operations within acceptable scientific principles to destroy the causative pathogen, but also address public and environmental concerns.

Strategies for the disposal of dead animals (entire animals or parts thereof) should be prepared well in advance of any emergency. Major issues related to the disposal of dead animals include the number of animals involved, biosecurity concerns over the movement of infected or exposed animals, people and equipment, environmental concerns, and the psychological distress experienced by farmers and animal handlers.

The legislation regulating animal health and the organisation of the Veterinary Authority should give the Veterinary Services the authority and the legal powers to carry out the activities necessary for the efficient and effective disposal of dead animals. Cooperation between the Veterinary Service and other relevant government bodies is necessary to develop a coherent set of legal measures for the disposal of dead animals in advance of any emergency.

Veterinarians should also integrate the environmental components within the concept of ‘One World, One Health’ and preserve biodiversity.

References

Opening ceremony

How to improve animal health worldwide

B. Vallat & P.-P. Pastoret
World Organisation for Animal Health, 12, rue de Prony, 75017 Paris, France

Summary
The World Organisation for Animal Health was created in 1924 under the name Office International des Epizooties (OIE); its global mandate is nowadays ‘to improve animal health and welfare worldwide’ for terrestrial and aquatic animals. The OIE is also in charge of setting international standards for animal health and welfare; 176 countries are Members of the organisation.

Firmly committed to international cooperation and solidarity, the OIE provides support for the world’s national Veterinary Services, now recognised as a ‘global public good’, and sees strengthening their capacities as a priority for public investment. Veterinary Services are increasingly working at the interface between human, animal and environmental health. The OIE has created a tool for the evaluation of performance of public and private components of Veterinary Services (the OIE PVS tool), and considers initial and continuous global veterinary education as a key component of the quality of Veterinary Services. Within its PVS tool and particularly through the important role to be played by statutory bodies, there is provision for the evaluation of the competencies and the continuous education of veterinarians, which are seen as priorities. These actions will help to improve animal health worldwide.

Keywords: Global public good – OIE PVS tool – Statutory bodies.

Introduction
In a rapidly changing world, veterinary education must face new challenges and continuously evolve to meet societal demands in the field of prevention and control of animal diseases, food security, food safety, public health and animal welfare. Appropriate education and training have a direct effect on the quality and performance of public and private components of Veterinary Services; therefore, the World Organisation for Animal Health (OIE) is considering the issue of initial and continuous veterinary education as part of its commitment to encouraging its members to strengthen the animal health policies and activities of their national Veterinary Services. Well-educated public and private veterinarians who have received appropriate training will help the OIE to fulfil its global mission: to improve animal health worldwide.

The global background
The OIE, together with the Food and Agriculture Organisation of the United Nations (FAO), the World Health Organization (WHO), the United Nations Children’s Fund (UNICEF), the UN System Influenza Coordination (UNSIC) and the World Bank, in 2008 published a report entitled ‘Contributing to ‘One World, One Health’: a strategic framework for reducing risks of infectious diseases at the animal–human–ecosystems interface’ (7). The OIE as well as the FAO prefers the concept of ‘One World, One Health’, instead of the concept of One Medicine, One Health, since the OIE has a global mandate for animal health and welfare, including wildlife. The 2008 document seeks to define a holistic approach to the prevention of epidemic/epizootic diseases, while maintaining the integrity of ecosystems for the benefit of humankind, our domestic animals and biodiversity, a topic that concerns us all.

Humankind is currently facing many different challenges, which require global solutions. One of these challenges is the spread of infectious diseases that emerge or re-emerge at the interfaces between animals, humans and the ecosystems in which they live. This situation is the result of several factors, including the exponential growth in human and livestock populations, rapid urbanisation, changing farming systems, closer interaction between livestock and wildlife, forest encroachment, changes in ecosystems and globalisation of trade in animals and animal products.

The most important factor is undoubtedly the dramatic increase in the world’s population, which is expected to reach 8 billion by 2025, mainly in Asia, Africa and Latin America, where most of the world’s poor live. This trend is likely to result in more poor people in absolute terms.
At the same time, some in-transition Asian countries are currently experiencing strong economic growth, with rapid urbanisation and greater demand for food, particularly of animal origin. Termed the ‘livestock revolution’ by Delgado (1), this phenomenon is leading to rapid change in farming systems. In 2008, over 21 billion food animals were produced to help feed a population of over 6 billion people. By 2020, this demand is expected to increase by 50%.

The increase in the human population is also putting pressure on land use, with further encroachment on natural forests and their rich and diverse fauna, thereby exposing humans and domestic animals to new pathogens.

The overarching objective of the strategic framework proposed in the document ‘One World, One Health’ (7) is to minimise the global impact of diseases of animal origin, including zoonoses, especially those with pandemic potential.

The approach articulated recognises the interdependence of human, animal and ecosystem health. It presupposes an international, interdisciplinary, cross-sectoral approach to the surveillance, control, prevention and mitigation of emerging diseases while preserving the environment, especially through compliance with the standards issued by the OIE.

**The global public good concept**

A global public good is a good whose benefits extend to all countries, people and generations.

In the case of the control and elimination/eradication of infectious diseases, the benefits are international and intergenerational in scope, and countries depend on each other; failure of one country may endanger the whole planet. Veterinary Services and animal health systems are fully eligible as a global public good and are recognised as such, since they are neither commercial nor strictly agricultural goods.

There are many benefits linked with the improvement of animal health systems, since control of animal diseases contributes to:

- food security, which has a strong link with public health
- public health through the control of zoonoses and implementation of food safety policies
- market access at local, regional and international levels
- poverty alleviation by securing the assets (animal capital ‘livestock’) and increasing animal productivity and food production
- animal welfare, since there is a strong link between animal health and welfare.

**Good governance**

Good governance requires appropriate legislation and its efficient implementation, through sufficient human and financial resources allowing national animal health systems to provide for:

- appropriate disease surveillance, early detection and notification, and transparency
- rapid response to animal disease outbreaks
- on-farm biosecurity measures
- compensation for livestock owners when their stock are slaughtered under disease eradication policies
- vaccination whenever justified
- education and research.

There are therefore several key elements for building and maintaining efficient Veterinary Services. First of all, they must be supervised by their governments. Efficient epidemiosurveillance networks must be in place, covering the entire national territory and coordinated by a well-structured national chain of command. There should be a strong alliance between the public and the private sectors (veterinarians, farmers and other stakeholders). All participants should use the concept and standards of ‘Quality of Veterinary Services’ democratically adopted by all OIE Members. Veterinary Services should be strongly supported by adequately educated veterinarians and good research facilities with highly qualified researchers.

Last but not least, if necessary, all Member Countries should use the possibilities offered by the use of the OIE Performance of Veterinary Services (PVS) tool (5), in order to obtain an external independent evaluation of their compliance with OIE international standards of quality.
Next steps would be to continuously improve animal health governance (by means such as legislation and increased budgets) and demonstrate permanently the economic and social justification for Veterinary Services.

Investment in Veterinary Services should be increased, including both its public and private components. As far as the investments are concerned, the approach should be horizontal: that is to say, they should be realised in stable periods using a systems management approach, rather than in reaction to a crisis. The cost of a national system oriented towards the permanent prevention of transboundary diseases is not high compared with the cost of dealing with crises such as an outbreak of foot and mouth disease (FMD) or bovine spongiform encephalopathy (BSE). This system is an insurance and must be supported by both farmers and consumers through the government of the Member Country. It goes without saying that initial and continuous training is of crucial importance. Finally, a fair and strong cooperation with public health policy-makers is also essential.

**Role and objectives of the OIE**

The World Organisation for Animal Health, created in 1924 under its historic name Office International des Epizooties, has conserved its previous acronym (OIE). It is one of the oldest and, with its 176 Members (America: 29; Africa: 51; Europe: 52; Middle East: 13; Asia/Pacific: 31), one of the most representative of all intergovernmental organisations.

Present on all five major regions of the world through its network of more than 230 Regional and Sub-Regional Representations, Collaborating Centres and Reference Laboratories, the OIE manages the world animal health and alert system and plays a key role in scientific research and information. Operating at the interface between animal health, human health and the environment, the OIE acts upstream and alongside agencies supporting the fight against animal diseases, and helps its members to prevent, control and even eradicate these diseases. In its capacity as the international reference organisation for animal health, its unique global reference for animal welfare, the OIE elaborates animal health and welfare standards in order to safeguard the food supply and the safety of world trade in animals and animal products within the frame of the World Trade Organization (WTO) Sanitary and Phytosanitary measures (SPS) Agreement.

Firmly committed to international cooperation and solidarity, the OIE provides support for the world’s national Veterinary Services, which are now recognised as a global public good, and sees strengthening their capacities as a priority for public investment.

The OIE was created primarily with the aim of controlling the international spread of infectious animal diseases. Over and above this historic mission, its new mandate is ‘to improve animal health worldwide’. This has considerably broadened its responsibilities, since it does not only require its 176 Members to share the same political will, but new institutional and technical mechanisms will have to be developed at national, regional and worldwide level. To succeed, the OIE must provide policy-makers with the right information, arguments and tools for this political will to be exercised effectively in a sustainable manner. These arguments must first and foremost be founded on a qualitative and quantitative evaluation of the political, social and economic benefits to be gained by investing more in new national, regional and worldwide animal health systems.

Investing in new animal health systems throughout the world thus helps not only to protect countries from natural or intentional threats linked to the introduction or the reintroduction of infectious animal diseases, including zoonoses, that they have already eliminated, but also to safeguard public health, reduce poverty and open to all the possibility of trading their agricultural products freely with the rest of the world.

By evaluating Veterinary Services’ compliance with its quality standards through its PVS tool (5), the OIE can also help Members to identify priority areas for investment on behalf of the National Veterinary Services in each Member Country that so wishes. The ultimate goal is to ensure that veterinary surveillance networks are in place everywhere, since early detection of diseases and immediate response are the keys to effective prevention and control of natural or intentional animal health disasters. There are provisions for the evaluation of competencies of veterinarians and paraprofessionals as well as continuing education (CE) in the PVS tool.
The objectives of the OIE are therefore:

– surveillance and control of animal diseases
– transparency of animal health information
– sharing scientific expertise
– safeguarding trade and consumers
– ensuring the sanitary safety of world trade
– safeguarding the food chain
– animal welfare and well-being.

Surveillance and control of animal diseases

Globalisation and consumerism are conducive to the spread of animal diseases. The OIE, acting as the hub of the international animal disease surveillance system and the driving force behind world veterinary research, is in the front line against the threat from animal diseases, including zoonoses. Central to the complex and close relationship between humans and animals are infectious diseases. Today, the world's human and domestic animal populations are in ever increasing numbers, in a perpetual state of movement and interaction, and have never been so close together: through the environment, agriculture and livestock, growth of trade in animals and animal products, and through food.

Globalisation also encourages the circulation of pathogens and their increased virulence. Dramatic events and spectacular crises serve as a constant reminder of the devastating consequences of these emerging or re-emerging diseases.

Transparency of animal health information

Faced with these threats, one of the essential missions of the OIE is to ensure transparency of the animal disease situation worldwide. Mainly based on a single list of animal diseases notifiable to the OIE as well as emerging diseases in certain conditions, each Member Country is under an obligation to declare the epidemiological events occurring within its borders. The OIE can then alert the international community so that each country can take the necessary precautions.

The OIE also establishes the list of countries officially free of diseases that Members consider pose a particularly serious threat. The World Animal Health Information System (WAHIS), linking each Member to the OIE, ensures the transparency and rapid transmission of animal health data. It also enables the immediate notification of any event involving emerging or re-emerging diseases detected by Members. In fact WAHIS allows the OIE to immediately make public by electronic means any epidemiological event notified by a Member. At the same time WAHIS feeds a database, WAHID, which includes a Web interface open to the public, giving all information and maps provided to WAHIS by the 176 OIE Members.

Sharing scientific expertise

As already mentioned, the OIE is a driving force for worldwide veterinary research. Through its network of more than 220 Reference Laboratories and Collaborating Centres, the OIE collects, analyses and publishes scientific data to help Member Countries in their fight against terrestrial and aquatic animal diseases.

OIE experts also come to the aid of countries facing major epidemiological crises, thus building on the veterinary profession's, farmers' and policy-makers' dedication and solidarity.

The OIE's internationally recognised veterinary expertise makes it the ideal partner of other international public health bodies in a wide range of programmes covering research, training for animal health players and awareness campaigns for populations at risk.

For instance, the OIE and the FAO have launched a new worldwide scientific network to support Veterinary Services in the diagnosis of animal influenza (OFFLU). This initiative also enables active cooperation with the WHO on matters relating to the animal–human interface. As an example, the OIE, the WHO and the FAO created together, the 'Global Early Warning System' (GLEWS), in order to improve the global early animal health alerting mechanism.
Safeguarding trade and consumers

Recent epizootics have shown the extent to which a serious animal disease event can have direct consequences for the economy of the world’s livestock production industries as well as on public opinion, trade and the global economy.

At the higher end of the food chain, the equilibrium that exists between production sectors and increasingly competitive markets is fragile, and is often vitally important for developing and transition countries. At the lower end of the chain, the relationship between consumers and food products of animal origin is likewise fragile, public opinion being increasingly concerned with the safety of the food chain.

In fact, the globalisation of trade requires a legal and scientific approach to the control of hazards, and the Veterinary Services have a decisive role to play in the health-related certification of exported products.

Ensuring the health-related safety of world trade

The OIE’s standard-setting work falls within the framework of the SPS Agreement, which came into force in 1995. Signatory countries of the SPS Agreement may be required to provide scientific justifications for applying standards that differ from those of the OIE.

The Terrestrial Animal Health Code (6), the Aquatic Animal Health Code (2) and their respective Manuals of Diagnostic Tests (3, 4) bring together the animal health, technical and organisational rules published by the OIE relating to the Member Countries’ animal health status and conditions governing trade in animals and animal products.

Undeniably science-based, the standards developed by the OIE are the result of a broad consensus of the Veterinary Authorities of Member Countries, by whom they are democratically adopted. It is precisely compliance with these standards that guarantees the international community effective animal health protection and ensures the continuity of world trade.

Safeguarding the food chain

Faced with the development of zoonotic risks associated with the world’s food system, the OIE is stepping up its action to achieve better food safety and is developing new synergies with the Codex Alimentarius Commission. The OIE is thus extending its standard-setting activity in the phases prior to the slaughter of animals and the primary processing of animal products.

The OIE is also very active in evaluating and strengthening the quality of national Veterinary Services, in their capacity as guarantors of food safety and veterinary public health.

These efforts include the ever-increasing number of public and private sector players involved in the chain of surveillance and certification of animal products.

Animal welfare and well-being

The OIE standards lead also the way on animal welfare.

The concepts of ‘animal health’ and ‘animal welfare’ are closely linked through their common scientific, ethical, economic and political dimensions. Today, animal welfare is a topical issue, due to a very wide public interest in animal protection and the need for more countries to gain access to international markets while respecting consumers’ demands in this field. Despite their cultural and religious diversities, the Member Countries of the OIE wished to have guidelines and recommendations on this topic, even though it does not fall within the scope of the WTO’s SPS Agreement. The first OIE work in this field gave priority to the welfare of animals used in agriculture and aquaculture, and to questions relating to their transport and slaughter, and their killing for disease control purposes. As the world organisation for animal welfare, the OIE endeavours to involve as many stakeholders as possible, including non-governmental organisations (NGOs), universities, research institutes, production sectors, companies and consumers, to ensure that the guidelines and recommendations proposed can be applied by all its Member Countries. The OIE has now started to publish standards in the field of laboratory animals and farmed fishes, and stray dog population control methods for rabies prevention.
Collaborating Centres, Reference Laboratories and the twinning programme

As already mentioned, the indubitable scientific expertise of the OIE is mainly based on the support of 35 Collaborating Centres, based in 20 different countries, covering 33 topics, and 187 Reference Laboratories based in 36 different countries, covering 100 diseases.

The Collaborating Centres are working on horizontal subjects for the OIE and Member Countries. They assist in the elaboration of procedures to harmonise animal disease control methods or international standards; they also coordinate collaborative studies, provide technical training and organise (and host) scientific meetings for the OIE.

The Reference Laboratories are mainly expert centres for worldwide standardisation. They store and distribute reference reagents, develop, conduct or validate diagnostic tests, coordinate technical and scientific studies, provide scientific and technical training, and organise laboratory proficiency testing.

A more recent OIE initiative is the Laboratory Twinning Programme. This programme aims to create links between an existing OIE Reference Laboratory or Collaborating Centre (Parent) and a national laboratory (Candidate). It also aims to improve expertise and diagnostic capacity in order to enable the institution to reach OIE standards, the ultimate goal being to achieve a designation as OIE Reference Laboratory whenever possible. It goes without saying that the candidate laboratory should be sustainable once the project is over.

The twinning programme extends the network of OIE capacity, expertise and standards. It provides regional support with better geographical coverage for diseases and topics that are a priority in a given region. It improves access for more countries to high-quality diagnostics and expertise. This better expertise helps to allow representatives of the Members to debate scientific justification for standards on an equal footing with other Members (better representation) and contributes to building a veterinary scientific community worldwide.

The OIE PVS assessment procedure

The PVS evaluations begin with a training and accreditation of experts by the OIE headquarters, then by a PVS evaluation of national Veterinary Services (using the OIE PVS tool, 5) and is succeeded by a PVS gap analysis and PVS follow-up missions.

The procedure of the OIE PVS assessment begins with an official request from the country on a voluntary basis. Dates are then proposed and the proposed PVS expert team, trained and accredited by the OIE, must be accepted by the relevant country. The mission is planned and prepared for in advance by the country’s representatives and the team leader. After the visit (two to three weeks depending on the size of the country) there is a peer review by another anonymous independent expert, a dialogue and the release of the report. The assessment brings many advantages for the Veterinary Service of the candidate country. It provides the opportunity for self-improvement, and a basis for national budget applications (to the ministry of finance or parliament) as well as external use of financial support if needed (through donors’ investment programmes).

The PVS gap analysis field visits allow for opening a dialogue with the country, an internal consultation and appropriation by the country, and finally a validation of choices and priorities for investment with the country concerned. There is a strong (initial and continuous) education component in the PVS assessment tool.

Conclusions

The OIE considers global initial and continuous veterinary education as a key component of the quality of Veterinary Services.

In a rapidly changing world, veterinary education must face new challenges and continually evolve to meet societal demands in the fields of food security, food safety, animal and public health policies and mechanisms, and animal welfare.
Appropriate education and training have a direct effect on the quality and performance of public and private components of Veterinary Services. Therefore the OIE is considering the issue of the quality of initial and continuous veterinary education as part of its commitment to encouraging its Members to strengthen their animal health policies and the activities of their national Veterinary Services. Well-educated public and private veterinarians who have received appropriate training will help the OIE to fulfil its global mission: to improve animal health worldwide.

References

Session 1

Prevention/control of transboundary diseases, zoonoses and emerging infections

Chair: Dr Barry O’Neil
The challenges of globalisation for veterinary education

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Summary

Livestock contribute significantly to the livelihoods of hundreds of millions of people worldwide. Many countries count receipts from trade in livestock and animal products as significant portions of their gross national product (GNP). Moreover, global demand for foods of animal origin continues to grow.

In recent years, there has been a notable increase in infectious livestock diseases, including many zoonoses. These have negatively affected animal and human health around the world. In addition, livestock production practices in both developed and developing countries are increasingly associated with environmental degradation, including global warming, deforestation and loss of biodiversity.

These developments put greater responsibility on veterinarians to provide effective services to farmers, monitor and control the spread of infectious diseases, ensure food safety, protect public health, and promote sustainable livestock production practices consistent with environmental health and biodiversity.

This paper reviews key factors contributing to the emergence of infectious diseases and livestock-associated environmental degradation, and suggests ways in which the veterinary curriculum can prepare graduates to effectively address these challenges.


Introduction

Globalisation can be defined in simple economic terms as the process of increasing the connectivity and interdependence of the world’s markets and business. Globalisation is not a new idea or process. Consider, for example, that about 750 years ago, Marco Polo and his brothers set out along the Silk Route to reach the court of Kublai Khan near present-day Beijing with the intent of expanding markets and business opportunities in Asia for merchants in Venice.

So how is it that our own particular period in history has come to be known as the ‘era of globalisation’? The answer lies mainly in the enormous technological advances that have occurred since the Industrial Revolution, and particularly in the 50 years since 1960. The jet airplane, the computer, the internet and the cellular phone have made the planet a smaller, more accessible, more interconnected and interdependent place for people to visit, relocate, conduct business, expand trade, exchange culture and ideas, share information and mobilise in support of common interests.

While globalisation has yielded many benefits, it also has created many new challenges for society, including challenges to the maintenance of animal, human and environmental health. For veterinarians to be professionally competent in these times, they must understand the important global trends affecting health and disease, and have the knowledge, tools and skills to respond effectively to these challenges. For this to happen, veterinary educators must specifically prepare their students and graduates to work in the ‘era of globalisation’.

The purpose of this paper is to briefly review the major trends of globalisation that are affecting animal, human and environmental health, to identify specific developments that require the expert attention of veterinarians, and to suggest some ways in which veterinary education can be adapted to prepare veterinary graduates to work successfully in the 21st Century.
Major trends shaping global society and their effects on health

The key trends affecting animal, human and environmental health are discussed briefly as follows.

High-speed transportation and communication

Modern jet travel now allows passengers to move from any place in the world with an airport to any other place within 36 hours, a time frame shorter than the incubation period of many viral and bacterial diseases. This means that infections can become globally disseminated before clinical disease is recognised. The severe acute respiratory syndrome (SARS) outbreak of 2003, which quickly spread to 29 countries, and the current H1N1 influenza infection, dramatically underscore this point. As such, the notion of ‘foreign’ or ‘exotic’ diseases has become less meaningful. Now, a wide range of diseases have the potential to crop up unexpectedly anywhere in the world, and some may quickly become endemic. West Nile virus infection in North America, unknown before 1999, but now firmly established in much of the continent, is a case in point. As these examples indicate, health professionals, including veterinarians, must be familiar with the epidemiology and clinical signs of a broad range of infectious diseases which may not at this time be present in their countries.

Modern communication has facilitated the rapid dissemination of information about disease occurrence, both scientific and journalistic. The World Organisation for Animal Health’s (OIE’s) World Animal Health Information System (WAHIS) and the International Society for Infectious Diseases’s Promed-Mail service are just two examples of sources for disease information. This information allows veterinarians to act more quickly to initiate disease investigation and control efforts, and also raises public expectation that they will move quickly to initiate those efforts. This means that regulatory veterinarians must have effective disease control plans in place, which are adequately resourced, and that they also must be able to communicate risk to the general public clearly and effectively.

Growth in international trade

International trade has grown dramatically since the Second World War. That growth has been facilitated by international efforts to break down trade barriers and to create the same terms and conditions for all trading partners through free market initiatives formalised through the establishment of the World Trade Organization (WTO) in 1995. Growth in the trade of livestock and foods of animal origin has been particularly strong. This is the result of several factors:

– the elimination or reduction of tariffs associated with free market reforms
– technological advances in containerised and refrigerated shipping
– a steadily increasing global consumer demand for foods of animal origin, associated with economic growth and increasing prosperity, particularly in developing countries.

The increased movement of live animals and animal products is associated with an increased risk in the spread of transboundary diseases of animals as well as zoonotic diseases, particularly food-borne diseases. As such, the WTO has actively promoted the development of regulations and policies which ensure that animal health and food safety are considered as core elements in international trade. The World Organisation for Animal Health (OIE) provides the scientific expertise to WTO for regulating the trade in livestock, while the Food and Agricultural Organization of the United Nations (FAO) and the World Health Organisation (WHO), through the Codex Alimentarius, provide the guidelines for regulation of food products, including foods of animal origin.

This increased trade poses numerous challenges and opportunities for veterinarians. These include:

– active participation in the development of risk assessments
– promulgation of reasonable, science-based regulations and policies that can minimise the spread of disease while facilitating free trade
– improved biosecurity on farms
– development of good manufacturing practices and hazard analysis critical control points (HACCP) for slaughter and food processing facilities
– research and development of improved screening and detection tests for pathogens
– enhanced disease surveillance and control.
War and terrorism

In the 30 years since 1980, the dominant form of armed conflict has shifted from wars between nations to conflicts within nations, or civil wars. War is a disruptive force on animal health. It can lead to the breakdown of specific disease control programmes, as has been documented in Zimbabwe (9), or the collapse of the overall veterinary infrastructure itself, as in Afghanistan (17). Conflict also produces refugee populations, and in agricultural societies refugees often flee with their animals, bringing livestock diseases to new areas of their country or into neighbouring countries. Attempts to maintain disease control efforts in times of war can be daunting. Novel approaches may be required. It is noteworthy that rinderpest was successfully eliminated from areas of conflict in the Horn of Africa in large part through the efforts of community-based animal health workers who were trusted by local populations and who utilised heat-stable rinderpest vaccine in effective vaccination campaigns under difficult logistical conditions (11). To accomplish this kind of success in disease control under difficult circumstances, veterinarians need strong leadership, planning, communication, extension and community development skills as well as technical veterinary knowledge.

The spectre of bioterrorism adds a new, troubling dimension to the challenge of controlling animal and human disease because of its unpredictability and malevolent intent. Bioterrorist events would not necessarily evolve as naturally occurring disease outbreaks might evolve. For example, multiple pathogens and multiple sites of introduction might be used, confusing the clinical picture and severely taxing the resources of disease control authorities. Furthermore, the majority of potential bioterrorist agents are zoonotic disease agents, meaning that animals and humans may be affected simultaneously. In fact, animal populations may well serve as important sentinels for early detection of bioterrorist threats to humans (15).

Veterinarians will need to participate in coordinated efforts with physicians and other emergency response professionals to contain bioterrorist attacks. Such participation will require skills in leadership, communication and interdisciplinary teamwork. Veterinarians must also play an active role in elucidating and understanding the ecology and epidemiology of bioterrorism disease agents, and participate in the establishment and implementation of appropriate disease surveillance and control efforts.

Climate change and other environmental perturbations

There is a two-way relationship between livestock production and environmental health. On the one hand, it is recognised that livestock contribute to climate change and other environmental problems, while at the same time, livestock health and productivity can be adversely affected by these same environmental perturbations. These relationships have been reviewed (16, 18). Ruminant animals contribute to greenhouse gas emissions and global warming by emitting methane from the rumen. The clearing of forests for cattle ranching is a major cause of deforestation and associated loss of biodiversity, particularly in Latin America. Intensive livestock production often produces manure in excess of what the surrounding land can utilise, and runoff of manure into waterways results in pollution and loss of aquatic life. Overgrazing contributes to rangeland degradation, particularly in semi-arid regions. These are just some examples of the kinds of problems that veterinarians must recognise and help to mitigate, through improved livestock management, education, policy making and/or research.

At the same time, patterns of disease in animals and humans are being influenced by environmental and climatic change. Global warming is currently associated with the northward spread of bluetongue in Europe (14). Outbreaks of Rift Valley fever in East Africa are linked to the occurrence of El Niño Southern Oscillation (ENSO) events (10), as are hantavirus infections in North America (27), malaria outbreaks in Africa and South America, dengue fever in Asia and cholera in South Asia (2, 25).

Landscape transformation is another environmental factor contributing to disease. The fragmentation of forests in North America into segments less than 2 ha has changed the ecology of forest fauna and led to increased transmission of Lyme disease to companion animals and humans (1). Increased settlement with a high density of domestic dog populations adjacent to Serengeti National Park is likely to have led to the unexpected emergence of canine distemper in lions in the park (4). The creation of logging roads into deep forest in west Africa has facilitated the hunting of primates for meat, the so-called bushmeat trade, and has led to the emergence of new human infections derived from butchering and eating primates, including T lymphotropic virus (21), Ebola virus and human immunodeficiency virus (HIV) (22).
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The continued growth of human populations and ongoing economic development are sure to drive human, domestic animal and wild animal populations into even closer contact and lead to further emergence of zoonotic diseases. Therefore, it is imperative that at least some veterinarians have training in disease ecology or wildlife biology along with knowledge of epidemiology and disease surveillance in wildlife populations.

Poverty and prosperity

Poverty remains widespread in human society. Based on 2005 World Bank figures, up to 1.37 billion of the world’s citizens live on less than US$1.25 per day, and an additional 2.56 billion live on less than US$2 per day (24). A large proportion of the world’s poor still live in rural areas. Many rural people, including the landless and pastoralists in particular, depend on livestock for their livelihoods. Poor livestock owners often have little or no access to preventive and curative veterinary services (8). As such, their livestock suffer considerable morbidity, mortality and reduced productivity, and serve as a source of transmissible diseases for livestock populations at large. This can seriously compromise national disease control efforts. Regrettably, in many developing countries, veterinary professionals, for economic or other reasons, are not willing or able to provide services to the poor, yet oppose efforts to sanction paraprofessionals who could provide such services. Following the lead of the OIE (19), the veterinary profession needs to recognise those situations under which paraprofessionals must play a role in effective, overall veterinary service delivery, and find ways to benefit from their participation rather than viewing them as usurpers or competitors. One approach would be for veterinary schools to take an active role in the curriculum development and training of paraprofessionals to ensure that reasonable standards of knowledge and practice are maintained, and that positive relationships between veterinarians and paraprofessionals are nurtured.

In developed countries, and increasingly in many developing countries, a growing, prosperous middle class has embraced the ownership of companion animals as a social norm, and has come to expect a high level of veterinary service delivery for their dogs, cats and other companion animals. The veterinary profession has responded enthusiastically, with increasing numbers of veterinary graduates entering companion animal practice and pursuing medical specialisations in support of individual animal care. The veterinary curriculum has evolved accordingly, with increasing time spent on the teaching of clinical medicine and surgery aimed at companion animals, and less time available for subjects aimed at food supply veterinary medicine and public health. At the same time, the demographic of veterinary school entrants has become increasingly urban and suburban and less rural. These factors, along with shifting market forces and changing patterns of livestock production, are resulting in a shortage of veterinary graduates willing and able to engage in food animal practice in rural areas in the United States of America (13) and elsewhere. Veterinary educators and the profession at large must ensure that there are focused recruitment efforts and appropriate admissions policies, with necessary inducements and incentives, to attract capable students into veterinary school who have a commitment and obligation to rural, food animal practice.

Emerging diseases and zoonoses

In the mid-20th Century, with the development of effective antibiotics and vaccines well advanced, there was a prevailing attitude among health professionals that the scourge of infectious disease had largely been conquered and the focus of medicine could be shifted to neoplastic, cardiovascular and other non-infectious categories of disease. Quite to the contrary, the current period is characterised by the emergence of new infectious diseases of animals and humans, and the re-emergence of diseases previously thought to be under control, such as tuberculosis. Compounding this growing problem is that most infectious agents considered likely to be used as bioterrorism agents are also zoonotic in nature (5, 6).

It is reported that 64% of 1,400 known human pathogens are zoonotic (7) and that 73% of emerging human pathogens are zoonotic (23). This includes many infections with global reach such as HIV, SARS, West Nile virus, highly pathogenic avian influenza H5N1, and the more recent influenza virus, H1N1. There are multiple, complex reasons for this emergence (3, 12). The movement of pathogens through modern jet travel, and landscape transformation leading to closer contact between wildlife and humans are mentioned above. Other factors include the raising of livestock and poultry in close association with people, inadequate biosecurity in livestock management and the development of antibiotic resistance in the case of bacterial diseases. Perhaps the greatest challenge for veterinarians and veterinary educators in today’s global society is, through research and training, to develop the tools and skills necessary to successfully understand, anticipate, track and control emerging zoonotic diseases, and to establish strong, cooperative linkages and networks with other health professionals across organisations and disciplines.
Implications for the veterinary profession

Broadly speaking, the functions of veterinarians can be divided into those that serve the private good and those that serve the public good. Private good functions result in direct benefits to the individuals for whom the service is provided. The diagnosis and treatment of disease in individually owned companion animals is a prime example. Public good functions result in benefits that extend beyond the individual recipient to society at large. Vaccination against highly contagious diseases, food inspection, and regulation of pharmaceuticals are obvious examples.

Veterinary medicine is at a crossroads. Globalisation is creating challenges that will require an expanding cadre of competent veterinarians committed to the performance of public good functions. Yet, at the same time, an increasing number of veterinary graduates are opting for careers in private clinical practice aimed at companion animals or in the industries that serve the companion animal sector. This situation is exacerbated by the fact that many veterinarians working for agencies that conduct public good functions are reaching retirement age, and replacements for their positions are not being identified. This is further aggravated by the current world economic recession, in which governments may freeze or eliminate positions rather than refill them.

The OIE recognises that Veterinary Services are a global public good and that ‘the concept of veterinarians as professionals who are only concerned with animal diseases should be broadened to include areas of activity that focus on public health outcomes, the control of risks along the food chain, as well as the welfare of animals’ (26). Some key activities of concern to OIE for official Veterinary Services around the world are to:

- develop sanitary standards related to animal health, zoonoses and animal welfare
- improve capacity to rapidly detect, diagnose and control animal diseases
- improve capacity to collect and rapidly disseminate national data on animal diseases
- support the access of animals and their products to national, regional and international markets
- meet international standards for Veterinary Services regarding legislation, structure, organisation, the role of the private sector and the role of paraprofessionals.

Clearly, the qualified personnel necessary to meet this vision must come from the world’s institutions of veterinary education through the relevant and effective training of veterinary students, and the creation of appropriate graduate degree, certificate and continuing education opportunities for veterinary graduates.

Challenges for veterinary education

With often limited resources and competing demands on staff time and space in the curriculum, schools of veterinary medicine have hard choices to make in preparing veterinarians effectively to serve the needs of global society in all its complexity. Yet it is clear that more time and effort must be spent on preparing veterinarians for active participation in disease surveillance and control, public health efforts and food supply veterinary medicine to meet the demands of the 21st Century. There is much room and need for discussion on how to achieve this. In fact, it is the focus of this conference and is also the subject of an entire recent issue of the OIE Scientific and Technical Review (20). Therefore, only some general recommendations will be made here about how to address the current situation.

Admissions and recruitment

Admissions policies should reflect the need for qualified candidates specifically interested in public good practice, and should maximise the opportunities for such candidates to apply to veterinary school, gain admission and graduate. A conscious effort must be made actively to recruit students into veterinary schools who have demonstrated a clear commitment to careers serving the public good. When possible, incentives for the recruitment of such individuals should be offered.

Core public good curriculum

Despite the conflicting demands, there must be a commitment to, and requirement for, a core public good curriculum for veterinary students that includes key topics such as:

- transboundary disease recognition and control
- zoonotic disease recognition and control
- principles of public health, epidemiology and disease surveillance
- food safety
- an overview on global issues in veterinary medicine.

Strong training in clinical medicine is also essential, as the foundation for effective disease surveillance is the capacity for veterinarians to examine sick animals properly and thoroughly, arrive at a logical differential diagnosis for the case at hand, and then properly collect appropriate samples for testing to confirm the diagnosis.

**Externship opportunities**

Just as the effective teaching of clinical medicine requires hands-on practical training in addition to classroom training, so it is too with public practice. Students need opportunities to rotate through public good institutions such as veterinary or public health departments to see and better understand first hand what the challenges and opportunities are in public practice, to meet role models, identify mentors, and to define career goals.

**Interdisciplinary electives**

There are a multitude of subjects outside the core of veterinary medicine which now influence and inform contemporary veterinary practice. Some examples are conservation biology, economics, business administration, climatology and environmental science. In the United States of America (USA) and some other countries, veterinary students enter the professional curriculum after a four-year bachelor’s degree programme. In many countries, however, veterinary students enter their professional programme immediately on leaving secondary school. It is especially important in these situations that students have elective time in their curriculum for exposure to subjects outside of, but germane to, their professional education.

**Graduate training**

Even with restructuring of the core veterinary curriculum, additional post-graduate training will be required to ensure that at least some veterinarians have advanced, sophisticated, technical and research skills necessary to address critical activities such as disease surveillance, risk assessment, epidemiological monitoring, and the development of new diagnostic tests and vaccines. At the least, there is a critical need for master’s degree programmes in public health and in epidemiology.

**Leadership training**

Veterinary medicine represents the only health discipline that has the study of comparative medicine at its core. As so many of today’s emerging and re-emerging diseases are zoonoses, veterinarians must play a more active and visible role in the identification, surveillance and control of these diseases. Addressing emerging diseases will require an interdisciplinary team approach that embodies the concept of ‘One Health’. Veterinarians are poised to play leadership roles in these efforts, and therefore need training specifically focused on development of leadership skills.

**Conclusions**

The current era of globalisation is associated with a marked increase of infectious diseases of livestock and poultry many of which are also zoonoses. These diseases are negatively affecting animal and human health around the world, and interfering with the expanding global trade in livestock and livestock products, including foods of animal origin. In addition, livestock and poultry production practices in both developed and developing countries are increasingly associated with environmental degradation, including global warming, deforestation and loss of biodiversity. These developments put greater responsibility on veterinarians to provide effective services to farmers, monitor and control the spread of infectious diseases, identify and control emerging diseases, ensure food safety, protect public health, and promote sustainable livestock production practices consistent with environmental health and biodiversity.

It is the responsibility of veterinary educators to prepare veterinarians to effectively perform these functions in the ‘era of globalisation’. However, veterinary education faces numerous constraints and challenges,
including reduced funding, limited space in the curriculum for new initiatives, and a growing cadre of students more interested in private clinical practice focused on companion animals than in provision of public good services. Veterinary educators must creatively address these challenges to ensure that the overall needs of society relative to animal, human and environmental health in the public sector are met.

References


The work of the Food and Agriculture Organization of the United Nations (FAO) and transboundary animal diseases in a globalised world

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Summary

Many countries use the term ‘exotic animal disease’ or ‘foreign animal disease’ to designate those diseases that could have disastrous consequences if they were to enter their territory because of direct losses to the domestic population suffering from the disease or required counterepizootic measures, loss in trade, or possibly from a potential zoonotic spill-over. From the point of view of the United Nations the preferred term is transboundary animal diseases (TADs), as nothing is of itself exotic or foreign in the global theatre. TADs are defined by veterinary experts as those diseases that are of significant economic, trade and/or food security importance for a considerable number of countries, which can easily spread to other countries and reach epidemic proportions, and where control/management, including exclusion, requires cooperation between several countries. Such a definition should include emerging infectious diseases (EIDs), most of which are likely to be zoonoses, but of uncertain impacts. FAO’s Emergency Prevention System – Animal Health (EMPRES-AH) focuses on some 12 to 14 diseases of transboundary nature (foot and mouth disease, rinderpest, contagious bovine pleuropneumonia, sheep and goat pox, peste des petits ruminants, highly pathogenic avian influenza, Rift Valley fever, Newcastle disease, African and classical swine fever, equine encephalitis, and under certain circumstances, rabies and brucellosis). The links between wildlife and livestock are seamless, and knowledge on management issues is imperative for future practitioners in understanding disease ecology. The key aspect to detection and containment of TADs and EIDs is to have all actors within the production and marketing chain linked with veterinary systems (encompassing those who teach at veterinary faculties, rural and urban practitioners, and regulatory authorities) to learn how to clinically suspect these diseases and call upon specialists in the case of uncertainty, and count on their active participation during emergency simulation exercises – at local or central levels. The common denominator for lowering risks and threats management of TADs (or other infectious diseases) is strategic epidemiology. This encompasses efforts to ensure that people heed warnings, communication of risk factors, disease recognition, detection and diagnosis, and cross-occupational efforts for response and eventual recovery. The role of the educator is to place importance on training future practitioners in investigative skills, open-mindedness in developing differential diagnosis lists, sample taking, risk analysis, care in not vectoring diseases off a premise, and knowing whom to contact in the event of mounting uncertainty. The new veterinary graduate should be well equipped to play a key role in globalised societies in the context of developed as well as developing counties.

Keywords: Animal – Transboundary disease – Veterinarian – Veterinary education.

Introduction

The mandate of the Food and Agriculture Organization of the United Nations (FAO) is to assure global food security and relieve hunger. FAO places a strong focus on policy dialogue and capacity-building to achieve its goals. As a result of this focus, during the 1970s and 1980s, a number of FAO-led projects in developing countries provided extensive assistance for capacity-building in animal health and production. In 1994, the FAO dedicated issue 80/81 of its World Animal Review to information exchange. One chapter was dedicated to veterinary education in developing countries (1). Much later, in 2005, the FAO updated an inventory of veterinary faculties worldwide, whose initial publication had been elaborated by the World...
Veterinary Association. To date, FAO continues actively to support veterinary capacity-building and education globally.

**Emergency Prevention System and transboundary animal diseases**

Transboundary animal diseases (TADs) are defined as epidemic animal diseases that are highly contagious or transmissible, with a potential for very rapid spread irrespective of national borders and causing serious socioeconomic impacts and, depending on the agent, potential public health consequences. The animal health component of FAO's Emergency Prevention System (EMPRES) has led control and elimination programmes for numerous priority diseases. With the emergence of the H5N1 strain of highly pathogenic avian influenza (HPAI) virus in 2004, FAO – in conjunction with other agencies – led the initial disease mitigation responses in Southeast Asia and later in Eastern Europe and Africa. Arguably, after rinderpest, the HPAI activities and related operations at FAO represent the largest effort for progressive control and prevention of any animal disease. In fact, from 2004 to 2011, over US$330 million was mobilised and disbursed through FAO to contain the evolving pandemic, which affected poultry-dependent livelihoods as well as domestic and international commercial interests.

As the HPAI crisis progressed, a lack of sufficient expertise became evident, especially of professionals acquainted with veterinary epidemiology, emergency relief and crisis logistics, TADs and avian influenza, poultry production systems, and rural development. The poor availability of well-rounded animal health professionals highlighted the need to re-evaluate the profiles of national and international veterinarians. In view of this, there was an overall sense of agreement among experts that there should be integration of ‘new’ subjects or themes into the curricula of graduate and post-graduate veterinary education programmes, with specific emphasis on practical epidemiological training, enhancing communication skills, development of cultural sensitivity and local understanding, ability to engage in multidisciplinary teamwork, and strategic planning. Innovative techniques and creative methods by educators can include problem-based learning, use of case studies, and simulation exercises.

New veterinary professionals need to grasp that the overlap between TADs and veterinary public health is not limited to the pathogen being a zoonotic agent. It also derives from the fact that insidious animal diseases affect people's livelihoods. TADs are a veterinary and a public health problem that has far reaching implications in terms of nutrition, human and economic development, trade and commerce, national stability, food security and food safety. The broad multidimensionality of diseases must be stressed.

**The veterinary profession in the 21st Century**

Fundamentally, veterinarians render their services to support both private and public goods. As the veterinary profession addresses the evolving needs of societies, the veterinary curriculum must therefore be creative and flexible to enable it to deliver veterinarians who are capable of addressing these rapidly changing needs. Over the last 40 years, much emphasis has been placed on clinical medicine – emulating that of physicians dealing with diseases in human beings – and the feminisation of the veterinary profession has led to more part-time employment and an emphasis on small animal practice. Notions on the importance of Veterinary Services as a public good are not often considered.

This important and overlooked fact needs emphasis: private and public veterinary practitioners are a pivotal component of the veterinary surveillance system, and their role as the first line of defence for the detection, early warning, and containment of any emerging or re-emerging animal disease is critical for the well-being of societies. For example, private practitioners need to provide timely reports of salient epidemiological or unclear events to Veterinary Authorities, and adhere to, and cooperate with, investigations, implementation of disease awareness, prevention and control measures. Their responsibility towards society as well as to their clients requires a shift in thinking, balancing private and public good activities, as the veterinary profession overall needs to protect human health and well-being while carefully weighing the economic and societal impact of diseases and their control measures.

There is increasing evidence that most emerging diseases are likely to have animal origins (4, 5), thus, veterinarians will require skills to detect problems when they are still small and recent, so they can alert authorities and possibly avert a pandemic or epizootic from occurring. It is for this same reason that FAO focuses on ‘tackling the disease at source’, which means epidemiological understanding and engagement at local level.
Furthermore, the veterinary profession needs to establish improved links with physicians, biologists and ecologists, and acquire other insights (into, for example, socioeconomics, regulation, legislation, oversight, efficient production practices, animal welfare, proper hygiene, pharmacology and herd health). National bodies, such as ministries of education, health and agriculture, and professional associations, should collaborate in the development of relevant curricula for veterinary students, and in-service training to address the present and future needs of countries/regions, including the drafting of profiles and credential reviews of veterinary faculty members. Veterinary faculties, for their part, should have appropriate infrastructure and personnel to carry out their work, and become more sophisticated according to agreed specificities. They must not lose sight of society’s needs.

Lastly, veterinary boards and veterinary faculty associations need to be created (where they are currently lacking) at national and regional levels. These boards and associations should establish a process of certification, promote continuous education, develop mechanisms of professional oversight, and ensure close alignment to the changing needs of society.

**Cooperation between developed and developing country veterinary education**

The international community, including FAO, the World Health Organization (WHO) and the World Organisation for Animal Health (OIE), should further facilitate the strengthening of cooperation between veterinary faculties in developing and developed countries through student and faculty exchanges, and research collaborations. The FAO continues to stimulate North–South and South–South cooperation, collaboration and exchange.

The exchange of academicians between countries gives them insights into different realities, familiarises them with the diagnosis and control of diseases that are not present in their own country, and provides practical experience (for example in field treatment methodologies, herd health programmes, field surgery and necropsy, slaughterhouse, border inspections and socio-cultural aspects) that affect or are affected by disease occurrence or risk. In a similar way, the exchange of students during the final years of their courses should provide them with a global outlook on disease prevention and control, equipping them with local sensitivities and language skills. To illustrate this point, FAO often accepts veterinary students to take on specific projects under a mentor. Similarly, it receives graduate veterinarians and visiting professors who delve into the international arena to gain a better understanding of global concerns and issues, while furthering their professional careers.

The developments of distance learning modules where students can receive credits at their faculties for successfully completing courses not available in their home country is a viable option for enabling veterinarians to develop new insights, gain exposure to broader issues, and get acquainted with international veterinary medicine. Also, the availability of online courses leading to master’s degrees, coupled with mentorship, presents tremendous potential for students from developing countries to further their education in specialty fields. The SAPUVETNET, a dynamic project linking five European and eleven Latin-American veterinary faculties, is a perfect example of the transcontinental coordination (www.sapuvetnet.org).

**A global parameter**

Since the 1800s educators and scientists have embraced the ‘One Health’ notion (7, 8). An 1856 quote from Rudolf Virchow highlights it neatly: ‘Between animal and human medicine there is no dividing line – nor should there be. The object is different but the experience obtained constitutes the solid basis of all medicine’ (6). Nowadays, with looming zoonotic diseases, this concept has been elevated to international discourse. This seems logical because we are tightly interrelated in the environment in which we live.

With this in mind, ‘tackling diseases at source’ requires a better spatial and temporal understanding of crucial determining factors to deal with multidimensional risks and their targeted management. The epidemiological recognition of risk variables, human behaviour and socioeconomic drivers is critical for tailored interventions for TADs. Moreover, from an educational perspective, it is therefore essential that veterinary students understand disease drivers, animal production systems, and the complex process of safe products reaching consumers (from farm to fork), as well as the efficient use of natural resources.
A local parameter

Extension services at the regional and local level are paramount to provide authoritative aspects of disease prevention and control. In this regard more emphasis has been given by national or local entities to crop agriculture than to veterinary and food safety aspects. This emphasis should be balanced to reflect the reality that livestock contributes substantially to the national and global agricultural gross national product (GNP), where the global average is 40% and in some countries the contribution is much higher (9). With this in mind, it is warranted to make a concerted effort to protect livelihoods and livestock from the ravages of TADs, the presence of a chronic underlying zoonotic problem, or the emergence of a novel pathogen. Veterinarians and their auxiliaries should be well prepared to act appropriately in the event of an emergency – for instance the incursion of foot-and-mouth disease (FMD), cerebrospinal fluid diseases, rabies, or strains of influenza such as H5N1 HPAI.

Perception of the veterinarian

The relentless efforts undertaken by FAO and its partners, in particular OIE, nongovernmental organisations (NGOs) and donors, to protect poultry from the devastation of H5N1 HPAI (from 2004 to the present) and to elucidate the role of wildlife in transmission dynamics, has markedly underlined the importance of veterinarians to uphold and promote public goods by protecting people and their livelihoods. Despite the impressive achievements so far obtained, much more needs to be done to improve global veterinary education.

Although the overall public perception of the veterinarian is positive (based largely on the romanticised picture of the profession in literature, on film and in television programmes), the reality is that graduate veterinarians are not trained to the level of proficiency required, and that their services, both public and private, attract in most cases only minimal economic remuneration. In global terms, the rewards for veterinarians are substandard compared with those in other specialised professions that require the same degree of academic preparation. The plethora of veterinary faculties often produce veterinarians who are not qualified to practice, which further erodes confidence and limits their inputs when problems arise. It would therefore be most appropriate and beneficial to highlight the achievements of veterinarians in the promotion of the global public good. Also, outstanding alumni can be recognised by elected officials and the public at large as a way to generate pride and respect locally and internationally. If the veterinary profession is to remain honourable, essential, respectable and admirable, then its image must be absolutely impeccable.

The role of international organisations in veterinary education

International organisations such as the FAO, OIE and WHO play an essential role in providing a forum for discussing issues related to international veterinary medicine, and in finding ways to enhance veterinary education at the global level. Resources are required to make such discussions feasible and viable in a formal established system that properly mentors visiting students and provides new regional or global understanding of issues to those wishing to pursue sabbatical leave. For instance, the FAO/WHO/OIE electronic conference on Veterinary Public Health and Control of Zoonoses, which was implemented in developing countries, addressed education, training and extension for veterinary public health participants (2).

More emphasis on international aspects and ramifications of the veterinary medical profession, including the scope and activities of international technical agencies and regional organisations, would need to be included in existing programmes to make comprehensive agendas. As previously mentioned, the FAO regularly receives students for internships and academics during their sabbaticals. This initiative could be expanded through memorandums of understanding with specific institutions or veterinary associations seeking training opportunities for their candidates or launching collaborative research proposals for their researchers and faculty members. Furthermore, seasoned experts from international organisations could regularly provide lectures at veterinary faculties and associations to share their latest insights and field experiences. There is no doubt that it is desirable to do more to take advantage of internet-based technologies such as video conferencing, chat, electronic messaging and virtual classrooms as these reduce travel time for staffers and associated logistical costs.
Additionally, international organisations regularly receive group study tours. These visits build stronger networks with interested institutions in specific thematic areas. Relevant information, materials and contacts can be shared through such networks. FAO’s Veterinary Public Health Networks presently link over 1,500 subscribers and provide weekly updates on diseases, publications, events, training and employment opportunities (3). The FAO-EMPRES subscribers and Bulletin list contains details of over 3,000 individuals. These include professionals in the OIE, the United Nations Environment Programme (UNEP), the United Nations Children’s Emergency Fund (UNICEF), WHO, NGOs, financial institutions and veterinary academics, as well as senior foreign animal health officers. Veterinary education needs to wholly prepare veterinarians to be able to address new challenges that arise from globalisation, urbanisation and changing production systems, as well as the rise of emerging and re-emerging diseases worldwide. International organisations thus play an essential role in linking and supporting veterinary institutions in shaping the veterinarians of the 21st Century. Graduating veterinarians must possess knowledge of the international processes of the OIE, the existence of FAO/WHO Codex Alimentarius, the global animal health landscape, and the scope and breadth of assistance that technical agencies provide to their member countries.

**Conclusion**

The range of activities carried out by veterinarians is very wide. These activities should be pursued professionally in the context of society’s needs. Today we are faced with new and more complex challenges which include TADs and zoonoses. Veterinarians also undertake basic and applied research in pathogen characterisation, immunology, vaccinology, and do research work with animal subjects that is designed to find cures for debilitating human ailments. Veterinarians work in public and private settings as civil servants, teachers, instructors, professors, researchers, marketers, salespeople and entrepreneurs, as well as independent practitioners. From the perspective of the relationships between emerging infectious diseases and humans, the truth is that veterinarians are unsung heroes in their efforts to curb the effects of epidemics and endemic chronic animal diseases, which are transmissible irrespective of national borders and cause serious socioeconomic harm. This deep-seated conviction is the one driving an evolving veterinary education to make a better and safer world for all.

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Zoonoses: the animal/human interface

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Summary

It is well documented that a significant percentage of diseases do not respect species borders any more than they do political borders. Doctors of veterinary medicine (DVMs) are truly doctors of very many species. As such, the interface between animal populations, whether terrestrial or aquatic (including animals for food production, companionship, sport, entertainment or education) and the human population is one that requires veterinary practitioners to exercise a number of competencies. The absence of such competencies can have profound negative social and economic consequences. It is essential that veterinary education provides veterinarians with the fundamental horizontal complex problem-solving abilities, diagnostic proficiency and communication skills that will enable them not only to limit effectively the health impacts of zoonotic diseases on the animal population, but to contribute to similar outcomes in the human population. With many newly emerging and re-emerging zoonoses, the impact on the animal owner or their family may well be as severe as, or even more severe than, the impact on the animal. This therefore requires an expanded consideration of risk and an expanded definition of consequence for diagnosis, treatment and integrated disease reporting. In such a reality, DVMs are therefore also doctors of very many situations and determinators of very many scenarios.

Keywords: Animal/human interface – Emerging disease – Zoonoses.
The need for educating wildlife health professionals

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Summary

The recognition of the importance of effectively diagnosing diseases, preventing sickness and managing the health of wildlife is rapidly growing around the world, as is the need for skilled veterinarians to provide leadership to face the challenges. Wildlife and wildlife disease control are closely linked to a number of important areas of concern in veterinary medicine because diseases are shared among wild species, domestic species and humans; wild animals are increasing being recognised for their social, cultural and economic value, and in some cases production systems are developing to meet these needs; there is a growing concern for animal welfare and well-being issues for wild species both free-ranging and in captivity, and the international trade in wildlife and wildlife products is growing to be of great significance. Wild animals can serve as sources of disease, victims of disease, and as valuable sentinels of both disease occurrence and environmental disruption. Currently few veterinary training programmes around the world are providing the skills needed for the next generation of wildlife veterinarians.

Keywords: Animal welfare – Environment – Wildlife.
Session 2

Early detection, notification and surveillance

Chair: Dr. Zhang Zhongqiu
Education and training needs to improve animal disease surveillance systems

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Summary

In order to promptly detect, diagnose and control animal diseases, surveillance systems rely on the early reporting of cases. Efficient surveillance systems require a strong veterinary presence in the field able to recognize and investigate disease occurrence. In developed countries, fewer and fewer veterinary students consider a career dealing with production animals. This trend is already having an impact on animal disease surveillance as there are fewer ‘eyes and ears’ in the field. In many developing countries, surveillance systems suffer from chronic under-budgeting, and this too results in a diminished field presence.

Even though veterinary medicine has always dealt with animal populations, veterinary education has not always placed sufficient emphasis on population-based approaches. In many countries the centre of attention of veterinary curricula has been on clinical aspects in companion animals. More recently, veterinary epidemiology courses have been included at the undergraduate level in some veterinary schools. However, there is still a need to enhance a broader understanding of population-based approaches to improve surveillance systems.

This paper attempts to identify the skills required within different levels of surveillance systems, with the hope that those directly involved in veterinary education can bridge the gaps in undergraduate as well as post-graduate programmes.

Keywords: Epidemiology – Population-based approach – Surveillance system – Veterinary education – Veterinary Service.

Introduction

In order to promptly detect, diagnose and control animal diseases, surveillance systems rely on early reporting of cases. Efficient surveillance systems require a strong veterinary presence in the field able to recognize and investigate disease occurrence. In developed countries, fewer and fewer veterinary students consider a career dealing with production animals. This trend is already having an impact on animal disease surveillance as there are fewer ‘eyes and ears’ in the field. In many developing countries, surveillance systems suffer from chronic under-budgeting, and this too results in a diminished field presence.

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Objectives

Three main objectives were defined:

– to identify problems affecting the efficiency of surveillance systems
– to describe the skills required at different levels within surveillance systems
– to propose possible solutions.
An informal survey (see the Appendix) was conducted among experts from academia and official Veterinary Services from around the world (Fig. 1), regarding the factors that affect the coverage and efficiency of surveillance systems, the perceived educational gaps, and potential solutions and alternatives. The views expressed in this paper represent the responses to the survey and the author’s own views.

**Surveillance**

Animal health surveillance is the collection, analysis and interpretation of data to determine the distribution of diseases in time and space, and establish actions leading to their control or eradication (3, 4). In recent years, there have been increased demands on official Veterinary Services worldwide to demonstrate in a scientific and transparent manner the animal health status within a country or a zone, or more broadly speaking, the animal health status of particular animal populations. This requires surveillance systems that are efficient, well organized and adequately funded. Disease surveillance systems play a central role in providing the science-based information needed to conduct risk assessments and regionalisation appraisals (5).

Some of the increased demands that impact directly on disease surveillance systems include the need to demonstrate disease freedom at the country or zone level, the application of compartmentalisation, and performing surveillance during and after an outbreak. All these activities require a significant number of samples and field work, which can strain surveillance systems and diagnostic laboratory networks.

How can surveillance systems become more effective? Active surveillance with the objective of demonstrating disease freedom has traditionally relied on statistically based surveys using a combination of approaches including clinical, serological and agent surveillance. Random surveillance is increasingly difficult to apply as it invariably requires large numbers of samples. For this reason, many surveillance systems now favour the use of targeted or risk-based surveillance. This is aimed at high-risk groups in the population, and is very useful in the determination of disease freedom as it requires a reduced number of samples, while still allowing an adequate confidence level. The identification of high-risk populations should be based on appropriate epidemiologic studies. From a veterinary education perspective, while it is not expected that all graduates should be able to design and conduct such studies, they do need to be able to interpret the results and understand their implications.

In general, surveillance systems are composed of a field force of official veterinarians whose task is to investigate disease occurrence. They are also responsible for increasing the awareness of producers, private practitioners, veterinary paraprofessionals and the general public of the importance of disease reporting.
Veterinary presence in the field

Many developed countries are experiencing a shortage of veterinarians working with production animals. This trend is driven by new graduates’ preference for an urban lifestyle and companion animal practice, and is resulting in a gap in coverage that may become critical in the near future. In the United States of America only about 17% of veterinarians work in food supply, including practising veterinarians and veterinarians working for governmental and corporate organisations (1).

This tendency is also seen in some other developed and developing countries, but not all. For example, Brazil has just under 100,000 vets, of whom 70,000 are active, meaning that low pay and fierce competition are driving graduates out of business. The presence of private veterinarians in the field is adequate in regions with more intensive livestock production and scarce where livestock production is either small-scale subsistence or very extensive beef production. The distribution of government veterinarians (both state and federal) follows the same trend, except that extensive beef-producing regions are reasonably well covered because of the export potential and the contribution of the livestock sector to the economy of each state. The above-mentioned competition in the private sector renders government jobs attractive, especially at the federal level, where salaries are well above the private sector and are likely to go up again. Although it is a fact that most graduates would favour working with small animals, there is no shortage of veterinarians to work with production animals. In the case of poultry and pigs, a large and growing sector, companies offer internships to students and often employ them upon graduation (Vitor Gonçalves, personal communication).

In other countries the coverage of surveillance systems may vary depending on the type of production system. For example, in Israel on dairy and poultry farms, the two main animal-based industries, the veterinary presence is adequate. However, the veterinary presence is not at the same level for beef, feedlot, sheep, goats and pigs (Arnon Shimshony, personal communication).
Factors affecting the effectiveness of surveillance systems

In addition to veterinary presence in the field, some of the factors that affect the effectiveness of a surveillance system include the level of awareness of private veterinarians and producers. Lack of knowledge and fear of the consequences of reporting are perhaps two of the main factors contributing to under-reporting of diseases. Occasionally, private veterinarians may face the prospect of endangering their source of employment by notifying the occurrence of disease within a production unit. This is especially true in countries that do not have adequate compensation policies.

Overall, greater emphasis should be placed on increasing the understanding of new graduates of the value of surveillance in enhancing production, its role in facilitating access to domestic and international markets, as well as its contribution to public health.

Population-based approaches in veterinary curricula

Many countries have increased the level of training in epidemiology for undergraduate veterinary students. Nevertheless, many veterinary schools around the world still place considerable emphasis on individual clinical cases, with little attention to population-based approaches. This is best summarised by one of the respondents to the questionnaire, who said, ‘As students we seemed to spend a lot more time learning about how to perform, for example, a heart transplant in a dog, rather than what to do in the event of an exotic disease outbreak.’

In Australia, the level of training in epidemiology is likely to be better today that it was in past generations of veterinary students. However, the challenge is to get the interest of students in the topic (I. East, personal communication).

In the European Union, epidemiology is listed as a compulsory subject in undergraduate training, and graduates should be familiar with basic principles of population medicine. The interest of undergraduates in farm animal medicine, and particularly veterinary public health, is limited and continues to decrease. Some countries have already started special programmes to encourage students to engage in farm animal careers. There is also a limited interest in laboratory work and research (K. Stärk, personal communication).

What changes are required in the veterinary curricula to better prepare graduates?

Training in epidemiology at the undergraduate level needs to be increased, emphasising practical applications to facilitate the understanding of concepts related to disease surveillance and the linkages between public health and animal health. It is important to realise, however, that the demands on the time of veterinary students are great, and it is not reasonable to expect that epidemiology lectures will receive a higher priority than clinical sciences, although both topics are intimately related.

Surveillance systems require appropriately trained epidemiologists. This level of training cannot be achieved at the undergraduate level, underscoring the increasingly important role for post-graduate training in epidemiology. As an example, most European graduates with an interest in working for Veterinary Services will follow some sort of post-graduate training that could be any of the following:

- MSc in veterinary epidemiology
- MSc in veterinary public health
- MSc in control of infectious diseases in animals
- Specialist training (e.g. residency in veterinary public health, European College of Veterinary Public Health)
- postgraduate diplomas or certificates.

Some countries have special training programmes offered by the official Veterinary Services. These may be extensive (e.g. France, Germany) and may lead to a second degree that may be compulsory for those wishing to practice in the state Veterinary Service (K. Stärk, personal communication).

Generally, there is a need to improve the epidemiological skills of veterinarians working in disease surveillance systems. From the perspective of managers of these systems, ensuring access to additional training poses particular challenges. Graduate-level programmes in epidemiology are usually expensive and require a significant time commitment. Funding is frequently the most important limiting factor.
Furthermore, the surveillance system may not be able to secure a position for the trainee once they complete their degree.

Some alternatives that could be implemented include the development of modular diploma and master’s-level programmes that include a mix of face-to-face teaching and distance education. Such programmes would allow trainees to remain in their positions while completing their degrees. Additionally, if credits could be accumulated across multiple institutions and even across international borders, the cost and time that trainees would need to spend away from their institutions could be reduced (D. Pfeiffer, personal communication).

**Role of international organisations**

Several international organisations offer training for veterinary officials in areas related to epidemiology, surveillance and risk analysis. The World Organisation for Animal Health (OIE), through its network of collaborating centres, has organised several such courses. As an example, the OIE’s Collaborating Centre for Animal Disease Surveillance Systems, Risk Analysis and Modelling, the Centers for Epidemiology and Animal Health (CEAH) of the Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services of the USA (USDA-APHIS-VS), host every year an international course in veterinary epidemiology directed at official veterinarians from all over the world. Over 400 veterinarians have attended these courses. In addition, CEAH through the USDA's International Technical and Regulatory Capacity Building Center (ITRCB) has organised specific courses directed at epidemiological aspects of the control of avian influenza in all regions of the world (the Americas, Middle East, Eastern Europe, Southeast Asia and Africa).

Official Veterinary Services, international organisations and non-governmental organisations are well placed to identify priorities and gaps in education in their areas of influence. However, these organisations are not educational bodies and thus should communicate with academic institutions in order to satisfy the demand for specialised training.

**Conclusions**

Veterinary medicine has always dealt with animal populations. Nevertheless, veterinary education has for too long focused on individual clinical cases as the cornerstone of veterinary medicine. Over time this has led to educators with a bias towards clinical sciences. While diagnosis and treatment of individuals remains important for animals that have a significant economic or sentimental value, when dealing with production animals, the individual becomes less important and the herd or the flock is the appropriate unit of concern. Veterinary curricula at the undergraduate level should devote more time to population-based approaches, placing greater emphasis on the public health responsibilities of veterinarians. All veterinarians, but especially those working in public service, play a significant role in protecting public health. They achieve this in two major ways: by helping prevent diseases that are directly transmissible from animals to humans and by guaranteeing food security. The World Food Summit declaration stated that ‘Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life’ (2). The contribution of the veterinarian to food security is therefore through implementing measures aimed at guaranteeing food safety from the farm to the first point of transformation, as well as ensuring a sufficient food supply by limiting the impact of animal diseases on production.

Some potential solutions to increase the number of students that would follow a career in production animals include programmes for tuition repayment, guaranteeing a certain number of slots for prospective students with a farming background or a demonstrated desire to work in a farming environment, and establishing internships within official Veterinary Services that would allow students first-hand experience in surveillance (P. Morley, A. Hill, F. Olea and D. Van Metre, personal communications).

Short courses offered by international organisations as well as other institutions have attempted to improve the epidemiological knowledge of veterinarians working in public service, mostly within official Veterinary Services. While this type of course is important and provides useful ‘hands-on’ information for participants, it is not a replacement for proper academic training in epidemiology. Post-graduate-level training in epidemiology is still needed. Academic institutions in conjunction with the official Veterinary Services should explore viable alternatives, including offering post-graduate programmes that allow students to remain in their current positions while completing their degrees.
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Appendix: Questionnaire

1. In your opinion, is there a sufficient veterinary presence in the field? In some developed countries fewer and fewer veterinary graduates are interested in working with production animals, potentially hindering the ability to detect the occurrence of diseases. Is this also true in other developed countries? In developing countries?

2. What are the factors affecting the coverage of surveillance systems?

3. Do new graduates have adequate skills to understand the importance of surveillance and their role in surveillance systems?

4. What changes are required in the veterinary curricula to better prepare graduates?

5. Is there sufficient emphasis on population approaches at the undergraduate level?

6. What should be the role of international organisations and their collaborating centres in providing training for veterinarians already working in the field?

7. Are new graduates interested in doing diagnostic work in the lab?

8. Are there other aspects that you would consider important?

References


Participatory surveillance (involving farmers and paraprofessionals)

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Summary
Participatory disease surveillance (PDS) is one of the main branches of participatory epidemiology (PE), an evolving methodology which relies heavily on indigenous knowledge and terminology. The participatory approach has long been known within the animal health realm. The launch of international projects to address epizootic diseases in developing countries, which encountered the limitations of conventional epidemiological methods, led to a recognition of the need to upgrade PE as integral part of official disease surveillance systems. The World Organisation for Animal Health (OIE) has recognised PDS as a methodology in searching for evidence of clinical rinderpest and historical disease patterns, and it became instrumental in the eradication of this disease in Africa and Asia. It has also been used for other epizootic diseases. This paper reviews past, recent and prospective applications of PDS, the need to incorporate the method, so far restricted to developing countries, into national surveillance networks elsewhere – particularly concerning animal health in small farms and backyard holdings – and the need to consider its introduction into university curricula.


Introduction
During the late 1980s, rinderpest became confined to East Africa, with the areas generally recognised to be endemically affected being remote, marginalised pastoral communities. Veterinarians who were delegated to this region by non-governmental organisations (NGOs) and the Food and Agriculture Organization of the United Nations (FAO), to participate in rinderpest eradication and other projects, encountered serious difficulties, and they were at times not sufficiently equipped by their Western training to deal with them. In light of the emerging drawbacks, interest began to grow in alternative approaches and methodologies. Eventually, the constraints led to the educated utilisation of locally available knowledge, including what is now known as ethnoveterinary medicine (EVM), and subsequently the development and application of participatory epidemiology (PE) and participatory disease surveillance (PDS). This paper discusses these concepts, their relationship to the World Organisation for Animal Health (OIE), and the developing involvement of veterinary schools.

Participation by stakeholders is essential for all surveillance systems. In fact it is an essential for the early detection of any clinically detectable disease. The paper will address the role of small farmers in disease surveillance.

Ethnoveterinary medicine
Animal breeders across the world have been accumulating knowledge on animal disease and diagnostic skills since ancient times. The term EVM is mainly used in the context of under-developed countries.

Ethnoveterinary medicine focuses on livestock keepers’ knowledge and approaches to animal health care. Keepers are an essential source of information on suspected cases of infectious diseases at large, and are particularly important in the detection of new disease entities. Thus, nomadic cattle owners could demonstrate to under-experienced animal health professionals a firm diagnosis of rinderpest; some owners even husbanded mild strains purposely to immunise their young stock (18). In southern Sudan and Kenya, a good agreement between pastoralists’ and veterinarians’ disease names and diagnostic criteria was demonstrated (3). In Israel, Bedouin shepherds recognised tick-paralysis (‘warwar’) in goats, which appeared once every three years. As a result they avoided letting goats graze on the northern slopes of wadis in every third year. Eventually it was found that the syndrome is caused by a three-host tick which breeds on northern wadi slopes (9). Masai tribesmen have recognised for centuries that malignant catarrhal fever...
occurs among cattle that have contact with calving wildebeest, and they isolate their cattle during this time (10). There are numerous other examples (1) of indigenous knowledge.

Vernacular disease names introduced into the conventional scientific terminology are another testimony of the EVM origins – or ‘existing veterinary knowledge’ – of such diseases throughout the world. Examples are surra, kata (a synonym for pestes des petits ruminants – PPR), Jaagsiekte, scrapie (also known as Rida, tremblante and traberkrankheit), Maedi-Visna and bluetongue. There are many others.

The failure or lack of sustainability of projects in the developing world and the shortcomings of modern veterinary medicine have encouraged the recognition of EVM as an input into community-based animal health care and epidemiological intelligence (17). Ethnoveterinary information is a key aspect of the new approach called PE, which has been developed to improve epidemiological surveillance in remote areas and encourage community participation in disease control (15).

**Participatory epidemiology and participatory disease surveillance**

The transition from EVM to PE came about in the early to mid-1990s, when community participation attracted greater attention within NGOs and veterinary research centres, and was applied in diverse situations.

The PE approach is a relatively new branch of veterinary epidemiology which adapts the methods of participatory rural appraisal (PRA) and rapid rural appraisal (RRA) and combines them with conventional veterinary investigation and epidemiological approaches. In PE, as in PRA, information is validated by cross-checking, using multiple techniques and informants whose traditional knowledge of animal diseases (and their local vernacular names) is respected and utilised if applicable (15). Participatory approaches can help to overcome some biases of conventional survey methods (especially questionnaires), for instance by reaching places away from main roads, meeting all classes of people, and visiting areas beyond project areas. They may also be the only alternative when sample surveys are precluded.

The two key features of participatory data collection are, first, triangulation: information is gained from several intentionally different perspectives; and second, flexibility. Appraisals are not rigidly pre-planned and executed without deviation. Techniques and questions may be changed during the investigation.

The main methods for collecting information are:

- **Semi-structured interviews**: the major participatory method. In contrast to the structured design of interviews used in developed countries, interviews have only a basic structure, and the interviewer should improvise, depending on the responses and interests of the informant;

- **Scoring and ranking** (matrix scoring and proportional piling). This involves the creation of a matrix, with different diseases on the horizontal axis, and characteristics associated with the diseases (e.g. clinical signs) on the vertical axis. Piles of counters (e.g. stones) are then used to complete the cells of the matrix;

- A variety of **visualisation** (e.g. mapping and modelling) and diagramming techniques such as seasonal calendars and historical timelines (15).

These methods can be combined in a number of different ways, depending on the topic under investigation, and result in a combination of observations from the participants, semi-quantitative scores, and quantitative data (11).

To address the needs of FAO’s rinderpest eradication project, an innovative participatory methodology for surveillance programmes was gradually developed, and eventually became PDS. This is a form of active surveillance that taps into traditional information networks to track down and diagnose outbreaks of infectious disease (16). Investigations using PE/PDS should be conducted by veterinarians trained in the approach, since the triangulation or cross-checking of information includes conventional veterinary investigation methods such as clinical, pathological and laboratory examinations (13). The PDS method has been recognised by the OIE for surveillance of clinical rinderpest (22).

The strengths and weaknesses of PE/PDS have been discussed (19). Some strengths are noted above. Among the weaknesses of PDS, some epidemiologists criticise its qualitative approach, and point at difficulties related to the lower level of indigenous knowledge in communities that are less dependent on livestock. The sensitivity and particularly the specificity of the methodology have been debated as well.
To develop capacity for PDS, an iterative training process has been used to build on and refine concepts, using a guided experiential learning process (11).

The PE/PDS techniques have been intensively used for the surveillance of major epizootics. In addition, they have been applied to solve epidemiological questions, including unravelling the underlying aetiology of challenging clinical syndromes (5, 6), and to develop epidemiological models of disease transmission, combined with quantitative techniques (11, 14).

Six major epizootic diseases were the subject of PDS projects in 13 countries during the years from 2001 to 2009:

- rinderpest: Afghanistan, Ethiopia, Kenya, Pakistan, Sudan, Somalia, Tajikistan, Uganda, Uzbekistan and Yemen
- foot and mouth disease (FMD): Afghanistan, Tajikistan, Turkey and Uzbekistan
- PPR: Afghanistan, Tajikistan and Uzbekistan
- highly pathogenic avian influenza (HPAI): Egypt, Indonesia, Kenya and Sudan
- contagious caprine pleuropneumonia (CCPP): Ethiopia
- Rift Valley fever (RVF): Kenya.

In several of the countries, these projects led to investigations and findings concerning other animal health conditions, such as rinderpest-like syndrome in Ethiopia and Kenya, and contagious bovine pleuropneumonia (CBPP) and bloody diarrhoea (shialukho shekamafugi) in Uganda (13). In Pakistan, where rinderpest was the initial target, haemorrhagic septicaemia and PPR were eventually found to be of the highest significance.

**Veterinary paraprofessionals, community animal health workers and small farmers**

The employment of veterinary paraprofessionals by State Veterinary Services for the performance of animal disease control activities, including surveillance, is common practice and has been regulated in most countries, with different variations and under various names (e.g. stock inspectors, veterinary technicians, veterinary assistants, feldschers). The OIE refers, in its *Terrestrial Animal Health Code* (Terrestrial Code), to the 'veterinary paraprofessional' as 'a person who, for the purposes of the *Terrestrial Code*, is authorised by the veterinary statutory body to carry out certain designated tasks (dependent upon the category of veterinary paraprofessional) in a territory, and delegated to them under the responsibility and direction of a veterinarian. The tasks for each category of veterinary paraprofessional should be defined by the veterinary statutory body depending on qualifications and training, and according to need’ (23). In the past, veterinary paraprofessionals were mostly an integral part of Veterinary Services. Since in many countries, traditional government Veterinary Services are being reshaped into smaller and more dynamic regulatory and epidemiological services, they have to rely on non-governmental providers of primary surveillance data. Their status is acknowledged by the OIE, as expressed within its definition of Veterinary Services: ‘Private sector organizations, veterinarians or veterinary paraprofessionals are normally accredited or approved to deliver functions by the Veterinary Authority’ (23).

Another category of animal health workers, common in East Africa and other developing countries, is community animal health workers (CAHWs). These are mostly small farmers or pastoralists, community-based service providers, trained by professionals and operating under professional veterinary supervision, mostly through the sponsorship of NGOs and national projects. CAHWs are local experts: the ground-level eyes and ears of a surveillance system in remote areas. For example, they provided the first news of rinderpest outbreaks to their supervisors in Karamoja, Uganda, in 1994 and Eastern Equatoria in southern Sudan in 1998. The CAHWs are a significant component of PE/PDS projects. They do not replace formal investigations but can trigger investigations and greatly assist veterinarians who are undertaking these activities in marginalised areas. It is assumed in PE that surveillance is a set of integrated activities, and veterinarians (not CAHWs) who have been trained in the approach conduct PE investigations (13). Since CAHWs are community members, there is a need for specific definitions to distinguish clearly between them and veterinary paraprofessionals.

The phrases PE/PDS have been coined for developing countries, but participation by stakeholders is indeed an essential tool in all surveillance systems globally, particularly when early detection is at stake. Small farmers own 85% of the world’s farms, and their participation in animal health programmes is crucial if
programmes are to achieve their goals. A questionnaire sent to the Veterinary Authorities of OIE Members showed that the majority (median 90%) of livestock farms are considered small (12). Small farmers directly provide information used for surveillance in most countries; in some countries, they provide more than 80% of such information. This applies to various sectors of the farming industry and in relation to all animal species and husbandry methods. For example, in Israel there are 90,000 honey bee hives, owned by 400 registered beekeepers. Epidemiological information, seasonal bee colony development and performance is obtained by weekly contacts with a group of 10 to 15 experienced beekeepers from geographically different parts of the country. Unusual events are followed by clinical and laboratory investigations. The same channel also serves to distribute information on novel diagnostic or therapeutic practices.

In 2007, the OIE endorsed an African resolution, supporting the participatory approach and encouraging the training of livestock owners in participatory epidemiology (20). This was extended to include small farmers worldwide, by the resolution on ‘Participation of Small Farmers in Animal Health Programmes’, adopted in 2008 (21).

**Veterinary schools and participatory epidemiology**

Following the earliest introduction of participatory methodologies into the animal health sector in eastern Africa, mainly by NGOs, there was need for veterinarians trained in participatory development approaches. Two institutions, the International Veterinary Medicine Program at Tufts School of Veterinary Medicine (Massachusetts, United States of America) and the Centre for Tropical Veterinary Medicine in the University of Edinburgh (United Kingdom), were involved from the onset in animal health projects in Africa using a participatory approach, involving their graduates in such projects.

A survey addressing the use of a participatory appraisal was conducted in 1998 among veterinarians working in Africa (2). It included veterinarians working with governments, NGOs, veterinary or agriculture colleges, multilateral and bilateral agencies, and independent consultants. One of the main conclusions was that lack of training was an important problem hindering the wider and correct use of PA by veterinarians. The qualitative nature of the data produced by PA was the second most commonly cited disadvantage. In addition to the participants in Africa, the questionnaire was sent to ten university departments in Europe and North America with specialist interest in tropical veterinary medicine; only one responded.

By mid-2007, at least four African veterinary schools were teaching PE at either undergraduate or postgraduate level and were involved in regional projects. Capacity-building in PE was a common feature of programmes intended to strengthen government disease surveillance systems in Africa and beyond, including Europe (4).

In an attempt to obtain for this review some current impression on the status of PE/PDS within the veterinary higher education establishment in developed countries, 31 veterinary schools were contacted by e-mail during 2009. They were asked if PE or PDS were addressed in the undergraduate curriculum of their respective schools. Later, information from a Japanese school was added. In all, 19 out of the 31 (61.3%) responded: 9 of the 10 USA-based schools, 6 out of 15 European, and the one school contacted from each of Australasia, Africa, the Middle East and Asia. Neither of the two from Latin America responded.

Positive replies, confirming the inclusion of PE/PDS in undergraduate curricula, were received from three schools: one USA-based, one European and one South African. One European, two USA-based and one Japanese university reported that, while they are not included in their undergraduate curriculum, PE/PDS are included in their post-graduate programmes.

One of the responders included the following among other observations: ‘I would think that the biggest problem of “participatory systems”, as for syndromic surveillance, lies in the low specificity.’

In summary, out of 19 veterinary schools from which information became available, seven addressed PE methodologies to some extent, in their undergraduate or their postgraduate programmes and research activities. Although these results are somewhat biased both by the initial selection of the contacted schools and by their response rate, it seems that the methodology has already gained some recognition within the veterinary educational system in developed countries.
**Concluding note**

The PE and PDS methodologies are now used by epidemiologists and researchers in a steadily growing number of developing countries, and have gained initial recognition on the international regulatory animal-health level. Similar or rather modified methodologies may be put to test in developed countries, addressing small farmers and other stakeholders, in order to improve the coverage and intensity of veterinary surveillance systems there. In view of the observed interest of some schools in the methodology during the last decade, an increased involvement of veterinary schools in such projects may be anticipated. Their research capacities might help to bring improved sensitivity and specificity to the methodologies, an issue which is at present undergoing discussion among epidemiologists from different schools.

The inclusion of EVM and PE in the curricula, in either undergraduate or post-graduate sections, deserves consideration. Study of PE may help improve the anamnestic capacity of graduates to obtain maximal information from animal owners, not only in developing counties. If EVM is included, it could be incorporated into a history of veterinary medicine course; the phrase ‘without the past, there is no future’ may be applicable.

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**References**

Session 2: Early detection, notification and surveillance


Renewed veterinary education is needed to improve the surveillance and control of World Organisation for Animal Health (OIE) listed diseases, diseases of wildlife and rare events

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Summary

Emerging infectious animal diseases (EIDs), some of which are zoonoses, have taken on a growing importance in the first years of the 21st Century. Because of the joint presence of many risk factors, as well as scarce resources in developing countries, many EIDs have a tropical origin. With the increasing intensity of international travel and goods exchange, these EIDs may reach any part of the world. They represent unprecedented public health, socio-economic and information challenges. A stronger solidarity between Northern and Southern countries is needed to reinforce the capacity of Veterinary Services, improve research and teaching, and implement disease control programmes. Recent disease emergences, such as bluetongue in Europe, have highlighted the need to reassess teaching objectives and contents for the prevention and control of diseases listed by the World Organisation for Animal Health (OIE), diseases of wildlife and rare events. Earlier diagnosis, new concepts in infectiology, biosecurity, better skills in entomology, ecology, health economics, epidemiology and risk analysis must be covered. Moreover, teaching engineering (e.g. e-learning courses, and capacity building for evidence-based veterinary medicine through case-based disease study or focus groups) and dissemination must be improved. This paper reviews new prospects for veterinary initial and continuing education.


Introduction

We present here the new challenges with which animal health stakeholders are confronted, and the possible consequences for the adaptation of the academic and post-academic training of veterinarians. Training of animal health stakeholders (e.g. community animal health workers, veterinary technicians, paraveterinarians and other professionals) is much broader. However, the scope of this paper is limited to veterinarians in the strict sense.
A peculiar epidemiological situation

Changes in the epidemiological situation of diseases are a continuous and unavoidable process that may reach any part of the world. To illustrate this fact, the particular situation of Europe is developed in this section with emphasis on the links between Northern and Southern countries.

Disappearance and (re-)appearance of infectious diseases

In Europe, animal health was improved during the 20th Century with advances in dealing with both zoonotic (e.g. brucellosis, tuberculosis, rabies) and major (e.g. foot and mouth disease, Aujeszky's disease) animal diseases (12, 13). While insect-borne pathogens (e.g. bluetongue (BT) virus, West Nile fever virus, Rift Valley fever virus) and tick-borne pathogens (e.g. *Borrelia* spp., *Anaplasma phagocytophylum*, *Babesia* spp., tick-borne encephalitis virus, *Rickettsia* spp. and Crimean-Congo haemorrhagic fever virus) are becoming an increasing and serious problem in Europe (21), they are also responsible for large economic losses on other continents related to disease effects and, in particular, to restrictions in the trade of animals and animal products. For example, since the summer of 2006, northern Europe has faced the emergence of BT in domestic ruminants. The BT epizootics raised concern because heavy reproductive disorders were reported in cattle and sheep during and after the autumn of 2007, in addition to increased mortality. In these conditions, the loss of mean gross margin per cattle or ewe was considerable, estimated at €205 per beef cow, €233 per dairy cow and €53 per beef ewe (19).

Worldwide, between 1940 and 2004, 335 emerging infectious animal disease (EID) events were observed. These demonstrate non-random global patterns. The EID events are dominated by zoonoses (60.3%) such as highly pathogenic avian influenza, West Nile fever and Rift Valley fever. The majority of these (71.8%) originate in wildlife. Moreover, 54.3% of EID events are caused by bacteria or rickettsia, reflecting a large number of drug-resistant microbes (23). In addition, since 1980, 87 new EIDs have emerged, of which 58 are viral diseases. Among these, 49 were caused by RNA viruses (25). (The potential mutation rate of RNA-viruses is high, and other genetic events like reassortment add to this process, in particular in viruses with a segmented genome [such as avian influenza virus and BT virus]). International experts (the World Organisation for Animal Health [OIE], the World Health Organization [WHO] and the Food and Agriculture Organization of the United Nations [FAO]) assume that between 8 and 34 new EIDs will have emerged by 2015 (25). They represent growing veterinary public health, economic and information challenges. Some of them have a tropical cradle from where they threaten Northern countries, especially through international trade and travel. They underline the link between Northern and Southern countries, and also the crucial role of Veterinary Services (e.g. 48).

In this context, the quality of clinical observations plays a prime role in identification of diseases. It is proportional to the farmers’ and veterinarians’ level of information, awareness and training. The intensity of observation is also important, and seems to depend directly on herd size and number of veterinary visits in each herd (40). For example, in the United States of America (USA), according to the National Animal Health Monitoring System, the rate of neurological problems in breeding females in beef herds, expressed in affected bovines per thousand, doubles when herd size is less than 100 head, and is nil when herd size is over 300 (4).

Moreover, diagnostic and control methods are quickly changing. High-throughput diagnostic methods relying on the latest developments of genomics are becoming increasingly used, with affordable costs. However, there is sometimes a growing gap between all these scientific and technologic developments, and training courses given in veterinary and technician schools. Also, the optimal design of epidemiological surveys using these new tools is very different from ‘traditional’ designs.

Factors of (re-)emergence

The world is confronted with new epidemiological risks because of, among other factors, climatic changes, human demographics and behaviour, economic development and land use (e.g. the increasing demand for arable land and pastures and the development of urban and peri-urban animal production), poverty and social inequality, and events related to globalisation of trade in animal and animal products (Table I).

There is some evidence supporting the impact of climate change on the occurrence, distribution and prevalence of livestock diseases (e.g. 17, 31, 53, 54). However, when trying to disentangle the effect of climate change and other possible causes of disease upsurge, it is often the case that social and
**Table 1 Main factors influencing the emergence of animal diseases according to the period of time**

Source: (30)

<table>
<thead>
<tr>
<th>Factor</th>
<th>2007</th>
<th>2017</th>
<th>2027</th>
</tr>
</thead>
<tbody>
<tr>
<td>International travel and commerce</td>
<td>↑</td>
<td>↑↑</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Climate change and weather</td>
<td>↑</td>
<td>↑↑</td>
<td>↑↑↑</td>
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<tr>
<td>Economic development and land use</td>
<td>↑</td>
<td>↑↑</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Poverty and social inequality</td>
<td>↑</td>
<td>↑↑</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Human demographics and behaviour</td>
<td>↑</td>
<td>↑↑</td>
<td>↑↑↑</td>
</tr>
<tr>
<td>Breakdown of public health measures</td>
<td>↑</td>
<td>↑</td>
<td></td>
</tr>
<tr>
<td>Changing ecosystems</td>
<td>↑</td>
<td>↑</td>
<td></td>
</tr>
<tr>
<td>Intent of harm</td>
<td>↑</td>
<td>↑</td>
<td></td>
</tr>
<tr>
<td>Lack of political will</td>
<td>↑</td>
<td>↑</td>
<td></td>
</tr>
<tr>
<td>Microbial adaptation and change</td>
<td>↑</td>
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<td></td>
</tr>
<tr>
<td>Technology and industry</td>
<td>↑</td>
<td>↑</td>
<td></td>
</tr>
<tr>
<td>War and famine</td>
<td>↑</td>
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</tbody>
</table>

economic factors, including trade and travel, play a much more important role (e.g. 44, 45). It is therefore inappropriate to use only climate-based models to predict future disease incidence (32). In fact, understanding the mechanisms that underlie newly emerging and re-emerging infectious diseases is one of the most difficult scientific problems facing society today (25), despite the fact that different models designed to help understand this phenomenon have been developed in recent years, e.g. a model of the ecological continuum between host and pathogen (8) (Fig. 1), a model improving clinical detection of rare events (33, 36) and a convergence model of zoonotic diseases (Fig. 2) (24).

![Figure 1 Interactions with zoonotic pathogens within a host-parasite continuum between wildlife, domestic animal, and human populations](image)

Source: (8)

The host-parasite ecological continuum (here parasites include viruses and parasitic prokaryotes). Most emerging diseases exist within a host and parasite continuum between wildlife, domestic animal and human populations. Few diseases affect exclusively any one group, and the complex relations between host populations set the scene for disease emergence. Arrows denote some of the key factors driving disease emergence.
If we want indicators of risk, and a system to monitor how such indicators change over time, we need to construct quantitative models relating risk factors (temperature, land-cover, human behaviour, etc.) to outcomes (disease case numbers). Therefore, we need a good understanding of the epidemiological processes at the origin of introduction, installation and spread of diseases. We also need disease surveillance systems with a high sensitivity for the detection of suspect cases, and a high specificity for diagnosis.

Stakeholders of animal health and disease surveillance must be aware of these issues. Therefore, training courses must be adapted to prepare veterinarians and technicians to play their role fully in disease prevention, control and surveillance.

The temporal evolution of EIDs suggests they will preferentially be vectorial diseases and pathogens resistant to classical treatments (23). The majority of EID events originate in wildlife because of interspecies transmission (e.g. Ebola) and are increasing significantly over time (23, 29). Although they can arise anywhere in the world, the promiscuity between humans and animals is one of the main risk factors (25). In addition, some EIDs may also emerge in companion animals (e.g. 2).
In addition, changes may occur in the epidemiology of known diseases. For example, the transplacental transmission of BT virus (BTV) was well known among veterinarians working in infected areas (e.g. 5) but has mostly been associated with the use of modified live vaccines of different BTV serotypes (26, 27). Moreover, it was unclear whether this transmission had an epidemiological significance. Recent studies (9, 10, 39, 50, 56) and reviews (7, 37, 39, 41) during the 2006 to 2008 BT epizootic in North-West Europe have shown that transplacental transmission may result in the birth of infected calves and possible disease transmission to other cattle in the stable. Moreover, new sites of emergence within cattle sheds were identified (57). The inexorable radial expansion of serotype 8 (BTV-8) across Europe increases the risk for an encounter between this serotype and others, particularly those that occur in the Mediterranean basin, where vector activity spans the year. This increases the risk for reassortment of individual BTV gene segments (36). Such changes imply efforts in terms of education to allow veterinarians and animal health stakeholders to adapt their practices and decisions.

Emerging infectious animal diseases represent health, as well socio-economic, international, biological, partnership and media challenges. There is thus a need to develop new educational programmes, new disciplines and new research themes in epidemiology, microbiology and infectiology of EIDs. Moreover, the problem being global, these solutions must be adapted to various ecological and socio-economic contexts, including those found in less-developed countries. Veterinary, agronomic and medical know-how are resources and assets required to take up these challenges.

**Perspectives and new prospects**

Many new prospects could influence the renewed veterinary education. In this section, we present three examples: the new concept of ‘One World, One Health’; biosecurity; and Millennium Development Goals (MDGs).

*‘One World, One Health’*

The only way to prevent health hazards is to adapt the existing systems of health governance at world, regional and national levels in a harmonised and coordinated manner. In this context, a concept popularised by the Wildlife Conservation Society, ‘One World, One Health’, was recently promoted, indicating the growing awareness of the link between animal and human public health. The OIE, WHO and FAO (with the support of the United Nations Children’s Fund [UNICEF], the UN System Influenza Coordinator [UNSIC] and the World Bank) have prepared a consensus document entitled ‘Contributing to “One World, One Health”: a strategic framework for reducing risks of infectious diseases at the animal–human–ecosystems interface’ (14). From a practical viewpoint, the application of this concept implies global measures for a more efficient coordination between medical and veterinary health policies, taking into account new requirements to prevent and control zoonotic diseases (Table II). This concept needs a trans-sector, interdisciplinary and international collaboration to adapt disease surveillance and monitoring, as well as preventive and control measures, while preserving the environment.

<table>
<thead>
<tr>
<th>Table II Key elements of effective prevention programmes in both animal and public health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source: (14)</td>
</tr>
<tr>
<td>Adequate infrastructure and expertise (including training) at the national and local levels, and in ports of entry</td>
</tr>
<tr>
<td>Timely and responsive disease surveillance systems for animal and human populations</td>
</tr>
<tr>
<td>Up-to-date emergency preparedness and response plans</td>
</tr>
<tr>
<td>Capacity for communication of risk level</td>
</tr>
<tr>
<td>Capacity to meet international agreements and standards</td>
</tr>
<tr>
<td>Permanent reporting and improvement of biosecurity</td>
</tr>
<tr>
<td>Governance and legislation in line with international standards</td>
</tr>
<tr>
<td>Adequate and sustainable laboratory capacity supported by external quality assurance systems</td>
</tr>
<tr>
<td>Established monitoring and evaluation of Veterinary and Public Health Services</td>
</tr>
<tr>
<td>A legal framework with incentives for cooperation with the private sector</td>
</tr>
<tr>
<td>A communication protocol between animal and public health surveillance systems</td>
</tr>
</tbody>
</table>
**Biosecurity**

There is a growing public interest in the prevention and control of new pest and disease introductions (51). For example, many EIDs related to wildlife are caused by highly pathogenic agents (e.g. haemorrhagic fevers like Lassa fever, Ebola and Marburg). Preventing the occurrence of such diseases requires higher levels of biosecurity, and thus, appropriate training in veterinary schools and universities. The international definition of biosecurity in the domain of animal health is quite broad (55):

> Biosecurity is the implementation of measures that reduce the risk of introduction (bioexclusion) and spread of disease agents (biocontainment); it requires the adoption of a set of attitudes and behaviours by people to reduce risk in all activities involving domestic, captive exotic and wild birds and their products.

It includes different activities, such as vaccination, quarantine, surveillance, slaughtering, indemnification, cleaning and disinfection, each needing detailed explanations on the concept, design and implementation.

Any recommended biosecurity measure must consider the socio-economic realities of those who will implement it. In terms of epidemics, spread matters as much as the initial disease introduction and local installation. Biosecurity is one of the key pillars in slowing disease spread. Each measure must be practical and sustainable for all stakeholders – producers, traders, intermediaries and service providers and all those pursuing activities that may contribute to the dissemination of pathogenic agents (15). The fundamental principles of biosecurity are the following:

- Biosecurity is about reducing the risk of introduction and spread of infection;
- Actions of people are fundamental in applying biosecurity;
- Biosecurity consists of three major stages – segregation, cleaning and disinfection – segregation being the most effective and disinfection the least effective.

In addition, a greater focus on international cooperation to deal with threats at source and a commitment to refocus biosecurity on building resilience to invasion into agrosystems rather than building walls around them are recommended (51). The information, awareness and training should begin at each school or university involved in the training of veterinarians and animal health technicians (e.g. 6).

**Millennium Development Goals**

In 2000, in order to improve world health and welfare, the United Nations adopted different agreements leading to the implementation of Millennium Development Goals (MDGs). These goals include the improvement of world health (http://www.who.int/mdg/en/). The sixth goal aims to combat acquired immunodeficiency syndrome (AIDS), malaria and other diseases. More recently, some authors have proposed to adopt MDGs in animal health, such as for tuberculosis caused by *Mycobacterium bovis* (22). MDGs should be considered as a main challenge for the future in animal health, and thus the training of vets and veterinary technicians should be adapted to face these challenges.

**Veterinary initial and continuing education for the new decade**

**Initial veterinary basic education**

The part of the syllabus devoted to education on OIE-listed diseases, wildlife diseases and rare events is still limited in numerous schools and faculties of veterinary medicine around the world. It concerns, in particular, courses on infectiology (parasitology, bacteriology, virology, immunology, vaccinology), epidemiology, legal dispositions for the control of transmissible diseases, and regulations regarding veterinary medicine.

It is self-evidently impossible to teach trainees about all diseases, and veterinary education focuses on the most frequent diseases that will be encountered by veterinarians and veterinary technicians. Therefore, one essential skill to be acquired is an adequate mode of reasoning for the study of a new EID. The new format of academic veterinary training requires teaching the concepts, methods and tools that enable individuals to analyse any contagious disease. The following topics should be privileged to improve veterinary education on OIE-listed diseases, wildlife diseases and rare events (23, 35, 46, 49):
- infectiology of emerging infectious diseases with a particular focus on zoonotic vector-borne diseases and pathogens resistant to classical treatments
- wildlife diseases, and in particular the inter-species transmission of diseases
- immunology and vaccinology
- applications of genomics in new diagnostic methods
- epidemiology and risk analysis applied to veterinary sciences
- understanding the key factors for emergence of rare events and spreading of infectious and parasitic diseases
- evidence-based methodology for disease prioritisation (e.g. 3, 16, 28)
- main elements of world, regional and national health organisations
- elements of clinical approach, epidemiology and differential diagnosis leading to the suspicion that a disease subject to regulation is present in the country or threatening
- first regulatory measures to prescribe, and sampling methods related to diseases subject to regulation, present in the country or threatening (confirmatory modalities)
- new skills in developing or working efficiently in surveillance information systems (including an early warning system for diseases)
- technical and regulatory modalities and also the organisation of a collective fight against transmissible diseases
- new skills in biosecurity, entomology, ecology and ecosystem health
- animal health economics, and socio-economic ramifications of disease control
- veterinary public health perspectives including a ‘One World, One Health’ approach and steps to achieve MDGs
- evidence-based veterinary medicine through case-based disease studies (an integrated approach to diseases).

Particular attention should be paid to risk analysis, in the context of trade policy (in particular, the World Trade Organization [WTO] Agreement on the Application of Sanitary and Phytosanitary Measures [SPS Agreement]). The method can be used to assist in the choice of an appropriate national response strategy following an incursion of an emerging or re-emerging disease. The choice of strategy in the affected regions should be made after an independent, scientific and collective assessment which considers the range and magnitude of consequences of implementing or not implementing measures or surveillance programmes for all susceptible domestic livestock and possibly wildlife (scenario analysis). Such risk assessment should be performed taking into account current scientific knowledge, the particular local situation and uncertainties about the parameters used in the model. In addition, decision trees are often used to clarify the path to appropriate measures. Risk analysis includes evaluation of several parameters such as the probability of exposure to infectious agents and the cost and consequences of application of specific measures. Trade, and more generally movements of animals and animal products, is a crucial factor to consider (18, 36, 42).

Initial veterinary professional education

Veterinary practitioners are privileged actors in disease surveillance networks (e.g. sentinel veterinarians). They are appointed by the competent body (official Veterinary Services) to achieve, on its behalf, specific official controls in operators owning or handling animals or animal products. This appointment usually goes with an animal health mandate.

In addition to basic courses in veterinary medicine, initiatives have been taken in France during recent years to make mandatory a one-week preliminary specific training course for veterinarians involved in animal health measures. The objectives of this course are to teach trainees about the issues at stake in animal health programmes, as well as the nature of the roles allocated by the director of veterinary services, and the way they should be carried out. These courses are coordinated by the schools or faculties of veterinary medicine and involve the main actors in animal health: veterinary medicine faculties, lawyers, official Veterinary Services, farmers, veterinarians and veterinary associations, veterinary laboratories, and veterinarians. A synopsis of this training course is presented in Table III.

These initiatives contribute to the harmonisation, standardisation and improvement of the effectiveness of the animal health actions of veterinarians working within the framework of an animal health mandate. However, these training courses should also integrate the new concepts of ‘One World, One Health’, biosecurity and MDGs, and their practical implications in terms of veterinary training. This rise of the medical world in the field of veterinary medicine is appropriate for addressing the zoonotic aspects of
### Table III Typical syllabus for the initial education necessary for a role in animal health and disease control in the French system

Source: [11]

<table>
<thead>
<tr>
<th>Part</th>
<th>Objectives</th>
<th>Contributor</th>
<th>Modality</th>
<th>Contents</th>
<th>Time</th>
</tr>
</thead>
</table>
| 0 ( facultative) | • To identify the level of knowledge  
• To update knowledge  
• To control prerequisites  
• To help students appreciate the main professional characteristics needed by those working in animal health roles | TR | Lec | • Animal health legislation  
• Contagious diseases  
• Manual of diagnosis and management of epizootics  
• Regulatory news  
• Epidemiological actualities | 3h |
| 1 | • To give sense to the future action of the Veterinary Service  
• To be able to set the Veterinary Service’s actions in the context of the macroeconomic environment and different stakeholder interests  
• To identify the determinants (other than technical) to be considered when decisions are taken in the animal health sector | TIVPS | Con | • The role of the state  
• The national animal disease control system  
• The national and international stakes in animal health  
• The main international normative institutions (OIE, EU)  
• The competences and community decision-making process, illustrated by concrete examples (avian influenza, bovine spongiform encephalopathy, bluetongue, foot and mouth disease) | 3h |
| 2 | • To be able to distinguish between public and private rights  
• To identify the legal bases of animal health policy  
• To identify the links between the general principles of law and the administrative activities of the Veterinary Service | TR [lawyer] | Lec | • General principles of law  
• Sources and different sectors of law  
• The hierarchy of standards  
• Administrative and legal organisation  
• Administrative activity (lawful capacity and administrative policy) and responsibility | 3h |
| 3 | • To specify the relations between the regional directions of Veterinary Services and the central Veterinary Service | DVS | Con | • Links between general principles of law and administrative activities of the Veterinary Service  
• Rights and duties related to the animal health mandate  
• Laws and regulations governing the Veterinary Service  
• Conditions of remuneration and practical aspects | 3h |
<table>
<thead>
<tr>
<th>Part</th>
<th>Objectives</th>
<th>Contributor</th>
<th>Modality</th>
<th>Contents</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>• To identify the partners, their respective roles and inter-relations &lt;br&gt; • To identify the positioning of the Veterinary Service &lt;br&gt; • To identify the expectations, the logics of action and the constraints of employer and partners</td>
<td>DSV  &lt;br&gt; SDG  &lt;br&gt; TVG  &lt;br&gt; VS  &lt;br&gt; VL  &lt;br&gt; TR</td>
<td>W</td>
<td>• Organisation of the collective fight at the local level  &lt;br&gt; • Organisation of medical prevention  &lt;br&gt; • Health monitoring  &lt;br&gt; • Plan of emergency intervention</td>
<td>3h</td>
</tr>
<tr>
<td>5</td>
<td>• To be able to adopt a position as a Veterinary Service:  &lt;br&gt; – to understand what depends on the animal health mandate  &lt;br&gt; – to identify the necessity to strictly follow the instructions of the Veterinary Service  &lt;br&gt; – to identify the consequences of a failing Veterinary Service  &lt;br&gt; – to know when, how, and why to report actions to management</td>
<td>TR</td>
<td>PW</td>
<td>• ‘Rural’ and ‘urban’ clinical cases</td>
<td>2h</td>
</tr>
<tr>
<td>6</td>
<td>• To identify the difficulties of positioning of the Veterinary Service with respect to clients and operators  &lt;br&gt; • To know why, when and how to return account</td>
<td>DSV  &lt;br&gt; TR</td>
<td>PW</td>
<td>• Series of situations, e.g. emergency culling, control of animal introduction</td>
<td>2h</td>
</tr>
<tr>
<td>7</td>
<td>• To identify the stakes, objectives and practicalities of the animal health visit  &lt;br&gt; • To use official information systems</td>
<td>TVG  &lt;br&gt; VS</td>
<td>PW</td>
<td>• Animal health visit &lt;br&gt; • Utilisation of a national database intended for veterinarians (BDIVet)</td>
<td>2h-3h</td>
</tr>
</tbody>
</table>

**Evaluation**<br> Evaluation of students’ acquired knowledge | TR | QCM |

**Key:**<br> Con: conference <br> SDG: animal health defence group <br> TR: teacher-researcher <br> DVS: head of Veterinary Services <br> TVG: technical veterinary group <br> VL: veterinary laboratory <br> Lee: lecture <br> TIVPS: teaching institute for Veterinary Services <br> PW: practical work <br> Veterinary Public Services <br> W: workshop
animal health. The programme of training courses must be flexible enough to integrate other possible missions linked to the animal health mandate. Ideally, this type of education could be integrated into basic veterinary teaching, or after delivery of the title of doctor of veterinary medicine (DVM). A regional harmonisation is also desirable to provide all veterinarians with a relevant and coherent initial education, without circumventing the principle of free circulation of veterinarians within the European Community.

A better basic knowledge on zoonotic diseases and the principles of their surveillance, prevention and control in animal populations should also be provided to doctors of human medicine during their initial education, in a large number of countries.

**Continuous veterinary education and teaching**

The choice of the domestic animal, wildlife and rare-event diseases that should be OIE-listed is dependent on their impact on veterinary public health, human health, the economy and international trade. Veterinarians must have the required skills to suspect the presence of these diseases (clinical presentation and epidemiological aspects), achieve the appropriate samples to confirm the diagnosis, release an early warning for the official Veterinary Services, and take appropriate emergency actions to control the disease outbreak. Because they will probably be confronted by new emerging diseases, continuous (post-academic) education is an essential element to improve the quality of early warning. Its organisation must be effective (38, 47).

In this respect, the goal of continuing education is to update the theoretical and practical animal health knowledge of veterinarians, and to maintain and develop skills for the interventions needed in the evolving frame of their animal health mandate. The design of continuing education courses must address pedagogic goals which are carefully developed by animal health specialists and specialists in the design of training programmes, working in strong interaction. It should be coordinated by a national school of Veterinary Services where it exists, or by a school or a faculty of veterinary medicine. The proposed system of continuing education is illustrated by Figure 3.

**Training of teaching staff**

The training of veterinary officers, laboratory veterinarians, teachers in schools and faculties of veterinary medicine should be achieved in two directions:

- the acquisition of specific knowledge of OIE-listed diseases, wildlife diseases and rare events
- pedagogical and training engineering methods both to teach students and to design appropriate course content and selected relevant teaching methods.

For example, distance-learning courses can be organised, thanks to the availability of better information and communication technologies (ICT). Computer networks and broadband data exchange facilities are now widely available. Nevertheless, the effectiveness of distance learning must be compared with that of face-to-face training courses, where a direct contact with the trainer makes the transfer of knowledge easier. Moreover, communication facilities are often missing in developing countries, where training needs are the highest.

The veterinary education on OIE-listed diseases, wildlife diseases and rare events relies on the study of scientific literature, the practice of scientific research, but also on participation in practical workshops, as well as direct exposure to disease outbreaks or endemic situations. Teachers in veterinary schools often have only a theoretical knowledge of these diseases, because they have not been observed for a long time in their country. It is important to overcome this lack of practical expertise by participating in expert groups or international meetings, or better, by organising international exchanges to provide field experience. Financial support is needed to organise such international exchanges. There are means already available in bilateral cooperation programmes, and in international funding programmes such as the European Commission’s Framework Programme (FP) for Research and Technology Development. The Seventh FP, a ‘People’ programme for training and career development of researchers, is an example. Large, integrated research projects and excellence networks, are other opportunities for capacity building and involvement in an international and active research/training community.

A recent example is the EDEN project on emerging, vector-borne (human or zoonotic) diseases in a changing European environment (www.eden-fp6project.net/). This project involves 24 countries in Europe, the Middle East and Africa. After five years of activity, approximately 170 peer-reviewed papers have been published,
and 60 PhD theses have been achieved or are in progress, many of them involving young veterinarians as the students, and teachers in European veterinary schools or universities as the supervisors. Another example is the Epizone excellence network (www.epizone-eu.net/) for better control of animal diseases. This network has developed a specific theme on communication and education, ‘Spreading excellence’. It includes notably the possibility to implement study exchanges or the assessment of distance-learning tools.

Renewed training involves a deep knowledge of aetiology, pathogenesis, immunology, vaccinology, epidemiology, risk analysis, diagnosis and means of prevention and control of infectious diseases. The trainer must have a high level of skills in these domains. It is not possible to produce a skilled trainer in a few sessions without relying on a solid, scientific, practical and broad level of competence. In addition, initiatives strengthening the links between Northern and Southern countries should be promoted. Among such initiatives are continuing education on the infectiology and epidemiology of EIDs in Northern countries, with a sufficiently large participation of teachers coming from Southern countries, and vice versa. Twinning programmes also exist to create links between the veterinary education establishments of developed and developing countries, and these should be promoted. Recent initiatives have been developed in this direction by the Faculty of Veterinary Medicine, University of Liège (www.formcont.auwe.be and www.formavet.be) and the French Research Institute for Development (IRD) has initiated an international medical and veterinary entomology master course which is given at the Abomey-Calavi University (Benin), involving European and African students (www.mie.bj.refer.org/).

Figure 3 Interactions between trainers and veterinary practitioners within the framework of continuing education established to reinforce passive epidemiosurveillance

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Continuing education of veterinarians

Continuing education aims at updating the knowledge of veterinary practitioners. It is essential for young veterinarians with little experience in the matter of OIE-listed diseases, wildlife diseases and rare events, and also for older veterinarians with respect to new or emerging diseases. This updating of knowledge should be undertaken by high-level trainers. Sharing knowledge (for example, using focus groups) cannot be neglected: the experience of senior and foreign veterinarians who are regularly dealing with diseases of interest that are exotic in other countries increases the value of education (1).

The choice of topics depends on the risks of emergence or re-emergence of exotic diseases. An error of appreciation is possible: e.g. bovine spongiform encephalopathy in 1986, foot and mouth disease in 2001 and BT in northern Europe in 2006 remind us that emergence is always hard to foresee. The choice of diseases to address is easier when the disease has already emerged in other countries. Timely dissemination of information is thus possible for stakeholders. Another question related to the quality of education has not been solved yet: the period during which the educated veterinarian keeps a sufficient skill in passive epidemiomosurveillance. It may show large variations between individuals.

Assessment of knowledge acquisition

Continuing education should always be followed by an evaluation of the knowledge acquired by veterinary practitioners according to appropriate methods: exercises of simulation or settings in situation, for example (34). Indeed, numerous factors may reduce the assimilation of data, e.g. tiredness, professional stress, difficulty in memorising information and lack of attention.

Maintenance of knowledge

After the training course, and even if the course evaluation was satisfactory, details of what was learned only persist in the memory for a limited time. The estimation of the time at which refresher training is needed is important to maintain disease surveillance at a good quality level. Frequent updates are necessary, not only regarding emerging diseases, but also to refresh knowledge on endemic diseases. Veterinary practitioners have at their individual disposal different methods of support: their memory, scientific and medical books and papers, and also computer networks (e.g. the OIE website, www.oie.int), provided that a substantial effort was undertaken to place quality information on the internet, at their disposal, in their mother tongue.

Improving the detection of OIE-listed diseases, wildlife diseases and rare events

In addition to the quality of the veterinary practitioner, other factors influence the early detection of OIE-listed diseases, wildlife diseases and rare events. Livestock farmers and official Veterinary Services are other links upstream and downstream. A mutual confidence is required between all the disease surveillance stakeholders for a good acceptability of regulations and surveillance protocols. Important points are fair regulation, and communication that is appropriate in both quantity and quality. Expert systems (artificial intelligence) are also – or will soon be – available to veterinarians, for support in differential diagnosis of diseases (38, 40, 43, 52).

Conclusion and recommendations

Recent disease emergences, such as BT in Europe, have highlighted the need to reassess teaching objectives and contents for the prevention and control of OIE-listed diseases, wildlife diseases and rare events. The amount of subjects increases each year but it is not possible to increase accordingly the time allocated to teaching trainee veterinarians about all these diseases. Therefore, it is crucial for veterinarians to acquire and adopt an adequate mode of understanding of new diseases. Earlier clinical diagnosis, new concepts in infectiology, better skills in entomology, ecology, integrated ecosystem health, epidemiology and risk analysis must be covered. Teaching engineering (e.g. e-learning, skills of evidence-based veterinary medicine through case-based disease study or focus-group), and dissemination must be improved.
References


Session 2: Early detection, notification and surveillance


Legislation and surveillance

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Summary

By monitoring livestock health, Veterinary Services are contributing to food security and the food safety of animal products. To perform these key tasks, they must use techniques and implement decisions requiring a range of relevant, up-to-date information. Surveillance systems in all areas of veterinary public health, together with literature watch, are important tools for this task. This paper begins by placing the key areas of surveillance within their general veterinary context, seen from a ‘farm to fork’ angle. Next surveillance systems are discussed in terms of the legal environment of a constitutional state in order to show, with the aid of a few examples, that any revisions or changes in veterinary legislation should take into account aspects relating to data ownership, as well as to the conditions governing data collection and use.

Keywords: Surveillance – Veterinary legislation.

Introduction

The title of this paper should be ‘Surveillance and legislation’, rather than the reverse, because it is surveillance that is crucial and legislation serves only to provide a satisfactory framework for surveillance.

The author’s experience as a quality specialist has taught him that, for a system to be sound and sustainable, it must always be built on the strong and steadfast motivation of the stakeholders involved. This is possible only after asking the question ‘Why?’ and receiving a satisfactory or convincing answer.

By monitoring livestock health and the food safety of animal products, all the world’s Veterinary Services are contributing to food security, wealth creation, safe trade and public health, which makes Veterinary Services a global public good. There are no better reasons for striving to provide Veterinary Services with the structures and resources they need to operate.

Setting aside methods that require systematic and repetitive action, it is also acknowledged that the efficiency of a process relies not only on its fitness to perform the tasks at hand, but also on continual adjustment of that process to achieve the required outputs. Whether for design or evaluation, Veterinary Services must therefore have access to sufficient and necessary data. Most technical data come from surveillance.

Limiting the discussion to general principles, and for the purposes of this paper, all active and passive epidemiological surveillance techniques have been lumped together with science and literature watch under the term ‘surveillance’.

As surveillance performed in aid of Veterinary Services is a component of veterinary public service, inevitably it is subject to the law. It is therefore important for all operators involved in designing surveillance, particularly scientists, to be fully aware of the legal issues raised by surveillance, and it would also be useful to point out these problems to future Veterinary Administration practitioners as part of their training.

So, after reviewing the main points relating to surveillance in the field of veterinary public health, a few legal considerations are discussed.

Surveillance is crucial

All actions by Veterinary Services, particularly in the supervision of trade-related aspects of animal health, contribute to the key tasks mentioned earlier.

All intelligent action relies on the ability to adapt knowledge and techniques to the circumstances, based on any relevant new information that may enhance such knowledge and techniques. Surveillance for the purpose of producing information in real time is therefore seen as an essential and vital task of Veterinary Services.
Even though surveillance is not sufficient in itself, as action depends on the ability to utilise the information and resources provided, surveillance is still a necessary link in the chain for efficient action. (Efficiency means to achieve an objective using as few resources as possible. This term is used precisely to highlight the importance of cost-effectiveness, rather than just effectiveness, which does not include this notion.)

**Persistent situations**

In some cases, it seems, systematic procedures are applied on the basis of past experience or theory without even knowing whether they are useful or effective. One such example could be the application of periodic, systematic anti-parasite treatments without knowing the level of infestation or even the offending parasite, and without measuring either the gain in productivity or the resistance produced.

By contrast, biological, zootechnical or even climatological monitoring leads to a more efficient approach. This (hypothetical) case demonstrates that it is the utilisation of information (including species, incidence and importance, cost and weight gain) that makes this possible.

This group should include all the endemic pathologies for which the type and scale of the response should be based on a cost and results analysis, as the results can be highly variable, particularly in the case of public health. For instance it is clear that the prevention of a single case of human rabies cannot be compared with an episode of Newcastle disease.

Be that as it may, the response to a problem will rely on a formal or informal risk analysis, which can only be carried out on the basis of information, some of which will be provided by surveillance systems.

**New situations**

There are new events of which Veterinary Services must be aware at the earliest opportunity to enable them to decide what measures to take. Once again it is surveillance systems and their sensitivity that enable Veterinary Services to adopt the appropriate approach. However, the systems implemented must have been designed with this in mind and kept operational.

**Modern tool**

Surveillance systems have become essential in a general context where Veterinary Services are being given increasing responsibility and where efficiency takes precedence over effectiveness.

Evaluations of the performance of Veterinary Services (PVS evaluations) assign all the necessary importance to surveillance systems via the 12 critical competencies, in particular competencies II.3 (risk analysis), II.5 (epidemiological surveillance) and II.6 (early detection) of the second fundamental component (technical authority and capability).

**Scope of surveillance**

Apart from in the fields of literature and science watch, surveillance is useful in all areas of veterinary public health.

**Veterinary public health**

Unlike for English-speakers, for whom the term ‘veterinary public health’ refers chiefly to zoonoses and the food safety of animal products, the French consider this term to mean:

‘all actions relating directly or indirectly to animals and to animal products and by-products that help to safeguard, sustain and improve human health, that is to say human physical, mental and social well-being.’

It is in this very broad sense that the term is used here, and deliberately so.

Indeed, it shows that the veterinary field is very homogeneous and that ‘farm to fork’ is doubtless the most appropriate approach. For instance, residues are controlled not by product inspection but by the control of veterinary medicinal products; conversely, product inspection often provides useful information for monitoring livestock health.
Overall scheme

Animal production and animals can be seen as a complex at the centre of a network that gathers inputs and generates products and by-products, while at the same time maintaining relations with their environment (Figs 1 and 2).

This complex encompasses the full range of techniques for animal husbandry and breeding, trade and so on.

The safety of this complex relies largely on the quality of local or imported inputs, including:

- livestock feed
- veterinary products and quality of care
- the environment (habitat and wild fauna).

The safety of the resulting products also depends on, and indirectly provides information about, the situation upstream; this makes the products themselves an element of surveillance.

Points of surveillance

Clearly the supervision of veterinary public health will be facilitated by the adoption of a holistic approach, and most of the critical surveillance points can be pinpointed within the overall scheme.

For each critical point it will be necessary to identify the relevant data and the sources of such data, as well as the means for collecting and processing the data.

Technical tasks that rely on a combination of many competencies, such as clinical medicine, surveys, observation, laboratory results or information and data-processing systems, are complex and require specialists.

Proof of this is the huge array of networks, observatories and agencies operating in the areas of animal health, human health and food safety.
Operators
Anybody who comes into contact with relevant information is a potential surveillance actor. This may be the livestock producer or any other operator, but the key actor is the veterinarian. Generally speaking it is the veterinarian, at least in the realm of animal health, who is the first to come into contact with the information and is able to perform the initial selection. It goes to show the importance, first, of establishing a network to ensure access to information, and second, of supervising that network, to ensure the quality and homogeneity of the information. This is where legislation comes in.

Legal framework
Having established the need for surveillance, we can now address the means, and in particular the legal framework. Indeed, in addition to the technical difficulties there are legal constraints of which we should be aware.

The legal status of information can vary widely from country to country.

A distinction needs to be made between problems arising from the collection of information that is useful in enabling Veterinary Authorities to discharge their duties and those involved in the utilisation of that information. Collection of information is essentially a technical act, and the difficulties that arise are technical ones, but the use of information is governed by data protection and intellectual property laws which must be obeyed with care. The law on intellectual property is overseen by the World Intellectual Property Organization (WIPO).

Without going into detail, it is important to examine this subject because legally it is not always possible to set up surveillance simply on the basis of an administrative decision, and it is no accident that epidemiological surveys or access to information must be provided for in veterinary legislation.
At their summit in Bucharest in 2006, the heads of state and government using French as a common language (La Francophonie) undertook to intensify efforts to protect the fundamental right to the protection of personal data. In 2007, the chair, Omar Bongo, invited the French-speaking countries to translate their undertaking into concrete action, and Abdou Diouf stressed the need to implement all human rights.

In a world where four out of five countries have no legislation on data protection, we might well wonder what will become of societies that generate and use technologies that are ever more invasive of privacy (such as biometrics, geolocation and radio-frequency identification), and it is a subject that is sure to continue gaining momentum. Burkina Faso, the first African country to equip itself with data protection legislation, demonstrates that it is a universal concern.

The aim of this digression is to show that, however technical it may be, veterinary legislation cannot, and should not, be exempt from the societal and legal framework, but on the contrary, it should be integrated harmoniously into it.

**Constitutional state and governance**

To be simplistic, a constitutional state is one that respects the hierarchy of acts and the separation of the legislative, executive, and judicial powers of government.

Many constitutions protect individuals and their fundamental freedoms, especially:

- the right to property
- the right to privacy
- freedom of trade and work
- freedom of movement
- the right to privacy of communication.

Normally such rights and freedoms can be curtailed only by law, on the condition that it is in the public interest. This means that, whether or not specific legislation exists, it is inadmissible to gather information about a trade or profession or about animals (privately owned objects) without the minimum justification and guarantees. In theory, no ministerial decision, or even presidential decree (executive power), that is not backed by a legislative authorisation may demand that a test be conducted on an animal.

This shows that veterinary legislation cannot be built according to the vision of technicians alone, and that the entire context must be taken into account, regardless of how onerous this might be.

It should be emphasised that, in a constitutional state, it is not permitted to build compulsory surveillance networks or to gain access to certain data without legislative authorisation. While this does not preclude the contractual development of networks, such networks cannot be made compulsory.

**Information**

As most technical veterinary actions require information, it is necessary to identify that information and to determine the legal framework surrounding it in order to adopt the appropriate legislation, taking into account other laws. For example, how can medical information be obtained and used for research or animal health purposes when such information is covered by medical privilege, and how is it possible to find out about health events in a factory where trade secrecy is essential?

**Ethical categories of data**

Most of the data of use to Veterinary Services concern the various activities carried out in the veterinary field, the traceability of products and animals, and epidemiological information. Provided that they are limited to the requirements of the Veterinary Services and are not used for other purposes, they are material data that pose no ethical problems.

In all cases, respect for confidentiality and professional privilege is a requirement.

By contrast, medical data, especially on zoonoses and food poisoning outbreaks, are personal and come within a different ethical framework that veterinary legislation will need to take into account.
Types of data

Veterinary Services need both up-to-date ‘basic’ data and ‘incident’ data.

In the main, basic data comprise records of operators and animals. Added to this are data on strategic stocks (such as official stocks of veterinary medicinal products or food stocks). The law will simply stipulate that the competent authorities are authorised to collect, record and utilise these data, which it is compulsory to provide. The law will need to protect individual freedoms either by listing the classes of data and the uses that may be made of them, or by specifying the objective. The law should not hand over unlimited power to the executive.

Incident data are extremely variable in terms of their nature and source.

a) Disease reporting

A key piece of data is the compulsory notification of diseases or suspicions. Although most veterinary legislation provides for this, the form varies widely. Some legislation does not specify the diseases concerned, which gives inordinate power to the Veterinary Services, coupled with enormous responsibility, which they do not seem to consider. Other legislation relies on lists. In this case, the Veterinary Services are not allowed systematic and compulsory access to data concerning non-listed diseases.

Therefore, when respecting individual freedoms, great care must be taken to give Veterinary Services sufficient access to epidemiological data and to allow for rapid changes to these rights by enshrining them in regulations rather than in law.

b) Pathogens

While the problem of animal disease reporting is well known, that of pathogen reporting is not quite so well known.

Not all legislation makes it obligatory for laboratories, especially private ones, to transmit information on any pathogens they might encounter. This is particularly true for zoonoses.

So, even though the health services may provide anonymous statistics on brucellosis, for example, it is rare for Veterinary Services to be informed of human brucellosis diagnoses that they could use for epidemiological surveys.

A comparison of the zoonosis tables in the World Animal Health Information System (WAHIS) with the statistics of the World Health Organization (WHO) is sufficient to prove that no real interaction exists.

The only thing to distinguish Salmo nella enterica isolated in a medical laboratory from the same S. enterica isolated in a veterinary laboratory is the fact of whether it is notifiable. It is therefore the job of legislation to stipulate the cases where information should be communicated, and how this should be done.

c) Animal movements

As most legislation considers animals as chattels, the possession and use of animals is also governed by the law.

Identification, including the marking of animals or groups of animals and the registration of the corresponding data, is an item of basic data. All information on animal health and movements provides incident data of paramount importance. They have a direct impact on freedom of trade and may be regulated only by a legislative authorisation.

It is also necessary to ensure that the electronic processing of such data complies with the provisions in force, and that it is legal to use the data for surveillance purposes.

In many cases there is legislation on statistics that prohibits the release of basic data. It is the job of the law to describe the provisions governing satisfactory access for veterinary public health purposes.

d) Health alerts

Zoonoses and food poisoning outbreaks are very important items of information that veterinary legislation very seldom takes into account, and they are often handled by the public health authority. In spite of the difficulties surrounding personal medical information, it would be useful for veterinary legislation to take these subjects into account.
Data sources

There is nothing particularly problematic about the principle of collecting basic data. Although basic data can be difficult to collect and to keep up to date, this is more a problem of resources than a legal problem.

Sources of incident data vary widely, and a useful point to bear in mind is the duty of disclosure. In many instances, legislation makes it compulsory for ‘anyone who has knowledge’ on an issue of relevance, rather than just ‘the livestock keeper or the veterinarian’, to disclose information.

Added to this general obligation are special obligations, mainly for the purpose of settling legal disputes over professional secrecy or medical privilege.

Thus veterinary legislation will need to state explicitly the duties for laboratories, veterinarians or doctors to disclose certain data in compliance with their ethical obligations.

Networks

Each subject is a special case for which the relevant data, data sources and means of data collection and use must be defined. It is often sensible to entrust such activities to specialists unconnected with the Veterinary Administration. Except for networks operating on a voluntary or contractual basis, they should obey the same rules. Thus, for networks operating in regulated areas, the law will need to provide for the possibility of delegation.

OIE guidelines

The OIE guidelines for the development of veterinary legislation clearly demonstrate the importance of the legislative basis for surveillance operations. Twenty-five of the 200 recommendations relate directly to surveillance, not including inspection proper. They are listed in the Appendix.

Conclusions

At a time when there is concern for the good governance and performance of Veterinary Services, it is important for veterinary legislation to keep abreast of changing circumstances. A global public good should not be exempt from the principles of a constitutional state, and this must be taken into account when changing legislation. Surveillance, which is an essential tool for Veterinary Services and is based on the collection and utilisation of information, is a highly sensitive matter in terms of rights and freedoms.

This provides an opportunity to stress once again that veterinary legislation should be considered not as an isolated discipline solely for technicians but as a veterinary public health instrument that must comply with local legal and cultural practices.

Appendix: OIE guidelines for veterinary legislation: points relating to surveillance

Interventions by inspectors

Powers

Inspectors should have powers and procedures to:

(i) gain access to documents

(ii) take samples.

Part II: technical recommendations

Veterinary and paraveterinary professions

Laboratories in the veterinary field

The veterinary legislation should define the conditions for the classification, approval, operation and supervision of laboratories at each level.
Delegation of powers

General principles
The veterinary legislation should provide for the possibility of the competent authorities delegating specific tasks related to official activities.

The specific tasks delegated, the body(ies) to which the tasks are delegated and the conditions of supervision by the competent authority should be defined.

Health provisions relating to animal production

Identification and traceability
Veterinary legislation should address the following elements:

(ii) the possibility to make animal identification compulsory for certain species, regions or functions
(iii) the power of the competent authority to control movements of animals and changes of ownership
(v) the use of identification data for veterinary matters
(vii) the type of data to be recorded and the responsibilities of each party, notably those of animal keepers
(viii) the conduct of checks and corrections, as may be required to ensure the reliability of information in the database, notably in respect of animals that have died or have been slaughtered for any reason
(ix) respect for constitutional liberties by restricting the use, security and confidentiality of data.

Animal markets and other gatherings
Veterinary legislation should address the following elements:

(i) registration of all permanent or temporary animal markets and other animal gatherings.

Animal feed
Veterinary legislation should address the elements listed below:

(ii) registration and, if necessary, approval of establishments and the provision of health requirements for relevant operations.

Animal by-products (i.e. products not used for human consumption)
Veterinary legislation should address the elements listed below:

(iii) registration and, if necessary, approval of establishments and the provision of health requirements for relevant operations.

Animal diseases

Surveillance
Veterinary legislation should address the following elements:

(i) collection, transmission and utilisation of epidemiological data relevant to listed diseases
(ii) an early warning system.

Disease control
Veterinary legislation should address the following elements:

(i) different lists of diseases, with provision (as appropriate) for: emergency measures, or measures for prevention, control or eradication, or surveillance measures
(iii) arrangements for the declaration of animal diseases including on the grounds of suspicion
(iv) measures for official disease surveillance.
Veterinary legislation should provide for the following general measures:

(v) epidemiological investigations.

**Veterinary products**

*Quality of veterinary products*

To give effect to the objectives identified above, veterinary legislation should address the elements listed below:

(iv) surveillance for adverse effects arising from the use of veterinary products.

**Safeguards for the food production chain and traceability**

Veterinary legislation should address the following elements in order to ensure the food safety of animal products:

(i) recording all significant health events that occur during primary production

(vii) obligations for producers to withdraw from the marketplace all products likely to be hazardous for human or animal health.

The competent authority should have the necessary powers and means to rapidly withdraw any products deemed to be hazardous from the food chain or to prescribe uses or treatments that ensure the safety of such products for human or animal health.

*Premises and establishments pertaining to the food chain*

Veterinary legislation should address the following elements as appropriate:

(i) recording the coordinates of operators working within the food chain.
Législation et surveillance

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Résumé
En veillant à la santé du cheptel, les Services vétérinaires participent à la sécurité alimentaire et la sécurité sanitaire des aliments d’origine animale. L’exercice de ces missions fondamentales repose sur la mise en œuvre de techniques et de décisions qui nécessitent un ensemble d’informations pertinentes et actuelles. Les dispositifs de surveillance, dans tous les domaines de la santé publique vétérinaire et même de la veille documentaire constituent pour cela un outil majeur. Les points névralgiques de la surveillance sont d’abord replacés dans un schéma général du domaine vétérinaire envisagé de la fourche à la fourchette.

Dans un second temps les systèmes de surveillance sont discutés dans l’environnement juridique de l’État de droit afin de montrer, sur la base de quelques exemples, que la révision ou l’évolution des législations vétérinaires doit prendre en compte les aspects relatifs à la propriété des données ainsi qu’aux conditions de leur recueil ou de leur exploitation.

Mots clés: Législation vétérinaire – Surveillance.

Introduction
Je devrais plutôt dire « surveillance et législation » car c’est la surveillance qui est essentielle et la législation n’a pour objet que de lui donner un cadre satisfaisant.

Il faut retenir d’une expérience de qualiticien que la construction solide et durable d’un système repose toujours sur une motivation forte et constante des acteurs. Celle ci n’est possible que si le « pourquoi » a été posé et si la réponse apportée est satisfaisante ou convaincante.

Parce qu’en veillant à la santé des cheptels et à la qualité sanitaire de leurs productions, tous les Services vétérinaires du monde contribuent à la sécurité alimentaire, à la production de richesse, à la sécurité sanitaire des échanges et à la santé des populations, ils constituent un bien public mondial. Il n’y a pas de meilleures raisons pour s’attacher à donner aux Services vétérinaires les structures et les moyens nécessaires à leur action.

Or, si on néglige les méthodes fondées sur des actions systématiques et répétitives, il est également acquis que l’efficience d’un processus dépend de son adéquation aux tâches à réaliser d’une part et à son ajustement permanent en fonction des résultats obtenus d’autre part. Que ce soit au niveau de la conception ou de celui de l’évaluation, les Services vétérinaires ont donc besoin des données nécessaires et suffisantes. La plupart des données techniques sont issues de la surveillance.

Pour ne s’attacher qu’aux principes généraux, et pour les besoins de la présentation, nous confondons dans le terme de « surveillance » l’ensemble des techniques de surveillance épidémiologique active et passive ou même la veille scientifique et documentaire.

La surveillance réalisée au bénéfice des Services vétérinaires, est un des éléments de l’action publique vétérinaire. A ce titre elle ne saurait s’affranchir de l’environnement juridique.

Il est donc important que l’ensemble des opérateurs, notamment les scientifiques, qui participent à sa conception aient bien conscience des problèmes de droit que soulève la surveillance et il ne serait pas inutile que ceux ci soient également soulignés auprès des futurs praticiens de l’Administration vétérinaire dans le cadre de leur formation.

Après un rappel des principaux points de surveillance dans le champ de la santé publique vétérinaire, quelques éléments de droit seront donc évoqués.
Caractère fondamental de la surveillance

Toutes les actions des Services vétérinaires, notamment la maîtrise sanitaire des échanges contribuent aux missions fondamentales déjà évoquées.

Toute action intelligente repose sur la capacité d’adapter des connaissances et des techniques au contexte en fonction des informations nouvelles pertinentes qui viennent les enrichir. Dès lors, la surveillance qui a pour objet de produire de l’information en temps réel apparaît comme une fonction indispensable et vitale pour les Services vétérinaires.

Même si elle n’est pas suffisante puisqu’il faut aussi une capacité d’exploitation des informations et les moyens de l’action, elle reste un maillon nécessaire pour une action efficiente.

Les situations pérennes

On peut sans doute appliquer des procédures systématiques sur la base d’une expérience passée ou de la théorie sans même savoir si elles sont utiles ou si elles ont un effet. L’exemple pourrait en être certains traitements anti-parasitaires périodiques et systématiques où l’on traite sans connaître le niveau d’infestation, voire même les parasites en cause, et où on ne mesure ni le gain de productivité ni les résistances produites.

Au contraire le suivi biologique ou zootechnique voire climatologique permet d’adopter une attitude plus efficiente. On voit bien dans ce cas (hypothétique) que c’est l’exploitation d’information (espèces, incidence et importance, coût, gain de poids…) qui le permet.

Il faudrait ranger dans ce groupe toutes les pathologies endémiques pour lesquelles la nature et l’importance de la réponse devraient s’appuyer sur une étude coût-résultat, le résultat pouvant être d’essence très variable, particulièrement lorsqu’il à trait à la santé publique. Il est par exemple évident que la prévention d’un seul cas de rage humaine ne peut pas s’envisager de la même façon qu’un épisode de maladie de Newcastle.

Quoi qu’il en soit, la réponse à un problème reposera sur une analyse de risque –formelle ou non – qui n’est possible que sur la base d’informations dont une partie proviendra des systèmes de surveillance.

Les situations nouvelles

Restent enfin les évènements nouveaux dont il faut avoir connaissance au plut tôt pour pouvoir décider des mesures à prendre. Là encore ce sont les dispositifs de surveillance et leur sensibilité qui peuvent permettre aux Services vétérinaires d’adopter l’attitude pertinente. Encore faut-il que les systèmes aient été prévus pour cela, mis en place et maintenus en état de fonctionnement.

Outil moderne

Dans un contexte général où la responsabilité des Services vétérinaires apparaît de plus en plus et où l’efficience s’impose sur l’efficacité, les dispositifs de surveillance deviennent essentiels.

Les évaluations PVS y accordent d’ailleurs toute l’importance nécessaire au travers des 12 compétences critiques, notamment II.3 (Analyse de risque) II.5 (Surveillance épidémiologique) et II.6 (Détection précoce) de la deuxième composante fondamentale.

Champ de la surveillance

En faisant abstraction des domaines de la veille documentaire et scientifique, la surveillance trouve son utilité dans tous les domaines de la santé publique vétérinaire.

La santé publique vétérinaire

Contrairement aux anglophones pour qui le terme de « santé publique vétérinaire » désigne essentiellement les zoonoses et la salubrité des aliments d’origine animale, le même terme désigne pour les français:
«l’ensemble des actions qui sont en rapport direct ou indirect avec les animaux, leurs produits et sous-produits, dès lors qu’elles contribuent à la protection, à la conservation et à l’amélioration de la santé de l’Homme, c’est à dire son bien-être, physique, moral et social.»

C’est dans ce sens très large qu’il est employé ici et cela à dessein.

Cela permet en effet de rappeler que le domaine vétérinaire est très homogène et qu’une approche de la fourche à la fourchette est sans doute la plus pertinente. Par exemple c’est le contrôle de la pharmacie vétérinaire qui permet le contrôle des résidus et non pas l’inspection des produits ; inversement l’inspection des produits constitue souvent une source d’informations utiles à la maîtrise sanitaire des élevages.

**Le schéma global**

L’élevage et les animaux peuvent être vu comme un complexe au centre d’un réseau qui concentre des intrants et qui génère des produits et sous-produits tout en entretenant des rapports avec leur milieu (Figs 1 et 2).

Ce complexe englobe toutes les techniques d’élevage et de reproduction, d’échange et de commerce des animaux, etc...

La sécurité sanitaire de ce complexe dépend grandement de la qualité des intrants, locaux ou importés, au rang desquels figurent :

- Les aliments du bétail
- Les produits vétérinaires et la qualité des soins
- L’environnement (milieu et faune sauvage)

![Figure 1 Risque pour la santé animale](image-url)
La qualité sanitaire des produits qui en sont issu dépend également et renseigne indirectement sur la situation en amont : ils constituent ainsi eux-mêmes un élément de la surveillance.

Les points de surveillance

Il apparaît clairement que la maîtrise de la santé publique vétérinaire sera facilitée par une vision globale et l’on peut identifier sur le schéma la plupart des points critiques d’une surveillance.

Pour chacun d’eux il faudra identifier les données pertinentes, leurs sources ainsi que les moyens de recueil et de traitement.

Les aspects techniques qui reposent sur de nombreuses compétences alliant, entre autres, la clinique, les enquêtes, l’observation, les résultats de laboratoire ou les systèmes d’information et de traitement des données, sont complexes et requièrent des spécialistes.

Il suffirait pour s’en convaincre de regarder le nombre de réseaux, d’observatoires ou d’agences que ce soit en santé animale, en santé humaine ou en sécurité sanitaire des aliments.

Les opérateurs

Toute personne au contact de l’information pertinente est un acteur potentiel de la surveillance. Ce peut être l’éleveur ou n’importe quel opérateur mais il convient d’insister sur le vétérinaire. C’est lui qui, de manière très générale et en santé animale au moins, est au contact de la première information et est capable d’opérer le premier tri. C’est dire l’importance du maillage d’un territoire d’une part pour assurer l’accès à l’information et de son encadrement d’autre part pour en assurer la qualité et l’homogénéité. On entre ici dans la législation.


**Le contexte juridique**

Parce que nous avons établi la nécessité de la surveillance nous pouvons maintenant aborder les moyens et notamment le cadre juridique. Aux difficultés techniques s’ajoutent en effet des contraintes juridiques qu’il convient de connaître.

Selon les Etats, les informations peuvent avoir divers statuts juridiques.

Il convient de distinguer les problèmes liés aux informations produites et à leur exploitation qui relèvent du droit de la propriété intellectuelle (OMPI) et celui du recueil des données utiles à l’exercice des responsabilités des autorités vétérinaires qui nous intéresse ici.

Sans entrer dans le détail, il est important de s’interroger sur ce sujet car il n’est juridiquement pas toujours possible de mettre en place telle ou telle surveillance par une simple décision administrative et ce n’est pas par hasard qu’il faut prévoir dans la législation vétérinaire la possibilité d’enquête épidémio logique ou l’accès à l’information.


Dans un monde où 4/5 des Etats n’ont pas de législation sur la protection des données il y a pourtant lieu de s’interroger sur le devenir des sociétés qui génèrent et utilisent des technologies de plus en plus invasives pour la vie privée (biométrie, géolocalisation, RFID...) et il est certain que ce sujet ira en s’amplifiant. Le Burkina Faso, premier pays africain à se doter d’une telle législation, démontre que cette préoccupation est universelle.

Cette digression a pour but de montrer que la législation vétérinaire, aussi technique soit-elle, ne peut pas et ne doit pas s’affranchir du contexte sociétal et juridique mais au contraire s’y inscrire harmonieusement.

**Etat de droit et gouvernance**

De manière très simplifiée, l’Etat de droit est celui qui respecte la hiérarchie des textes et la séparation des trois pouvoirs législatif, exécutif et judiciaire.

Or beaucoup de Constitutions protègent l’individu et ses libertés fondamentales notamment en matière :

– de propriété
– de vie privée
– de liberté du commerce et du travail
– de déplacement
– du secret des communications.

Leur restriction est généralement du domaine exclusif de la Loi et à la condition d’un intérêt public.

Sur ces principes, qu’il existe une législation spécifique ou non, il n’est pas acceptable de recueillir une information sur une activité professionnelle ou sur des animaux (objets de propriété privée) sans un minimum de justification et de garanties. Dans cette hypothèse, une décision ministérielle ou même un décret présidentiel (pouvoir exécutif) qui ne repose pas sur une habilitation législative ne pourraient théoriquement pas imposer de faire un test sur un animal.

On voit donc qu’on ne peut pas construire une législation vétérinaire sur la seule vision des techniciens et qu’il faut prendre en compte l’ensemble du contexte, aussi pesant soit-il.

Il faut insister sur le fait que, dans un Etat de droit, on ne peut pas construire des réseaux de surveillance obligatoires ou accéder à certaines données sans une habilitation de nature législative.

Cela n’empêche pas cependant de développer des réseaux sur des bases contractuelles mais ceux ci ne peuvent pas être rendus obligatoires.
Les informations

La plupart des actions techniques vétérinaires nécessitant des informations, il est nécessaire de les identifier et de déterminer le cadre juridique qui les entoure afin d’adopter les textes appropriés en tenant compte des autres lois.

Comment par exemple obtenir et utiliser une information médicale pour les besoins de la recherche ou de la police sanitaire alors que ces informations sont par ailleurs couvertes par le secret médical ou connaître les événements sanitaires dans une usine où le secret industriel est essentiel.

Catégories éthiques de données

La plupart des données utiles aux Services vétérinaires concernent les différentes activités exercées dans le domaine vétérinaire, la traçabilité des produits et des animaux et les informations épidémiologiques. Il s’agit de données matérielles qui ne posent pas de problème d’éthique dès lors qu’elles sont limitées aux besoins des Services vétérinaires et qu’elles ne sont pas déviées de leur objet.

Dans tous les cas le respect de la confidentialité et du secret professionnel s'impose.

En revanche des données médicales, zoonoses et TIA en particulier, sont personnelles et entrent dans un cadre éthique différent dont la législation vétérinaire devra tenir compte.

Type des données

Les Services vétérinaires ont besoin des « données de base » tenues à jour et de « données incidentes ». Les premières consistent principalement en l’enregistrement des opérateurs et des animaux. On peut y ajouter les données de stock stratégique (médicaments vétérinaires d’intervention, stocks alimentaire…). La loi prévoira simplement que les autorités compétentes sont habilitées à recueillir, enregistrer et exploiter ces données dont la fourniture est obligatoire. Elle devra protéger les libertés individuelles soit en énumérant ces données et l’usage qui peut en être fait soit en précisant l’objectif. Elle ne devrait pas confier un pouvoir illimité à l’exécutif.

Les secondes sont extrêmement variables par leur nature et par leur source.

a) Déclaration des maladies

Une donnée essentielle est la déclaration obligatoire des maladies ou des suspicions. La plupart des législations vétérinaires la prévoient mais de manière très variable. Certaines ne précisent pas les maladies concernées ce qui donne un pouvoir exorbitant aux Services vétérinaires mais aussi une responsabilité qu’ils ne semblent pas mesurer. D’autres s’appuient sur des listes. Dans ce cas les Services vétérinaires ne peuvent pas accéder aux données relatives aux autres maladies de manière systématique et obligatoire.

Il faut donc faire très attention, dans le respect des libertés individuelles, à donner aux Services vétérinaires un accès suffisant aux données épidémiologiques et de permettre une évolution rapide de ces droits qui figureront plutôt dans les règlements que dans la loi.

b) Agents pathogènes

Alors que le problème de la déclaration des maladies animales est bien connu celui de la déclaration des pathogènes l’est un peu moins.

Toutes les législations n’intègrent pas l’obligation pour les laboratoires, privés en particulier, de transmettre des informations sur les pathogènes qu’ils rencontrent. C’est notamment vrai pour les zoonoses.

Ainsi, si les services de santé peuvent donner des statistiques anonymes sur la brucellose par exemple, il est rare que les SV soient informés des diagnostics de brucellose humaine qui pourraient être utilisés pour des enquêtes épidémiologiques.

Il suffit pour s’en convaincre de comparer les tableaux zoonoses de Wahis avec les statistiques OMS pour se rendre compte que le courant ne passe pas vraiment.

Or qu’est ce qui distingue une S. enterica isolée dans un laboratoire médical de celle isolée dans un laboratoire vétérinaire sinon le statut de déclaration obligatoire ou non. C’est donc à la législation d’envisager les cas qui justifient la communication d’information et sa forme.
c) Mouvements des animaux

L'animal étant dans la plupart des droits considéré comme un bien meuble, la réglementation de sa possession et de son usage, passe également par la Loi.

L'identification comprenant le marquage des animaux ou des lots et l'enregistrement des données correspondantes est une donnée de base. Toutes les informations sanitaires et de mouvement sont des données incidentes de la plus grande importance. Elles touchent directement à la liberté du commerce et ne peuvent être réglementées en dehors d'une habilitation législative.

Il faut en outre prendre garde à ce que le traitement informatisé de ces données respecte les dispositifs en vigueur et il faut s'assurer qu'elles pourront juridiquement être exploitées pour les besoins de la surveillance.

Il existe souvent des textes relatifs aux statistiques qui interdisent la fourniture des données de base : c'est à la loi de décrire les dispositifs permettant un accès satisfaisant pour les besoins de la santé publique vétérinaire.

d) Alertes sanitaires

Les zoonoses et les toxi-infections alimentaires sont des informations très importantes que peu de législations vétérinaires prennent en compte et elles ne sont souvent traitées que par l'autorité sanitaire. Malgré les difficultés propres aux informations à caractère médical personnel, il est bon que ces sujets soient pris en compte par la législation vétérinaire.

Source des données

Il n'y a pas de difficulté particulière sur le principe du recueil des données de base. Cela peut néanmoins être difficile à effectuer et à tenir à jour mais il s'agit de problèmes de moyens et non juridique.

Les données incidentes relèvent de sources très diverses et il est utile de préciser l'obligation de transmission. Ainsi beaucoup de législations prévoient « toute personne ayant connaissance … » et pas seulement « le détenteur des animaux ou le vétérinaire » sont tenus de déclarer…

A l'obligation générale il faut ajouter des obligations particulières, notamment parce qu'il y a lieu de régler des conflits juridiques en matière de secret professionnel ou médical.

Ainsi il faudra que la législation vétérinaire prévoie explicitement l’obligation de déclaration de certaines données pour les laboratoires, les vétérinaires ou les médecins dans le respect de leurs obligations déontologiques.

Réseaux

Chaque sujet est un cas particulier dont il faut déterminer les données pertinentes, les sources et les moyens de recueil et d'exploitation. Il est souvent judicieux de concéder ces activités à des spécialistes hors de l'administration vétérinaire. Sauf pour les réseaux fonctionnant sur des bases volontaires ou contractuelles, ils devront respecter les mêmes règles. Aussi, pour les réseaux intervenant dans les domaines réglementés, la loi devra prévoir la possibilité de délégation.

Les lignes directrices de l'OIE

L'importance de la base législative pour les opérations de surveillance transparaît très nettement dans les lignes directrices pour le développement de la législation vétérinaire de l'OIE. Sur les 200 recommandations 25 touchent directement à la surveillance, non compris l'inspection proprement dite. Elle sont regroupées en annexe.

Conclusions

Au moment où l'on se préoccupe de bonne gouvernance et de performance des Services vétérinaires, il est important que la législation vétérinaire soit en phase avec l'évolution des contextes. Un bien public mondial ne saurait être affranchi des principes de l'Etat de droit et il faut que les évolutions législatives en tiennent compte. La surveillance qui est un outil essentiel des Services vétérinaires et qui s'appuie sur le recueil et l'exploitation d'informations revêt un caractère très sensible en terme de liberté.
Cela me permet d’insister à nouveau sur la nécessité de ne pas considérer la législation vétérinaire comme une discipline isolée au service exclusif des techniciens mais comme un instrument de la santé publique vétérinaire qui se doit d’être conforme aux usages juridiques et culturels locaux.

**Annexe**

*Lignes directrices de l’OIE pour la législation vétérinaire : Points en rapports avec la surveillance*

**Interventions des inspecteurs**

**Pouvoirs**

Les inspecteurs devraient disposer des droits et des procédures leur permettant :

(i) d’accéder aux documents;  
(ii) d’effectuer des prélèvements.

**Partie II : recommandations techniques**

**Les professions vétérinaires et paraprofessionnelles vétérinaires**

*Laboratoires à compétence vétérinaire*

La législation vétérinaire devrait préciser les conditions pour la classification, l’agrément, le fonctionnement et le contrôle de chacun des niveaux de qualification des laboratoires.

**Les délégations**

*Principe général*

La législation vétérinaire devrait permettre aux autorités compétentes de déléguer des tâches spécifiques relevant de leurs attributions.

La définition des tâches déléguées, le(s) délégataire(s) et les conditions de contrôle par l’autorité compétente devraient être précisément définis.

**Dispositions sanitaires relatives à l’élevage**

*L’identification et la traçabilité*

La législation vétérinaire devrait:

(ii) prévoir la possibilité de la rendre obligatoire pour certaines espèces, territoires ou usages
(iii) autoriser le contrôle des mouvements des animaux par l’autorité compétente
(iv) permettre d’utiliser les données de l’identification pour les besoins du domaine vétérinaire
(vii) déterminer la nature des données devant être enregistrées et les responsabilités de chaque intervenants, notamment celles des détenteurs d’animaux
(viii) prévoir les contrôles et les corrections appropriées permettant d’assurer la fiabilité des données figurant dans les bases et prévoir notamment le retrait des animaux morts de quelque façon que ce soit
(ix) garantir les libertés constitutionnelles en limitant l’usage des données et en garantissant leur confidentialité et leur sécurité.

**Marchés et rassemblements d’animaux**

La législation vétérinaire devrait:

(i) imposer l’enregistrement de tous les marchés et rassemblement d’animaux permanent ou temporaire.

**L’alimentation animale**

La législation vétérinaire devrait prévoir:
(ii) L'enregistrement et, si nécessaire, l'agrément des entreprises et les règles sanitaires relatives aux opérations effectuées.

Les sous-produits animaux (impropres à la consommation humaine)
La législation vétérinaire devrait:
(iii) prévoir l'enregistrement et, si nécessaire, l'agrément des entreprises ainsi que les règles sanitaires relatives aux opérations effectuées;

Maladie des animaux
La surveillance
La législation vétérinaire devrait organiser:
(i) la collecte, la transmission et l'exploitation des données épidémio-logiques relatives aux maladies listées
(ii) un système d'alerte rapide.

La lutte contre les maladies
La législation vétérinaire devrait prévoir:
(i) différentes listes de maladie selon qu'elles nécessitent des mesures d'urgence ou des mesures de prévention et d'éradication ou des mesures de surveillance
(ii) l'organisation de la déclaration des maladies ou de leur suspicion
(v) les mesures de surveillance officielles;
La législation vétérinaire devrait comprendre les mesures générales suivantes:
(v) les recherches épidémio-logiques.

Pharmacie vétérinaire
Qualité des médicaments
En vue de la délivrance et du suivi des autorisations, la législation vétérinaire devrait prévoir
(iv) l'organisation de la pharmacovigilance.

Protection de la chaîne alimentaire et traçabilité
La législation vétérinaire devrait permettre de garantir la qualité sanitaire des denrées d'origine animale en:
(i) obligeant à l'enregistrement de tous les événements sanitaires intervenus pendant les phases de production primaires
(vii) obligeant les opérateurs à retirer du marché les produits susceptibles de présenter un danger pour la santé humaine ou animale.

L'autorité compétente devrait disposer de moyens juridiques pour retirer rapidement de la chaîne alimentaire tout produit à risque pour la santé humaine ou animale ou pour en prescrire une utilisation ou un traitement garantissant la santé humaine et animale,

Etalissages intervenant dans la chaîne alimentaire
La législation vétérinaire devrait quand nécessaire:
(i) permettre le recensement des opérateurs intervenant dans la chaîne alimentaire.
Session 3

Veterinary public health and the ‘Veterinary Services’ concept

Chair: Dr Jamil Gomes de Souza
The ‘Veterinary Services’ concept and the training of officials

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Summary
According to the international standards of the World Organisation for Animal Health (OIE), public Veterinary Services refers to the public policy conducted by the governments in the fields such as the fight against regulated contagious diseases, animal-origin food safety, international health certification and related issues. The Veterinary Services are considered as an international public good. Good governance in Veterinary Services means, inter alia, well-trained staff and public–private partnership.

It is estimated that, worldwide, about 10% of veterinarians will be involved in fields linked to public Veterinary Services activities. As most of them will not be given specific training, key concepts and tools of public action should be included in common veterinary curricula. This would also widen the capacity of veterinarians to react to new challenges.

The specific training of Veterinary Services staff is a major tool for human management and policy implementation in a given context. The common veterinary training can be completed by post-recruitment initial training (vocational training) organised by the employer and regular continuous education courses. Contents include scientific and technical knowledge, administrative knowledge and professional know-how.

Veterinary competencies linked with Veterinary Services activities are taken into account when evaluating the performance of national Veterinary Services using the OIE PVS tool. The OIE could usefully set up guidelines relative to veterinary education (a common veterinary curriculum and specific training for Veterinary Services staff).

Keywords: Continuous education – Official Veterinarians – Post-recruitment training – Veterinary education – Veterinary paraprofessionals – Veterinary Services – World Organisation for Animal Health (OIE).

Introduction
This paper aims to determine how veterinary education should contribute to the performance of the Veterinary Services policies worldwide.

The Veterinary Services and the veterinary profession play a fundamental role in society, by responding to important concerns of citizens, in fields such as:

- essential protein production
- food safety and security
- protecting animal health and welfare
- protecting public health
- poverty and malnutrition alleviation
- access to markets, wildlife, environment (6).

As public and private action complement each other, this paper proposes the notions which all veterinary students should be aware of in the field of action of public Veterinary Services, then focuses on the specific training that official veterinarians should be given.

Role and societal importance of national Veterinary Services
Depending on the countries, the role of public Veterinary Services can cover varied fields of action.
According to the international standards of the World Organisation for Animal Health (OIE) (7), adopted by consensus by OIE Members, national Veterinary Services are:

the governmental and non-governmental organisations that implement animal health and welfare measures and other standards and guidelines in the Terrestrial Animal Health Code (Terrestrial Code) in the country. The Veterinary Services are under the overall control and direction of the Veterinary Authority. Private sector organisations are normally accredited or approved to deliver functions by the Veterinary Authority.

The Veterinary Authority means:

the Governmental Authority of a Member Country, comprising veterinarians, other professionals and paraprofessionals, having the responsibility and competence for ensuring or supervising the implementation of animal health and welfare measures, international veterinary certification and other standards and guidelines in the Terrestrial Code in the whole country.

These definitions refer to public policy conducted in the fields such as the fight against regulated contagious diseases, animal-origin food safety (as a minimum at the production stage) and international health certification. They exclude the routine care of animals and zootecical actions such as artificial insemination even if in certain countries those actions are performed in whole or in part by civil servants.

For the implementation of collective actions managed by public Veterinary Services, numerous on-farm activities (such as vaccination, taking of samples and inspections) can be delegated to private veterinarians or to veterinary paraprofessionals working under the supervision of a veterinarian. Likewise, laboratory tests, the implementation of identification, etc. can be delegated to private entities (6).

The field of action of Veterinary Services in food safety varies depending on the country, either because public action in this matter remains limited (which is the case in numerous developing countries or countries in transition), or because those activities are shared with other services (5).

The Terrestrial Code (7) set up quality standards that Veterinary Services worldwide should comply with. These standards pertain, in particular, to:

– good governance and the adoption of efficient veterinary health policies
– legislation
– administrative organisation
– competencies
– the role of livestock keepers and private veterinarians in disease management
– transparency
– international veterinary certification
– human and financial resources.

The early detection of an emerging or re-emerging disease upon its occurrence and the rapid response to such events are crucial principles to be implemented.

A serious health-related event affecting the animal kingdom can have global consequences on the rural economy and food consumption, while at the same time presenting a threat to public health. This is why Veterinary Services are considered as an ‘international public good’ within the meaning attributed to that concept by the World Bank (investment decisions should not be based on their direct economic impact, but considered in relation to the benefit they bring to the entire society) (6). In this line, the responsibility and the interest of prosperous countries is to help developing countries to build or rebuild sustainable veterinary systems.

The OIE emphasises the importance of the good governance of animal health policies by national Veterinary Services, which should be directly linked with the country’s policy regarding rural development and food self-sufficiency.

Governance covers a complex set of public and societal actions which have as a final objective the optimal management of all animal diseases, food safety, animal welfare, wildlife health (disease monitoring), and even of the environmental impacts including those on biodiversity. Good governance is based on independent and impartial Veterinary Services that are able to enforce the strict application of the laws.
The efficiency of the Veterinary Services relies on sufficient resources, including human resources and well-trained veterinarians. The OIE tool for the evaluation of Performance of Veterinary Services (OIE PVS tool) has been designed to evaluate the quality and efficiency of the national Veterinary Services of a country. Two critical competencies out of 37 to be checked are focused on the competencies of veterinarians and veterinary paraprofessionals, which are directly linked to initial education, and on their continuous education (8).

**The common veterinary curriculum**

It is estimated that, worldwide, about 10% of veterinarians will be involved in fields linked to public Veterinary Services activities, either employed full-time or part-time (in particular in slaughterhouses) in the public Veterinary Services, or carrying out specific tasks on behalf of Veterinary Services (for example for the performance of on-farm activities).

As most of them will not be given specific training, it is of high importance that key concepts and tools of public action should be included in the common veterinary curricula.

In addition, this would be useful to all veterinarians, regardless of their intended future occupation. A better understanding of the evolving context of their trade, and of national and international stakes (in particular the international commitments of their country), would widen their capacity to react to new challenges and new opportunities.

This would also tend to limit the rivalry between the public and private sectors, so as to improve the performance of the veterinary health monitoring network. Indeed, all veterinary practitioners will have to interact, more or less closely, with official Veterinary Services – or at least they should do so. Alongside the livestock keepers, veterinarians stand sentry to detect contagious animal diseases, in particular zoonoses. They can support the public Veterinary Services for both routine matters and epizootic diseases. This concerns both the rural veterinarians and those in practices caring for companion animals (good examples of these needs are rabies and bird flu) (1).

**Contents**

The items to be taught in the common veterinary curriculum, and the pedagogical methods, depend on the situation of each country and region, in particular on the tasks the national Veterinary Services are in charge of. The national Veterinary Services could usefully be associated with the drawing-up of these contents.

The main headlines should be the same worldwide. This includes, in particular:

- understanding the scope of action of the public Veterinary Services (within the meaning of OIE standards)
- the societal importance of their missions
- the history of their structuring
- their involvement in animal health, animal welfare, essential protein supply, etc.

The quality standards of the national Veterinary Services need to be placed within the context of the actual situation in a specific country. Knowing the key elements of international governance implies studying the new global health services context, the competent international organisations, and the legal and economic aspects (1).

In Table I, the items marked (*) are to be considered for inclusion in common veterinary curricula. Including those notions in the common veterinary curriculum would be an innovative element that represents a strategic broadening of the professional culture of veterinarians (1).

**Training of officials**

Ideally, the veterinarians recruited into national Veterinary Services should be given specific training, in addition to the common veterinary curriculum, to acquire the knowledge, tools and soft skills (such as self-management skills) needed to carry out their assignments. This vocational training is not an objective in itself, but a tool for policy implementation in a given administrative and juridical framework.
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Table I  A non-exhaustive list of items to be considered

[A] Scientific and technical knowledge: scientific basis, practical aspects, inspection, regulation of:

- *epidemiology applied to public action (disease surveillance programmes, survey linked to disease outbreaks, etc.)
- food safety: food microbiology, food hygiene, physical and chemical contaminants
- food technology: methods of production, conservation, consumption; new products (especially imported) and related risks
- *management of food safety: hygiene, good practices, HACCP, food safety objectives, responsibilities of producers etc.
- *welfare and protection of animal etiology
- *wildlife protection – biodiversity
- environmental protection

* Remark: Contagious animal diseases, means of prevention and fight, national and international regulation, should be studied within the common veterinary curriculum as they represent core competencies for all veterinarians; however, it could be necessary that officials’ education goes further into these topics.

[B] Administrative knowledge

- *national law applied to the VS public sector (constitutional, criminal, administrative and common law) – regional and international regulations of concern
- public management, public policies
- public finances – cost of public policies
- *economics of agrifood production, agricultural policy etc.
- *VS: concept, evolution of missions – within the meaning of the International Standards (OIE) and within the national organisation
- *global governance in animal health and food safety:
  - OIE (including the rights and obligations of Member Countries)
  - FAO
  - Codex Alimentarius, WHO
  - World Trade Organization (WTO) – SPS Agreement
  - international (World Bank) and regional donors
  - the new global context and its consequences
- *risk analysis (according to WTO/SPS and OIE rules) – appropriate level of protection (ALOP)

* The privatisation policy pertaining to veterinary medicine and surgery (in the countries concerned).

[C] Professional know-how – soft skills

- human resource management, including sociology of organisations
- preparation and assessment of public policies
- (possibly) comparative administration
- *official inspection strategy, organisation and methods (first or second level) – programming of controls
- *communication, relations with the media, with consumers
- *crisis prevention and management
- IT systems
- (possibly) concepts of sociology of nutrition, anthropology
- foreign languages

* Items to be included in the common veterinary curriculum (and to be studied deeper in the specific curriculum for official veterinarians).

For purposes of simplicity, this paper focuses on the training of veterinarians who are devoted full-time (or most of their time) to the official tasks of public Veterinary Services, and who represent the backbone of the system. The training needs of other officials, when they occur (private veterinarians undertaking some official tasks on behalf of the public Veterinary Services, veterinary paraprofessionals, etc.), need to be considered with the same approach and in a comparable manner.

Properly directed, training of officials is a key tool for the management of Veterinary Services, underlined by the Veterinary Services policy. It is an essential vector for the transmission of values and a shared culture and for the capitalisation of know-how. It should aim to standardise practices and have these develop uniformly. Some decentralised States view the training of staff in administrative subdivisions as an instrument of guidance and coherence (5).
**Forms of training**

**Prior initial training**

Prior initial training designates the level of competencies acquired (or required) prior to recruitment into Veterinary Services. It is directly linked with the content and quality of the common veterinary curriculum. Deficiencies are often noted, undermining effective performance in the Veterinary Services. Disparities can exist between universities within the same country, or between veterinarians trained abroad in different countries.

Some countries have made it mandatory that applicants should have attended selected veterinary university courses in order for them to be eligible for public service or to qualify for higher posts.

**Post-recruitment initial training or vocational training**

Post-recruitment training, organised and paid for by the employer, is intended to supplement prior scientific training with the specific technical and administrative expertise that is required for working in public Veterinary Services.

Post-recruitment training makes it possible to introduce new concepts and new methods, and to update knowledge, in the Veterinary Services to which the young officials will be assigned.

This form of training is unknown in many countries, where learning occurs on the job. However, empirical training risks perpetuating bad habits, mistakes, compartmentalisation and divergent approaches among Veterinary Services. It is worst in small services, especially in developing countries, where a single poorly trained and inadequately equipped official might be assigned to a remote region.

Some Veterinary Services run short training sessions, lasting a few days or a few weeks, to present the central administrative processes and outline the legal dimension.

The practice of setting a 6, 12 or 24 month probationary period before job confirmation is frequent, with or without associated short training, and sometimes with tutoring.

There appear to be very few countries that provide long-term post-recruitment training for their civil servants. In France, veterinary officials in the Veterinary Services have been trained in the specialised postgraduate National School of Veterinary Services (ENSV) since 1973. This training, now also available to foreigners, lasts one to two years and covers technical aspects (Hazard Analysis and Critical Control Points [HACCP], environment, epidemiology, quality assurance and so on), administrative matters (law, economics, international politics etc.) and management (2). It prepares the ground for a range of appointments.

Within the European Union, a regulation relative to the integrated approach of official health controls (the ‘hygiene package’ of 2004) governs the recruitment of official veterinarians who have to pass an examination on a wide range of technical and administrative subjects (the actual training modalities are left for the Member States to decide) and should have received 200 hours of tutored practical training (4). However the subjects considered remain technical and do not address the governance of public policies and of the Veterinary Services.

**Continuous education**

Continuous education, or staff development training, serves to keep agents abreast of technical or administrative developments or to enable their career advancement. The basic format is generally a session lasting a few days and focusing on a specific occupational theme.

The critical competency about ‘Continuous education’ in the OIE PVS tool checks:

- access on a regular basis
- annual review and updating taking into account needs, new information or understanding
- implementation for part or all relevant personnel (8).

In many developing countries, personnel have only access to ad hoc training modules organised by international organisations.

On the other side, some countries include continuous education in a global policy of institutional training, with annual or even multi-annual programming organised by the employer ministry. The training sessions
are either organised directly by the administration or commissioned from universities, specialist schools or vocational associations, following tailored specifications.

Continuous education can be optional and free of charge to the agent. On the other hand, it is sometimes mandatory (the agent can even have to pay for it) for certain courses, with a minimum number of days each year or a system of points to be accumulated over a given period.

Contents

In summary terms, three types of knowledge need to be transmitted:

– the scientific and technical knowledge
– administrative knowledge, relating to specific areas of public control
– professional know-how, management, non-specific personal skills.

The span of technical/scientific subjects to be taught depends on the usual career of official veterinarians in the country, on the span of Veterinary Services missions and on the content of the prior initial training. Table I lists the main items to be considered (it is not exhaustive) (1, 2, 3, 4, 7).

Targeted expertise will depend on individual situations:

– command (mastery) for tolls and know-how needed for assigned missions
– knowledge, for technical elements not used in everyday practice but where intelligible discourse is required with highly qualified operators or colleagues
– awareness (introduction), for the more general elements.

Organisational concerns

The training can be entrusted to a specialised body which will be in a better position to accommodate the demands of employers and staff expectations. The employer will define the benchmark competences (the skills needed) while the training body will translate these into an appropriate instruction programme (the learning/pedagogical methods needed to acquire the skills).

Formal recognition of acquired competence (diploma) can be envisaged if the training is sufficiently long but is not usually needed for vocational training.

Whether initial or continuous training, and whether organised by an administration, a university or a public administration school, it is enriching to have a variety of course facilitators: lecturers in life sciences (veterinarians, technologists, toxicologists etc.), in law, economics, management, social sciences; representatives of administrations (the umbrella ministry, but also from the ministry of justice, trade, finance, the interior etc.); researchers, private operators and other relevant individuals.

Training trainers within the Veterinary Services will help to spread the training sessions. These trainers will receive instruction to go further in their specific domain of competency as in face-to-face training. They will need to use standard materials so that the training message can be coherent (transparencies, slides, exercises, trainer manual, course books etc.). Such materials can be developed during the training of trainers.

Many developments are expected from information and communication technologies (ICTs). Their actual content will have to be carefully designed. Remote training does not usually provide a full substitute for face-to-face training, in particular when it comes to personal skills and building professional networks.

Conclusion

Veterinary Services are one of the few public services defined in international standards. They are considered as an ‘international public good’ according to the impact of their activities on animal health, as on public health and nutrition.

The Terrestrial Code identifies the public tasks that national Veterinary Services should be in charge of, and sets up quality standards. All OIE member countries are committed to fulfilling these quality standards. Amongst others, the competency of Veterinary Services staff is a key point to be considered. The OIE PVS tool checks competencies and continuous education of Veterinary Services staff.
Many countries rely on skills gained during initial training in veterinary universities for their official veterinarians, but these do not always seem commensurate with the task at the end. Investing in human resources and especially in post-recruitment (vocational) training, as in continuous training, within a structured training policy, is the foundation of management of Veterinary Services. Indeed, the value of a structure resides primarily in its staff.

It can also be suggested that the common veterinary curriculum includes concepts relative to public action in animal health and the international and national governance of the Veterinary Services, as most of the veterinarians who will work in the public sector will not be given any specific training. This would benefit all veterinarians and lead to enhance the collaboration between the public and private sectors.

The OIE could usefully set up guidelines relative to the common veterinary curriculum and to the training of Veterinary Services staff, to support its Member Countries, using amongst other sources the experience gained by OIE PVS assessor and the competencies of its network of Collaborative Centres specialised in the training of Veterinary Services staff (Lyons, Buenos Aires, Minneapolis, Dakar).

Wanting to harmonise the systems as a first step would seem illusory, considering the institutional history for each country and the costs of more complex training systems. The author insists however on the importance of special vocational training, organised by the employer, which makes it possible to transmit technical tools and competencies, and also professional culture and values.

References


An introduction to veterinary public health

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Summary

In recent years there has been an increased recognition of the importance of veterinary public health, which has expanded to cover a multitude of aspects related to the animal–human–environment interface. Veterinary public health is a fundamental component of public health where the main objective is to enhance human health and well-being. The wide scope of this definition can create some difficulties in determining the precise role of veterinary public health from a practical perspective. Understanding these issues will enable the development of appropriate curricula for both undergraduate and postgraduate training, which will ensure that the veterinary profession is able to meet its increasing obligations at both national and international levels.

Keywords: Activities – Components – Curriculum – Definitions – Veterinary public health.

Introduction

In a rapidly changing world the relevance and importance of veterinary public health (VPH) as an essential component of public health has become more widely recognised. The drivers for this change are well documented and impact on many areas of veterinary activity. Globalisation of travel and trade, population changes and movements, urbanisation, climate change and global warming and many other factors all contribute to the way in which zoonotic diseases emerge and are transmitted around the globe. Many of these changes will impact on demand for food, which in turn has consequences for production, trade and consumption.

These and many other developments are already changing the role and contribution that the veterinary profession can make in the future. This in turn is acting as stimulus for a reappraisal of the undergraduate and postgraduate veterinary training requirements to meet the needs of society. To provide a brief overview and introduction to VPH the paper is divided into four short sections

– the concept of VPH
– the components of VPH
– the activities in VPH
– a curriculum for VPH.

The concept of veterinary public health

The first formal definition of VPH was published by the joint World Health Organization (WHO) and Food and Agriculture Organization of the United Nations (FAO) Expert Group on Zoonoses in 1951. The report stated that ‘veterinary public health comprises all the community efforts influencing and influenced by the veterinary medical arts and sciences applied to the prevention of diseases, protection of life, and promotion of the well being and efficiency of man’ (4). This institutionalisation of VPH by the international organisations had little impact on the degree of cooperation and collaboration between the two professions (veterinary and human medicine), which continued to drift apart in the late 20th Century (9).

An FAO/WHO joint technical report in 1975 modified the earlier definition and stated that ‘veterinary public health is a component of public health activities devoted to the application of professional veterinary skills, knowledge and resources for the protection and improvement of human health’ (5).

In the 1980s Schwabe introduced the term ‘one medicine’ (3) to emphasise the importance of a unified approach by the medical and veterinary professions to zoonoses. This has evolved into today’s ‘One Health’ approach, which seeks to promote partnership by developing increased cooperation and collaboration between professionals working in the human and veterinary fields.

The currently accepted definition of VPH endorsed by the WHO, FAO and the World Organisation for
Animal Health (OIE) was the output of a 1999 WHO consultation on ‘Future trends in veterinary public health’. This defined VPH as ‘the sum of all contributions to the physical, mental and social well-being of humans through an understanding and application of veterinary science’ (6). The new definition was more consistent with the original WHO definition for human health and also with the values, goals and targets of the WHO vision ‘Health for all in the 21st Century’.

The comprehensive nature of the new definition emphasised the importance of the VPH contribution to the mental and social well-being of humans in addition to physical well-being. This can lead to problems of determining what should be included within the remit of VPH. During the foot and mouth disease (FMD) outbreaks in the United Kingdom (UK) during 2001 and again in 2007 there was no evidence of transmission of the virus from animals to humans. The impact of these outbreaks and their control on the mental and social well-being of certain sectors of the population was considerable. Consequently it can be argued that VPH should incorporate the major non-zoonotic diseases which have an impact on animal production, animal health and welfare and which also affect the social and mental well-being of the public.

Since 1999 a number of other definitions have been used by various organisations working in the field of VPH. There can also be some confusion over the definitions, especially where organisations refer to VPH and food safety as separate topics. This is seen particularly in the European legislation (1) that specifies the training requirements for veterinary surgeons. VPH is not defined nor are details provided on the content of the public health component of the veterinary course, while VPH and food safety are considered separately.

One of the reasons for this may be that VPH is the discipline primarily of the veterinarian while food safety involves many other disciplines such as microbiologists, food scientists and technologists. In the report of the 1999 WHO consultation, it was considered that ‘Veterinary public health is an essential part of public health and includes various types of cooperation between the disciplines that link the health triad, people-animals-environment, and all of its interactions’ (6). In line with the ‘One Health’ concept the scope of VPH is clearly multidisciplinary, requiring a team approach involving many other professions.

The wide scope of the FAO/OIE/WHO definition can create some difficulties in determining the precise role and educational needs of VPH from a practical perspective. A clear understanding of the scope for VPH is important if a curriculum is to be developed to ensure that new veterinary graduates have a detailed understanding of the subject. It is equally important to differentiate between the topics to be included in the undergraduate curriculum and those that should be dealt with in post-graduate courses or as part of the life-long learning process.

The components of veterinary public health

In the 1999 WHO report veterinary science was considered a core discipline that performs essential public health functions (6). The report also indicated that veterinary science emphasises preventive, economic and population aspects of animal health and production, as they relate to human health and well-being. Taken at face value the currently accepted definition of VPH could imply that all veterinary activity could be considered to be part of VPH, which makes it necessary to identify clearly the core areas for VPH.

It is unrealistic and impractical to suggest that the whole of veterinary science is a component of VPH, although many of the disciplines within the umbrella of veterinary science will contribute to VPH. It is important to identify the specific components of VPH as opposed to those which provide the supporting scientific knowledge and expertise. A broad range of skills are required, with a focus on risk and the health needs of the population.

For practical purposes the main components of VPH can be considered to comprise the following:

- basic sciences
- risk analysis
- epidemiology and population medicine
- food hygiene, science and technology
- clinical skills.

Basic science

As VPH contributes to public health through the knowledge, skills and resources of veterinary science it is important to define the skills in veterinary science that are needed and for which training is required.
These include the acquisition of scientific knowledge and understanding of the basic areas of traditional veterinary science, such as bacteriology, virology, parasitology, pathology, immunology, pharmacology and toxicology. Generally these subjects are taught separately from a specific VPH course, but a comprehensive understanding of the basic sciences is critical in providing the framework on which VPH skills and activities depend.

**Risk analysis**

Many animal-related public health risks are complex especially when there is often uncertainty and inadequate scientific information available to support the introduction of evidence-based policies to control the risk. In some circumstances wide variations in public opinion can also be a significant risk factor. In these circumstances risk analysis, with its four main components of hazard identification, risk assessment, risk management and risk communication, is a central component of VPH. It provides the expertise essential for those working in VPH to assess and manage animal-related public health risks, and to communicate these risks to a range of stakeholders. VPH supports activities to improve human health by identifying, assessing and managing exposure to the hazards arising from animals, their products or the environment. Such hazards include zoonoses, chemicals and the drugs used in animals.

**Epidemiology and population medicine**

Unlike much of the work in human medicine which deals with individuals, VPH is about prevention and involves whole populations. Veterinary epidemiology is one of the main components of VPH. A wide spectrum of problems can be encountered in VPH when dealing with the complex interactions of animal–food–human and the environment. Investigations deal with populations of animals, people and food, and involve an exact definition of the questions to be answered and careful study designs to provide the answers.

**Food hygiene, science and technology**

In recent years there has been a shift to a more risk-based approach to food safety. This puts the emphasis firmly on audit, and moves away from inspection to the use of the hazard analysis critical control concept, and principles of good farming practice and good hygienic practice, where there is clarification on who does what, when, how and where. There is also a far greater emphasis on the longitudinal integration of all parts of the food chain, especially with the development of controls throughout the chain.

In European legislation (1) veterinarians require an adequate knowledge of the hygiene and technology involved in the production, manufacture and putting into circulation of animal foodstuffs, or foodstuffs of animal origin intended for human consumption. A knowledge of the laws, regulations and administrative provisions relating to these areas of work, including the production of foodstuffs, is also required.

**Clinical skills**

Clinical skills are also important, although these will not necessarily be taught under the umbrella of VPH. The abilities to examine animals, collect samples, reach diagnosis and where appropriate evaluate fitness for human consumption are essential for the veterinarian working in the field of VPH.

**The activities in veterinary public health**

In order to contribute effectively to activities covered by VPH, the veterinarian will need to draw on the expertise, knowledge and resources gained from the five components listed in the previous section. A number of publications have defined the activities and areas of importance for VPH (2, 6, 7, 8, 9). Traditionally VPH activity was focused primarily on zoonoses and food hygiene, which in spite of all the changes and new developments in the last decade remain the core activities. With the advent of the ‘One Health’ programmes and the all-embracing FAO/OIE/WHO definition, these activities have expanded, although they may vary from country to country. For convenience VPH activities fall into a number of related categories, many of which overlap. These are listed below:

- Zoonoses prevention and control, including diagnosis, surveillance, early identification of new and emerging infections, risk analysis, epidemiology, prevention, control and elimination of the zoonotic agents. This also includes all aspects of occupational health;
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- Food safety and increasingly food security and sustainability are important and long-standing activities within the remit of VPH. The quality, quantity and safety of food of animal origin is critical, as is the prevention and control of food-borne illness of animal origin. There is an overriding need to minimise the risk of biological, chemical and physical contamination entering the food chain through animal products produced in the country or imported from elsewhere around the world. It is equally important to ensure that non-zoonotic diseases such as FMD that can have a major impact on food production are controlled. The protection of drinking water is of specific importance, especially in the developing world;

- Environmental protection, which includes waste management, disposal of animal by-products, impact of medicines and a whole range of activities linked to vectors, water, wildlife and use of animal monitors;

- Animals in society, where it is well recognised that animals are important for social interactions and in certain cases for therapy. Ethical issues such as animal cloning could be included within this category, as could all aspects of animal welfare in production throughout the food chain;

- Liaison between all those professionals involved in protecting human health is critical to success. Developing joint policies to protect humans, successfully solving problems, identifying and conducting research, implementing control programmes in animals and humans and fostering good communication all depend on good liaison between the medical and veterinary professions (9);

- Other areas where liaison is important include those specific activities that cross professional boundaries. The list below is not comprehensive but gives an indication of some areas where VPH expertise can be involved:
  - biologics development and production
  - biomedical research
  - emergency actions including natural and human-induced disasters
  - health education and extension
  - management of public health emergencies
  - production and control of biological products and medical devices.

A curriculum for veterinary public health

There is debate in many countries concerning the structure of the core undergraduate curriculum and the time and resources available to teach the different subjects. While all veterinary faculties teach VPH in one form or another, the training varies considerably between countries, and sometimes even between veterinary schools in the same country. Often VPH is not seen as a clearly identifiable subject, especially when it is incorporated into other subjects such as clinical studies where it may have no obvious separate identity.

Trainee veterinarians may be taught about VPH during courses in basic sciences, where for example the public health significance of parasitic zoonoses would be covered in parasitology, while controls of these diseases could be dealt with in clinical studies. Often VPH is covered in those parts of the curriculum dealing with zoonoses, food safety and inspection, legislation, public health, technology of production or notifiable diseases, but it is not necessarily identified specifically as VPH. This is not necessarily a disadvantage, but there is a need for the curriculum to encourage integration of VPH concepts and to demonstrate the important role that veterinarians have to play in relation to human health throughout the entire veterinary teaching programme from the first year until graduation.

The previously described components of VPH should be taught in veterinary schools but the way in which each school formulates its curriculum must depend on the current and future needs of VPH in its own country. There must still remain an international component applying to all, and then the further differentiation could apply. It may also be feasible to develop and review the curriculum for VPH education at both the undergraduate and post-graduate level on a regional basis, since it is clear that different parts of the world have different needs when dealing with human health (2).

Conclusions

With the revived interest in VPH there is a need to ensure that existing university curricula enable veterinary science graduates to have confidence to work in VPH. The curriculum should encourage integration of VPH
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Concepts across the entire veterinary teaching programme. In order to integrate VPH into the goals of public health as proposed by the One Health concept, it is essential to improve the relationships between human medicine and veterinary science, with the potential for joint training where appropriate. To be successful all professionals active in the field of public health must have the knowledge and skills to address the issues, making use of the new insights and tools, and an awareness of the contributions that can be made by other professions.

The aim should be to produce graduates who are aware of and enthusiastic about the important role veterinarians have in public health in its broadest sense. Upon graduation veterinarians must have a basic foundation to build on, and must be equipped with the theoretical and practical knowledge, understanding and skills to pursue a structured progression from undergraduate level through the appropriate post-graduate training necessary to enable them to fulfil their roles and responsibilities and to face the opportunities and challenges of the 21st Century.

References


Risk evaluation in animal disease control: the perspective of a Veterinary Authority

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Summary

The veterinary world and livestock industry have changed considerably in recent decades. Intensive livestock keeping and international trade in animals and animal products have grown worldwide, and consumer protection is increasingly becoming the standard for activities related to the food chain. Activities of Veterinary Services have evolved accordingly and are increasingly regarded from the viewpoint of a healthier food chain. Despite this change in activities, animal diseases that are of no consequence for the food chain, including both zoonoses and animal diseases in the true sense of the word, are still of major concern for all veterinary services.

For Western Europe, these diseases include amongst others:

- animal diseases that have historically been important economically and are important from an animal health viewpoint, that have been eradicated from livestock but that might be reintroduced at any moment, e.g. foot and mouth disease (FMD), African swine fever and avian influenza
- animal diseases that are present or endemic in certain areas on the continent or that are maintained by a wildlife reservoir, and that can spread out at any moment, e.g. classical swine fever, bluetongue and Aujeszky’s disease
- exotic animal diseases that are pressing on the borders of the continent, e.g. African horse sickness
- zoonotic diseases – emerging, re-emerging or endemic – such as tuberculosis, West Nile fever and pandemic flu A/H1N1
- (zoonotic) diseases that show a sudden change in nature, e.g. Q fever.

In each of these examples, the major responsibility for the Veterinary Authorities lies in performing sufficient monitoring and surveillance and in managing good and swift disease control in case of outbreaks, the re-emergence or increased prevalence or pertinence of the disease.

In recent years, in view of the increasingly limited means at the disposal of most Veterinary Services and in order to make optimum use of the available resources, planning of activities by Veterinary Services has been based more and more on a scientifically based risk evaluation cycle.

In this cycle a given problem or threat is analysed and subsequently moulded into an action plan. Usually, this plan consists in monitoring and surveillance of the disease, paying particular attention to early detection of outbreaks, to factors promoting the spread of the disease and to disease control measures appropriate to the situation. Once the plan has been executed, the results are used to evaluate the original plan. This evaluation, combined with a reassessment of the situation in case circumstances have changed, will lead to the fine-tuning of the action plan, and subsequently to a continuous cycle of execution, evaluation and adaptation of the plan.

This risk evaluation cycle is the shared responsibility of both the Veterinary Authorities and the field veterinarians. The former are responsible for the elaboration and evaluation of the plan and for consciousness raising and information concerning the disease. The latter will play a key role in the execution of the plan and in the early detection and risk assessment of the disease.

From the point of view of the Veterinary Authority, the ideal field veterinarian or field staff should therefore:

- be well trained and skilled in dealing with animal diseases
- be specialised in the species or branch they are working in
- always keep an open mind and resist making routine decisions or taking a routine approach to the clinical cases presented
- be well aware and informed of legislation and new developments in the field
- have a good knowledge of the livestock industry
be ready to make quick and appropriate use of secondary facilities and second opinions (e.g. laboratory facilities, opinion of peers)
act independently (of industry)
be ready to collaborate with authorities.

For their part, staff performing the assessment and the elaboration and evaluation of the action plan should:

have a good technical and scientific knowledge of animal diseases
have a good practical knowledge of animal diseases
have a good knowledge of national and international legislation
have a good knowledge of livestock/industrial environment
have a good knowledge of national and international trade and trade flows
have a basic training in epidemiology
be able to pass on information on a comprehensible level.

Changed animal health policies, altered livestock-keeping practices and the increased scope of activities of Veterinary Authorities pose challenges for veterinarians and those training and supervising them, both during their education and in subsequently keeping up to date with information. These challenges are numerous, and include:

keeping up to date with knowledge on endemic, exotic, re-emerging and new animal diseases and zoonotic animal diseases, including both livestock and wildlife diseases
making sure that sufficient practical training in disease recognition and identification is organised for field veterinarians, specifically when a disease has been absent in the field for a long time
fine-tuning education to the specialism that is increasingly required in the field, where three different types of animal keeping can be observed – that is, large-scale industry, medium-sized (village) holdings and backyard/hobby holdings – each with its own problems
the continuing increase in scale of the livestock industry, which demands higher standards, poses specific demands with regard to diagnosis and treatment, leads to more devastating consequences in the event of outbreaks, and could bring about a conflict of interest as a result of the industry’s ‘farm to fork’ approach and its tendency to try to solve its own problems first before turning to the Veterinary Authority
the decrease in second-line laboratory facilities
the lack of sufficient platforms for peer consultation
the sensitisation of field veterinarians to biosecurity and prevention, zoonotic diseases and their importance as first-line risk assessors
scientific training in veterinary epidemiology.

It is clear that the education of fit-for-purpose veterinarians should not be limited to university or to studies to obtain a veterinary degree alone, but should be continued afterwards as well. Such continuous education can only be achieved by a combined effort of university faculties, post-university education bodies and Veterinary Authorities. These bodies need to pass on the necessary information in an exhaustive and comprehensive way, organise practical training and create the necessary platforms for peer consultation. A veterinary corps educated in this continuing and appropriate manner will then be able to assume its key role in the risk assessment of animal diseases.

Keywords: Control/monitoring of animal diseases – Field veterinarian – Risk analysis – Veterinary education and training – Veterinary Services.
Enhancing the role and participation of veterinarians in biomedical research

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Summary

The success of biomedical research is ever more critical to the needs of a growing world population and changes in our environment. Veterinarians with their broad understanding of comparative medicine and with appropriate advanced training are uniquely suited to conduct biomedical research, providing in-depth knowledge of a large number of medical specialties ranging from molecular biology to the clinical aspects of diseases in animal models and populations, to applied research that translates basic and clinical research findings into effective applications in real world settings. However, a critical challenge that biomedical research is confronting today remains the shortage of veterinarians with advanced biomedical research training. Evidence indicates that veterinarians as principal investigators continue to comprise an inadequately small percentage of funded scientists. A concerted effort to increase the number of veterinarians trained in biomedical research is needed to ensure their participation in providing solutions to the ever-increasing problems facing animal and human health.

Veterinarians are needed to serve key roles in the research of emerging and zoonotic diseases to safeguard our global food supplies, public and environmental health, and to make advances in chronic diseases such as cancer, diabetes and cardiovascular diseases through basic research in animal models and clinical research. It is critically important to increase the number of veterinarians engaged in leading research programmes involving integrative approaches that cross-cut scientific disciplines and translational research. Creating opportunities for veterinarians in biomedical research in academia, the private sector and government will be paramount to fully support the public health needs of industrial and developing countries worldwide.

To meet the growing need for research veterinarians, a critical requirement is ensuring that there are appropriate training programmes. We suggest that such programmes require multiple components which include early communication with veterinary students to enunciate the importance of hypothesis-based research training and outline career opportunities. Veterinarians trained in biomedical research will be well suited to take on significant, more influential positions in the public and private sectors, and partner with the biomedical research community to provide solutions to the public health challenges of the 21st Century.

Keywords: Animal health – Animal model – Biomedical research – Clinical research – Comparative medicine – Genomics – One Health – Veterinarian – Zoonotic disease.

Introduction

The significant scientific advances made in the last decade in cell biology and genomics have raised the expectations of society for more efficient and effective biomedical research programmes that will rapidly deliver new medical breakthroughs. Veterinarians with appropriate advanced education and training are in the exceptional position of having the necessary skill set to discover and test new concepts, and then to
translate these scientific advances into fully utilised medical and field applications for improving human, animal and environmental health. However, to meet this achievable vision and goal, a concerted effort is needed to address the shortage of veterinarians working in biomedical research. This paper recommends steps to enhance the role of veterinarians in basic, clinical and applied biomedical research, starting with enlarging the scope and purpose of traditional veterinary education and post-graduate training programmes.

Of late, the universe of biomedical research has too often been considered to include basic research, human clinical trials and public health research. The important and critical contributions of animal health research to improving human health and well-being have been under-supported or neglected altogether. An important step in enhancing the role of veterinarians in biomedical research is therefore to recognise animal health as an essential component of biomedical research. This is especially appropriate under the ‘One Medicine, One Health’ movement currently promoted by the One Health Commission (formerly the American Veterinary Medical Association (AVMA) and American Medical Association (AMA) Task Force on One Health) (8, 9). Accordingly, this paper underscores the importance of a broader and more global definition of biomedical research that includes animal health research, with its focus on the health of humans and all domestic animals, as a critical path towards understanding human physiology, pathology and genetics, as well as effective translational research programmes that test and deliver solutions. Including animal health in the field of biomedical research will also have a fundamental impact on the delivery of preventive measures to combat new and emerging infectious diseases, most of which are zoonotic, and preventive measures to protect our food supply, preventive and therapeutic interventions for chronic diseases such as mental health, cancer, diabetes and cardiovascular diseases, as well as improvements in environmental health.

**A long history of contributions by veterinarians working in biomedical research**

Veterinarians have historically played a critical role in the discovery of some of the most important medical breakthroughs of the 19th and 20th Centuries. Notable contributions include Henri-Mamer-Onésime Delafond who is remembered for his pioneer research on *Bacillus anthracis*, the causative organism of anthrax (24); Jean-Joseph-Henri Toussaint who first cultured *Pasteurella multocida*, the causative organism of fowl cholera, which enabled Louis Pasteur to develop one of the first vaccines (20); Jean-Marie Camille Guérin, who co-discovered the first BCG vaccine against tuberculosis (7); Bernhard Lauritz Frederik Bang, the Danish veterinary pathologist who discovered *Brucella abortus* in 1897 (11); Robert Royston Amos ('Robin') Coombs, the veterinary immunologist who co-discovered the Coombs test (4); and Peter Charles Doherty, an Australian veterinary surgeon and researcher who received the Nobel Prize in Physiology or Medicine jointly with Rolf M. Zinkernagel in 1996 (5).

Although veterinarians continue to make significant contributions to medicine through animal research, there is a dearth of information available on veterinarians in biomedical research (13). The importance of veterinarians taking what are considered ‘non-practice’ alternative career paths in research at universities, and in government and industry is well understood (12). The organisations that have targeted and traditionally sustained careers paths for veterinarians in research are first and foremost universities, but many veterinarians also have critical roles in the research mission of government institutions and the pharmaceutical industry. A central role for veterinary scientists is their ability to understand and bridge independent but related initiatives in universities, government and industry into productive collaborative relationships.

**Universities**

Veterinarians with advanced degrees form the core faculty in colleges of veterinary medicine, and are essential for research, teaching and outreach programmes. The combined Doctor of Veterinary Medicine (DVM) and PhD degrees provide an excellent and unique background for applying fundamental new knowledge of basic science and conducting translational research to develop new therapeutics and vaccines for improving animal and public health. Faculties with DVM and PhD degrees are needed to conduct research on important diseases of food-producing animals and companion animals, and on animal models of human disease. They are also essential for conducting research on domestic animals with naturally occurring genetic, metabolic and infectious diseases in clinical settings at veterinary teaching hospitals. Veterinary teaching hospitals are typically the premier tertiary care facilities for patients referred from their
region, and have a rich case load of patients with unique conditions. These naturally occurring conditions are extremely valuable models for understanding basic mechanisms of disease pathogenesis, which can lead to improved diagnostics and therapeutics for both animal and human health.

There is a critical shortage of DVM/PhD research scientists and teachers to train future veterinary scientists, especially in high-priority areas of infectious diseases. They provide very important role models for veterinary students. In the United States of America (USA), there is a serious shortage of veterinarians in rural agricultural areas, federal government agencies, and in disciplines such as public health and food safety. Veterinarians are an integral part of effective public health systems. The majority of the biological agents that pose the highest risk to public health cause diseases that can be transmitted from animals to humans; veterinarians have expertise in diagnosing, preventing and controlling these diseases.

The shortage of veterinarians with advanced degrees leads to the hiring of non-DVM faculty at colleges of veterinary medicine. Paramount to the research mission of veterinary colleges, non-DVM faculty members provide core competencies in applying successfully for grants and conducting and publishing researcher results. However, the research may not be focused on problems related to veterinary medicine; rather it might be focused on models for human disease (10). While this is critically important research, it often does not directly solve important problems in animal health, public health and food production. Veterinarians with PhD degrees are key partners in the ‘One Health’ approach to solving these problems. Federal funding agencies need to increase the emphasis on translational research and ‘One Health’ initiatives when producing calls for proposals and making funding decisions.

Government

Although there is a great diversity of employment opportunities for veterinarians in state and federal governments, there is no single educational background beyond the DVM that prepares a veterinarian for these opportunities. Most veterinarians in the federal government of the USA work for action and regulatory agencies (Table I). The majority work for the Department of Agriculture (USDA) (58%), followed by the Department of Defense (22%), and Health and Human Services (10%). Veterinarians working in these positions require additional experience and education in medicine and epidemiology. A small number of veterinarians work in biomedical research, but the majority work in agencies with human health missions and not agriculture. For example, only 40 veterinarians work for the Agricultural Research Service (ARS), as both support scientists and primary investigators, while 85 work for the National Institutes of Health (NIH) and 77 for the Centers for Disease Control and Prevention (CDC). Educational and experience requirements leading a veterinarian to a successful biomedical research career in federal agencies involve an intense period of mentored research training. It is in part the requirement of this additional training that currently restricts the number of veterinarians available for biomedical research positions in the federal government of the USA. Additionally, the numerous other opportunities available to research-trained veterinarians in industry limit the available pool for recruitment by state universities and federal research agencies in the USA.

Developing science-based solutions to the current and emerging disease challenges facing animal agriculture, including those at the animal–human interface, requires an increase in the number of research-trained veterinarians. Increasing the pool of veterinarians trained in biomedical research in the federal government of the USA requires the development of financial incentives to recruit and retain from the current pool of research veterinarians; including a role for research veterinarians in the mentoring/education of the next generation (before their career decisions are made), and developing partnerships with veterinary schools for the undergraduate recruitment of veterinary students interested in research careers.

Animal health industry

The animal health industry employs veterinarians in a wide array of positions that centre on the development, regulatory review, marketing and sale of animal health products such as drugs, vaccines, foods and nutritional supplements. The trends for compensation (that is, salary and associated rewards) in these ‘non-practice’ alternative career paths have been increasing significantly for the two decades since 1990 in the USA, with veterinarians reporting salaries of greater than US$200,000 annually in 2003 (19). A significant number of jobs in the multidimensional animal industries include positions in traditional research and development, toxicology, microbiology, pathology, genomics and molecular sciences, all of which require additional training beyond a veterinary degree.
Veterinarians in the human and veterinary pharmaceutical industry provide an array of medical, business and scientific contributions to the delivery of new pharmaceutical products and vaccines. The level of scientific training required for these various jobs ranges from basic clinical knowledge associated with a veterinary degree and private veterinary practice experience, to advanced research training at both master’s and PhD levels. In addition, it is critical to have a working knowledge of the business of veterinary medicine with regard to health management of food and companion animals. Pharmaceutical companies strive to provide customers with the best-quality products possible, and for most customers, obtaining a return on their investment is one component of what is viewed as a quality product. The veterinary divisions of these companies often leverage the knowledge gained out of their human health research and development divisions. Thus, having veterinarians positioned within a company to recognise potential veterinary applications of drugs at early stages of new drug discovery and development will provide opportunities for novel drug discovery – and uses for currently unmet veterinary medical needs. Veterinarians are uniquely
positioned with their academic training to recognise a wide range of clinical applications of new drugs with highly specific mechanisms of action that might apply across several animal species – sometimes in treatment of diseases quite different from the original human disease target. It is equally important for veterinarians engaged in biomedical research to recognise the possibility of a broad potential impact of their research when investigating diseases in animals where animal models for human diseases are not currently available or are limited to rodent models that may not be predictive of success in humans.

Gaps and challenges

There is a critical shortage of veterinary scientists in all segments of biomedical research (12, 25). At the root of these shortages are gaps in education, post-graduate training, funding and food animal medicine.

Education

The AVMA reported in 2008 that the mean age of veterinary graduates in the USA was 27.9 years (18). The AVMA further reported that of the 554 new veterinary graduates seeking an advanced degree, only 13 were seeking a PhD (2.3%). Of the 1,525 veterinary graduates in the USA seeking employment in 2009, 43.5% accepted positions in advanced education, but only 2.1% of veterinary graduates pursued advanced education involving a graduate degree (MPH, MPVM, MS or PhD) (17). Of the veterinary graduates seeking advanced education, 90% pursued specialty internships in companion animals (76%), equine (18%), exotic animals (2.3%) or food animals (2.2%). The mean annual starting salary for veterinary graduates seeking advanced education was US$28,545 versus US$64,185 for graduates accepting positions in private practice. The mean educational debt among 2009 veterinary graduates with debt (86.6%) was US$129,976. Thus the cost of continuing education in the USA after obtaining a veterinary degree is prohibitive on both the personal and financial levels.

Postgraduate training

As indicated above, the financial and personal cost of obtaining DVM and PhD degrees is a major disincentive for students considering career pathways. They often have a high debt load after completing the DVM degree and would need to spend several more years with high expenses and low income before completing a PhD and securing a stable professional position. This is especially true for those who desire to become faculty members. The DVM degree in the USA requires on average eight years of study (four years of undergraduate studies followed by four years in an accredited veterinary school); a significant number of graduates have eight years or more. The PhD requires an additional four to six years. Most universities require mentored postdoctoral experience in order for an individual to be eligible for a tenure-track assistant professor position. Postdoctoral positions often last from three to six years. After being hired into an assistant professor position, seven years are typically required to achieve tenure. The requirements for achieving tenure have increased at many universities in recent years. The veterinarian seeking a faculty position will usually need to relocate for the PhD programme, and again for the postdoctoral programme and assistant professor position. If the person has a family, the spouse may need to find new employment each time and children are uprooted from schools and friends.

Universities could help this situation by recognising the importance of the DVM degree and the extra time required to achieve that degree. The individual with a DVM/PhD will typically already have had four more years of intensive education than a candidate with only a PhD degree. Therefore, innovative approaches could be used to shorten the process; for example, DVM/PhD candidates who are brought into a heavily mentored environment for two to four years to gain the skills necessary to successfully publish papers and write grant applications could then transition to a tenure-track position at the same institution.

Universities, federal agencies and industry should also recognise the extensive and unique training of veterinary scientists with DVM and PhD degrees by providing higher salaries that are commensurate with the extra training required. Federal funding agencies should provide more grant programmes to fund PhD training for DVMs. They should also increase student loan forgiveness programmes for DVMs pursuing advanced training. These incentives are essential to increase the number of DVM PhD scientists to meet the needs of society in coming years.
Finally, as indicated in the section concerning careers for veterinary scientists in state and federal governments in the USA, there is a primary requirement for a period of intense, mentored research training. Critical aspects of this training include didactic course work, which should be minimised and structured to provide a solid foundation in statistics, molecular biology, epidemiology and disease pathogenesis, and importantly mentoring in the writing of clear, cohesive and persuasive research proposals. Paramount to this training is the ability to write testable hypotheses. In addition to the more traditional research training opportunities concerning primarily problems in agriculture, the training opportunities need to be expanded to include issues at the human–animal interface.

**Funding**

The relative investment in animal health research in the USA has historically been low, and insufficient to support basic and applied research programmes, with the large majority of federal funding being appropriated for research in defence, human health and plant sciences (14).

The investment of the government of the USA in non-defence research and development (R&D) in the last 20 years has averaged 0.4% of gross domestic product (GDP) (1, Table I-3). For fiscal year 2010, the total federal R&D in the USA budget will be US$147.525 billion, with US$79.989 billion appropriated for defence (military) research, US$30.184 billion appropriated for human health research at the National Institutes of Health, and only US$2.243 billion appropriated for agricultural research (1, Table I-1). This US$2.243 billion investment in agricultural research consists of US$1.283 billion for Agricultural Research Services (ARS), the intramural research arm of the USDA, and US$1.343 billion for the National Institute for Food and Agriculture (NIFA), which administers the USDA’s extramural research programme.

The ARS budget for the Animal Health National Program (NP 103) in 2010 is approximately US$71 million (Jill Stetka, ARS, personal communication), or 5.5% of the entire USDA intramural research portfolio. Similarly, the Agriculture and Food Research Initiative (AFRI), the USDA competitive grants extramural research programme, includes approximately US$12 million for animal health research (Peter Johnson, NIFA, personal communication) out of a total of US$262 million, or 4.5% of the AFRI funds appropriated for fiscal year 2010 (2).

Adequate funding for animal health research in government, universities and the private sector is paramount if biomedical research programmes are to sustain careers for veterinary scientists.

**Food animals**

The critical need for veterinarians with research training is probably best understood when considering food animals. The central role of food animals in providing global protein and contributing to the economy in developed and developing countries points to the critical need for veterinarians trained in the diagnosis and prevention of infectious diseases. A primary example is foot and mouth disease (FMD). Many countries are free of FMD infection and maintain free status through strict import restrictions enforced by regulatory veterinarians. The concern with this strategy is that cattle, swine and sheep populations in FMD-free countries are fully susceptible because of the lack of population immunity. Enhanced global trade and the resulting increased movement of animals and animal products puts great stress on the maintenance of FMD-free status. Novel vaccines and control strategies are needed to ensure that introduction of diseases such as FMD in countries with naïve populations can be limited in terms of animal health and economic impact. Veterinary scientists are necessary to develop such tools to assure stable protein supplies and economic stability.

There is also a need for basic scientific knowledge on how to better control diseases in food animals. Many of the challenges facing veterinary medicine in food animal practice are disease problems that are not amenable to the traditional methods of antimicrobial therapy and vaccination, or they require novel vaccines to provide protection but these vaccines may require more extensive research than is required for a simple inactivated vaccine approach. Moreover, some diseases do not rise to the economic threat level necessary to support the cost of regulatory approval of a vaccine. Finally, once a disease achieves foreign animal disease status in a country, it takes on a whole new set of challenges with regards to features of vaccines used that allow a country to maintain its freedom from disease status. A new challenge for veterinary scientists is increased laboratory biosecurity requirements and the additional expenses associated with these requirements. These increased demands also raise the diligence required by scientists to interact and comply with various regulatory agencies.
For some diseases, entirely new approaches to preventing economic losses may be required. Veterinarians have unique opportunities to view the pathophysiological effects of diseases at both the individual animal and herd level. This perspective and the ability to manage disease problems on a herd-level basis is sometimes easier to implement in a food animal production setting than when dealing with individual companion animals. One example of this is the reduction of clinical infectious diseases (mastitis, metritis and retained placental membranes) in postpartum dairy cows through the prevention of parturient paresis and subclinical hypocalcemia caused by metabolic alkalosis.

A broader view of health problems often affords a new perspective on the underlying causes of disease. Training in veterinary medicine provides a comprehensive view of physiology, nutrition and immunity; when this is coupled with an advanced research degree, advances in our understanding of factors contributing to some of the more complex disease syndromes often emerge.

Another important challenge for the veterinary scientist is the current environmental changes that are shrinking the urban–rural divide and increasing societal pressures on public lands for both grazing and recreation. This shrinking divide has led to infectious disease problems at the wildlife–domestic animal interface such as brucellosis in wildlife and cattle and bacterial pneumonia in bighorn and domestic sheep. Veterinary scientists are uniquely qualified to provide solutions for these important problems impacting on the food supply, the health of both wildlife and domestic animals, and land use issues.

Dire predictions of a shortage of veterinary scientists in the USA have been heard for decades, and inevitably these predictions have come true. The lower numbers of graduates in selected fields of scientific endeavour in the USA may be linked to uncertainty around career opportunities and lower salaries relative to careers in medicine, law and finance.

There is a significant shortage of veterinarians with scientific expertise in food animal biomedical research at universities and federal agencies. Figures in Table I indicate a federal veterinarian work force in the USA of just over 3,000; however, fewer than 1.8% of these veterinarians (i.e. Agricultural Research Service veterinarians) are actively engaged in leading or conducting biomedical research for animal health. Shortages of veterinarians with advanced graduate degrees also exist in the pharmaceutical and biological industries. The resulting impact is that necessary research to solve veterinary medical problems may not always benefit from the most recent information from the scientific community.

**Enhancing the role of veterinarians in biomedical research**

Although significant challenges remain, there are many opportunities for veterinarians to enhance their role in biomedical research. Some of the most important opportunities include increasing the participation of veterinarians as primary investigators in animal and human health research, in new scientific disciplines such as genomics, and taking on leadership roles in the public and private sectors.

**Primary investigators**

There is an important distinction to be made between veterinarians who work in biomedical research as support scientists, and veterinarians who lead research programmes as principal investigators and research collaborators. While both are needed and face critical shortages, the need for veterinarians as support scientists in areas such as laboratory animal medicine has taken centre stage in the USA, and dominates the call for more veterinarians in biomedical research (12). However, perhaps the biggest issue is to actually ensure that veterinarians have a role as primary investigators. This will enable the veterinary profession to make important contributions in biomedical research that are uniquely suited to their training, knowledge and skills. An important step in that direction will be to create new opportunities for veterinarians to undertake careers in biomedical research and empower them as primary investigators. This will raise the intrinsic job satisfaction of veterinarians who undertake careers in biomedical research, when they know there is a possibility to enhance their careers as primary investigators through the conduct of good basic and applied research that is focused on the needs not only of human health but of veterinary medicine as well. This necessarily demands that a career in veterinary biomedical research should not be considered subservient to human biomedical research needs.
**Animal health**

Key to enhancing the role of veterinarians in biomedical research on animal health (i.e. research conducted for the direct benefit of animals) will be the recruitment, training and retention of high-quality veterinary scientists in the field of animal health. A long-term commitment to greatly increasing funding for animal health research by the government of the USA would go a long way towards increasing the attractiveness of impactful careers in veterinary biomedical research.

Although the medical community recognises and embraces the importance of animal health research, and especially the needed investments in comparative medicine, most biomedical research programmes that utilise animal models are dominated by the use of rodents, especially mice.

**‘One Medicine, One Health’**

The demands of society for rapid medical breakthroughs to address the public health challenges of the 21st Century are challenging the biomedical research community to create more efficient and effective translational research programmes. Veterinarians interested in research at the animal-human interface (zoonoses) often receive their training at a medical school. While this training is certainly appropriate in meeting the majority of needs for a career in biomedical research, additional training is required to truly bridge the gap with animal health issues. This is especially critical for agricultural research in animal production systems and food safety, which is the source of the large majority of zoonotic diseases affecting animals and human health.

Although the medical community recognises and embraces the importance of animal health research, especially the needed investments in comparative medicine, most biomedical research programmes that use animal models are dominated by the use of rodents, especially mice. This presents tremendous opportunities for animal health research programmes as over 70% of public health threats are zoonotic diseases, many of which are diseases of livestock, poultry, and wildlife (9). The ‘One Medicine, One Health’ concept promoted by the AMA and AVMA should therefore champion the training of veterinarians to support biomedical research, but also take concrete steps to support veterinarians to lead research programmes as principal investigators in animal research. Veterinarians are also in the unique position of having the necessary skill set to advance scientific information resulting from fundamental research programmes into concrete medical applications. One of the important events necessary to realise this will be to link the medical and veterinary professions to provide integrated solutions to the challenges presented by zoonotic diseases.

An example of a recent concept addressing this issue is the Paul G. Allen School for Global Animal Health at Washington State University. The mission of the Allen School is to provide innovative solutions to global infectious disease challenges through research, education, global outreach, and application of disease control at the animal–human interface.

**Animal genomics**

Animal genomics is a new field of research that capitalises on the sequencing of domestic animal genomes and rapidly evolving genome-enabled technologies. The ensuing explosion of new high-throughput technologies arising from the genomics field is enabling the analysis of entire animal genomes, their transcriptome and proteome, providing the links between the genetic code and the diversity of living organisms (15). Importantly, genome-enabled technologies are providing new opportunities for understanding disease mechanisms and novel approaches for improving the health and welfare of animals. Veterinary scientists have a unique opportunity in fulfilling the promise of genomics, which has already begun to catalyse the multibillion-dollar biotechnology industry (23) and is fostering the development of powerful tools in biomedical research (6, 21). Successful examples have already been demonstrated with the development of animal models to address human diseases and new tools to create comparative phenotypic models (16). Likewise, the animal health research community now has access to new powerful research tools to discover effective measures to prevent, diagnose and treat diseases.

**Leadership roles in the public and private sectors**

An important step for veterinary scientists will be to take on additional responsibilities by taking leadership positions with increasing levels of responsibility in the public and private sectors. Presently, there is a
dearth of veterinarians at higher levels of management in most institutions with a research mission. The notable exception is veterinary medical colleges, where veterinarians continue to lead and manage the academic curriculum and the operations of veterinary campuses.

**Recommendations**

- Support post-graduate training programmes to increase the number of veterinarians with DVM/PhD degrees;
- Provide resources for recruiting, training and retaining veterinary scientists in animal health research;
- Increase animal health research programmes that support global food security and disease control initiatives;
- Increase the participation of veterinary scientists in ‘One Medicine, One Health’ initiatives;
- Provide resources necessary for veterinary scientists to participate in the genomics revolution;
- Provide incentives for veterinary scientists to take on leadership roles in the public and private sectors.

**Conclusions**

Although the information provided in this paper is sourced primarily from the veterinary medical profession in the USA, many of the gaps and challenges in biomedical research are applicable to the veterinary profession worldwide. There are significant differences in the training and practice of veterinary medicine in many countries. For instance, while most veterinarians in the USA and Europe practise companion animal medicine (dogs, cats, horses) in private animal hospitals, the large majority of veterinarians in developing countries work for the government in public practice in support of animal agriculture.

Veterinarians with advanced training in biomedical research are critical to the future health and well-being of human beings and animals worldwide. Appropriately trained veterinarians are uniquely positioned to solve the growing disease and societal problems emerging at the human–animal interface. These problems include zoonotic diseases, food safety, infectious and metabolic diseases of agriculturally important animals that limit food and fibre production, emerging diseases at the domestic animal–wildlife interface raising public concerns about use of public lands for agriculture, and diseases of our companion animals, which are becoming an increasingly important component of the well-being of increased numbers of our aged human population.

The first step in ensuring that an appropriate number of veterinarians enter biomedical research is to educate policy makers in the historical and future importance of research-trained veterinarians in solving a multitude of crucial well-being and health issues, from food production to prevention of human disease. Clearly funding of educational opportunities will be critical to solving the current and growing shortage of research veterinarians. However, funding of educational opportunities alone will not solve this problem. Without interventions in this issue from all sectors in society (universities, industries and governments) that require research-trained veterinarians to advance current and future economic and health issues, remedies will not be forthcoming or sustained.

**References**


‘One Health’: developing the interface

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Summary

The continuing animal and human health crises caused by influenza viruses of the H5N1 and H1N1 sub-type have focused the attention of international organisations and donors on the need for improved veterinary infrastructure in developing countries and the need for facilitating communication between the human and animal health sectors.

Possibly the biggest challenge is to find novel ways to maximise the use of the information that is generated as a result of the improved networking and diagnostic capacities. In the era of globalisation, emerging and re-emerging diseases of public health relevance are a concern to developing and developed countries, and are a real threat because of the interdependence of the global economy. Communication and analysis systems available should be tailored to meet the global health priorities, and used to develop and constantly improve novel systems for the exploitation of information to generate knowledge.

Keywords: Diagnosis – Influenza viruses – Networking – ‘One World, One Health’.

‘One Health’: developing the interface

Great attention has been devoted to the concept of ‘One Health’ recently (1). International organisations involved in public health management have endorsed documents which lay out a roadmap, new concepts and ideas related to this novel perspective encompassing multidisciplinary health management strategies (1).

This new paradigm has attracted many supporters, although some of the exact principles of execution have not been defined completely. Full adoption by the global health community will require major changes in mindset and operational practice. We are now at a critical point with particular reference to training new generations of professionals, who will receive higher education in scientific and medical disciplines, if we are to optimise the opportunity the ‘One Health’ concept provides.

The concept of ‘One Health’ is based on the interconnection and subsequent interdependence of factors contributing to health in a globalised environment. It stretches beyond what we would define as ‘medical aspects’ since it is influenced greatly by the environment, the interventions that affect the environment, and by economic aspects that are related to interventions of the veterinary and medical professions. A typical example is certain types of animal husbandry, developed to sustain rural communities, as they may have implications for public health and on the perpetuation and spread of certain diseases of animals.

In order to be implemented in full, the concept of ‘One Health’ requires a multidisciplinary approach and a precise awareness of specific areas of competence. It would seem logical that in an interconnected and interdependent world, training of primary health professionals should encompass a broader perspective on this transversal environment than is needed by other health-related professions.

International crises related to emerging infectious diseases have been managed traditionally by the veterinary profession, while the infection or disease was confined exclusively to the animal world. As soon as the disease or infection became a concern for human health, management was taken over by the medical experts. However recent outbreaks of zoonotic diseases such as severe acute respiratory syndrome (SARS), H5N1 highly pathogenic avian influenza and the recent human influenza pandemic caused by an H1N1 influenza virus of animal origin, have established the added value of promoting and maintaining a multidisciplinary approach to crisis management in order to maximise the results by tackling the problem from different angles.

It is well known that formative years are extremely important in determining the mindset and thus affecting the general approach of the veterinary profession. In the current environment, and especially in Europe,
university courses are managed mostly with a ‘vertical approach’. This means that there are functional boundaries which prevent undergraduate students from cross-fertilising their areas of knowledge with students who are training for another profession, although they may have similar or overlapping classes in the early years of study. It would seem reasonable, for example, for veterinary students and medical students to attend at least one part of their microbiology, infectious diseases or parasitic diseases classes together prior to branching off into the specific topic that they are training for. For the sake of clarity, early training years could where possible converge at the start of the class and diverge when the areas of knowledge become specific to the profession. These could be graphically represented as Y-shaped courses. In a similar vein, students who are training to become environmentalist professionals could share some of their early classes with veterinary and medical students.

In addition, follow-up seminars with a transversal approach that encompasses the ecological, medical and veterinary aspects of a certain disease or infection would allow students to be aware of the impact and occurrence of any given pathogen or vector in a related but different area of expertise. It would seem appropriate that during the final part (or after the end) of their Y class, students would meet their fellows again and discuss the areas of knowledge that differ in the advanced section of their course. This could be achieved through seminars, which could be represented graphically with an X. The seminars should be targeted at the fellow students, but also at younger students involved in the single vertical branch of the Y classes.

The development of a class of professionals who are well aware of the existence of areas of expertise in other disciplines could represent the interface that is most essential to implement the ‘One Health’ vision. Nowadays scientists and professionals who are trying to stitch together a transversal and multidisciplinary approach to selected problems may have gained the knowledge, awareness and personal contacts to facilitate a multidisciplinary approach in their activities. It would seem that the biggest problem that needs to be overcome is a cultural one. Medical doctors, veterinarians, environment specialists and other related professionals perceive themselves as people working in completely different fields, and at times feel threatened by colleagues who operate in a different context.

Training of a new generation of professionals who understand and promote the ‘One Health’ vision will also facilitate the bridging of gaps of knowledge and the full exploitation of information that is already available but only used for the scope it was generated for. For example, since 2004, thousands of isolates of avian influenza virus have been collected during surveillance campaigns in wild and domestic birds worldwide. The veterinary community has generated mostly limited data on viral subtypes and pathogenicity (i.e. whether the strain can be classified as a low pathogenic or highly pathogenic strain). However, since all influenza A viruses originate from avian influenza viruses which cross the species barrier, the genetic and antigenic information contained in the avian isolates is likely to be of great relevance to aspects related to public or animal health. Thus, the efforts made by one category of professional can be invaluable to other disciplines, leading to expansion of areas of research and optimisation of strategic policies in science to support decision making in health management.

References

Diseases of animals and humans: promoting multidisciplinary action

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The deviations of (humans) from the state in which (they were) originally placed by Nature seem to have proved to (them) a prolific source of Diseases. (adapted from 11)

Summary

Infectious diseases in humans cause significant worldwide morbidity, mortality, social and economic disruption. Health services that can hardly cope with 'chronic' infectious diseases are put into a state of shock when unheralded outbreaks occur. New infectious diseases continue to emerge and most come from animals. The prevention and control of emerging and re-emerging infectious diseases requires multisectoral and cross-disciplinary approaches. The veterinary and human medical professions have to collaborate and understand each other's culture and practices, in order to effectively plan and execute joint programmes and policies. Different approaches to disease control and risk assessment can challenge the fostering of good relationships at the individual, institutional and government levels. Research into diseases of animals affecting humans, which is necessary for the development of control policies, must also cross sectoral boundaries. Veterinary and human health professionals must be more familiar with and learn to understand the analyses of other bio-medical sciences as well as the social sciences, including politics, economics and anthropology. When the professions work together in partnership they can be a powerful force to advocate political action enabling multisectoral action, networking and data sharing, capacity building, risk communication and community engagement designed to better respond to local and global threats. Preparation for collaborative and coordinated work, as exemplified in a One Health or 'One World, One Health' approach, should become second nature in future professional practice.

1 This statement also applies to animal diseases but the article is written from the viewpoint of human health.

Keywords: Emerging infection – Medical education – ‘One World, One Health’ – Veterinary education – Zoonosis.

The burden of infectious diseases in humans

Infectious diseases cause significant human morbidity and mortality globally. In developed countries, the burden of infectious diseases is composed of viral and bacterial diseases of the respiratory tract and gastro-intestinal tract, hospital-acquired infections and sexually transmitted infections. In developing countries, the presence of parasitic diseases and vaccine-preventable diseases significantly increases this burden (29). Infectious diseases can be chronic, as is the case with human immunovirus (HIV), partly as a consequence of anti-retroviral drugs, while the outcomes of other chronic viral infections, e.g. hepatitis B and C, are also significant.

Despite the critical need for health promotion and prevention programmes for infectious diseases, these programmes, where they do exist, are often underfunded and undervalued. Immunisation is a major component of prevention programmes, and while initiatives such as the Global Alliance for Vaccines and Immunization (GAVI) have markedly improved access to immunisation in the last decades, the availability of new vaccines in the developing world always lags behind that in developed countries. Gains have been threatened or reversed by resistance to the practice of immunisation for diseases that were close to being controlled, e.g. measles, rubella and polio.

Outbreaks of infectious disease, even where they do not result in significant morbidity and mortality, will often cause a shock and added burden to already stressed public health and health care systems (4), a threat to health worker safety and security, and may have serious social and economic consequences. The
ultimate example of this is a pandemic of influenza which can, for periods of weeks, disrupt the life of a community and, during its course, be the cause of significant adverse societal consequences.

**Emerging infectious diseases**

While the burden of existing infectious diseases is already a challenge, new diseases continue to be recognised. Recent examples include Nipah, severe acute respiratory syndrome (SARS) and influenza A H5N1 and H1N1. The important feature of these newly described diseases, apart from the immediate threat to human health and the cause of outbreaks, is that they are often unpredictable, their transmissibility and severity are often initially unclear and their consequences unknown. Related to these unknowns, there will be the unplanned response that they demand for use of resources. These resources may include laboratory services, epidemiology, event management, risk communication, promotion of behavioural change, as well as 'public health measures' such as school closures, business closures, recall of products and immunisation programmes. These will be expensive in terms of financial and human resources.

**Zoonoses**

Diseases of animals transmitted to humans at their interface, i.e. zoonoses, should be viewed in this context of emerging infectious diseases. As has been widely quoted, 70% of emerging infectious diseases are estimated to come from animals (9). It is possible to both recognise and control zoonotic diseases in animals, and prevent or minimise human disease, but the epidemiology of these diseases can make this difficult.

The range of diseases transmitted from animals to humans is large, and varies across the world. There are numerous factors that influence the epidemiology of zoonoses in animals and hence influence risk to humans. These include:

- farming practices and intensive agriculture
- slaughter and food preparation practices
- ecological pressure that enhances the risk of transmission from wildlife to domestic animals or humans
- climate change, which necessitates the movement of animals in search of food and alters the range and distribution of vectors that transmit disease
- veterinary practice, such as the inappropriate use of anti-microbials
- culture, which is reflected in relationships with domestic animals
- economic factors, where animals are commonly valuable possessions for families
- movement of live animals and meat to markets at great distances from farms
- illegal movement of animals across borders
- natural changes in viruses, e.g. influenza A.

A full understanding of the interrelationships among these diverse factors requires both the application of a range of professional expertise, e.g. veterinary medicine, human medicine, microbiology, epidemiology and climatology, as well as political and social sciences, including economics and anthropology, and an in-depth country-specific knowledge of a range of influences, from ecology to politics.

Zoonoses 'have major socio-economic implications through direct impact of the disease and through individual, collective and international costs incurred in preventing and controlling the disease in both human and animals' (14). In some cases, the direct cost of zoonotic diseases, in animals and humans, to economies and health care systems may be obvious, e.g., bovine spongiform encephalopathy (BSE), new variant Creutzfeldt–Jakob Disease (vCJD) and SARS. Other costs may be less obvious. For example, food-borne disease is greatly under-reported and infections from salmonella, campylobacter and listeria often do not result in hospitalisation or death, but the continuing high numbers of infections cumulatively result in great costs to society.

**Action to prevent and control zoonoses across sectors and disciplines**

The continued emergence and burden of diseases at the human animal interface requires a close working relationship between the animal health and human health sectors. It has been recognised that an understanding of risk factors and transmission of infectious diseases in animals can lead to more
effective prevention and control in humans. Indeed, control in animals can sometimes eliminate the risk in humans.

The basic concept of collaboration between the animal health and human health sectors would seem to be straightforward, and has been described variously as One Medicine and One Health. One Medicine was explained in a veterinary medicine textbook (22) as the link between veterinary practice and the improvement in human health. One Health is described as an ‘initiative’ and a ‘movement to forge co-equal, all inclusive collaborations between physicians, veterinarians, and other scientific-health related disciplines’ (18). The realisation that most zoonotic diseases arise from wild and not domestic animals led to the concept ‘One World, One Health’ (19). In addition, the wish to ensure recognition of the importance of health in relation to our biosphere has led to a broadening of the concept to include ecosystem health (8). The concept can therefore mean different things, and one label does not fit all. In addition, the same labels can be interpreted differently, as shown in the European Commission’s recent campaign (6), where One Health appears to be about the relationship between veterinarians and farmers.

Despite these differences in terminology and interpretation, the common objective of collaboration between the animal and human health sectors is more effective disease recognition, response, control and prevention, allied with sustainable development of systems and processes that reduce risk of disease in animals as well as the risk to humans.

As already noted, factors in the emergence of infectious diseases are numerous, and hazard and risk analyses should lead to the conclusion that many approaches and partners will be needed to find a solution. The mix will vary depending on a disease or country and environment. The aim should be to be as multi-sectoral and cross-disciplinary as possible.

**The benefits of collaboration**

There are clear examples of cases where a collaborative approach was needed and not implemented but such an approach would have been beneficial. Zinsstage and Tanner provide examples where cooperation ‘between two well structured entities’ was ‘not very easily achieved’ and the response to emerging zoonotic diseases has often not been the result of use of established systems (34). An illustration of this is an outbreak of human rabies in Peru, which was found to be caused by vampire bats seeking out new hosts as a result of an epizootic in cattle (2). The public health sector had not been aware of the event in cattle, and there was a delay in the identification of human cases as they occurred in a population that did not readily seek medical care. It is possible that an even more effective response could have been mounted if there had been pre-existing relationships and collaboration between the sectors. Processes and collaboration should not have to be developed or revived for each new event. Ideally, the right disciplines will be ready to be engaged in a response using predefined plans. The rapid response to West Nile virus infection in Canada was a result of the recognition that cross-disciplinary partnerships needed to be formed (3). This was achieved rapidly and has demonstrated the utility of the maintenance of such relationships. In relation to Nipah virus disease in Malaysia, it was noted in 2000 that the outbreak was controlled successfully but that one of the lessons learned was the need for an effective intersectoral group dealing with zoonotic diseases (16).

There are also many instances where the concept is apparent in action, but almost always this has not been as a result of an explicit prior recognition of the need for multi-sectoral collaboration. This may well mean that the extent of collaboration of other sectors could be greater. There are also examples where, as a result of the need to control disease, many actors from different sectors become involved. Again this has not resulted from a deliberate ‘One World, One Health’ approach and therefore has not been the basis for future planning or the development of structures for collaboration and cooperation set up in preparation for future responses.

There are illustrations of the concept in action, although not named as such, in response to particular needs. This is true of surveillance systems and mechanisms jointly developed for food-borne disease, e.g. Global Salm-Surv (30) and INFOSAN (31), and for trans-boundary animal diseases, e.g. GLEWS (32) and GF-TADS (33). On the other hand, a *Nature* commentary states that ‘surveillance of human diseases that originate in animals remains in the nineteenth century’ and that ‘animal and public health bodies must now step up and fund a serious joint initiative in this area’ (17).
The response to H5N1 is a good example of collaboration where control of a disease in animals has decreased risk to animals and humans. Influenza A (H5N1) virus has devastated poultry rearing at many levels in many countries and has occasionally caused human infection with a high case fatality rate. Large amounts of resources have been put into prevention and control of avian influenza and pandemic influenza preparedness (given the potential for H5N1 to cause an influenza pandemic). Collaboration between international agencies has also been encouraged by funding mechanisms for joint programmes, e.g. from the Canadian International Development Agency (CIDA) (5). Ong et al. refer to H1N1 as a ‘multifarious virus that traverses multiple sectors and borders requiring cooperative action between all and by all’ (20).

There are still gaps in knowledge, e.g. in relation to poultry vaccination policies and exact modes of transmission of H5N1 to humans. Although joint research has been undertaken on possible sources of infection for humans, these have yet to be clarified (27). Environmental studies and studies of knowledge, attitudes and behaviour have not yet resulted in consistent behaviour change in populations at risk. The H5N1 outbreak has also raised other complex issues, such as the wish for benefit sharing in exchange for the sharing of viruses. These continuing challenges and questions can best be confronted by multiple sectors and disciplines.

There are also situations where pre-existing arrangements enabled an effective response. The outbreak of Ebola Reston in pigs and humans in the Philippines required joint missions between the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE) and the World Health Organization (WHO), joint risk assessments and joint risk communication which were mounted quickly as a result of established relationships (28). The continuing investigation of the relationship between disease in swine and H1N1 in humans again required rapid mobilisation of resources from the animal health and public health sectors, and joint assessment and risk communication in an environment of intense public scrutiny. The description of the epidemiology of Rift Valley fever in the Horn of Africa was followed by the prediction of outbreaks in subsequent years through collaboration between the human health and animal health sectors and specialists in remote sensing and climatology (1).

The greatest threat to health and economies as a result of zoonoses is in developing countries. In this context it is important to highlight where the ‘One World, One Health’ concept is being promoted and put into action. Academic and research institutions, supported by ministries responsible for human and animal (domesticated and wild) health in the Democratic Republic of Congo (DRC), Mozambique, South Africa, Tanzania and Zambia, i.e. five countries of the Southern African Development Community (SADC) with faculties of medicine and veterinary medicine in their universities, have recently formed a consortium known as the Southern African Centre for Infectious Disease Surveillance (SACIDS), with its headquarters located at the Sokoine University of Agriculture (SUA), Morogoro, Tanzania. (The initial external financial support for SACIDS has come from Google.org, the Rockefeller Foundation and Wellcome Trust.) This is an effort to enhance the collaboration between the human and animal health sectors for the detection, identification and monitoring of infectious diseases across the sectors. This collaboration is being further reinforced at the national level by forming national virtual centres for infectious diseases known as National Centres for Infectious Disease Surveillance (NatCIDS).

The driver for the SACIDS consortium is the optimal utilisation of the available resources, while respecting the separate roles of human and animal health sectors in disease surveillance and response. Thus, the collaboration now involves laboratories at the full range of biosafety up to the biosafety level (BSL)-4 at the National Institute for Communicable Diseases (NICD) of South Africa and BSL-3 veterinary laboratories, such as those at the Onderstepoort Veterinary Institute (OVI) in South Africa and the School of Veterinary Medicine at the University of Zambia (UNZA). It is planned that over the next five years there will be at least one small BSL-3 facility in each participating country to cater for safe primary handling of potential highly dangerous pathogens. The consortium also includes laboratories that are accredited by WHO, OIE and FAO as reference and collaborating centres, such as NICD, OVI and the International Livestock Research Institute (ILRI).

The governance structure of SACIDS is based on equity and shared vision between the two health sectors. Thus the SACIDS director is assisted by two deputy directors, one for the human and the other for the animal health sector, and at the national level the coordinator is assisted by a deputy from the opposite sector. SACIDS employs only a lean secretariat and virtual graduate school comprising the executive director, one epidemiologist, one ICT specialist, a procurement cum administration officer and an accountant.
The research and training activity of SACIDS is also driven by the same goals of inter-sectoral equity and a shared vision. There is a consensus among its members to focus attention on the neediest institutions in the DRC, Mozambique, Tanzania and Zambia. To that end, SACIDS will be establishing two regional One Health MSc programmes: in molecular biology, based at SUA in Tanzania and Eduardo Mondlane University in Maputo, and one in analytical epidemiology, based at UNZA. The continuing professional development programmes (CPDs), which will be coordinated by the University of Pretoria and the SACIDS secretariat, will also cater for the two health sectors. PhD and postdoctoral research fellowships have also been selected to enhance inter-sectoral collaboration on either a shared disease problem, such as Rift Valley fever, or shared technology, such as FMD, as a driver for molecular biology. SACIDS is setting up cross-sector research approaches, including a study on resource mapping and preparedness analysis across the human and animal health sectors that has just started in the DRC and Tanzania with two postdoctoral research fellows, a physician and a veterinarian.

**Challenges in implementation of the concept**

It is clear, therefore, that collaboration between sectors does take place, and in some cases is institutionalised, and that collaboration can also happen around an event, but how can this become the norm and how can relationships be sustained?

There are many reasons why collaboration may not exist at the level of governments, universities and international organizations. One factor may be the relationship between the practice of veterinary medicine and the practice of human medicine. Veterinary practice is highly segmented and overwhelmingly private. Human medicine is segmented and is also heavily dependent on general practitioners, who in many countries are publicly funded, although they practise privately. A sociological analysis in the context of H5N1 reported that ‘vets and medics do not always have the same perspectives, as we were repeatedly told in our interviews’ (23). There is also a sense that veterinarians are undervalued in relation to their physician colleagues. This concern is evident when the sharing of resources has been deemed to be inequitable, for example at the start of the search for resources to respond to H5N1. On the other hand, ministries of agriculture may have greater influence than those of health, reflecting the importance of the farming sector to the economy.

As noted above, collaboration in outbreak situations can work, but risk assessments from the two professions will inevitably be different. That for animals will have to take account of economic risks, whereas a risk assessment for humans is likely to be more high profile and gain more media attention, and may focus on the risk of death, however small, or the risk of transmission of disease, however limited. Although a human health assessment will necessarily consider economic risks, e.g. to tourism, a primary focus will be on reducing disease and death. Media attention can also result in a greater leverage of resources for human health.

Where a culture of joint research may exist, it is not obvious whether collaboration is promoted within the university setting or encouraged by funding that is dedicated to research involving both sectors. Joint research implies data sharing, and if information is obtained from different reporting systems and different laboratory systems, this might be less easy to facilitate. Of note is the recognition given by the Consultative Group on International Agricultural Research (CGIAR) to the potential benefits of cooperation between the agriculture and health sectors (26).

At the clinical level it has been found that physicians are not comfortable discussing the role of animals in the transmission of zoonoses, whereas most patients do not view veterinarians as a source of information on zoonoses (7). This in itself is not surprising, but it contributes to systems where interaction between the professions is limited and surveillance systems remain separate. This was the case when the West Nile virus infection emerged in New York City and very few veterinarians reported a zoonotic infection to public health authorities (25).

Veterinarians do work in the public health sector, e.g. the Public Health Agency of Canada (PHAC). In Italy, the national veterinary service is within the Ministry of Health, but this is an isolated example. Veterinarians are employed by WHO but ‘Veterinary Public Health’, which did represent the force of veterinary medicine within WHO, only remains as an entity in the Pan American Health Organization (PAHO). In 2000, Meslin et al. highlighted the importance of inter-sectoral collaboration for disease containment, and of independence of sectoral interests and transparency when managing certain health risks (16). There are no obvious examples of physicians working in the animal health sector.
It is safe to assume that there are far more professionals and scientists involved in the domestic animal sector than in the wild animal sector. There are obvious financial explanations for this, although it could be argued that the 'worth' or benefits of a healthy ecosystem would be difficult to quantify in strict economic terms. This challenge will become increasingly important now that the role of wildlife as the source of emerging infectious diseases is clearer, e.g. birds as intermediate hosts of West Nile virus, bats and Nipah virus and Ebola, wild cats and the SARS corona-virus, and migratory birds and H5N1. This means that wildlife biologists and veterinarians will have to be more involved in prevention and control of these diseases. The enormous legal and illegal trade in animals and the huge amount of food products that traverse the globe also demand the increased involvement of the private sector and more distant sectors of government, e.g. customs and excise (12).

As has been seen in the response to H5N1, there are many issues in the identification of the circumstances of transmission which remain poorly defined. Even where it is acknowledged that wet markets or a close physical and cultural relationship between poultry and humans exist in certain societies, any intervention designed to change practices requires the application of social and behavioural sciences, including direct community involvement. The identification of differences between knowledge attitudes and behaviour is the first step in a long path towards disease risk reduction. In addition, an understanding of the political economy (13) of a disease may also be fundamental in designing meaningful policies for prevention and control. This has been recently demonstrated in publications by the STEPS Centre (Social, Technological and Environmental Pathways to Sustainability) of the University of Sussex in the United Kingdom in relation to H5N1 infection.

The differences, and consequences of those differences, between the veterinary and human health professions and the agriculture and human health sectors in government have to be recognised and confronted before collaboration can be built and the potential of the synergy that it creates is realised.

**Confronting the challenges**

Ong et al. concluded that '[t]his convergence of animal and human disease threats ... suggest an urgent need for a corresponding convergence of animal and public health officials, professional organizations and partners to meet these challenges' (20). Following discussions at the December 2007 New Delhi International Ministerial Conference on Avian and Pandemic Influenza, a number of organisations produced a 'Strategy for Reducing Risks of Infectious Diseases at the Animal–Human–Ecosystems Interface' (24). This work was the stimulus for the March 2009 meeting: "'One World, One Health': from ideas to action', organised in Winnipeg, Canada, by the Public Health Agency of Canada in collaboration with WHO, FAO, OIE, UNICEF, UNSIC and the World Bank (21). The meeting made some key recommendations for the promotion of the concept of 'One World, One Health':

- foster political will
- support partnership and collaboration
- encourage data sharing
- build capacity (infrastructure and skills)
- develop communication strategies and plans
- provide incentive for reporting adverse events
- encourage stakeholder and community engagement
- develop supra-country approaches.

In order for the concept to be more widely accepted and the basis for action, there has to be advocacy for a multi-sector and cross-disciplinary approach to diseases at the animal–human interface. Globally, this can be promoted by the collaborators in the Winnipeg meeting. However, there are obvious gaps in representation of the wildlife and ecosystem health sectors, at least in the discussions so far. Although FAO does have a mandate in relation to wildlife, it is limited. Organisations such as the International Union for the Conservation of Nature and the Wildlife Conversation Society have to become partners. Another perspective will also be added by those promoting ecology and health, and ecosystem health, including the United Nations Environment Programme.

International organisations have worked more closely together as a result of collaboration in response to H5N1. The funding of programmes made conditional on collaboration, e.g. by CIDA, has also promoted interaction. However, more fundamental changes are needed to ensure that at all levels those working in the human and animal sectors are committed to the imperative of involving all relevant disciplines in
programme planning and execution. This does not necessarily require the establishment of programmes of One Medicine, One Health, or ‘One World, One Health’, but rather that there be an underlying tenet of inclusion. It has been suggested that there should be sustained personnel interchanges between ministries of agriculture and ministries of health, and promotion of integration of national animal and human health services, but there will have to be cultural shifts within agencies and the development of new systems and capacities (15).

There are a number of levels where advocacy and example can occur. The first is at the level of international organisations. An approach to zoonotic diseases by international organisations should be based on strategies demanding inclusion of all relevant sectors and disciplines. Disciplines that are under-represented or that are traditionally part of another structure, e.g. economics, should be sought out. At the country level, political will can demand joint action on issues with the highest level of leadership, and inclusion of relevant ministries responsible for human health, animal health and wildlife. This example can be replicated at regional, local and village levels. In a village in a developing country, a community health worker could also act, as reported by the Wildlife Conservation Society, as a community animal worker. Political will for change can be the outcome of demonstration of advantages of multi-sectoral action through successful outbreak investigation, joint response, joint missions, joint risk assessment and communication, and joint preparedness. Legislation on surveillance could require cross-reporting by veterinarians of zoonotic diseases to public health and by physicians to Veterinary Authorities.

In order to better address these complex issues it is necessary to involve, more consistently, policy expertise from outside the realm of bio-medical science, i.e. experts in economics, political science, anthropology and behavioural sciences. Political support for programmes to prepare for emerging diseases such as H5N1 has been garnered by the realisation of the potential for adverse economic consequences, as was seen with SARS. Economic expertise should be sought from non-health and agriculture departments and from the academic sector. The utility of economic analyses has been demonstrated with the cost–benefit analysis of vaccination of livestock against brucellosis, which showed that taking into account human health benefits only is not sufficient.

Conclusion

The outcome of multi-sectoral and cross-disciplinary collaboration will be an ability of communities, organisations and governments to efficiently and effectively confront the continued appearance of emerging zoonoses. A key to the establishment of a culture of collaboration is the development of relationships based on an understanding which has become second nature. This could be achieved early on in the career of practitioners and scientists by joint professional education and training, practice, policy development, research and advocacy. Alliances can become an integral part of the way of working of schools of human and veterinary medicine, schools of public health and advanced training of veterinarians, and relationships between professional associations (10). The Southern African Centre for Infectious Disease Surveillance is a strong example of what is possible. The academic community and professional associations can also be a powerful advocacy lobby for strong collaborative partnerships.

References


Session 3: Veterinary public health and the ‘Veterinary Services’ concept


Session 4

Food safety

Chair: Prof. Kazuya Yamanouchi
Role of the World Organisation for Animal Health (OIE) and of the Veterinary Services in food safety

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Summary

The control of food safety is now universally recognised as a public health priority. It requires a global approach, from production to consumption or, as it is commonly referred to, ‘from farm to fork’.

The elimination or control of food risks at source has proved to be a more effective way of reducing or eliminating health risks than an approach based solely on inspecting the finished product. For animal foodstuffs and other foodstuffs of animal origin this necessarily means controlling the health status of the animals from which these foodstuffs are derived.

International animal health standards have thus been defined to ensure that consumers benefit from a harmonised level of safety during international trade in food products. These standards are adopted by the Food and Agriculture Organization of the United Nations (FAO), World Health Organization (WHO) Codex Alimentarius Commission and the World Organisation for Animal Health (OIE), based on the sharing of tasks as agreed between the organisations.

In line with its mandate, the OIE has the aim of promoting animal health and veterinary public health worldwide by fulfilling its role as reference organisation for scientific standards on all matters relating to animal health and zoonoses, and animal production food safety. A working group has been set up and it should be noted that the group includes Codex Alimentarius experts.

The OIE’s work in this sector has resulted in the adoption of Terrestrial Animal Health Code standards on a number of topics, including biosafety in farms (hygiene and disease security procedures in farms), traceability, inactivation of pathogens and vectors, animal welfare (transport of animals) and the use of certain types of veterinary medicinal products (guidelines on the responsible use of antibiotics).

Veterinarians receive training that focuses not only on animal diseases (including zoonoses) but also on food hygiene; they are therefore particularly competent to play a key role in the field of food safety, and especially the safety of foodstuffs of animal origin, throughout the food chain.

The Veterinary Services play a central role in implementing the risk-based recommendations contained in regulations on food safety.

At the farm level, the Veterinary Services fulfil a vital role, checking that animals are kept under satisfactory conditions of hygiene, ensuring the surveillance, early detection and treatment of animal diseases, including those with a potential impact on public health, and promoting the responsible and prudent use of biologicals and veterinary medicinal products, including antimicrobials, in farms. They also advise and inform animal producers on how to avoid, eliminate and control hazards posing a threat to animal production food safety, such as drug or pesticide residues, mycotoxins and environmental contaminants.

In 2004, in response to recurrent sanitary crises, the European Community introduced a raft of regulations entitled the ‘Hygiene Package’, offering a ‘new approach’ to food safety in compliance with international standards.

The particularity of the Hygiene Package is that it involves all the players throughout the food chain ‘from the stable to the table’, including the control services. Thus, all operators from primary plant production through to delivery to the consumer are involved, encompassing animal feed, primary animal production and all the intermediaries (grain transporters, animal transporters, warehouses, etc.).

Within the framework of applying the Hygiene Package, the French Veterinary Services of the Ministry in charge of Agriculture and Food are in charge of all the controls throughout the food chain. In this way they verify compliance with regulatory requirements governing the declaration of animal production activities,
traceability (through the keeping of farm registers and transmission of health information to abattoirs), and hygiene and welfare conditions relating to animal feed and animal production.

Proper control of animal production health risks can only be achieved if there is close collaboration between the Veterinary Services and all the professionals involved in animal production, namely farmers and veterinary practitioners.

Keywords: Food safety – OIE – Veterinary Service – World Organisation for Animal Health.

Introduction

The World Organisation for Animal Health (OIE) is one of the three global standard-setting organisations under the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement).

Although initially the OIE’s field of competence was confined to standards for the prevention and control of animal and zoonotic diseases, in recent years it has been broadened to include such fields as animal welfare, animal production food safety and the quality of Veterinary Services.

The OIE considers Veterinary Services to be a ‘global public good’, and in 2001 it signed an official agreement with the World Bank in order to help to bring the Veterinary Services into compliance with international standards.

The best way to guarantee food safety and quality is to take an integrated and multidisciplinary approach covering the entire food production chain. The elimination or control of food risks at source (the preventive approach) has proved to be a more effective and less costly way of reducing or eliminating undesirable health risks than an approach based solely on inspecting the finished product.

The OIE has therefore focused its efforts on setting standards and guidelines to support the on-farm activities of Veterinary Services, with the objective of improving the safety of the foodstuffs produced by farms.

The role of the World Organisation for Animal Health in food safety

The OIE was established in 1924 to prevent the global spread of animal diseases, to safeguard not only animal health but also human health, owing to the existence of a large number of zoonoses.

The OIE’s main objectives are to ensure transparency in the global animal disease situation, to share scientific information on animal diseases and to set international standards to control and prevent the emergence or spread of animal diseases.

The third OIE strategic plan (2001–2005) called upon the OIE to be more active in the area of public health and consumer protection.

The OIE therefore concluded an agreement with the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) to determine the respective responsibilities of the OIE and the Codex Alimentarius Commission for setting international reference standards for food safety under the SPS Agreement. The OIE is responsible for setting standards concerning the production phase of food-producing animals until they reach the slaughterhouse or dairy.

In 2002, the OIE set up a working group to coordinate its work on food safety during the primary production phase. The OIE Animal Production Food Safety Working Group comprises representatives from the Codex Alimentarius Commission, FAO and WHO, together with experts from various continents. In its work, the group takes a scientific approach that considers the entire ‘farm to fork’ food chain as a continuum.

Some of the working group’s main achievements have been to:

- draw up a guide to good farming practices for animal production food safety (joint OIE/FAO publication [2])
- adopt standards on identification systems to achieve animal traceability (Chapter 4.2 of the OIE Terrestrial Animal Health Code [1])
- adopt a standard on the control of hazards in animal feed (Chapter 6.3)
- adopt standards concerning the problem of antimicrobial resistance and the prudent use of antimicrobial agents in veterinary medicine (Chapters 6.7 to 6.11)
– engage in a debate on foodborne diseases and to draft standards on such diseases as salmonellosis, *Escherichia coli* infection and tuberculosis.

It is crucial to take a holistic approach to the food chain, with surveillance at every stage of animal production, placing special emphasis on:

– animal husbandry conditions
– animal identification and traceability, in order to be able to identify the farm of origin in the case of a problem and to adopt the necessary corrective measures
– products administered to animals either as feed or veterinary medicinal products.

**Role of Veterinary Services in animal production food safety**

For the effective implementation of, and compliance with, OIE standards, members must introduce good animal health governance by equipping themselves with the necessary human and financial resources. Veterinary Services, comprising public or private veterinarians and paraveterinarians, are the most appropriate organisations for this.

By virtue of their multidisciplinary training, veterinarians are the best equipped to identify and analyse on-farm animal health problems and to ensure that food from animals is safe.

Veterinarians attend to farms to:

– ensure compliance with the requirements for animal welfare
– ensure proper animal identification and traceability by recording animal movements
– inspect the products administered to animals (such as feed and veterinary medicinal products).

Veterinary Services are also responsible for inspecting live animals prior to their entry into the slaughter chain, as well as the carcasses of slaughtered animals (ante- and post-mortem inspection). This means that they oversee the entire chain from farm to slaughterhouse.

**Example within the European Union and implementation in France**

In January 2000, following the food crises arising from bovine spongiform encephalopathy (BSE), the European Commission started to overhaul Community food regulations. Between 2002 and 2005, it published six regulations that together make up the ‘Hygiene Package’.

What is unusual about the Hygiene Package is that it involves all actors in the ‘farm to fork’ food chain, including inspection services. This means that all operators from primary plant production through to delivery to the final consumer are concerned, encompassing animal feed, primary animal production and all intermediaries (including grain transporters, animal transporters and warehouses).

Six main regulations were adopted (cf. Fig. 1):

**Regulation (EC) 178/2002, known as the ‘Food Law’,** defines the following obligations and key objectives for all food business operators:

– Food safety: no foodstuff may be placed on the market if it is considered to be unsafe or if it poses a risk to human or animal health or to the environment;
– Traceability: all operators must be able to identify their customers and suppliers;
– Responsibilities: all operators are responsible for the quality of the products they provide;
– Withdrawal and recall: operators must withdraw from the market or recall any product considered to be unsafe or harmful to human or animal health;
– Notification of the supervisory authorities.

This regulation forms the basis of all food and feed safety legislation. The other regulations apply the above general principles to more specific fields.

**Regulation (EC) 852/2004** on the hygiene of foodstuffs establishes general hygiene rules applicable to all foodstuffs. In particular it lays down hygiene rules applicable to all food business operators carrying out primary production.
Regulation (EC) 183/2005 laying down the requirements for feed hygiene. It defines the obligations and hygiene rules applicable to all operators involved in the animal feed chain from primary plant production to feed distribution to animals.

Regulation (EC) 853/2004 laying down specific hygiene rules for food of animal origin does not apply to primary production.

Regulations (EC) 882/2004 and (EC) 854/2004 laying down rules on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare.

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<td>General hygiene rules for all foodstuffs (including the retail trade)</td>
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<td>Specific hygiene rules for food of animal origin (excluding the retail trade)</td>
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Figure 1 Architecture of the hygiene package

Impact of the hygiene package on food business operators carrying out primary production

Any producer of animals destined to provide food for human consumption is a food business operator covered by the hygiene package. Such producers are obliged to abide by all the provisions in this package of regulations.

Producer responsibility for food safety

Livestock producers are fully accountable for the safety of the food they produce throughout all the production stages. They are obliged to take any necessary measures as soon as they become aware of a hazard (withdrawal from the market and recall of foodstuffs). Animal feed suppliers, who are also subject to the hygiene package, have the same obligations and are required to take any required measures.

On-farm traceability

All food business operators must be capable of identifying any person who has supplied them with a foodstuffs or animal feed, or any substance that such food or feed might contain. They must also be able to identify any persons to whom they have supplied a product.

This system of traceability (upstream and downstream) should make it possible to withdraw a product from the market should it be unsafe.

To achieve these objectives, all farmers therefore have the following obligations.
Notification: registration or accreditation of activities

The main objective of this measure is for the supervisory authorities to be aware of all establishments and their respective activities.

Record keeping

The hygiene package requires a number of registers to be established.

The aim of a register is to keep a written trace of all the measures taken to control hazards, that is to say, the origin of animal feed, drug therapy, analysis results, etc.

Food chain information

The purpose of food chain information (FCI) is to provide slaughterhouse operators with certain information 24 hours in advance, to enable them to use this information for their animal health control plan (risk analysis and hazard analysis critical control point [HACCP] plan). This information is also conveyed to the Veterinary Services to enable them to plan their ante- and post-mortem inspection of animals. FCI is therefore an essential element in the current risk-based approach to food control.

Food chain information will include:
- the farm’s status
- the animal’s health status
- drug treatments administered to the animals
- relevant analysis results
- general production data.

Compliance with hygiene and welfare requirements

Animal feed

*Regulation (EC) 183/2005* defines the hygiene provisions applicable to any operator that produces plants for animal feed without further processing. The general principles recommend:
- avoiding all sources of contamination, whether chemical (plant protection, biocidal or other products), physical (by air or water), or biological (insects or rodents), in order to minimise problems of cross-contamination
- keeping clean feed storage facilities and containers and vehicles for transporting feed
- storing separately all potential sources of hazardous contamination (such as biocidal, plant protection and veterinary medicinal products).

*Regulation (EC) 183/2005* also applies to operators who make complementary animal feed on the farm. The hygiene requirements are stricter, and such operators must:
- comply with standards for facilities and equipment
- train their staff
- keep production records
- set up a HACCP system
- comply with transport and storage standards
- conduct quality control.

Animal production

The hygiene package defines general requirements for the production of animals destined to provide food. It defines good animal feed practices and includes measures for:
- animal grazing
- feeding equipment
- storage and distribution to minimise cross-contamination
- water and watering of animals.
Guides to good practice

To comply with all these requirements, the Hygiene Package encourages trade organisations to produce guides to good practice to serve as reference documents for voluntary good practice by professionals in their trade sector.

The role of the French Veterinary Services in ensuring compliance with the hygiene package

In 1995, France reorganised its animal health system by separating risk management from risk assessment, which was entrusted to an independent agency: the French Food Safety Agency (AFSSA, now renamed ANSES, the French Agency for Food, Environmental and Occupational Health and Safety).

The French Veterinary Services report to the Ministry in charge of Agriculture and Food. They are in charge of overseeing food of animal origin throughout the food chain from primary production to delivery to the consumer – from farm to fork.

The Veterinary Services are organised into a single chain of command from the central level (with the French food administration [DGAL]), which is responsible for introducing national regulations and for defining the national animal health policy, while Veterinary Services are devolved to the regional level, with local Veterinary Service entities in charge of implementing the national animal health policy. The Veterinary Services also have at their disposal a network of animal health and food hygiene testing laboratories. France’s entire Veterinary Services have recently been accredited under the ISO 17020 standard on inspection bodies.

The Veterinary Services comprise public service veterinarians (veterinary public health inspectors [ISPV]) and technicians from the Ministry of Agriculture. The central government delegates certain on-farm animal health duties to private veterinary practitioners with a government animal health accreditation mandate (mandat sanitaire). These are prophylactic duties for preventing and controlling certain regulated animal diseases, for on-farm animal health inspections aimed chiefly at checking compliance with the Hygiene Package, and for the delivery of animal health certificates for export.

These mandated private veterinarians are able to inform livestock producers of the risks of certain practices and to help them to implement the regulations effectively. The on-farm animal health inspections by mandated veterinarians, together with all the information collected at the slaughterhouse for the purposes of food chain information, enable France’s Veterinary Services to plan food control using a risk-based approach.

In addition, in the event of an animal health problem, the Veterinary Services are able to trace a foodstuff back to the farm of origin and to take the required corrective and preventive measures thanks to the traceability system that has been set up throughout the food chain in compliance with the hygiene package.

Conclusion

France’s animal health system therefore relies on close collaboration between three main sets of stakeholders:

- livestock producers, who are responsible for producing healthy animals and food of animal origin that poses no health risk to consumers, as well as for implementing the tools required for effective traceability
- private veterinarians who oversee the animal health status of farms, advise livestock producers on the tasks within their remit and carry out animal health duties on behalf of the central government
- public Veterinary Services, which are responsible for overseeing food production as from the on-farm primary animal production phase, and which perform a consumer-protection duty.

The Veterinary Services play a key role in food safety control because they oversee every link of the chain from farm to slaughterhouse.

The veterinary profession is at the heart of this system. To perform these risk analysis and hazard appraisal tasks, veterinarians must receive multidisciplinary training that is not confined to animal health, but also encompasses the sciences of food safety and health policy as a whole.
References

Rôle de l’OIE et des Services vétérinaires en sécurité sanitaire des aliments

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Introduction

L’Organisation mondiale de la santé animale (OIE) est l’une des trois organisations mondiales pour l’élaboration des normes faisant référence au titre de l’accord sur l’application des mesures sanitaires et phytosanitaires (SPS) de l’Organisation mondiale du commerce (OMC).

Si initialement le champ de compétence de l’OIE se limitait aux normes de prévention et de lutte contre les maladies animales et zoonotiques, il a fait l’objet ces dernières années d’une extension à des domaines plus larges tels que le bien-être animal, la sécurité sanitaire des aliments d’origine animale en phase de production ou encore la qualité des services vétérinaires.

L’OIE considère les services vétérinaires comme un Bien Public International et un accord officiel a été signé en 2001 avec la Banque mondiale dans un objectif de favoriser leur mise en conformité avec les normes internationales.

La meilleure méthode pour garantir la sécurité sanitaire et la qualité des denrées alimentaires est une approche intégrée et pluridisciplinaire couvrant la totalité de la chaîne de production de denrées alimentaires.

L’élimination ou la maîtrise des risques alimentaires à la source, autrement dit l’approche préventive, s’avère plus efficace et moins onéreuse, pour réduire ou éliminer les risques sanitaires indésirables qu’une approche fondée uniquement sur la vérification finale des produits.

C’est pourquoi l’OIE s’est investie dans l’élaboration de normes et lignes directrices afin de renforcer l’action que peuvent avoir les services vétérinaires au sein de l’élevage dans un objectif d’améliorer la qualité sanitaire des aliments produits.

Rôle de l’OIE dans la sécurité sanitaire des aliments

L’OIE a été créée en 1924 afin de prévenir la diffusion au niveau international des maladies animales, dans un but de santé animale mais également de santé humaine du fait de l’existence d’un grand nombre de zoonoses.

Les principaux objectifs de l’OIE se définissent par la mise en transparence de la situation sanitaire animale à travers le monde, le partage de l’information scientifique concernant les maladies animales et l’élaboration de normes internationales pour lutter et prévenir l’apparition ou la dissémination des maladies animales.

Le troisième plan stratégique de l’OIE, couvrant la période 2001-2005, a demandé à l’OIE de « jouer un rôle plus actif dans le domaine de la santé publique et de la protection du consommateur ».

Un accord a ainsi été conclu avec la FAO et l’OMS afin de déterminer les domaines de compétence respectifs de l’OIE et du Codex alimentarius pour l’élaboration de normes internationales servant de référence au titre de l’accord SPS dans le secteur de la sécurité sanitaire des aliments. L’OIE est ainsi compétente pour l’élaboration de normes concernant la phase de production des animaux producteurs de denrées alimentaires jusqu’à leur conduite à l’abattoir ou à la laiterie.

L’OIE a mis en place en 2002 un groupe de travail pour coordonner ses travaux dans le domaine de la sécurité sanitaire des aliments en phase de production primaire. Ce groupe de travail est composé de représentants du Codex alimentarius, de la FAO, de l’OMS et d’experts des différents continents. Il travaille selon une approche scientifique continue sur toute la chaîne alimentaire de la « fourche à la fourchette ». 
Parmi les principaux travaux conduits par ce groupe peuvent être cités:

- L’élaboration de guide de bonnes pratiques d’élevage (document conjoint OIE/FAO)
- L’adoption de normes concernant l’identification et visant à assurer la traçabilité animale (chap. 4.2)
- L’adoption d’une norme sur la maîtrise des dangers associés à l’alimentation animale (chap. 6.3)
- L’adoption de normes concernant le problème de l’antibiorésistance et l’usage prudent des antibiotiques en médecine vétérinaire (chap. 6.7 à 6.11)
- Une réflexion sur les maladies à l’origine d’intoxication alimentaire et la rédaction de normes notamment sur les salmonelloses, *Escherichia coli*, la tuberculose.

Il est crucial d’avoir une approche globale de la chaîne alimentaire avec une surveillance à tous les stades de la production animale, incluant notamment les conditions d’élevage, l’identification et la traçabilité des animaux afin de pouvoir en cas de problème identifier l’élevage d’origine et pouvoir les mesures correctrices nécessaires, les produits administrés aux animaux qu’il s’agisse d’aliments ou de médicaments vétérinaires.

*Rôle des Services vétérinaires dans la sécurité sanitaire des aliments en phase de production*

Pour une mise en œuvre effective et un respect des normes édictées par l’OIE, les pays membres doivent mettre en place une bonne gouvernance sanitaire en se donnant les moyens humains et financiers nécessaires. Les services vétérinaires, composés de vétérinaires publics ou privés et de professionnels paravétérinaires, représentent les organisations les mieux adaptées.

Les vétérinaires de par leur formation pluridisciplinaire sont les plus compétents pour appréhender et analyser les problèmes sanitaires en élevage et s’assurer que les animaux ne présentent pas de danger pour les denrées alimentaires qu’ils produisent.

Ils sont présents dans les élevages pour contrôler le respect des conditions de bien-être animal, de la bonne identification des animaux et de leur traçabilité par l’enregistrement des mouvements, ou encore les produits qui leurs sont administrés (aliments, médicaments vétérinaires...).

Les services vétérinaires assurent également le contrôle des animaux avant leur entrée sur la chaîne d’abattage et les carcasses des animaux abattus (inspection ante et post-mortem). Ils assurent ainsi un contrôle sur la globalité de la chaîne depuis l’élevage jusqu’à l’abattoir.

*Exemple au sein de l’Union européenne et application en France*

En janvier 2000, suite aux crises alimentaires liées à l’ESB, la Commission a engagé une refonte de la réglementation communautaire dans le domaine de l’alimentation. Ainsi six règlements ont été publiés entre 2002 et 2005 constituant le « paquet hygiène ».

La particularité du paquet hygiène est qu’il concerne l’ensemble des acteurs de la chaîne alimentaire de la fourche à la fourchette y compris les services de contrôle. Ainsi tous les exploitants depuis la production primaire végétale jusqu’à la remise au consommateur englobant l’alimentation animale et la production primaire animale et tous les intermédiaires (transporteurs céréaliers, transporteurs d’animaux, entrepôts...) sont concernés.

Six règlements principaux (cf. figure 1) ont été adoptés:

*Le règlement 178/2002 ou « food law »* : définit un certain nombre d’obligations et d’objectifs clés pour l’ensemble des exploitants de la chaîne alimentaires à savoir:

- sécurité sanitaire: aucune denrée ne peut être mise sur le marché si elle est considérée comme dangereuse ou présente un risque pour la santé humaine, animale ou pour l’environnement
- traçabilité: chaque opérateur doit pouvoir identifier ses clients et fournisseurs
- responsabilité: chaque exploitant est responsable de la qualité des produits qu’il cède
- retrait et rappel: chaque opérateur doit procéder au retrait ou rappel des produits qui sont considérés comme dangereux ou préjudiciables à la santé humaine ou animale
- information des services de contrôle.
Ce règlement constitue le socle fondateur dans le domaine de la sécurité sanitaire des denrées alimentaires et des aliments pour animaux. Les autres règlements reprennent ces principes généraux dans des domaines plus spécifiques.

Le règlement (CE) n°852/2004 relatif à « l’hygiène des denrées alimentaires » établit les règles générales d’hygiène applicables à toutes les denrées alimentaires. Notamment il fixe des règles d’hygiène à respecter par les exploitants agricoles de la production primaire.

Le règlement (CE) n°183/2005 fixe les exigences en matière d’hygiène des aliments pour animaux. Il définit des obligations et règles d’hygiène applicables à tous les opérateurs intervenant dans la chaîne de l’alimentation animale depuis la production primaire végétale jusqu’à la distribution de l’aliment à l’animal.

Le règlement (CE) n°853/2004 relatif « aux règles spécifiques d’hygiène applicables aux denrées alimentaires d’origine animale » ne s’applique pas à la production primaire.

Les règlements (CE) n°882/2004 (CE) n°854/2004 fixent les règles relatives « aux contrôles officiels effectués pour s’assurer de la conformité avec la législation sur les aliments pour animaux, les denrées alimentaires et avec les dispositions relatives à la santé animale et au bien être des animaux ».

![Figure 1 Architecture du paquet hygiène](image)

**Impact du paquet hygiène sur les exploitants de la production primaire animale**

Tout éleveur d’animaux producteurs de denrées destinées à la consommation humaine est un acteur de la chaîne alimentaire concerné par le paquet hygiène. Il a pour obligation de respecter l’ensemble des prescriptions définies dans ce corpus réglementaire.

**Responsabilité du producteur en matière de sécurité sanitaire des aliments**

L’éleveur est pleinement responsable de la qualité des aliments qu’il va produire à toutes les étapes de la production. Il a obligation de prendre toutes les mesures nécessaires dès lors qu’il a connaissance d’un danger (retrait et rappel des denrées). Le fournisseur d’aliment pour animaux également soumis au paquet hygiène a les mêmes obligations et devra prendre également les mesures qui s’imposent.
**Traçabilité en élevage**

Tout exploitant du secteur alimentaire doit être en mesure d’identifier toute personne lui ayant fourni une denrée alimentaire, un aliment pour animaux ou toute substance susceptible d’être incorporée dans ceux-ci. De même il doit pouvoir également pouvoir identifier toutes les personnes auxquelles il a fourni un produit.

Ce système de traçabilité (amont et aval) doit pouvoir permettre d’effectuer des retraits lorsqu’un produit est susceptible de présenter un danger.

Concrètement pour atteindre ces objectifs, tout exploitant agricole a des obligations de:

**Déclaration : enregistrement ou agrément de son activité**

Le principal objectif de cette mesure consiste pour les services de contrôle d’avoir connaissance de chaque établissement et de l’activité de ce dernier.

**Teneur de registres**

Le paquet hygiène demande la mise en place d’un certain nombre de registres.

Le registre a pour objectif de conserver une trace écrite de toutes les mesures prises afin de maîtriser les dangers à savoir l’origine des aliments pour animaux, les traitements médicamenteux, les résultats d’analyses etc.

**Transmission de l’information de la chaîne alimentaire (ICA)**

L’objectif de l’ICA est de fournir 24 heures à l’avance un certain nombre d’informations à destination de l’abatteur afin que celui-ci les exploite dans le cadre de son plan de maîtrise sanitaire (analyse de risque et plan HACCP). Ces éléments sont également transmis aux services vétérinaires pour adapter l’inspection ante- et post-mortem des animaux. Ils constituent donc des éléments essentiels dans la démarche d’analyse de risques qui est désormais la base des contrôles.

Ces informations concerneront le statut de l’exploitation agricole, l’état sanitaire des animaux, les traitements médicamenteux administrés aux animaux, les résultats d’analyses pertinents et des données générales de production.

**Respect des conditions d’hygiène et de bien-être**

*En matière d’aliments pour animaux*

Le règlement R 183/2005 définit les dispositions relatives à l’hygiène applicables à tout exploitant qui produit des végétaux destinés à l’alimentation des animaux sans autre transformation. Les principes généraux recommandent:

- d’éviter toute source de contamination chimique (produits phytosanitaires, biocides ...), physique (par l’air et l’eau), ou biologique (insectes ou rongeurs), de maîtriser les problèmes de contamination croisée
- de maintenir propres les équipements de stockage, transport des aliments
- destockerséparément toutes les sources de contaminations dangereuses (biocides, phytopharmaceutiques, médicamente vétérinaire ...).

Il concerne également les exploitants qui fabriquent eux-mêmes à la ferme des aliments supplémentés. Les conditions d’hygiène sont plus strictes et les exploitants doivent:

- respecter des normes d’installation et d’équipement
- former leur personnel
- tenir des registres de production
- mettre en place un système d’analyse des risques et maîtrise des points critiques (HACCP)
- respecter des normes de transport et d’entreposage
- effectuer des contrôles de la qualité.
**En matière d'élevage des animaux**

Le paquet hygiène définit des dispositions générales applicables à l'élevage des animaux producteurs de denrées alimentaires. Il définit des bonnes pratiques en matière d'alimentation des animaux avec des mesures concernant aussi bien:

- le pacage des animaux
- les équipements servant à l'alimentation
- l'entreposage et la distribution avec un objectif de maîtrise des contaminations croisées
- l'eau et l'abreuvement.

**Guides de bonnes pratiques**

Pour mettre en place l'ensemble de ces exigences, le paquet hygiène encourage les organisations professionnelles à rédiger des guides de bonnes pratiques qui sont des documents de référence, d'application volontaire, conçu par une branche professionnelle pour les professionnels du secteur.

**Rôle des Services vétérinaires français dans le contrôle du paquet hygiène**

En 1995, la France a réorganisé son système sanitaire en séparant la gestion du risque de l'évaluation du risque qui a été confiée à une agence indépendante : l'agence de sécurité sanitaire des aliments (Afssa).

Les services vétérinaires français dépendent du ministère de l'alimentation, de l'agriculture et de la pêche. Ils ont en charge le contrôle des denrées alimentaires d'origine animale tout au long de la chaîne alimentaire depuis la production primaire jusqu'à la remise directe au consommateur, de la « fourche à la fourchette ».

 Ils sont organisés selon une chaîne de commandement unique depuis l'échelon central (avec la direction générale de l'alimentation) qui a la responsabilité de la mise en place de la réglementation nationale et la définition de la politique sanitaire nationale, et de services déconcentrés au niveau régional avec des entités locales des services vétérinaires en charge d'appliquer la politique sanitaire nationale. Ils disposent également d'un réseau de laboratoires d'analyses en santé animale et en hygiène alimentaires. Actuellement l'ensemble des services vétérinaires est en phase d'accréditation selon la norme ISO 17020.

Les services vétérinaires sont composés de vétérinaires fonctionnaires (inspecteurs de santé publique vétérinaire) et de techniciens du ministère de l'agriculture. L'État délègue certaines actions de police sanitaire en élevage aux vétérinaires praticiens privés disposant d'un mandat sanitaire délivré par l'État. Il s'agit de missions de prophylaxie dans le cadre de la prévention et la lutte contre certaines maladies animales réglementées, de visites sanitaires en élevage dont le but est notamment de contrôler l'application du paquet hygiène et de certification sanitaire à l'exportation.

Ces vétérinaires sanitaires sont à même d'informer les éleveurs des risques que peuvent présenter certaines pratiques et les aider à mettre en œuvre efficacement la réglementation. La visite sanitaire qu'ils effectuent dans les élevages ainsi que l'ensemble des informations recueillies à l'abattoir par l'ICA permettent aux services vétérinaires de programmer les contrôles selon une approche basée sur l'analyse de risques.

Par ailleurs grâce à la traçabilité mise en place avec le paquet hygiène tout au long de la chaîne alimentaire les services vétérinaires peuvent remonter jusqu'à l'élevage d'origine en cas de problèmes sanitaires et prendre les mesures correctrices et préventives qui s'imposent.

**Conclusion**

Le système sanitaire français repose ainsi sur un trépied qui résulte de la collaboration étroite entre:

- l'éleveur qui a la responsabilité d'assurer la production d'animaux en bonne santé, de denrées alimentaires d’origine alimentaire ne présentant pas de risques sanitaires pour le consommateur et de mettre en œuvre les outils nécessaires à une bonne traçabilité
- le vétérinaire privé qui surveille la situation sanitaire de l’exploitation, conseille l’éleveur dans les tâches qui lui incombent et assure des actions de police sanitaire pour le compte de l’État
- les services vétérinaires publics qui ont la responsabilité du contrôle de la production des denrées alimentaires depuis la phase de production primaire en élevage et assurent leur mission de protection du consommateur.
Les services vétérinaires jouent un rôle central dans le contrôle de la sécurité sanitaire des aliments car ils sont présents à tous les maillons depuis l'élevage jusqu'à l'abattoir.

La profession vétérinaire est au cœur de ce système. Pour assurer ces missions d'analyse des risques et d'expertise des dangers, les vétérinaires doivent bénéficier d'une formation multidisciplinaire ne se limitant pas à la santé animale mais incluant également les sciences de la sécurité sanitaire des aliments et de la politique sanitaire dans sa globalité.

**Bibliographie**

Summary

Foodborne zoonoses constitute one of the most important public health problems associated with foodstuffs, and they can also have an enormous economic impact. Increased international travel and trade in food have increased the risk of rapid global spread of these zoonoses. The most important pathways for the transmission of zoonotic hazards from animals to humans via foodstuffs are shown and the roles of veterinarians and other professions in investigating outbreaks of foodborne zoonoses are discussed. The importance of considering the whole of the food chain and of using the Hazard Analysis and Critical Control Points (HACCP) approach in preventing and controlling such outbreaks is emphasised. The occurrence, effects and methods to prevent or control the most important foodborne zoonotic hazards are discussed, and information is provided on Codex and the World Organisation for Animal Health (OIE) standards, guidelines and recommendations related to foodborne zoonoses.


Introduction

For the purposes of this paper, foodborne zoonoses are defined as infections and diseases that are transmissible between animals and humans via foodstuffs. This definition encompasses not only zoonoses caused by bacterial zoonotic agents, but also parasites and prions. Viruses can be transmitted between humans via foodstuffs, but are not considered here mainly because current knowledge about their importance as foodborne zoonotic agents is limited.

Public health and economic importance

Foodborne zoonoses constitute one of the most important public health problems associated with foodstuffs, resulting in millions of cases of human diseases annually. For example, in 2007 there were over 200,000 reported confirmed cases of campylobacteriosis and over 150,000 cases of salmonellosis in the European Union alone (3). The severity of zoonotic diseases can vary from mild gastro-intestinal symptoms to acute renal failure, chronic debilitating diseases (such as Guillain-Barré syndrome), abortion and even death. Veterinary students should be made aware of the public health importance of zoonoses and that, as a result of poor follow-up and incomplete reporting, official statistics on such diseases represent only the tip of the clinical iceberg.

In addition to the negative effects on public health, foodborne zoonoses also have an enormous economic impact, in the form of increased costs for healthcare, loss of earnings and production, loss of market access, etc. Unlike animal diseases that are not transmitted to humans, the economic burden of foodborne zoonoses, such as campylobacteriosis and salmonellosis, is borne mainly by the affected food consumers and the health services, rather than by agriculture and the food industry.

Increased international travel and globalisation of the food and feed trade have increased the risk of rapid global spread of foodborne zoonoses. Changes in microorganisms and in human demographics and lifestyle have also increased the risk of foodborne zoonoses. In some countries the incidence of some zoonoses, for example campylobacteriosis, shows marked seasonal variations, with much higher levels during the warmer period of the year and there is good reason to believe that climate change may result in an increase in such zoonoses.

Goals of veterinary education on foodborne zoonoses

Historically, veterinary education has had a very strong focus on animal health, but in recent decades there has been increasing awareness of the public health importance of foodborne zoonoses and the role that veterinarians can play in combating them. An example of this was the decision by World Organisation for
Animal Health (OIE) in 2002 to establish a permanent Working Group on Animal Production Food Safety to coordinate its work on food safety, including zoonoses, and provide advice to its Director General and Specialist Commissions.

The education and training of veterinarians, which includes both animal health and food hygiene components, should prepare them to play a central role in ensuring food safety, especially the safety of foods of animal origin. It should provide them with broad knowledge about the foodborne zoonoses of global importance and in-depth information about zoonoses of particular national and regional importance. Regardless of whether they intend to work in the public or private sector, their education and training should enable veterinarians to play a key role in the detection, investigation, prevention and control of foodborne zoonoses, thus enabling them to make a major contribution to improving public health. Although the main focus should be on measures that can be taken during primary production and slaughter/harvesting, it should be borne in mind that veterinarians often play a central role in later parts of the food chain, both in the food industry and trade, and in the food safety authorities.

Veterinary education should provide students with information on relevant policies, goals and strategies regarding zoonotic diseases, including programmes to combat the spread of such diseases. Students need to be taught about national legislation, guidelines and recommendations related to foodborne zoonoses, including the role and responsibilities of the Veterinary Services in investigating, preventing and controlling/eradicating such diseases. They should also be informed about the standards, codes of practice, guidelines and recommendations on foodborne zoonoses adopted by relevant international organisations, in particular the OIE, the Codex Alimentarius Commission (CAC), the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO). Attention should be drawn to Section 6 of the OIE Terrestrial Animal Health Code (Terrestrial Code) (7), which deals with veterinary public health.

### Some important foodborne zoonotic hazards

The most commonly reported zoonoses in Europe (3) in recent years are caused by *Campylobacter* spp., *Salmonella* spp., *Listeria monocytogenes*, *Mycobacterium bovis* and *Brucella* spp., but the situation may be different in countries in other parts of the world. In view of the possibility of rapid global spread of zoonoses, it is important that veterinary education should give a good general coverage of the most important foodborne zoonoses of global importance, and provide more in-depth information about zoonoses of particular national/regional importance. It should cover both zoonoses transmitted to humans from terrestrial animals and those transmitted from aquatic animals. Information about the occurrence, characteristics, routes of transmission, symptoms of disease produced in humans, infective dose, and methods used to identify and eliminate or control at least the following zoonotic hazards, should be included:

**Bacterial zoonotic hazards**
- *Bacillus anthracis*
- *Brucella* spp.
- *Campylobacter* spp.
- *Listeria monocytogenes*
- *Mycobacterium bovis*
- *Salmonella* spp.
- *Shiga-toxin-producing Escherichia coli* (STEC) (also known as Verotoxigenic *E. coli* [VTEC] and Enterohaemorrhagic *E. coli* [EHEC])
- *Vibrio* spp.
- *Yersinia enterocolitica*.

**Parasitic zoonotic agents**
- *Clonorchis* spp.
- *Cryptosporidium parvum*
- *Echinococcus granulosus*
- *Giardia intestinalis*
- *Opisthorchis* spp.
- *Taenia* spp.
- *Toxoplasma gondii*
- *Trichinella spiralis*.
Prions

- Prions causing transmissible spongiform encephalopathies (TSEs), in particular bovine spongiform encephalopathy (BSE).

Pathways of transmission of zoonotic hazards

Veterinary students should be taught that foodstuffs may become contaminated with zoonotic agents at many different points along the food chain from primary production to the final consumer (see, for example, reference 4 concerning STEC). Food-producing animals may already be infected at birth and can also become infected by contact with other animals (including wildlife) and via contaminated feed, pasture and drinking water, animal housing, insects and so on. Fish and shellfish may become contaminated with such agents due to contamination of the aquatic environment and their feed. Growing food plants (e.g. spinach and lettuce) and drinking water sources may become contaminated with zoonotic agents (e.g. STEC) from water contaminated with excreta from infected animals (and humans) and the use of such water for crop irrigation.

Animal feed is an important route for introducing *Salmonella*, BSE and other hazards into the food chain. Students should be taught about the need for primary producers to take measures to reduce or eliminate the risk of contamination of feed with zoonotic agents, and about the CAC (1), OIE and FAO recommendations on good animal feeding practices.

The use of antimicrobial agents in animal production may lead to the development of zoonotic agents that are resistant to the antimicrobials commonly used to treat human infections, and students should be taught about the importance of responsible and prudent use of antimicrobials in animal husbandry and the OIE recommendations on this subject.

Zoonotic agents present in the gut of slaughter animals may be transferred to the carcass and also spread to the carcasses of other animals through cross-contamination due to poor slaughterhouse hygiene. Therefore education about a modern risk-based approach to meat inspection, as outlined in the CAC’s ‘Code of hygienic practice for meat’ (2) and the OIE *Terrestrial Code* (7), are core components of veterinary education, as is practical experience of meat inspection in slaughterhouses. Students should be made aware of the dual function of ante- and post-mortem meat inspection, that is, to ensure the safety and suitability of the meat for consumption and to provide information on animal health/diseases to be used as a basis for corrective measures in primary production.

Eggs may become infected or contaminated with zoonotic agents derived from infected animals or from the environment. *Salmonella* Enteritidis is a particular public health problem. While *Salmonella* in general contaminates poultry flocks through a number of environmental sources, *Salmonella* Enteritidis is characterised by its ovarian transmission pattern. Students should be informed that it is possible to eradicate or significantly reduce *Salmonella* Enteritidis, as well as other serovars of *Salmonella*, from flocks producing eggs or poultry meat through a guided policy for eradication from the top of the production pyramid, that is, from grandparent flocks through breeder flocks to layer flocks, and by preventing reintroduction from feed.

Poultry meat is a major vehicle for transmission of *Campylobacter* spp. and *Salmonella* spp. and has been implicated in large numbers of outbreaks of disease caused by these bacteria. Veterinary students should be informed about the recommendations made and under development by relevant international organisations (e.g. OIE, CAC, WHO, FAO) and experts from different parts of the world (see for example 5, 6) to tackle this problem by applying measures along the whole of the food chain.

Contamination of foods with zoonotic agents can occur at many points post-harvest/slaughter – during food processing, storage, transport/distribution and commercial or domestic food preparation. Which of the above routes of contamination is most important varies with the zoonotic agent and food concerned and the hygienic practices (or lack thereof) applied.

Veterinary education should include information on how different zoonotic agents can be inactivated or their levels in foodstuffs reduced to safe levels during food processing/preparation by heat treatment (e.g. pasteurisation), freezing, irradiation, chemical agents or the application of other techniques.
Investigating outbreaks of foodborne zoonoses

Despite efforts to prevent them, many outbreaks of disease caused by foodborne zoonotic agents still occur and are likely to do so in the foreseeable future. Veterinarians should be trained to play a key role, together with other professionals, in investigating and terminating such outbreaks and taking action to prevent further outbreaks. In addition to veterinarians, investigating such outbreaks can involve analysts, epidemiologists, food technologists, human health professionals, microbiologists, the affected individuals, food control authorities, agriculture, the food industry, and trade and regional and international organisations. Veterinarians should be taught how such investigations are best carried out, and the importance of close cooperation and clear and rapid communication between all involved. They should also be made aware of the strengths and limitations of the epidemiological (e.g. case-control studies) and other methods used in such investigations, and of the importance of traceability. Sensitive, specific and reliable analytical methods are a key factor in investigations of foodborne disease. Veterinary education should include information about recent developments in analytical methodology, including advanced molecular testing techniques, e.g. ‘molecular fingerprinting’, which have opened up new possibilities to more specifically identify the causative organisms in persons affected by foodborne zoonoses and to identify the food(s) involved with greater certainty.

Whole food chain and preventive approach to food safety

As already mentioned, foodborne zoonoses constitute a major problem of both public health and economic importance, and veterinary education should emphasise the advantages of using a modern approach to prevent or control them. Students should be taught that food safety and quality are best assured by an integrated, multidisciplinary approach, considering the whole of the food production-to-consumption chain. Eliminating or controlling zoonotic hazards at source, i.e. a preventive approach, is more effective in reducing or eliminating the risk of unwanted health effects than relying on control of the final product. Veterinary education should include information about the evolution of approaches to food safety, from traditional controls based on best practices (good agricultural practice, good hygienic practice, etc.), via more targeted food safety systems based on hazard analysis and critical control points (HACCP) to risk-based approaches using food safety risk analysis. It should cover the basics of food safety risk analysis and its three components, risk assessment, risk management and risk communication, and how risk analysis is applied in practice to reduce the risks associated with foodborne zoonoses.

In many cases, contamination of foodstuffs with zoonotic agents can be prevented or markedly reduced by the application of control measures at different parts of the food chain. However, some bacteria, such as *Campylobacter* spp., are widely distributed in the environment and, despite prolonged efforts, it has hitherto proved virtually impossible to eliminate them from certain foods, e.g. broiler meat. Furthermore, it must be realised that in many cases it is impossible to guarantee consumers that foodstuffs are free from zoonotic agents. Veterinarians have an important role to play in informing the catering industry and the general public about potential problems associated with zoonotic agents in the foods they handle, and about good hygienic practices in the kitchen, including storage of perishable foodstuffs, the need to ensure adequate heating of certain foods, e.g. poultry meat, and how to avoid cross-contamination when preparing foods. This type of risk communication is an important component of food safety risk management.

Keeping abreast of developments

Changes in microbiological populations can lead to the evolution of new pathogens, development of new strains of ‘old’ pathogens, development of antimicrobial resistance that can make a disease more difficult to treat, and to changes in the ability of pathogens to survive in adverse environmental conditions. It is therefore important that in their training veterinarians receive information and guidance on sources of further information and how they can keep themselves abreast of developments in the field, including emerging and re-emerging foodborne zoonotic diseases. They should, of course, be informed about how they can best follow developments in their own and neighbouring countries, and also how to track international developments. At the international level, much valuable information on foodborne zoonoses can be obtained from the websites of the OIE (www.oie.int), the CAC (www.codexalimentarius.net), the WHO (www.who.int), and FAO (www.fao.org). The OIE’s *Terrestrial Code* can be accessed via the OIE website and all the Codex standards, recommendations and guidelines can be accessed via the Codex website. Other useful sources are the websites of European Food Safety Authority (EFSA) (www.efsa.europa.eu), the European Centre
for Disease Prevention and Control (ECDC) (www.ecdc.europa.eu) and the Centers for Disease Control and Prevention in the United States of America (CDC) (www.cdc.gov).

References


Animal identification and traceability – current OIE standards

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Summary

Animal identification and traceability are important tools for work in animal health and public health. The World Organisation for Animal Health (OIE) has adopted a set of standards in order to use these tools correctly in different areas of animal health and public health.

Animal identification and traceability are used in key activities such as:
- the management of disease outbreaks and food safety incidents
- vaccination programmes
- herd/flock husbandry
- zoning/compartmentalisation
- surveillance
- early response and notification systems
- animal movement controls
- inspection
- certification
- fair practices in trade
- utilisation of veterinary drugs, feed and pesticides
- cost and benefit studies.

The OIE defined and adopted General Principles, that animal traceability and traceability of products of animal origin should have the capability to be linked to achieve traceability throughout the animal production and food chain and should be under the responsibility of the Veterinary Authority.

Whatever the specific objectives of the chosen animal identification system and animal traceability, there is a series of common basic factors and these must be considered before implementation:
- the legal framework
- procedures
- the competent authority
- identification of establishments/owners
- animal identification and animal movements.

The General Assembly of national representatives of the OIE’s 174 Member Countries and Territories adopted general principles and recommendations on the design and implementation of identification systems to achieve animal traceability (see Chapters 4.1 and 4.2 of the Terrestrial Animal Health Code (the Code)).

The OIE standards are fully applicable in the field, are compatible with the varying economic and technical capacities of OIE Members and are non-discriminatory.

In the development of standards it has also been necessary to define terminology to prevent ambiguity of meaning.

These Code texts are the key international references relevant to the development and implementation of animal identification and traceability systems. Members of the OIE and the Codex Alimentarius Commission are encouraged to implement systems that comply with these standards as a basis for protecting animal and public health and facilitating international trade.

**Introduction**

The standard-setting work of the World Organisation for Animal Health (OIE) commenced, as is customary in the OIE, with a process of scientific review and of investigation of Members’ needs, considering the importance of such work for full compliance with OIE objectives to improve animal health worldwide.

In preparation for the Technical Item on identification and traceability presented at the 72nd OIE General Session in May 2004, a questionnaire was drawn up and sent to all Members. One of the recommendations arising from the questionnaire, which was subsequently adopted by the International Committee, was for the OIE to draw up standards on animal identification and traceability.

The OIE Director General convened an *ad hoc* Group on Animal Identification and Traceability, which has been working on the basis that these standards should serve as an important tool for managing animal health, zoonoses, trade and animal health crises. The *ad hoc* Group comprised experts from different regions of the world, and its work took into account Codex Alimentarius Commission (Codex) activities to ensure proper coordination and complementarity between OIE and Codex standards.

When drawing up the draft standards, the *ad hoc* Group sought to ensure that the standards were fully applicable in the field, compatible and non-discriminatory for Member Countries.

Standards have been adopted relating to the definitions of the most relevant terms in use. In addition, two chapters have been included under Section 4 (General recommendations: disease prevention and control). They are Chapter 4.1 on ‘General principles on identification and traceability of live animals’ and Chapter 4.2 on the ‘Design and implementation of identification systems to achieve animal traceability’.

The First OIE International Conference on Animal Identification and Traceability, held in Buenos Aires in March 2009, issued a set of recommendations that involved additional standard-setting work for the OIE.

**Development of standards on identification and traceability – preliminary stages**

Identification and traceability have been employed since ancient times; in fact, they could be said to date back to the time when animals were first used for human food and for traction. The use of this concept therefore evolved gradually in step with animal production systems, depending on the intensity of production and, in many cases, on the need to obtain information for increasing production, for genetic improvement and for the control of certain diseases. However, the use and implementation of identification and traceability did not form part of a standardised process, even within a single country or zone.

Lack of uniformity with regard to identification and traceability even extended as far as defining the meaning of the terms used, and hence their scope, as well as such factors as the elements used, or registration and quality systems.

In fact, what some defined as animal identification was precisely what others defined as animal traceability.

One of the factors that might be said to have triggered the intensive debate on identification and traceability in the cattle sector (at least in Argentina) was the mad cow (bovine spongiform encephalopathy [BSE]) crisis that struck the United Kingdom, and immediately afterwards Europe. Identification and traceability was one of the tools that the United Kingdom and Europe used to help to bring the disease under control, and this enabled them to apply the animal health strategies stemming from the scientific research conducted to ascertain how best to fight BSE.

As a result, the concept of identification and traceability, associated with the mad cow crisis, which was headline news in the world’s media for a long time, also gradually grew in scale and became increasingly common in the terminology used.

Implementation of the identification and traceability concept requires a set of elements, including devices for identifying animals.

As the concept grew in scale in the media, different types and models of animal identification device began to appear on the market, including various sorts of ear tag, microchip implant and intraruminal bolus. In addition, private-sector suppliers of such devices mounted a huge lobbying campaign to induce governments to implement identification and traceability systems, preferably on a compulsory basis but, failing that, on a voluntary basis.
In 1996, there was much discussion of the concept in Argentina, after which the Argentine Congress tabled a bill making it compulsory to identify all animals in the country. The bill triggered the realisation that more information was required about the concept of identification and traceability, and so the OIE and Argentina’s National Health and Agrifood Quality Service (SENASA) organised an OIE international seminar on the permanent identification of animals and traceability: from farm to fork (Seminario Internacional de la OIE sobre identificación permanente de animales y trazabilidad: del Campo al Plato), held in Buenos Aires on 25-26 November 1998.

Participating in this first international seminar were the world’s leading experts of the day, as well as Chief Veterinary Officers from Australia, Brazil, Canada, the European Union, France, Germany, Italy, New Zealand, the United Kingdom, the United States of America (USA) and Argentina. The seminar was attended by around 700 people from every continent.

First and foremost, the seminar provided an opportunity to exchange experiences with countries that had already implemented identification programmes at different stages of advancement, and to find out each country’s experience and objectives, and which type of programme they had decided to implement. In addition, discussions were initiated concerning the advantages and disadvantages of each of the animal identification devices available on the market, by means of a field study that the European Union had begun to conduct (2) to compare the different devices, and the results given by each device in relation to such variables as retention in the animal, readability and ease of application.

Scientific contribution of the OIE in the preliminary stages.

OIE Technical Item at the 72nd OIE General Session and OIE Scientific and Technical Review 20 (2) devoted to the traceability of animals and animal products

In its continuing bid to further scientific knowledge, the OIE decided to introduce identification and traceability as Technical Item II at its 72nd General Session in May 2004. It commissioned Dr Luis Barcos as the expert to present the item and, jointly with Dr Daniel Chaisemartin, he produced a questionnaire to be sent to the Members (4).

The answers to the questionnaire from 98 Members were truly significant and provided the first ever worldwide guide to inform future OIE standards.

The summary of the presentation of the Technical Item was (1):

Animal identification and traceability have become issues of increasing interest and are closely related with disease control procedures as an epidemiological tool, with a heavy impact on matters such as public health and trade. A questionnaire was sent to OIE Member Countries to obtain information about the status of each of the countries in order to perform an international analysis of: competent authorities and regulations, registration systems, mandatory animal identification, purposes of animal identification, elements used in animal identification, documentation used for animal movements, harmonisation and standardisation procedures applied by the Member Countries, how animal identification and traceability relate to factors such as public health, animal health, trade, bioterrorism, economic aspects and the OIE’s role in this respect. Most of the Member Countries replied that they did think the OIE should propose the creation of international rules and guidelines.

The International Committee adopted a recommendation on the matter, in which it decided to form an ad hoc Group.

The OIE also convened experts from around the world to produce an issue of the OIE Scientific and Technical Review compiling all world knowledge to date on animal identification and traceability. This publication has provided, and still provides, a very important scientific basis for developing and discussing standards, as well as for supporting their national implementation (3).
Work of the ad hoc Group and involvement of OIE Specialist Commissions

In compliance with the mandate of the International Committee, the recommendation of the OIE Regional Commissions for Africa and the Middle East and the recommendation of the World Trade Organization (WTO) Committee on Sanitary and Phytosanitary Measures (SPS Committee), the OIE Director General convened an ad hoc Group, comprising experts from all five continents and a Codex representative, and commissioned the OIE Animal Production Food Safety Working Group to draw up the terms of reference for the OIE ad hoc Group.

The ad hoc Group comprised the following experts: Dr Luis O. Barcos (Argentina), chair; Prof. Hassan Aidaros (Egypt); Dr Yamato Atagi (Japan); Dr Tony Britt (Australia); Dr Annamaria Bruno (Codex); Dr Martine Dubuc (Canada) and Dr Musa Fanikiso (Botswana).

The OIE Animal Production Food Safety Working Group recommended that the ad hoc Group should work in accordance with the following terms of reference and that, in addition, Codex should be called upon to ensure the consistency of any future standards drawn up by the two organisations for ensuring the traceability of animals and animal products.

The terms of reference set out the following objectives for the ad hoc Group’s work:

1. Agree on key definitions.

2. Enumerate a set of principles for good live animal identification and traceability. The principles should be broad, be valid for all the relevant animal species and take into account the differences among OIE Member Countries:
   - compatibility among systems
   - ability to transfer information
   - cost/benefit regarding all OIE Member Countries.

3. Based on these principles, lay out the main points that constitute a good system for identification and traceability of live animals and the outcomes required. Those points should include:
   - the minimum requirements for good animal identification and traceability
   - the options available
   - the advantages and the disadvantages of the various options.

4. Develop a set of recommendations for the practical implementation of the system. For practical reasons, this system should apply to bovine species first, with other species to be addressed subsequently.

The ad hoc Group started work based on these terms of reference. An important aspect of this work was that its meetings were attended not just by the members of the ad hoc Group, but also by members of OIE Specialist Commissions, such as the Code Commission and the Scientific Commission, because identification and traceability is a cross-cutting concept.

The ad hoc Group documents were discussed in the Specialist Commissions and sent to Members for comment as a first stage in the standard-setting process.

To initiate an intentional process of basic stages, a document containing definitions and general guidelines was sent to the Members for comment. After incorporating the Members’ comments, the OIE General Session adopted these first two points as standards in 2006.

After this, the ad hoc Group continued working on the second part of the terms of reference concerning the design and implementation of identification and traceability systems, which once again were sent to the Members for comment and subsequent adoption by the International Committee.

Ensuing stages in OIE identification and traceability standards

The OIE Members now have international standards that have not only been democratically adopted, but have also followed the process described earlier, with the result that the world’s leading scientific knowledge has been incorporated and all the Members have been involved by providing comments.
The stage currently in progress is to implement these standards in the field, after which they will be evaluated using the OIE PVS tool for the evaluation of Performance of Veterinary Services.

Continual updating of OIE standards is part of the routine process and, in the future, the Members’ interest will lead to further adaptations to incorporate all animal species and new technologies.

References


Identificación y trazabilidad de los animales – normas actuales de la OIE

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Introducción

El trabajo de elaboración de los Estándares de la Organización Mundial de Sanidad Animal (OIE) ha comenzado, como es usual en la OIE con un proceso de revisión científica e investigación de las necesidades de los Miembros y de su importancia para poder cumplir adecuadamente los objetivos de la OIE de mejorar la Sanidad Animal a Nivel Mundial.

Como documentación preparatoria para la preparación del Tema técnico sobre Identificación y trazabilidad presentado durante la 72.ª Sesión General de la OIE en mayo de 2004, se elaboró un cuestionario que fue remitido a todos los Miembros, dentro de las recomendaciones surgidas del cuestionario y posteriormente adoptadas por el Comité Internacional figuraba la necesidad de que la OIE elaborara normas en la materia.

Director General de la OIE conformó un Grupo ad hoc sobre identificación y trazabilidad de los animales que ha trabajado teniendo presente que las normas deben servir, entre otros usos, de herramienta de gestión de la sanidad animal, las zoonosis, el comercio y el control de las crisis sanitarias. Este Grupo ad hoc estuvo integrado por expertos de diferentes regiones del mundo y en él se tomaron en cuenta las actividades del CODEX a efectos de asegurar una adecuada coordinación y complementariedad entre las normas de la OIE y las del CODEX.

En el trabajo de elaboración de los borradores se ha buscado que las normas sean realmente aplicables en el terreno, compatibles y no discriminatorias para los Países Miembros.

Se han adoptado normas relacionadas con las definiciones de los términos utilizados más relevantes. Asimismo, dentro del Título 4 – ‘Recomendaciones Generales: Prevención y profilaxis de enfermedades’, se ha desarrollado el Capítulo 4.1 sobre los “Principios generales de identificación y trazabilidad de los animales vivos” y el Capítulo 4.2 relativo a la “Creación y aplicación de sistemas de identificación que permitan el rastreo de animales”.

Durante primer Conferencia Mundial de Identificación y trazabilidad de los Animales de la OIE realizada en Buenos Aires en Marzo 2009, surgieron una serie de recomendaciones que implican un trabajo adicional en los estándares de la OIE.

El desarrollo de las normas de identificación y trazabilidad – etapas previas

La Identificación y trazabilidad se ha utilizado desde épocas muy remotas, se puede decir desde que los animales se utilizaron para la alimentación humana o para la tracción. Asimismo la utilización de este concepto fue evolucionando a medida que evolucionaron los sistemas de producción animal, en cuanto a su intensidad, en muchos casos en la necesidad de obtener información para aumento de la producción, el mejoramiento genético y el control de algunas enfermedades. De todos modos esta utilización e implementación no se realizó bajo un proceso estandarizado, incluso dentro de un mismo País o zona.

La diversidad de la identificación y trazabilidad estaba presente desde las definiciones de lo que significaban las palabras utilizadas y por lo tanto el alcance de las mismas, así como los elementos utilizados, los sistemas de registro y de calidad entre otros.

De hecho lo que para algunos significaba identificación animal para otros era exactamente el significado de trazabilidad animal.
Podría decirse que uno de los factores que desencadenó al menos en la Argentina un fuerte proceso de comenzar a hablar de Identificación y trazabilidad en el sector del Ganado Bovino, fue la Crisis de la Vaca Loca en el Reino Unido primero y de inmediato en Europa.

De hecho una de las herramientas que utilizaron en Reino Unido y Europa para ayudar al control de la enfermedad fue la identificación y trazabilidad, por medio de la cual pudieron aplicar las estrategias sanitarias que brindó la investigación científica que se desarrolló a los efectos de conocer como luchar contra la encefalopatía espongiforme bovina (EEB).

Entonces el concepto de identificación y trazabilidad, ligado a la crisis de la Vaca Loca, que ocupó un relevante lugar en los medios durante mucho tiempo, también fue creciendo y haciéndose cada vez más común en la terminología utilizada.

El concepto de identificación y trazabilidad, necesita para su implementación una serie de elementos como son los dispositivos para identificar los animales.

En forma contemporánea al crecimiento en los medios de este concepto comienzan a aparecer en el mercado diferente tipo y modelo de dispositivos para identificar animales, como diferentes modelos de caravanas, micro chip subcutáneos, microchip para aplicación intra ruminal, entre otros, y el enorme lobby del sector privado proveedor de estos dispositivos para que los Gobiernos implementen ya sea en forma obligatoria, preferentemente o voluntaria sistemas de identificación y trazabilidad.

En 1996, en Argentina, se escuchaba muy fuertemente este concepto, y surge una propuesta de una Ley del Congreso de la Nación para identificar todos los animales del País.

Esta iniciativa desencadena la idea de que era necesario tener más conocimiento del concepto de identificación y trazabilidad y la OIE y el Servicio Nacional de Sanidad y Calidad Agroalimentaria (SENASA) organizan un Congreso de Identificación Animal y Trazabilidad que se llama “Del campo al plato”.

Este primer congreso realizado en Noviembre de 1998, en la ciudad de Buenos Aires, tuvo la participación de los mejores expertos Mundiales en ese momento, como así también de los Jefes de Servicio Veterinario de Alemania, Reino Unido, Unión Europea, Francia, Italia, Nueva Zelanda, Australia, Brasil, Canadá, Estados Unidos y Argentina, con una participación de cerca de 700 asistentes provenientes de pasapases de todos los continentes.

En ese Congreso se pudo en primer lugar intercambiar las experiencias de países que ya estaban con programas de identificación implementados en diferentes estadios y se pudo conocer su experiencia y los objetivos que se perseguía en cada uno de los Países y para ello que tipo de programa se implementaba, asimismo se comenzó a discutir las ventajas y desventajas de cada uno de los dispositivos que había en el mercado para ser utilizados en la identificación de los animales, por medio de un trabajo de campo que había comenzado a desarrollar la Unión Europea, por medio del cual comparaba (2) los diferentes dispositivos y el resultado que se obtenía de cada uno en cuanto a variables como, retención en el animal, capacidad de lectura, facilidad de aplicación, entre otros.

El aporte científico de la OIE en las etapas previas,
Tema Técnico de la OIE en la 72.a Sesión General de la OIE y la Revista científica y técnica Rastreabilidad de los animales y de los productos de origen animal, 20 (2)

La OIE, continuando su avance de toma de conocimiento científico, decide introducir como Tema Técnico II a la Identificación y trazabilidad en la 72.a Sesión General en Mayo 2004, para lo cual convoca al Dr. Luis Barcos, como experto para que presente este tema, en cual en conjunto con el Dr. Daniel Chaisemartin desarrollan un cuestionario para ser enviado a los Miembros (4). Las respuestas obtenidas a este cuestionario por 98 Miembros fueron realmente relevantes y la primer orientación Mundial que existió para marcar el futuro de los estándares de la OIE.

El Resumen de la presentación del Tema Técnico fue (1):

“La identificación de los animales y la trazabilidad se han convertido en temas de creciente interés y relacionados estrechamente con los procedimientos de control de enfermedades, como herramienta
de la epidemiología y con una gran influencia en los aspectos de Salud Pública y comercio entre otros. Se ha enviado un cuestionario a los Países Miembros con el objeto de obtener información acerca de la situación relativa de cada uno de los países para que permita un diagnóstico internacional relacionado a: autoridades competentes y reglamentaciones, sistemas de registros, obligatoriedad de la identificación de los animales, objetivos de la identificación de los animales, elementos utilizados en identificación de los animales, documentación utilizada para el traslado de animales, procedimientos de armonización y normalización aplicados por los Países Miembros, relación entre la identificación de los animales y la trazabilidad relativa a factores como Salud Pública, Sanidad Animal, Comercio, Bioterrorismo, Aspectos Económicos y el rol de la OIE sobre este tema. Los Países Miembros respondieron en forma afirmativa y en su mayoría en que la OIE debería proponer la creación de normas y directrices internacionales".

El Comité Internacional adopta una Recomendación relativa a este tema en la cual decide la formación de un Grupo ad hoc.

Asimismo la OIE convoca a expertos de todo el Mundo para realizar compilar en un número de la Revista científica y técnica todos los conocimientos Mundiales hasta el momento relativos a la Identificación y trazabilidad de los Animales. Esta publicación ha sido y es una base de mucha importancia como elemento científico para la elaboración y discusión de los estándares y una ayuda para su implementación en los Países (3).

**El trabajo del Grupo ad hoc, las Comisiones Especializadas de la OIE**

El Director General de la OIE, cumpliendo el mandato del Comité Internacional, y la Recomendación de las Comisiones Regionales de África y Medio Oriente y la recomendación del Comité SPS, convoca a un Grupo ad hoc, conformado por expertos de los 5 continentes y un representante del Codex, le encomienda al Grupo de Trabajo de Inocuidad Alimentaria en Producción Animal de la OIE que elabore los términos de referencia para el Grupo ad hoc de la OIE.

El Grupo ad hoc fue conformado por los siguientes expertos, Dr. Luis O. Barcos, Argentina (chair), Prof. Hassan Aidaros, Egipto, Dr. Yamato Atagi, Japon, Dr. Tony Britt, Australia, Dr. Annamaria Bruno, Codex, Dr. Martine Dubuc, Canada, Dr. Musa Fanikiso, Botswana.

El Grupo de Trabajo de Inocuidad Alimentaria en Producción Animal de la OIE recomendó que el Grupo ad hoc trabaje con los siguientes términos de referencia y que además se convoque al Codex a los efectos de asegurar la coherencia de las futuras normas que se elaboren entre ambas organizaciones y que aseguren la trazabilidad entre los animales y los productos de origen animal.

Los términos referencia incluyeron los siguientes aspectos en los cuales el Grupo ad hoc debía trabajar:

1. **Acordar las definiciones más relevantes**
2. **Enumerar una serie de principios a tener en cuenta para el adecuado manejo de la Identificación y trazabilidad de los animales.** Estos principios deben ser lo suficientemente amplios como para abarcar a las especies animales más relevantes y deberían tener en cuenta las diferencias entre los Miembros de la OIE y deberían además tener en cuenta la:
   - compatibilidad entre diferentes sistemas
   - habilidad de transferir información
   - costos y los beneficios que tendrían los Miembros de la OIE.
3. **Teniendo en cuenta los principios generales, establecer una línea de procedimientos que constituyan los puntos más importantes de un Sistema de Identificación y trazabilidad de los Animales de acuerdo a los objetivos definidos, y esos puntos defina incluir al menos:**
   - requerimientos mínimos para la identificación de los animales
   - diferentes opciones disponibles
   - ventajas y desventajas de cada una de las opciones
4. **Desarrollar recomendaciones para la aplicación practica del sistema.** Por razones practicas comenzar con este diseño en bovinos y luego otras especies.
En base a estos términos de referencia el Grupo ad hoc comenzó a desarrollar su trabajo, un aspecto importante de este trabajo fue que en las reuniones además de la participación de de los miembros del Grupo ad hoc también participaron miembros de las Comisiones Especializadas como el Código y la Científica, puesto que la identificación y trazabilidad e identificación es un concepto horizontal.

Los documentos del Grupo ad hoc fueron discutidos en las Comisiones especializadas y enviados a los Miembros para comentarios como un primer paso en la elaboración de los estándares.

En primer término y a los efectos de ir en etapas básicas se envió a comentario a los Miembros un documento conteniendo las Definiciones y Lineamientos Generales, luego de introducir los comentarios recibidos de los Miembros estos dos primeros puntos fueron adoptados por la Asamblea como estándares en la Sesión General del 2006.

Posteriormente el Grupo ad hoc continuó trabajando el la segunda parte de los términos de referencia relacionados al Diseño de los sistemas de Identificación y trazabilidad, los cuales nuevamente fueron remitidos a comentarios a los Miembros para comentarios y posterior adopción por parte del Comité Internacional.

**Los pasos siguientes en los estándares de identificación y trazabilidad de la OIE**

Los Miembros de la OIE tienen ahora standards Internacionales adoptados democráticamente, y que además han seguido un proceso como el que se ha descripto que ha permitido tomar el mejor conocimiento científico mundial y la interacción con todos los Miembros a través de sus comentarios.

La etapa que continua ahora es la implementación en el terreno de estos estándares, los cuales serán evaluados por medio de la herramienta PVS.

La actualización permanente de los estándares de la OIE es parte del proceso normal y futuras adecuaciones a todas las especies animales y a nuevas tecnologías podrán ser incluidas como resultado del interés de los Miembros.

**Bibliografía**

Session 5

Animal welfare

Chair: Dr Dietrich Rassow
The scientific assessment of animal welfare*

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* Some sections of this paper are derived, largely unaltered, from Mellor D.J. and Stafford K.J. (21).
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Summary

This paper reviews some aspects of the development of animal welfare science during the last 20-30 years and considers the continuing absence of a unified definition of animal welfare in the published literature. The many animal-based sciences that have provided the foundations of contemporary animal welfare science emphasise its multidisciplinary character. It is noted that the contributions of veterinary and agricultural sciences to improving the welfare of animals, long before animal welfare became an idea considered to merit scientific investigation, are currently not fully appreciated and do not receive the recognition they deserve. The three major orientations towards animal welfare that have emerged – the biological function, affective state and natural state orientations – are noted. An integrated characterisation of animal welfare is presented which reflects the contemporary emphasis given to affective state, i.e. the positive, neutral or negative sensations or emotions the animal experiences. This emphasis on the animal's actual experience highlights the logic of endeavouring to focus most attention on animal welfare outcomes, not management inputs or facilities, when setting animal welfare standards. The use of readily available, well-validated scientific indices of different aspects of an animal's functional status that can affect what it experiences is discussed. It is noted that such functional indices can be used to rule out or to demonstrate that animal welfare has been compromised in various ways although they are not direct indices of the emotional states or sensations the animal may experience. Finally, the inclusion of animal welfare science in veterinary curricula internationally is considered, as is the importance of scientific assessment as a major factor in determining animal welfare standards.


Introduction

It is a truisum that to assess any attribute or condition scientifically, or in any other way, we must first have some notion of what is being assessed. Thus, in order to assess animal welfare scientifically we need to have a cogent idea of what animal welfare is. Yet, this confronts us with a difficulty because, to date, no all-embracing definition of animal welfare has emerged despite considerable effort to derive one (18, 25). There are several linked reasons for this. First, animal welfare emerged as a concept considered worthy of scientific investigation only about 30 years ago (17, 18, 26). It is not surprising therefore that early attempted definitions were modified or alternatives provided as more investigators gave thought to the subject. Second, beginning with these ideas, and continuing even today, an underlying evolution in notions about what animal welfare is has become apparent. This evolution was driven at each point in time by interactions between what was then new knowledge about animal functionality and what were then current ideas regarding animal welfare, and these, in their turn gave rise to fresh thinking about both animal welfare and related functionality. Third, all of this has affected and has been affected by the range of societal views on what constitutes acceptable or unacceptable ways of treating animals, views which are based on prevailing (and evolving) ethical, social, cultural, religious, economic and other values (7). It is beyond the scope of this paper to trace these developments in detail, especially as they have been reviewed elsewhere (e.g. 12, 25). Nevertheless, after commenting on the often-unacknowledged past contributions of numerous science disciplines to improvements in animal welfare, this paper outlines three main orientations towards animal welfare that have emerged over the last 30 years. It then provides an integrated characterisation of animal welfare and considers its relevance to the scientific assessment...
Multidisciplinary origins and character of animal welfare science

Recognition of veterinary involvement in animal welfare developments has been mixed. Veterinary science contributions that have greatly enhanced animal welfare through improvements in animal health during at least the last century have often been underestimated or ignored (18). This is partly because the solutions found so reduced the prevalence of some health problems that their welfare effects are virtually unknown today; for instance, at least 60 vaccines have been developed for controlling painful and distressing infectious diseases in animals (18). It was also because such advances were made well before animal welfare emerged as a concept and, in a more recent development, before the very close link between animal health and welfare was accepted in the animal welfare arena (2, 17, 18, 26). In addition, the emergence of the concept of animal welfare itself and the drive to pursue the related sciences originally occurred predominantly outside the veterinary profession so that, in some respects, involvement of the profession in animal welfare as a specified area of scientific interest was initially quite limited (26). This began to change after about 1995, so that within ten years the majority of the then 19 animal welfare professors worldwide were located in veterinary schools (26). Also by 2005, various aspects of the identification, causes, correction, management and prevention of animal welfare compromise, and major responsibilities of veterinarians in this arena, had been included in the curricula of at least 15 veterinary schools around the world (10, 13, 14, 24).

The contributions over at least the last 50 years of agricultural sciences to the welfare of farm livestock also rarely receive due acknowledgement (17). Thus, the major impact of crop and soil sciences, agricultural engineering, and of animal production, nutritional and environmental sciences on animal welfare is underestimated today, probably because numerous problems that were addressed scientifically were solved many years ago or can still be managed effectively by the approaches devised then (18). For instance, 50 years ago we did not know the precise nutrient requirements of livestock at different stages of the production cycle, or how crops, pastures and soils could be managed to meet those requirements, or how husbandry practices and breeding could be used to improve the ‘environment fit’ of different species or breeds of animals. The acquisition of this scientific knowledge, plus that underpinning the prevention, diagnosis and treatment of animal diseases, as well as the successful use of this knowledge to solve or minimise previously intractable nutritional, environmental, health and other such problems, now enables other animal welfare issues to be given higher scientific priority (17, 18). These issues are currently being addressed predominantly by application of behavioural and neural/cognitive sciences.

Animal welfare science is therefore multidisciplinary in origin and current activity. Its progenitor and contemporary partner disciplines include animal behaviour science and cognitive-neural science, as well as animal husbandry, biochemistry, genetics, immunology, nutrition, physiology, pharmacology, veterinary pathology and veterinary clinical sciences (18). It follows that the scientific assessment of animal welfare rests on knowledge and skills derived within these disciplines as well as from the newly emerged discipline of animal welfare science. However, as noted above, before animal welfare can be assessed scientifically, it is necessary to understand what animal welfare is.

Three main animal welfare orientations

Three general animal welfare orientations may be recognised at present (8). The first is a biological function view. This holds that, generally, welfare is good when animals are healthy, growing and reproducing well, and, for farm animals, when good meat, milk, egg and fibre productivity of individuals is associated with good health and reproductive performance. The second is an affective state orientation which emphasises the potential for animals to suffer or have positive experiences. According to this view, good welfare is present when animals adapt without suffering and/or with positive emotional experiences (feelings) during their interactions with other animals, people and the environment. Finally, there is a natural state view which holds that welfare may be compromised in proportion to how far the conditions in which animals are kept deviate from the presumed original wild state of the species and, in particular, by the extent to which the animals are, or are not, able to express most of their natural behaviours. These three orientations provide different perspectives on animal welfare and could
lead to different conclusions being drawn about the welfare status of animals in particular situations (8). The conclusions will also depend on how the welfare status is assessed, for instance, whether such assessment is according to how well animals cope with their environment, or their fitness in terms of their health, reproductive success and survival, or the extent to which their needs are being met (provided that there is agreement on what those needs are), or in terms of the absence of negative states and/or the presence of positive states (18).

**An integrated characterisation of animal welfare**

Animal welfare may be characterised in terms of the following principal features (18):

- Animal welfare is a state *within* an animal. It is not management procedures applied to the animal, or features of the animal’s environment, which may affect its welfare;

- The animal must be phylogenetically and developmentally *sentient*; i.e. it must have a brain with sufficient functional sophistication to transduce impulses in sensory and other nerves into experienced sensations;

- As animal welfare relates to *experienced* sensations, the animal must be *conscious*; unconscious animals cannot experience anything;

- These experiences can be negative, neutral or positive;

- These experiences arise as the integrated outcomes of sensory and other neural inputs from within the animal’s body and from its environment;

- These inputs are processed and interpreted by the animal’s brain according to its species-specific and individual nature, and past experience;

- The integrated outcome represents the animal’s current experience (i.e. its welfare status), and this changes as the balance and character of the inputs change;

- These experiences are *subjective states* and, *based on human experience*, are likely to include negatives such as thirst, hunger, nausea, pain and breathlessness, and positives such as satiety, contentment, exploration and play;

- As subjective states they cannot be measured directly;

- However, informative indirect indices of such experiences are available and rely on knowledge of physiological, pathophysiological and behavioural responses, critically evaluated with particular regard to the specific context of the animal;

- The welfare status of an animal at any one time may vary on a continuum between extremely bad to very good.

This characterisation of animal welfare emphasises *affective state* expressed in terms of the negative, neutral or positive subjective experiences an animal may have. The nature and range of these experiences may be suggested by reference to updated versions of the Mellor and Reid (19) ‘five domains’ paradigm for animal welfare assessment (15, 18, 20).

The five domains represent areas of potential welfare compromise. The first four domains, encompassing potential *nutritional*, *environmental*, *health* and *behavioural* compromises, are largely physical or functional. Sensory inputs from these domains result in subjective experiences in the *fifth mental* domain, which also receives sensory inputs elicited by external stimulation. Examples of likely subjective experiences associated with compromise in each of these domains are as follows:

**Nutritional**

- water deprivation leading to thirst
- food deprivation leading to hunger
- nutrient imbalances (deficiency/excess) leading to debility or weakness.
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**Environment**
- extremes of cold leading to chilling and debilitating hypothermia
- extremes of heat leading to hyperthermic distress
- injurious housing leading to pain.

**Health**
- disease, injury and functional impairment leading to, for instance, breathlessness, nausea, sickness, pain, distress, fear or anxiety.

**Behaviour**
- space restrictions, isolation or barren environments leading to, for instance, boredom, frustration, loneliness or helplessness.

**Mental**
- sensory inputs arising from compromise in the other four domains, plus cognitive inputs and related mental activity arising from external challenge (e.g. eliciting ‘fight-flight–fright’ responses), resulting in experienced sensations of thirst, hunger, weakness, debility, breathlessness, nausea, sickness, pain, distress, fear, anxiety, helplessness, boredom, and so on.

The experiences just described are negative. This is in line with the predominant characterisation, over the past 30 years, that good animal welfare represents an absence of negative states (25). More recently, however, good animal welfare is being considered to depend on the presence of positive experiences or feelings as well (4, 6, 9, 11, 28). Thus, other forms of welfare compromise may arise from an absence of positive mental states arising from an absence of feelings of reward or satisfaction in circumstances which hinder an animal's capacity to experience, for instance, vitality, companionship, contentment, satiety, happiness, curiosity, exploration, foraging and play (18).

The notion that a good state of welfare exists when the nutritional, environmental, health, behavioural and mental needs of an animal are met accommodates all of these considerations (18). That is because meeting the mental needs of animals can be taken to incorporate both the absence of demonstrably negative experiences and the presence of positive experiences that have been shown to be important to the animal.

Another point to re-emphasise regarding this focus on affective state is that the welfare status of an animal is what the animal itself experiences as the integrated outcome of all inputs into the mental domain that can affect its emotional state. It is therefore the assessment of the extent to which an animal’s own state is affected adversely when one or more of its needs are not catered to adequately that determines how badly its welfare is compromised. The question is: how can that be assessed?

**Assessment of welfare compromise**

Assessments of the welfare status of animals and the degree of welfare compromise they may experience are based on the substantial knowledge of functional disruptions studied by numerous scientists, veterinarians and others over at least the last 50 years (16, 18). Such assessments have been, and are, made by veterinarians and animal-based scientists in particular (e.g. 3, 17, 22, 23), and also by stock handlers, companion animal owners and others, as part of their daily engagement with animals in clinical, production, scientific, domestic and other contexts. These assessments rely on numerous well-validated indices that are available within the veterinary clinical arena (e.g. diagnostic tests), as well as in applied nutritional, environmental, behavioural and neural/cognitive spheres (e.g. state-specific physiological, pathophysiological and behavioural measurements). Indeed, there are so many that it is impractical to list them here, but some examples are available elsewhere (18). Note, however, that such indices relate to the degree of functional disruption in each of the domains of potential welfare compromise. The interpretation of what such disruptions mean in terms of the likely experience the animals may have requires the careful exercise of informed judgement.
Relationships between the biological function, affective state and natural state paradigms

Interestingly, current thinking about what animal welfare represents increasingly seems to be emphasising affective state (4, 11, 27), i.e. one of the three main ways animal welfare has been envisaged (8; see above). These three orientations, to date, appear to have been considered broadly to stand as parallel, somewhat independent paradigms. The foregoing discussion, however, suggests possible interactions.

The indices of biological function objectively relate to the physical-functional status of the animal. Such indices can have a quite specific focus, indicating the presence of particular functional states such as dehydration, undernutrition and hyperthermia (18), or they can be more general, focusing on the integrated overall outcome of all such states, or the ‘fitness’ of the animal expressed in ways that include egg production, milk production, growth, general health status and/or reproductive success (e.g. 1). The specifically focused functional indices are linked more to the animal’s experience, its affective state, than are the ‘fitness’ indices. This is because the former indices detect changes in functional states that elicit sensory inputs to the animal’s brain that lead directly to experiences such as thirst, hunger and hyperthermic distress.

The natural state orientation, in emphasising disjunctions or concordance between the animal’s current circumstances and those in its wild state, may be seen to focus attention beneficially on features of systems for managing animals which might induce negative affect or promote positive affect. Clearly, judgements about that would rely on methodologies and interpretations derived from both the biological functioning and affective state orientations.

Practical use of animal welfare status indices

In terms of the practical maintenance of acceptable animal welfare, it is important to note a feature of the relationship between the objective indices of specific functional states and the associated subjective experiences the animals may have. Animal welfare assessments that focus on affective state, inferred from human experience, are often viewed as being less rigorous than are those that rely on the use of functional state indices, so that caution is advised when making the required inferences about animals from human subjective experiences (4, 11, 27).

It is noteworthy, however, that as the functional state indices may be used to demonstrate an absence of unacceptable compromise in the nutritional, environmental, health and behavioural domains, and indeed in some areas of the mental domain (e.g. stress), their use can also exclude the significant negative affect considered to be associated with those specific compromises. It is therefore not necessary to be able to measure thirst, hunger, hyperthermic distress, pain, anxiety, fear and so on, directly in order to be confident that they are at acceptably low levels. This also means that when the functional state indices suggest that unpleasant affect may be present, the success or otherwise of corrective action may be determined by the extent to which the functional state indices have returned to levels that indicate the likely disappearance of those subjective experiences.

When assessing the type of compromise an animal in a poor welfare state may be experiencing, perhaps in the context of dealing with a serious regulatory infringement, both objective functional state indices and professional judgements about the likely associated affective states would be employed, as has long been the case.

There is an important caveat. Although some affective states, including thirst, hunger, breathlessness, pain and fear, seem likely to be experienced across most mammalian and avian species, the existence, nature and/or significance to the animals of other experiences such as boredom, frustration, loneliness and helplessness, and indeed vitality, companionship, contentment, satiety, happiness, curiosity, exploration, foraging and play, are either less well established or have not yet been convincingly demonstrated (18). Much greater caution must therefore be exercised when making evaluations that may be thought to involve the latter possible experiences (4, 11), at least until they are better understood and characterised.

Inclusion of animal welfare science in veterinary curricula

As noted above, a good state of welfare exists when an animal’s nutritional, environmental, health, behavioural and mental needs are met (18). Thus, many of the pre-clinical, paraclinical and clinical subjects taught within veterinary undergraduate degrees that are applied to animal care and management have relevance
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to animal welfare. It follows that animal welfare knowledge and skills can be included with relative ease in classes that are widely distributed in the curriculum. Such wide distribution has occurred in about half of the veterinary schools considered by Hewson and colleagues in 2005; the other schools had opted to mount specific papers on animal welfare or chose both options (10). The staff involved need to be competent, confident and enthusiastic about raising animal welfare issues regularly during the degree programme so that consideration of welfare implications becomes a natural and automatic part of the veterinary graduate's thinking. As in other specialist areas, an active research programme helps to support the required animal welfare expertise base within the school (17). Such staff can also be a source of advice to those in other institutions wishing to enhance the animal welfare content of their undergraduate degrees and research portfolios. The OIE is contributing to this globally by recognising Collaborating Centres in animal welfare, of which there are now three (see www.oie.int/eng/OIE/organisation/en_listeCC.htm). Their designations are:

1. Animal Welfare Science and Bioethical Analysis, incorporating five partners in New Zealand and Australia:
   - New Zealand:
     - Animal Welfare Science and Bioethics Centre at Massey University (Palmerston North);
     - Animal Behaviour and Welfare Research Centre at AgResearch, Hamilton;
   - Australia:
     - Animal Welfare Science Centre at the University of Melbourne;
     - Centre for Animal Welfare and Ethics at the University of Queensland;
     - Animal Welfare Research Group at the CSIRO, Chiswick, New South Wales;

2. Animal Welfare Research, incorporating two partners in South America:
   - Chile: Facultad de Ciencias Veterinarias, Universidad Austral de Chile;
   - Uruguay: Facultad de Veterinaria, Universidad de la Republica;

3. Veterinary Training, Epidemiology, Food Safety and Animal Welfare, Teramo. Italy.

The World Society for the Protection of Animals (WSPA) has also developed a course on animal welfare and ethics for veterinary schools and has distributed it internationally (5).

The importance of animal welfare in veterinary education has also been emphasised by the OIE and Veterinary Associations at both an international (World Veterinary Association and Commonwealth Veterinary Association), regional (Federation of Veterinarians in Europe) and national level, for example:

- British Veterinary Association Animal Welfare Foundation initiative
- American Veterinary Medical Association establishment of an animal welfare division
- New Zealand Veterinary Association establishment of an animal welfare coordinator position.

Formal recognition of particular experience and expertise by bodies such as the Royal College of Veterinary Surgeons, the Australian College of Veterinary Scientists and the International Association of Colleges of Laboratory Animal Medicine also reflect the reality that animal welfare is increasingly becoming a core area of veterinary activity.

Importance of science in setting animal welfare standards

As enumerated before (16, 17), science plays a major role when minimum standards and recommendations for best practice are formulated. Scientific knowledge in animal welfare-related disciplines and the scientific method in terms of its rigour and objectivity of evaluation, including critical peer review, are both employed. However, such experimental support for animal care and management practices is not the only matter considered. Others include common sense (critically evaluated), experience with the practical care and management of animals in the circumstances of their use, clinical observation of health and welfare status, and experience with the outcomes of veterinary therapies (16). Yet, these elements of knowledge and experience are not sufficient individually or collectively to determine precisely what are and are not acceptable minimum welfare standards. Although they do allow the known and unknown, theoretical and practical, workable and unworkable aspects of each problem to be clarified, and thereby provide a basis for decision making, setting standards on this basis alone is not always straightforward. In some cases, what a standard should be is apparently obvious, whereas in others it is less clear. In all cases, however, it
is a matter of judgement, judgement exercised collectively through accessing the expertise of individuals with diverse professional backgrounds, individuals who need to be recruited to serve on such decision-making bodies. The wider dimensions that need to be considered include ethical, social, cultural, religious, economic and other such factors (7, 16, 17, 26).

No such animal welfare decisions can be made on the basis of science alone, but science does underpin all of them. Judgement, broadly based and carefully exercised, is the other major element. Thus, it is usual for such standard-setting bodies, whether national (e.g. 16) or international, to formulate welfare standards in codes of practice by exercising scientifically informed best judgement.

Conclusions

As societal attitudes and practices evolve, animal welfare science will continue to make a vital contribution to informing and underpinning animal welfare policy and practice and to ensuring a better understanding of the complexities and trade-offs often involved in addressing specific issues. The veterinary profession will continue to play an important role via clinical practice, basic and applied research, input to policy formulation and standard setting, and by increasing involvement with professional organisations and other non-governmental organisations in advisory, policy and advocacy roles.

The subject area offers considerable intellectual challenges and also demands a partnership approach with other scientific disciplines and a proactive approach to effective communication with regulators, policy makers, the media, politicians and the general public. The OIE will continue to play an international leadership role in setting science-based, ethically principled animal welfare standards which reflect the cultural and religious diversity of its 176 Member Countries and also reflect the different stages of economic development.

References


Animal pain and World Organisation for Animal Health (OIE) guidelines

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Summary

Better understanding of the mechanisms of animal pain and its treatment, together with increasing societal expectations that animal pain, when significant, should be treated, are key facets of any contemporary consideration of related World Organisation for Animal Health (OIE) guidelines. Although negative welfare experiences such as thirst, hunger, nausea, breathlessness and sickness may be very distressing and cause suffering when they are severe, pain will probably be the most commonly acknowledged negative experience that will, initially at least, command widespread attention. This is because unlike these other negative experiences (which nevertheless do merit attention), pain has many more causes, including injuries of different types and numerous forms of disease-induced pathology, and many manifestations, so that a strong focus on pain and its management may help to address more areas of welfare concern than focusing primarily on any of the other negative states. The OIE guidelines completed to date include those on the transport, slaughter and killing of animals, stray dog control and fish transport. They deal with management of animal welfare generally, but include a significant focus on factors that are designed to minimise any pain and related distress the animals in question may experience. Another OIE publication deals directly with animal pain. In addition to helping some Member Countries or Territories to prepare or update their animal welfare regulations, including those dealing with pain, reference to these and anticipated future OIE publications would be helpful when animal welfare material is being introduced or enhanced in veterinary and related qualifications in those institutes where animal welfare teaching is not yet particularly prominent.


Introduction

During the last 30 years, the emergence of animal welfare science as a discipline has provided a sound basis for exploring the nature of animals’ needs and the ways those needs may be met while managing and using animals for human purposes under a wide variety of circumstances (27, 30, 37). During the last 20 years, this has led increasingly to animal welfare and its management being included in veterinary science and other qualifications worldwide (15, 20, 22, 34).

Animal welfare may be characterised in various ways (30, 35). Although the most appropriate way to define and describe animal welfare continues to be discussed (30), there is general agreement that an animal’s welfare ‘status’ relates to what the animal itself experiences on a continuum between positive experiences, representing good welfare, and negative experiences, especially markedly negative ones, representing suffering (30). The mental state of the animal is therefore very important. In negative terms, an animal’s mental state is now considered to include experiences such as anxiety, fear, thirst, hunger, nausea, breathlessness, sickness and pain. Negative mental states can arise because of external challenges such as frightening situations involving other animals, people or the environment. They can also arise because of functional changes within the animal as a result of nutritional, environmental, health and behavioural aberrations, disruptions or restrictions. Examples of these are hunger caused by starvation and pain caused by injury or disease-induced pathology.

Pain is among the most unpleasant experiences a person can have and, depending on its intensity, duration and character, pain can undoubtedly cause severe suffering in people. It is increasingly accepted that this is also true for animals (26). Thus, when an animal experiences significant pain its welfare will be compromised. This has led national advisory bodies in various countries and regions, including Australia, New Zealand and the European Union, to recommend that steps be taken to avoid or manage animal pain
in order to minimise the suffering it would otherwise cause. It also led the World Organisation for Animal Health (OIE), as part of its Global Animal Welfare Initiative, to publish its recent Technical Series volume entitled ‘Scientific assessment and management of animal pain’ (33). The purpose was to help those formulating government policies and industry practices to include approaches that would more closely reflect up-to-date knowledge about pain management in animals. It is interesting to note in this regard the recent French-government-sponsored forum on ‘Animals and Society’ (‘Rencontre Animal et Société’) and, arising from that, government support for a formal review of the literature on animal pain dealing with the following issues (P. Le Neindre, personal communication):

- what pain is
- how pain perceived by animals can be measured
- the consequences of pain for animals
- the types of animals that can experience pain
- how pain can be managed.

The scientific understanding of animal pain and its management is still developing, and this is reflected in an ever-increasing peer-reviewed literature on the topic. Nevertheless, validated strategies for pain management are available (e.g. 33). This provides opportunities to encourage the deployment of such scientifically supported knowledge and practices more widely across the world, while acknowledging that economic, technical and other constraints may impede this in some countries.

**Pain and animal welfare compromise**

To date, poor animal welfare has been understood predominantly in terms of the presence of negative states or experiences such as those enumerated above, but increasing attention is now being given to the absence of positive states such as satiety, contentment, exploration and play (30). Nevertheless, a focus on the detection and correction of negatives states, for the foreseeable future, is likely to remain the most fruitful approach for achieving large-scale improvements in animal welfare globally. Moreover, although negative states including thirst, hunger, nausea, breathlessness and sickness may be very distressing and cause suffering when they are severe, pain will probably be the most commonly acknowledged negative experience that will, initially at least, command widespread attention. This is likely to occur for two main reasons, the first being related to the physiology of pain and the second to human empathy and our growing understanding about animal pain.

The first reason, more specifically, is that unlike the other negative experiences just listed, pain has many more causes, including injuries of different types and numerous forms of disease-induced pathology, and it has many manifestations, which may be acute, chronic, localised, generalised, physical, emotional, adaptive or maladaptive – and more than one type of pain may be experienced at the same time (7, 10, 39). This means that a strong focus on pain and its management may help to address more areas of welfare concern than focusing primarily on any of the other negative states. Of course, this is not to suggest that these other states should be ignored.

The second reason is that pain is easily understood among people generally as having the potential to be exceptionally unpleasant. Accordingly, once a connection is made and accepted between the human experience of pain and the capacity of animals to experience it and suffer as a result, those people are likely to be more motivated to become proficient in dealing with the causes of pain and the methods for alleviating the pain that cannot be prevented.

Including detailed consideration of animal pain and its management in more veterinary and related qualifications across the world will consequently be an important means of achieving widespread improvements in animal welfare, and it will also help to improve veterinary leadership in this arena. Moreover, detailed reference to pain could be used to engender an understanding that animals can have extremely unpleasant experiences in addition to pain, thereby improving knowledge of other features of animal welfare compromise and providing a platform for addressing them too.

Attention should be given to the following overlapping factors relating to pain (25):

- acknowledgement that animal pain and its relief need to be taken seriously in the many different contexts in which animals are used
- causes and different types of pain
- pain recognition
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- pain mechanisms and how they can be manipulated to better control pain
- administration of pain-relieving drugs
- pain-alleviation methods which are easy to use, practical and economically realistic in each context.

The OIE Technical Series volume 'Scientific assessment and management of animal pain' (33) provides some information on these topics. Also, there are an increasing number of texts that deal with animal pain (e.g. 6, 12, 14, 21).

Attitudes towards animals that may experience pain

Animal welfare scientists now consider that most vertebrates are capable of experiencing pain (8, 30), and allied to this, that mammals and birds may suffer when pain is severe (30). Nevertheless, prominent and widespread attention is not yet given to pain avoidance and pain alleviation in different types of animals in the numerous different contexts in which they are used or managed.

An increasing number of veterinarians now provide pain relief to companion animals (19, 43), partly because of a greater availability of practical information about analgesic drugs, dose rates and dosing strategies (e.g. 36) and partly because of rising pressure from clients and professional colleagues (10, 19, 36, 39). Although this trend towards greater use of analgesics in veterinary clinics is now well established, it would be beneficial to engender a much wider commitment to pain relief by increasing the emphasis given to it in veterinary undergraduate and postgraduate teaching programmes.

Traditionally, farm livestock have not been provided with pain relief when exposed to tissue-damaging procedures such as castration, tail docking and dehorning. However, changes in public expectations and an increasing imposition of animal welfare standards by food-importing companies are likely to give impetus to wider use of pain alleviation strategies during such husbandry procedures (1, 4, 5, 29). Improved knowledge about farm animal pain and its management (9, 32, 40, 41, 42), provided to practising veterinarians directly and via veterinary teaching programmes, and explicit statements by national animal welfare advisory bodies supporting greater analgesic use on farms (29), will also contribute to this trend.

Improved practices applied to companion and farm animals are also being extended to pain control during the management of captive wild animals in zoos and game parks. Direct studies of pain and its control in such animals are likely to enhance treatment options by resolving uncertainties about analgesic dose rates and reducing problems with safe access to the animals (10).

In addition, wildlife managers, veterinarians and biologists are increasingly investigating and seeking to minimise the pain and distress caused by lethal and non-lethal methods of vertebrate pest control, including shooting, poisoning and trapping (17, 18). This development reflects a growing acceptance that the designation 'pest' does not disqualify such animals from being recognised as sentient, and, therefore, as being capable of experiencing and suffering from pain and other unpleasant sensations caused by control methods. Likewise, the pain-producing potential of marking procedures used to identify valued and endangered wildlife, including marine mammals, is receiving more attention (2, 3, 28). Although these trends in both the wildlife control and conservation arenas are likely to continue, it is not yet clear how significant pain will become as an issue in vertebrate fish (13), despite the increasing attention it is currently receiving (8).

Animals used in research, testing and teaching include all of the above categories, as well as laboratory guinea-pigs, mice, rats and rabbits, which are investigated in their own right and as models of other species including human beings (11, 12, 30). The ethical responsibility to minimise the pain, suffering or lasting harm that may be caused by the use of animals for scientific purposes has been recognised for many years (38) and has been included in animal protection or welfare regulations in various countries (e.g. 27, 43). Such regulations commonly refer to the Three Rs tenet of Russell and Burch (1959) (38), namely replacement, where possible, of animals by non-sentient animals or by non-animal alternatives, and if that is not possible, reduction of the number of sentient animals used to the minimum required to meet the objectives of the work, and refinement of the procedures to minimise any pain and distress the animals may experience (e.g. 23, 24). This approach is supported by methods to comprehensively assess the potential negative impact of research, testing and teaching procedures on the animals (30, 31, 43). In light of the facts that veterinarians are being employed increasingly to run animal research facilities, a veterinary speciality of laboratory animal science is recognised in some countries, and there is an international council for the accreditation of laboratory animal care standards (Association for Assessment and Accreditation of
Laboratory Animal Care (AAALAC) International (www.aaalac.org), inclusion of this area of animal welfare management in veterinary curricula can easily be justified.

**OIE guidelines and animal pain**

The OIE *Terrestrial Animal Health Code* contains guidelines or standards for animal care and management during transport by sea, land and air, and during slaughter for human consumption and killing for disease control purposes (44). The guidelines deal with management of the wider dimensions of animal welfare, but include a significant focus on factors that are designed to minimise any pain and related distress animals may experience during transport, slaughter and killing. Prepared by expert groups having international standing in the animal welfare arena, these guidelines or standards represent an integrated synthesis of up-to-date knowledge and related practice, and as such are useful reference material for those establishing animal welfare teaching programmes. Also relevant in this regard are the recently approved OIE guidelines for the control of stray dog populations (16) and the transport of farmed fish (45). In addition, separate sets of OIE guidelines on the welfare of laboratory animals, broiler chickens and beef cattle are currently being prepared, and guidelines on dairy cattle welfare are planned.

It is evident, therefore, that the OIE, through its Global Animal Welfare Initiative, is contributing indirectly to the better management of animal pain worldwide by its ongoing commitment to the development of broadly based animal welfare guidelines (e.g. 44), especially when these guidelines are used by those member countries and territories that are preparing or updating animal welfare regulations. The OIE is also making direct contributions via other publications, including the OIE Technical Series volume specifically on animal pain (33). Further indirect contributions are likely to occur when current and proposed OIE guidelines, and other pain-related publications, are used to introduce or enhance animal welfare material in veterinary and related qualifications in those institutes where animal welfare teaching is not yet particularly prominent.

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Session 6

Basic global needs for veterinary education

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Basic sciences in the veterinary curriculum

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Summary

The purpose of this paper is to highlight the importance of a university level for an appropriate veterinary education in general, and of the teaching of basic sciences in particular to veterinarians. This is crucial for them to be able to understand and deal with the challenges linked to animal health and welfare, veterinary public health, animal production and emerging diseases risks.

Basic sciences are supposed to prepare the student for pre-clinical and clinical sciences. The main components are:

- physics
- chemistry
- animal and plant biology
- biomathematics
- anatomy
- histology
- embryology
- physiology
- biochemistry
- molecular biology
- genetics
- immunology
- epidemiology
- ethology
- animal welfare.

However the organisation of basic sciences teaching is challenging, since there is now a common requirement for the curriculum to include additional topics (e.g. molecular biology, foreign languages, new information technology and new species of domestic animals) and this necessitates that the time allocated to traditional topics be reduced.

Furthermore, the occurrence of new methods of education requires basic sciences teachers to have a more broad-based knowledge about veterinary medicine and to be able to collaborate with clinical sciences teachers.

Keywords: Basic sciences – Education – Learning – Veterinary.

Introduction

As an ex-practitioner, ex-clinical teacher, ex-basic sciences teacher and current dean, I have asked myself: should we look to significantly reduce the teaching of basic sciences in the veterinary curriculum, in order to have more time available for clinical learning and tracking?

An explosion of the amount of teaching to undergraduate veterinary students is a result of:

- the occurrence of new domestic animal species
- new clinical disciplines
- new regulations
- new information technology (IT) and diagnostic technologies (4)
- new requirements at the level of specialised knowledge
- know-how and good manners.

Furthermore, the requirements of clients are increasing so fast that there will be no place any more for non-specialised vets like James Herriot.
Finally, the identification of specific day +1 skills, although a necessary requirement for the harmonisation of the veterinary curriculum and the warranting of its current suitability, may indirectly be responsible for a reduction in basic sciences teaching.

Is this appropriate? What should be the main objectives of a veterinary education?

The purpose of this paper is to highlight the importance of a university level for an appropriate veterinary education in general, and of the teaching of basic sciences in particular to veterinarians. It is indeed crucial for veterinarians to understand and be able to deal with the challenges linked to animal health and welfare, veterinary public health, animal production and emerging disease risks.

**Basic sciences in veterinary curriculum**

Basic sciences are supposed to prepare the student for pre-clinical and clinical sciences. The organisation of basic sciences is now challenging, since there is a regular requirement for additional topics to be taught, and this means there must be a reduction in the time spent on traditional topics (6).

The objective of this paper is not to describe in detail the content of the different courses included in basic sciences but to highlight some aspects of that content. Arbitrarily, the following subdivision could be proposed.

**Non-specific basic sciences**

The main elements of the non-specific basic sciences are physics, chemistry, animal and plant biology and biomathematics. Depending on the country, these courses are provided either during the first year of the undergraduate veterinary curriculum, during a preparatory year or, less frequently, in secondary school.

More recently, other courses have been added in some schools, e.g. foreign languages, bibliographical research, access to databases and bio-informatics. It is increasingly obvious that, because of the amount of relevant data and the frequency of changes to it, learning techniques for accessing and processing information is becoming more critical than acquiring the information itself.

**Morphological sciences**

The main elements of the morphological sciences are embryology, histology and anatomy. The time devoted to these courses has been reduced in most programmes, because of the deletion of unnecessary details and the use of modern technologies (5), like 3-D imaging, which contribute to accelerating the learning process and making it more efficient.

**Functional sciences**

The main elements of the functional sciences are molecular biology, biochemistry, genetic and genomic, physiology, immunology, ethology and animal welfare.

Molecular biology could be included in non-specific basic sciences. However there are today so many applications of it in veterinary medicine that this course should be linked to veterinary biochemistry with, as the main objectives, for students to understand the concepts, the main technologies and the potential clinical and research applications (10).

**Microbiology**

Microbiology includes bacteriology, parasitology, virology and epidemiology. Epidemiology has become a discipline taught by specialists because of the growing importance of veterinary public health and risk assessment in the daily work of many practitioners.

**Other topics**

During the early part of the curriculum, many schools have decided to structure options in ways which encourage students to select modules that had previously been less popular, e.g. food hygiene, rural practice and scientific research (9). Furthermore, it is appropriate to structure and integrate the curriculum so that
students are given an early introduction to evidence-based medicine, problem-based learning (7, 8) and team working.

The new methods of education that these developments are part of also require basic sciences teachers to have a more broad-based knowledge about veterinary medicine, and therefore to collaborate effectively with clinical sciences teachers.

Timetable

In most institutions, the teaching of non-specific basic sciences requires one year (which in some national systems equates to 60 credits), and the teaching of the remaining basic sciences requires two years (under the same system, 120 credits). However, in some countries, students are expected to have learned sufficient of the non-specific basic sciences during secondary school or in preparatory courses not linked to the veterinary faculty.

Conclusion

More than ever, there is a need for a veterinarian to have a solid education in the basic sciences. Of course, unnecessary details and specialised technologies should be avoided or provided during postgraduate education.

Basic sciences should therefore not be sidelined, since the major objectives of veterinary education include:

– the understanding of the concepts of life
– their application in relevant situations
– the acquisition of the culture of a proactive attitude (1, 2), evidence-based medicine (3), continuing education and adaptability to the changing requirements of society.

References

Preclinical sciences in the worldwide veterinary medicine curriculum

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Summary

Preclinical sciences are the natural bridge in the veterinary curriculum, since they link basic morphophysiological sciences and agents of disease with the clinical sciences, where the final integration of theoretical knowledge and development of skills takes place. Names of courses or modules of preclinical sciences, their depth, number of hours devoted to them, and balance between theory and practice may vary throughout the world. However, an attempt is made to summarise the essential courses required for students to have a solid base for the clinical area and make a successful start to their professional training. These include:

- general and systemic pathology
- clinical pathology
- imaging courses (radiology, ultrasound and others)
- pharmacology
- surgery
- a review of the most important domestic and foreign bacterial, mycotic, viral, parasitic and toxic diseases
- epidemiology
- theriogenology.

With different names, veterinary colleges offer a course in diagnostic methodology, where the student develops and integrates diagnostic skills with the use of live animals and other learning methodologies. In this chapter, the minimum knowledge and skills required by the students from these preclinical courses is described and discussed.

Keywords: Preclinical sciences – Professional competencies – Veterinary education.

Preclinical sciences are the link, within the veterinary curriculum, between the basic sciences, a term that covers the morphology and physiology of animals and the biology of disease agents, and the clinical sciences, the field where the final integration of knowledge, skills, aptitudes and attitudes takes place. The basic courses, modules or subject areas required for students to have a solid base for the clinical area and to make a successful start in their profession include general and systemic pathology, clinical pathology, imaging courses (radiology, ultrasound and others), pharmacology, surgery, a review of the most important domestic and foreign bacterial, mycotic, viral, parasitic and toxic diseases, epidemiology and theriogenology, as well as a course on diagnostic methodology. All of these are commonly part of undergraduate veterinary science curricula, although they are sometimes given different names.

The outline of coverage here draws on the American Association of Veterinary Medicine Colleges ‘Foresight report’ (1), Mexican course requirements (2) and a review of web pages from different veterinary medicine colleges.

The essential objectives of these courses should include the following elements

General pathology

Understanding of the mechanisms of disease and death, through the study of cellular and histological alterations, and the development of the skills to perform a necropsy and to describe in a written report the gross lesions found, relating them to the previously described clinical findings.
**Systemic pathology**

Understanding of the pathogenesis of the most common diseases, those of high economic impact, those that represent a public health hazard, and important exotic diseases which affect organs and systems of the local domestic animals, recognising the morphologic changes associated with each of these diseases. The student should also acquire the ability to collect, preserve and submit tissue and fluid samples to diagnostic laboratories after performing a necropsy.

**Clinical pathology**

Selection of corporal fluid, cell and tissue samples for laboratory analysis, understanding and performing diagnostic tests, interpreting results and relating them to the physical examination in order to establish a diagnosis and a prognosis for the patient.

**Imaging courses**

Development of a methodology to request and analyse radiographic and ultrasonographic studies in different animal species for diagnostic purposes, with a responsible attitude to protection against exposure to radiation.

**Pharmacology**

Knowledge of the effects and mechanisms of action of the main groups of drugs used in veterinary medicine. Understanding of the pharmacokinetics and pharmacodynamics of these drugs as well as their possible toxic effects, and understanding of the residual effects of those drugs in the environment and in food of animal origin. Knowledge of the routes of drug administration in different animal species and the ability to adequately prescribe veterinary drugs for domestic animals.

**Surgery**

Acquisition of the knowledge, skills, aptitudes and attitudes required for competence to perform basic surgical procedures for therapeutic or productive purposes.

**Infectious diseases**

Understanding the etiology, pathogenesis, diagnosis, prevention and control of treatment of the most important diseases of bacterial, mycological, virological or prionic origin in domestic animals, taking into consideration both animal and public health.

**Parasitic diseases**

To understand the etiology, pathogenesis, diagnosis, prevention, control and treatment of the most important local parasites taking into account their medical, economic and public health relevance.

**Toxicology**

Knowledge of the most common and locally important toxic substances of mineral, vegetal and animal origin, and recognition of their effects and signs in animals.

**Epidemiology**

Utilisation of methods to measure the level of health or disease in animal and human populations in order to provide solution alternatives for the surveillance, prevention, control and eradication of animal diseases, as well as for the preservation of public health.

**Theriogenology**

Understanding of the physiology and pathology of reproduction in domestic animals and development of skills and aptitudes for the reproductive management, artificial control of reproduction, evaluation of reproductive efficiency and biotechnological methods to promote an effective reproduction of domestic animals.
Diagnostic methodology
Integration of different diagnostic methods in the process of diagnostic problem solving based on medical evidence and the analysis of production parameters.

How these courses or modules are integrated into the main professional activities and competencies (CO) required by a newly graduated veterinarian

Activity 1: Clinical diagnosis to detect the health or disease state of an animal
CO1: Performs the anamnesis and elaborates the clinical history to verify the condition of the animal (courses involved: diagnostic methodology).
CO2: Performs the necessary holding and immobilisation of different animal species to verify their health or disease status (courses involved: diagnostic methodology and pharmacology).
CO3: Gathers and evaluates data on the vital signs and behaviour of the animal to determine its condition (courses involved: diagnostic methodology).
CO4: Identifies the pathologies present in animals during a physical examination (courses involved: diagnostic methodology, pathology, toxicology, infectious and parasitic diseases).
CO5: Elaborates a presumptive diagnosis of the health or disease status of the animal, based on the information obtained from the clinical history and the physical examination.
CO6: Performs differential diagnosis in animals considering the environment, host and possible agents (courses involved: diagnostic methodology, infectious and parasitic diseases, toxicology, pathology and epidemiology).
CO7: Performs necropsies according to a standard protocol and properly collects and preserves tissues and fluid samples whose further analyses will make it possible to complete, verify or modify the diagnosis (courses involved: pathology).
CO8: Identifies the pathologies present in cadavers during ante-mortem and post-mortem examinations (courses involved: pathology, toxicology, infectious and parasitic diseases).
CO9: Obtains samples of cells, tissues and corporal fluids from animals to perform and interpret laboratory tests which make it possible to verify or modify the previous clinical diagnosis (courses involved: clinical pathology, toxicology, infectious and parasitic diseases, diagnostic methodology).
CO10: Performs and evaluates basic imaging techniques (radiology and ultrasound) which make it possible to verify or modify the previous diagnosis (courses involved: imaging courses).
CO11: Integrates a definitive diagnosis of the case based on the analysis of all the information gathered (courses involved: diagnostic methodology, clinical pathology, toxicology, infectious and parasitic diseases, pathology, imaging courses and epidemiology).
CO12: Determines, based on the diagnosis of the case, possible epidemiological consequences and steps to be taken (courses involved: diagnostic methodology, infectious and parasitic diseases and epidemiology).

Activity 2: Provides medical or surgical treatment based on a previous diagnosis
CO1: Selects the appropriate medical or surgical treatment for the animal based on a previous diagnosis (courses involved: pharmacology and surgery).
CO2: Prescribes and administers drugs, chemical or biological products for the treatment of the diagnosed pathologies on different animal species (courses involved: pharmacology, toxicology, infectious and parasitic diseases).
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CO3: Follows the proper protocols for the correct handling of drugs, chemical and biological products, from their production to their final administration to animals and disposal of residues (courses involved: pharmacology, toxicology, infectious and parasitic diseases and epidemiology).

CO4: Prescribes drugs, chemical and biological products which preserve animal, public and environmental health to animals involved in the food animal production systems (courses involved: pharmacology, toxicology, infectious and parasitic diseases and epidemiology).

CO5: Specifies the length of administration and the correct withdrawal procedures for drugs and chemical products in animals to be used for human consumption (courses involved: pharmacology, infectious and parasitic diseases and epidemiology).

CO6: Explains to the client the proper use of the drugs prescribed as well as the possible consequences of misuse (courses involved: pharmacology, infectious and parasitic diseases and epidemiology).

CO7: Selects the appropriate surgical procedure for the animal, based on the previous diagnosis of the problem (courses involved: surgery).

CO8: Provides the appropriate anaesthetic procedure for the animal, according to the technique to be used, animal species and condition of the patient (courses involved: pharmacology and surgery).

CO9: Performs the appropriate presurgical, transurgical and postsurgical procedures in the animal according to the predetermined surgical procedure (courses involved: surgery).

Activity 3: Performs epidemiological procedures for the prevention, control and eradication of animal diseases

CO1: Explains to animal owners the necessary measures to accomplish the prevention and control of zoonotic diseases (courses involved: infectious and parasitic diseases pharmacology and epidemiology).

CO2: Designs programmes for the prevention, control and eradication of diseases of different animal populations according to local and international legislation (courses involved: infectious and parasitic diseases, pathology, and epidemiology).

CO3: Supervises the application and operation of biosecurity measures in animal production units, slaughterhouses, packing and rendering facilities (courses involved: infectious and parasitic diseases, and epidemiology).

CO4: Performs the diagnosis of the most important infectious, zoonotic and exotic diseases in domestic animals and wildlife (courses involved: diagnostic methodology, infectious and parasitic diseases and pathology).

CO5: Informs the local Veterinary Authority about zoonotic, exotic and other diseases for which reporting is compulsory, according to the procedure established (courses involved: infectious and parasitic diseases and epidemiology).

CO6: Selects the appropriate epidemiological method to be used when there is a suspicion of a zoonotic, exotic or compulsorily reportable disease in domestic animals (courses involved: infectious and parasitic disease, pathology and epidemiology).

CO7: Determines the prevalence or incidence, morbidity and mortality of infectious diseases in the animal populations under care (courses involved: epidemiology).

Activity 4: Care of animal welfare

CO1: Determines the animal health measures which allow improvement of the welfare of animals used by humans (courses involved: infectious and parasitic diseases, pathology and epidemiology).

CO2: Performs necessary euthanasia considering species and use, in ways that avoid animal suffering (courses involved: pharmacology).

CO3: Selects the containment and sedation methods for the appropriate management of animals (courses involved: pharmacology).
Activity 5: Improvement of the reproductive capacity of animals

CO1: Identifies the different alterations in the normal reproductive physiology in animals (courses involved: agents of disease, pathology, theriogenology and epidemiology).

CO2: Controls the estrous cycle for the reproductive management of animals (courses involved: theriogenology and pharmacology).

CO3: Prescribes drugs for the treatment of reproductive pathologies in different animal species, avoiding public health hazards (courses involved: theriogenology and pharmacology).

CO4: Performs surgical or chemical sterilisation procedures for the control of animal reproduction (courses involved: theriogenology, pharmacology and surgery).

Conclusion

This paper has presented a review of what are considered the most important preclinical sciences in the veterinary curriculum, and indicated how courses based on these sciences contribute finally to the professional competencies required for a successful start to a career as a general veterinary practitioner.

References


Clinical sciences including veterinary medicinal products

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Summary

In the next 40 years, society must learn to feed 9 billion people without further damaging the environment. World hunger is growing, in 2009 the number of people who went hungry exceeded 1 billion. In the developing world, consumers will be increasingly urban and demand a richer diet that includes more animal protein. In China and Pacific rim countries, urban populations will be increasingly provisioned from concentrated animal feeding operations (CAFOs), supplied by peri-urban operations, and with problems in waste disposal. CAFOs are widely used in the United States of America (USA). They require food animal veterinary curricula to adapt and teach ‘production medicine’. Similar programmes are rarely available outside the USA but need to be made globally available.

These programmes are unsuitable for small farmers and pastoralists in sub-Saharan Africa. They must learn to use local resources more efficiently. Delivery of veterinary care in these areas is inadequate. It should involve teams including licensed veterinarians, soil scientists, crop geneticists and credentialed veterinary paraprofessionals. Approaches to the problem will be discussed.

Keywords: Clinical science – Production medicine – Veterinary medicinal product.
Veterinary legislation, governance and organisation

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Summary

Recent outbreaks of a succession of zoonotic diseases such as avian influenza H5N1 and H1N1, as well as transboundary animal diseases including foot and mouth disease and African swine fever, have reinforced the need for strong Veterinary Services. Such services are crucial in the prevention, control and eradication of these diseases, as well as in working in an interdisciplinary way to support the contemporary ‘One World, One Health’ framework. Sound legislation, strong governance arrangements and effective organisational systems are essential to underpin Veterinary Services. Legislative principles need to be understood and customised in practical and applied legislation to meet the specific governmental and cultural characteristics of individual countries. Governance involves the exercise of powers, including components such as:

- leadership
- strategic vision
- decision making
- accountability
- transparency
- integrity.

Clear articulation and understanding of organisational function, form and strategic directions are required to ensure the effective and efficient management of Veterinary Services. The World Organisation for Animal Health (OIE) has identified legislation and governance as critical areas for strengthening Veterinary Services. It is suggested that universities and training institutions consider expanding training in these key areas.

Keywords: Governance – Legislation – ‘One World, One Health’ – Organisation – Performance of Veterinary Services tool (PVS) – Programme to Strengthen Veterinary Services in South East Asia (PSVS) – Veterinary Services – Veterinary statutory body – Zoonotic.

Introduction

Over the last 20 years a number of serious transboundary diseases of animals have had, and continue to have, major socio-economic impacts on countries throughout the world. Examples include foot and mouth disease, avian influenza, swine fever and the emergence of more virulent strains of infectious agents such as those involved in porcine respiratory and reproductive syndrome.

Of particular concern has been the emergence and re-emergence of a range of zoonotic diseases, that is, diseases transmissible from animals to humans. It is estimated that over 70% of new infectious diseases of humans that have occurred over the last 20 years are zoonotic. Examples include bovine spongiform encephalopathy, Nipah virus, severe acute respiratory syndrome (SARS), human immunodeficiency virus – acquired immune deficiency syndrome (HIV/AIDS), Ebola virus and rabies. In Australia, for example, new diseases such as Hendra virus, bat lyssavirus, Menangle virus and Japanese encephalitis have resulted in human illness and death.

Highly pathogenic avian influenza A H5N1 (HPAI) has been one of the more serious epizootics to occur, and has resulted in human deaths and major production losses estimated at US$20 billion. It is further estimated that, should H5N1 evolve to a pandemic of humans, the global cost could amount to US$2 trillion. Influenza A H1N1 currently affecting the world is one of the biggest human pandemics reported in terms of numbers of countries and people infected.

Food safety issues of bacterial, viral, prion, chemical and toxicological origins pose major threats and have been extensively reported in recent years. The incidence of foodborne illnesses is expected to increase...
further, raising consumer concerns unless a range of preventive measures are taken, including measures in
the veterinary public health area (9).

The risk of new and emerging diseases and foodborne illnesses is increasing. Factors predisposing to
this situation include increased global trade and tourism, rapid population growth and urbanisation,
tensification of livestock production, and environmental degradation and climate changes which can
affect the ecobiology of infectious agents. The demand for animal protein will continue to grow in line with
population growth, resulting in changed farming systems, including the integration of, or contact with, wild
animals, the source of many zoonoses (10).

Governments worldwide have responded to these significant problems by supporting a strategic framework
for reducing the risks of infectious diseases. This recognises the global interconnectivity of human and
animal populations, including wildlife populations, and the need to reduce risks at the human, animal and
ecosystems interface through a cross-sectoral and interdisciplinary approach – the ‘One World, One Health’
concept.

Key to success will be the willingness and ability of countries to build or strengthen Veterinary Services
to identify, prevent or manage infectious diseases working in close partnership with human health,
environmental and other organisations under a ‘One World, One Health’ (15) umbrella.

For Veterinary Services to be fully effective they must be supported by well-understood governance
arrangements and a sound underpinning legislative framework, as well as an effective organisational
system and chain of command. Many undergraduate veterinary science courses include an introduction to
legislation relevant to the practice of veterinary science. Veterinarians need a deeper understanding of the
basic principles of legislation, governance and organisation so that they can contribute meaningfully to
the development and review of legislation and governance systems in their countries.

An example of current activities that recognises the relationship between effective Veterinary Services and
underpinning legislative and governance arrangements is the World Organisation for Animal Health (OIE)/
Australian Agency for International Development (AusAID) regional initiative – the OIE/AusAID Project to
Strengthen Veterinary Services to Combat Avian Influenza and Other Priority Diseases in Southeast Asia
(PSVS). The goal of the PSVS is to enhance the capacity of Southeast Asian countries to detect and respond
effectively to emerging infectious diseases. The PSVS includes improvement of legislation and governance
arrangements for Veterinary Services as a key component.

**Governance**

Governance is difficult to define. It can be used to refer to how power is managed in running a country, an
organisation or a company, including how resources are managed and how decisions are taken, conveyed, monitored
and accounted for (1). Good governance requires strong leadership, strategic direction and stewardship.

Governance may be described as the process by which societies make decisions, decide who to involve
in the decision making and how they will be accountable. Integral to governance are the processes and
institutions that allow the public to express their point of view, exercise their rights, meet their obligations
and settle their differences. Accordingly, good governance means competent management of resources and
affairs in an open, transparent, accountable and responsive manner (2).

The United Nations Development Programme (UNDP) (13) recognises nine good governance principles:
- participation
- consensus orientation
- strategic vision
- responsiveness
- effectiveness and efficiency
- accountability
- transparency
- equity
- the rule of law.

The UNDP also promotes cooperation between the State, the private sector and civil society as an aspect
of good governance. Each plays a role – the State providing a favourable political environment, the private
sector providing employment and economic growth, and civil society contributing to both.
Chapter 3.1 of the OIE Terrestrial Animal Health Code (16) (the Terrestrial Code) includes guidelines for governance of Veterinary Services. It lists fundamental principles of quality for Veterinary Services, including elements such as independence, impartiality, integrity, the need for veterinary legislation and effective organisation to permit the Veterinary Services to implement animal health measures and provide international veterinary certificates.

The OIE emphasises the need for good governance and appropriate legislation to support Veterinary Services in early detection and notification of animal disease outbreaks, rapid response, compensation strategies (as an incentive to report disease) and vaccination where appropriate. Improvement in animal health systems will have flow-on effects to poverty alleviation, public health, food security and food safety.

**Legislation**

Legal systems regulate dealings between members of society. Different legal systems, such as customary law, common law and civil law, have developed in different parts of the world. The two main systems of law are common law, made up of case law established by precedent and composed of decisions of the courts, and civil law, made up of sets of written codes or rules (3). The civil law system is widely used in Europe and many Southeast Asian countries; however there are many similarities between the systems, and many countries’ legal systems include elements from both (12), with a tendency towards convergence.

Legislation is a legal rule or body of rules. It is a tool of governance (3). Legislation is used to implement policy in a range of areas, such as to maintain the structure of society (e.g. criminal law), to regulate relations between individuals (e.g. family law), to provide essential services beneficial to society (e.g. education law), and to collect taxes to finance the provision of services (taxation law) (8). There are different forms of government and arrangements for making legislation, and while the Western-style parliamentary approach is used here as a case example, the fundamental principles are universally applicable.

Legislation comes in two main forms: that made by parliament (statutes or parent legislation) and that made by those who have authority delegated by parliament (subordinate or subsidiary legislation). Statutes, or Acts, are the leading source of legal authority. They are an appropriate choice when the policy to be implemented alters existing rights and obligations and is intended to be permanent. Adoption of an Act informs the community of the importance the government places on the policy (6). Acts can take years to progress through the parliamentary process. They may contain a provision that authorises someone other than parliament, for example a statutory body or an office-holder, to make subordinate laws concerning certain matters (3).

Subordinate legislation does not need to go through the parliamentary process of enactment. It can be changed more quickly and easily than statutes, but is not subject to the scrutiny that the parliamentary process provides. It is an appropriate form of legislation when technical matters or matters of great detail are involved, or when the legislation is likely to need to be particularly responsive to change. Examples of subordinate legislation are regulations, orders, ordinances, ministerial decrees, proclamations and by-laws (3).

Legislation provides and protects rights, freedoms and benefits, but it also places constraints and responsibilities on individuals and groups in society. It is most likely to be effective if the majority of people in society support it (8).

Veterinary legislation should be drafted in plain language, should include legal powers to authorise the Veterinary Services to perform their roles effectively, should define a veterinarian and should clearly specify the authorities responsible for implementing the legislation. Laws need to be harmonised with existing structures, adapted to the capabilities of the country and appropriate to meet the needs of the country. High-quality legislation incorporates consideration of the behaviours and beliefs of those on whom it is imposed. Effective law reform requires the involvement of experts, utilising best-practice principles and international standards, and consultation with stakeholders to ensure its applicability to the country’s existing political, constitutional, economic and legal systems (5).

As legislation can take various forms and contain a range of information that aims to implement policy, it is necessary to consider what form of legislation and what information is needed for veterinary legislation to be effective.

The powers that Veterinary Services require to perform their duties should be contained in parent legislation. This should state the responsibilities of livestock owners and others involved in animal care, and clearly
state the enforcement procedures and authorities responsible for them. It should provide for subordinate legislation to allow for rapid introduction of measures to manage emergency situations or unanticipated needs (5).

International standards for veterinary legislation and governance may be found in Chapter 3.2. of the *Terrestrial Code* (16). Matters listed include:

- organisation
- structure and authority of the Veterinary Services
- human and financial resources
- legislation
- animal health and veterinary public health controls
- quality systems and performance assessment.

Legislation should empower Veterinary Authorities to exercise control of animal health and veterinary public health matters. It should apply to domestic animals and their reproductive material, animal products and other products subject to veterinary inspection, and wildlife with respect to the transmission of diseases to humans or domestic animals.

The controls (and necessary powers) required include:

- compulsory notification of certain animal diseases
- movement controls
- the right to inspect and test animals, animal products, animal feedstuffs, veterinary diagnostic materials and medicines, premises, vehicles and equipment
- quarantine of infected areas
- treatment and destruction of infected animals and contaminated materials
- controls over the use of veterinary drugs
- import/export controls including inspection and certification
- animal identification.

Legislation should also provide powers to operate veterinary laboratories and quarantine stations. Legislation should provide the right to deny or withdraw official certification, and provide penalties for misconduct by certifying officers.

The *Terrestrial Code* chapter also includes requirements for a veterinary statutory body (VSB), established under legislation, that registers veterinarians and paraveterinarians and determines standards of education and professional conduct. This is a key consideration for educational institutions, whose role is to provide quality education that will enable veterinarians to meet the standards required for registration, both at an undergraduate level and throughout their professional lives. The existence of legislation that establishes a VSB will carry with it descriptions of the roles and responsibilities of veterinarians – such as definitions of ‘acts of veterinary science’ – that serve to distinguish the profession. The roles and responsibilities of paraveterinarians will be complementary but different, and in many instances paraveterinarians will conduct their work under the supervision of a registered veterinarian.

The role of Veterinary Services in veterinary public health necessitates legislation for control over abattoirs, meat processing plants, and cold stores, with powers for inspection and action to ensure food safety. The Veterinary Services also need powers to control the production of food and to monitor for chemical residues, contaminants, and antimicrobial resistance and provide export certification for animal products.

Special powers are required for the control of emergency animal diseases, including clear and adequate powers for valuation and compensation for stock and property destroyed for disease control purposes (14).

To effectively exercise some of the powers required for emergency animal disease control, Veterinary Services need an effective chain of command system and support from other agencies such as police, emergency services, local government and customs (5). While many different organisational frameworks are suitable for the effective operation of Veterinary Services, roles and responsibilities, lines of reporting and systems for accountability must be clearly defined (4).

An area of law rapidly growing in prominence is animal welfare law. The OIE initiative to develop and publish agreed animal welfare standards in the *Terrestrial Code* (16) will help to provide guidance in the development of legislation. Animal health and welfare are inextricably linked. For example in emergency
disease outbreak situations there may be an urgent need to destroy large numbers of animals for disease control purposes, especially where the disease is zoonotic. Undue pain and suffering must be avoided despite pressures to act quickly and through the use of untrained personnel.

As part of the OIE global initiative for Good Governance of Veterinary Services, the OIE has prepared guidelines on veterinary legislation (17). These guidelines are available on the OIE website for use by countries in the development and/or enhancement of national veterinary legislation. At the request of countries, OIE has conducted missions to provide advice on the development of legislation, and it is anticipated that more countries will seek such assistance following PVS assessments and gap analyses. Other organisations such as the Food and Agriculture Organization of the United Nations have also assisted countries to develop legislation, in response to issues such as HPAI. The OIE Guidelines, when finalised, will provide essential guidance to support all these activities.

**Organisation and management**

Organisations are created to accomplish tasks. The structure, functions and performance of organisations and the behaviour of individuals within them are critical to achieving organisational objectives, which should be more or less well understood by their members. Sound management is critical to any organisation as it involves, inter alia, the coordination of human and financial resources to achieve programme objectives (11).

People make organisations work. A good culture in an organisation can result in improved efficiency and effectiveness through shared values, commitment and a desire to drive the organisation forward and meet performance needs (7). Sound and dynamic leadership will facilitate a good culture and help develop and gain agreement to a vision and strategic framework for the organisation.

There are many forms of organisations, depending on the particular political, social, cultural, religious and economic characteristics of the country involved. Notwithstanding this, the statements made above should generally be recognised as critical success factors for any organisation.

This is particularly true of Veterinary Services in an environment where the socio-economic impacts of emerging infectious diseases have been significant and the risks of such diseases are increasing. Veterinary Services are defined by OIE as ‘governmental and non-governmental organisations that implement animal health and welfare measures’ (16). This correctly demonstrates there are a range of other key players such as industry, farmers, scientists and the like who are essential to achieving animal health objectives.

The OIE states:

> The Veterinary Services must be able to demonstrate by means of appropriate legislation, sufficient financial resources and effective organisation that they are in a position to have control of the establishment and application of animal health measures, and of international veterinary certification requirements (16).

An outline of procedures and standards is described, including the importance of documentation and principles of quality, such as professional judgement, independence, impartiality, integrity and objectivity. Organisations should develop skills and competencies in:

- people management
- policy and strategy formulation
- finance and programme planning
- the development of performance indicators
- monitoring and evaluation
- compliance
- communications
- information systems
- occupational health and safety.

As organisations are ‘living’ entities they will be subject to change. A good culture will help minimise the impacts of change on members, particularly if this is accompanied by a transparent and an inclusive process.
Veterinary Services exist primarily to support a technical animal health function that includes veterinary public health, aquatic animal health and animal welfare. Organisations and management exist to support that function, and it is important to ensure this primary objective is met, and that management approaches and procedures are supportive activities and are not of themselves the primary activity of the organisation.

**Conclusions**

Emerging infectious diseases of a zoonotic and transboundary nature have resulted in severe adverse socio-economic impacts, and the risks of such diseases and foodborne illnesses are increasing. It is therefore critical that a holistic approach be taken to reducing such risks at the human, animal and ecosystems interface through a ‘One World, One Health’ approach.

Key to success are effective Veterinary Services supported by legislation, governance arrangements and a sound organisational system. The publication of OIE guidelines on the quality of legislation will greatly assist countries in drafting and/or revising their legislative arrangements.

It needs to be recognised that there will be difficulties in achieving these objectives given the varying economic, social and economic situations that exist in developing, in-transition and developed countries. However the fundamental principles underpinning Veterinary Services are sound and should apply to all.

OIE is to be congratulated for addressing the global issue of Veterinary Service needs and requirements through its PVS, gap analysis and follow-up tools which seek, in a programmed and systematic way, to assist Veterinary Services in establishing their levels of performance, identifying gaps and weaknesses, and quantifying the resources necessary to upgrade levels of compliance with OIE international standards.

PVS missions could usefully pay greater attention to veterinary education and training, as these are essential underpinnings necessary to support effective and sustainable animal health arrangements.

As efforts to improve Veterinary Services to meet contemporary and future needs will be of a long-term nature, there will be great value in supplementing education and training at universities and institutions in legislative, governance and organisational principles, as well as OIE standards.

**References**

Session 6: Basic global needs for veterinary education


Global veterinary day one competencies

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Summary

Day one competences are the combination of knowledge and skills that the young graduate needs to possess for a safe start as a veterinarian entering the profession.

Worldwide there is a need to define day one competences for new veterinary graduates, and the World Veterinary Association (WVA) has to take the lead.

The level of the global day one competences depends on the veterinary education offered by veterinary faculties/schools. Worldwide, some schools do not meet the minimum requirements of veterinary education to enable all veterinarians to perform their role in a professional manner.

Veterinary education is very important for the profession in controlling animal health, animal welfare and public health. The greater mobility of people and animals and the trade in animals and products of animal origin mean that a high standard of veterinary education is needed to prevent outbreaks of animal diseases, to prevent zoonoses and to certify that animals are healthy and products of animal origin are safe. Even investigating and diagnosing diseases and curing animals require a high standard of basic veterinary training.

In the context of ‘Evolving veterinary education for a safer world’ WVA has to pay attention to three main issues:

– the minimum requirements schools have to fulfil in veterinary education
– what the veterinary profession can expect of its educational establishments
– what society can expect of veterinary education.

Not fulfilling the minimum requirements at a global level can be a disaster for both the profession and society at large because the mobility of people, animals and products of animal origin needs the guarantee of a high standard of veterinary certification. People need to have confidence in this aspect of the profession. WVA has adopted new minimum requirements for veterinary education.

Veterinary professionals require an education provided by establishments that provide really good new graduate competence/day one competence for the various disciplines in the daily life of veterinarians. This is taken into account in the evaluation and accreditation systems that are used worldwide. WVA is preparing new proposals for a global level of day one competence. For graduates who take up employment in institutions there are guidance schedules but for graduates who go into private practice there is often less guidance and supervision.

The role of veterinarians in society is to provide a link between animals, animal owners and society. Society and (global) organisations need to trust in a high standard of veterinary education and professional implementation. Veterinarians have to protect society from animal disease outbreaks, zoonoses and food poisoning by products of animal origin.

A global minimum standard of veterinary education has to offer the new veterinary graduate the ability in all disciplines to fulfil their duties at a proper level for the benefit of people and animals. Veterinarians can maintain this competence through life-long learning.

Global day one competence and global life-long learning are of major importance to the global veterinary profession.

Keywords: Curriculum – Day one competence – Global – Minimum requirement – Veterinarian – World Veterinary Association.
Introduction

Day one competences are the combination of knowledge, skills and experience that new veterinary graduates need to possess when entering the veterinary profession to enable them to perform most of the duties that will be required of them. Worldwide, the profession as a whole has to define realistically what day one competences new graduates need. The World Veterinary Association (WVA) is necessarily taking the lead in guiding this process. The level of the global veterinary day one competences will depend on the quality of veterinary education and training offered by veterinary faculties or schools. Through the experience of OIE’s evaluating system ‘Performance of Veterinary Service’ (PVS) tool we know that many schools worldwide do not meet the requirements of adequate veterinary training to enable all veterinary graduates to perform all the duties required of them competently.

One of the main objectives for the WVA, according to its 1998 veterinary education policy paper, was ‘Harmonised worldwide systems of evaluation/accreditation of veterinary education and training to guarantee the high quality of the profession’ (1). To date implementation has only taken place on two continents, with a third to follow soon. The WVA needs to promote and encourage comparable systems on all continents. It has recognised the difficulties of achieving global evaluation and accreditation, which is not realistically achievable without the major financial and advisory support of many parties. A more practical alternative approach might be for the WVA to develop a comprehensive description of the minimum competences that should be required of a veterinarian on graduation.

The role of veterinarians

Veterinarians have to be enabled to perform all their duties in society, recognising that the specific requirements may vary between regions and countries. Veterinary training is the foundation for the profession in controlling animal health, animal welfare and public health. New areas such as environmental and eco-system health have also become increasingly dependent on veterinary participation and input. The scope of veterinary duties is broadly the same for all veterinarians, although individual veterinarians typically specialise in specific species or disciplines after graduation.

The greater mobility of people and animals within and between nations, and the global trade in animals and products of animal origin, call for a high standard of veterinary education:
– for the early detection and/or prevention of outbreaks of animal diseases and zoonoses
– to certify that animals are healthy for trade
– to ensure that products of animal origin are safe.

To investigate and to diagnose animal diseases, including early detection, and to determine the correct intervention or treatment for those diseases, requires a high level of basic veterinary training in all disciplines, covering both domestic and non-domestic animals. Individual veterinarians might play a role:
– as a practitioner
– as a hygienist
– as a state veterinary officer
– as a researcher in a research institute or in industry
– as an educationalist
– in the military
– as an expert in environment and climate change.

Veterinarians have to play a central role in the triangle formed by animals, animal owners and society. This role is based on their in-depth comparative training in science, knowledge, skills, ethics and veterinary attitude and aptitude. Their training should be objective, independent and impartial. There should be a clear distinction between veterinarians and paraprofessionals or veterinary technicians, who fulfil an important but supportive role.

Evolving veterinary education

Based on the role of veterinarians and in the context of the conference ‘Evolving veterinary education for a safer world’, the WVA and other stakeholders in fields related to animal and human health have, following on the ‘One World, One Health’ concept, agreed to pay attention to three main issues:
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– the minimum requirements for veterinary education for schools
– the expectations of the profession regarding veterinary training
– the expectations that society has of new graduates, and the day one competences that can be expected worldwide.

The minimum requirements

The WVA has drafted its vision of the minimum requirements for veterinary education, and the process of considering requirements is still continuing as part of a new veterinary education policy paper. Investigation, prevention and intervention/treatment of animal diseases are critical responsibilities of well-educated veterinarians. In defining the minimum educational and curricular requirements it is important to bear in mind these major responsibilities of the profession and to provide training to meet these outcomes. The most important training issues for graduates are:

– to control the major diseases of domestic animals
– to carry out food inspection
– to ensure the safety of food of animal origin
– to ensure animal health and welfare
– to control zoonotic diseases
– to conduct research on important topics related to animal health, animal welfare and public health, including issues related to environmental and ecosystem health.

Across the world, some global non-governmental organisations have suggested that there should be a worldwide goal to develop an internationally agreed system to ensure the harmonisation of training standards across national borders and to permit the free movement of well-trained and well-educated veterinarians between nations. However, the WVA believes that this is a not a realistic endeavour at the present time. The WVA does believe, though, that it is realistic to work towards harmonised outcomes in veterinary educational training worldwide by defining minimum day one competences. Harmonised outcomes would offer transparency for the profession and increase societal confidence in veterinarians as a whole. A harmonised diploma is divisive and difficult to achieve. It is also necessary to take care in the use of the term ‘diploma’ since such terms may mean different things to different people.

Expectations of the profession

The veterinary profession requires a level of education and training that ensures new graduates have acquired solid day one competences which enable them to make a professional and independent start on undertaking the various duties required daily of veterinarians. Graduates taking up posts in institutions can often access mentoring and guidance from experienced colleagues. New graduates going into private practice might not have access to this level of oversight. Experienced practitioners often complain that the skill levels of new graduates are not sufficient. However society expects a higher level of skills from veterinarians than undergraduate education can offer. Veterinary colleges must respond by providing graduates with both knowledge and applied skills. WVA also has a role to play, in determining and publicising the level of day one competences that should be required.

'Day one competence’ determines the initial competence of a veterinarian, the abilities and knowledge that should accompany the beginning of a professional career. More experienced practitioners are of course expected to develop their skills beyond this initial level.

Expectations of society

The role of the veterinarian in society is to act as a link between animals, animal owners and society as a whole, including consumers of animal products. In this context we can differentiate between various aspects of the overall concept of society, and in particular between animal (health)-related organisations, the medical world as a whole, and the general public. All these groups need to have confidence and trust in the high standard of veterinary education and professional implementation. Many of the general public are not really aware of the entire scope of veterinary responsibilities. Their only contact with veterinarians will probably be in seeking care and treatment for companion animals, and on the whole the level of satisfaction expressed over veterinarians’ dedication and abilities is high.
Many of the important duties that veterinarians have related to public health are little appreciated by the general public, and it is desirable to publicise them better. It is important for the profession, and the WVA as its mouthpiece, to convince both organisations and individuals that veterinarians are competent to fulfil their duties from day one, at the level that the public has come to expect. It is also important to ensure that the public have a realistic appreciation of day one competences.

**Day one competencies**

The adequacy of the curriculum content should be assessed by measuring objective outcomes, both during and at the conclusion of the veterinary educational programme. By the end of the programme of education, veterinary students should understand and/or be able to apply:

- Biological principles and mechanisms underlying animal health and disease, from the molecular and cellular levels to organismal and population manifestations;
- Normal physiological function, homeostasis, pathophysiology, and the natural history and manifestations of important animal diseases, both domestic and foreign;
- How to obtain adequate case histories, store and retrieve medical information properly, and communicate effectively with clients and colleagues;
- Theory and practice of medicine and surgery applicable to a broad range of species. This must include disease prevention, the ability to apply and interpret physical and laboratory diagnostic methods including diagnostic imaging, diagnostic pathology, biosecurity, therapeutic intervention including surgery and patient management, and care involving individual animals and populations;
- Principles of epidemiology, zoonoses, food safety, the interrelationship of animals and the environment, and the contribution of the veterinarian to public health;
- An understanding of the production systems of the livestock industries in which they may work, along with a thorough understanding of the factors that are limiting animal health and production within these systems;
- Professional ethics and delivery of professional services to the public;
- Knowledge, skills, values, attitudes, aptitudes and behaviours necessary to address responsibly the health and well-being of animals in the context of ever-changing societal expectations;
- An ability to use their knowledge to investigate animal health and production issues and continually to seek new knowledge to help improve their ability to provide high-quality veterinary care. That is, the recognition of the need for life-long learning and improvement must be part of their training culture.

Even when veterinary education fulfils these objectives, new graduates will experience gaps in practical skills, in their knowledge of day-to-day veterinary medicine, and lack experience in practice management. These can be reasons for a difficult transition from education to practice.

**Conclusions**

There are three main issues:

1. *The minimum requirements for veterinary education.* Veterinarians should graduate with most of the skills and knowledge that they will require to operate as new young veterinarians. They will have undertaken most of the basic technical procedures and will have a high level of theoretical knowledge, but it should be recognised that they will need practical experience to hone this knowledge and skills to a level required in the profession.

2. *The expectations of the profession of veterinary training.* The profession has the right to expect that new graduates will have the basic skills and knowledge required to undertake veterinary medicine in any form, but must also recognise that they will need assistance and mentoring in the first months of their career. WVA agrees that day one competences are the start competences which, if the new graduate is given reasonable support, will allow the graduate to develop rapidly into a veterinarian who will meet the needs of both the profession and society.
3. *The expectations of society of new graduates.* Society has the right to expect a high standard of veterinary care and expertise, whether animals are seen by a new graduate or a more experienced professional. A new young veterinarian, given appropriate mentoring and support, must be able to meet this requirement.

**Reference**

Continuous education: life-long learning for judgement and knowledge

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Summary

Veterinarians have an important role to play in both the development of a collective vision for a sustainable and all-inclusive world ecosystem, and the delivery of important elements within any such plan, including the place of animals (domestic and wild), food production and safety, and public and animal health.

Important aspects of their role are the need to be up-to-date, well-informed and capable of making good judgements at all levels, from the level of society to the level of individual animals. This highlights the need for an appropriate mix of core knowledge, information-sourcing skills, discriminatory and decision-making capabilities.

In order to proactively recognise the needs of society, professionals must engage in continuing education. The two key skills, judgement and the ability to engage in life-long learning, must be nurtured during the undergraduate phase and beyond, through courses which, as well as updating individuals, continue to enhance their higher order skills.

The significant problems we have cannot be solved at the same level of thinking with which we created them.

Albert Einstein

Keywords: Continuing professional development (CPD) – Decision-making – Life-long learning – Problem-solving.

Background

The recent financial crisis has delivered two important messages: first, that globalisation means failure of any part inevitably has widespread international repercussions, and second, that our creativity as a species has not been matched by our ability to recognise and manage the attendant risks. Global warming, the geographical spread of existing and the emergence of new diseases, and the rapid pace of extinction of other species with which we share this planet, also testify to our inability to manage our biological world, and present formidable challenges to our political leaders. In this context, veterinarians have an increasingly important role to play in the development of a collective vision for a sustainable and all-inclusive world ecosystem (27). Their knowledge and skills are essential to the delivery of important elements within any such plan, including the place of animals (domestic and wild), food production and safety, and public and animal health (3, 30).

Important to their role is the need to be up to date, well informed and capable of making good judgements at all levels, from the level of society, and groups of animals, to the level of individual animals and their problems (22). However, the individual's challenge and society's dilemma is that the pace of change is a direct consequence of an explosion in knowledge itself. In 2006, the world generated 161 exabytes of digital data, which is equivalent to 3 million times the information contained in all the books ever written (20). This constant updating and expansion means much of the detail of what has been learned is quickly out of date. The paradigm shift the internet has brought to university education has been to change institutions from custodians and disseminators of knowledge to communities which help individuals develop their abilities to source knowledge, discriminate between the authoritative and the spurious, and identify what is relevant to a problem which they have been challenged to address (28). This highlights the need for both students and graduate veterinarians to be developed and to develop themselves, throughout life, in three broad areas:

– core, discipline-related knowledge and technical skills
– the ability to source information, assess its authority and identify its relevance
– problem-solving and decision-making capabilities (17).
Implications for veterinary schools

Historically, curriculum designers have never coped well with burgeoning scientific knowledge (4). Curricula ‘drift’, and steadily become overloaded with content. Although, eventually, this precipitates a ‘shift’ in which the curriculum is debulked, this is often inadequate and the drift to overload continues. This means that, despite the fact that much of what they learn will be out of date within a few years of their graduating, veterinary students are assailed by more information than their predecessors. Unfortunately, this is at the expense of developing students who understand the ‘big picture’, and who can discriminate between what is important and what is trivial in relation to global societal problems and needs. There will always be a need to acquire new knowledge to provide the best possible advice to our clients at whatever level. However, increasingly, this will be in terms of very selective addition to core knowledge. The rest of the professional’s information requirements will be pursued on a ‘just in time’ rather than a ‘just in case’ basis, with professional judgement being the main skill that these clients (who have access to much of our knowledge themselves) will demand of us (29). The danger to be avoided was identified by the philosopher Bertrand Russell, as follows: ‘One of the troubles of our age is that habits of thought cannot change as quickly as techniques, with the result that as skill increases, wisdom fails.’

This means that the key generic skills for the veterinarian are judgement and ability to engage in life-long learning. However, these skills will not develop out of nowhere in a postgraduate phase; rather, they will need nurturing through earlier education, in particular during the basic clinical degree programme, so that they are second nature once an individual is qualified. Therefore, the first clinical programme needs to be carefully balanced in terms of the basic knowledge and skills required to function immediately following graduation, and the development of the ability to successfully manage further learning. It is very easy to produce highly structured and ‘instructionally aligned’ (5) educational programmes, which deliver knowledge and skills in a far more efficient way than in the past (17). Student memorisation of the frameworks we provide and the detail with which we populate them can be further enhanced by electronic means, so that we can fill student time outside the classroom with more visual feeds, via virtual learning environments, and more audio input, via podcasts. This creates an illusion of competence, with heavily dependent learners replicating what they have been taught in written examinations or objective structured clinical examinations, while their ability to think at a higher level and transfer their learning to new problems is compromised (20). There must be an appropriate balance between ‘adoptive’ (superficial/surface) learning of factual knowledge and simple competences, and the much more important ‘adaptive’ (deep) learning, necessary for problem solving, with creativity not subjugated to replication (1, 23).

The development of ‘day one’ technical skills is vital in providing a graduate with the ability to function at a basic professional level and a platform on which to build more complex practical skills, again on an ‘as needed’ basis (24). However, as with the proliferation of knowledge, care needs to be taken that the push to validate day-one skill sets does not lead to the same short-termism, with the teaching of fragmented, technical skills emphasised disproportionately above overall problem-solving and decision-taking abilities. Certainly, individual technical competences need to be acquired, but this must not be at the expense of overall capability (14).

Current provision of continuing professional development

The recognition of the need for the focus of the professional education to be ‘redirected from excessive emphasis on the accumulation of information to the acquisition of skills on how to find and use information (and) on problem solving’, and that ‘much more emphasis must be placed on post-DVM education programmes’ is not new in veterinary medicine (22). Therefore, it is reassuring that the requirement for life-long learning is recognised by the professional bodies in most European countries, and compulsory in about half of those that responded to a recent survey (12), as well as in other jurisdictions (19). Like most professions (15), where it is measured, this participation is largely assessed by inputs rather than outcomes, through a record of attendance at meetings and courses. However, there is a trend across a number of professions (particularly the larger professions) to move to output measures (11, 15), and in some countries, such as the United Kingdom, a modular structure of outcomes assessment is being put in place, including the (now compulsory for new veterinary graduates) professional development phase (first postgraduate year) which is a requirement to progress to Royal College of Veterinary Surgeons (RCVS) Certificates in Advanced Veterinary Practice (26).
In contrast to the first clinical degree programme which is based in universities and receives state funding, much of the available continuing professional development (CPD), as in medicine (18), is run by commercial companies, or veterinary associations, and funded by private practice. This means that although companion animals are well represented in such programmes, nationally and globally more important strategic areas such as farm animal medicine and public health, which have smaller interest groups in each country and are commercially more marginal, tend to be neglected. In addition, this provision is largely around lecture-based (or online) short courses, designed to fill specific knowledge gaps, or residential workshops designed to address well-defined skills requirements, such as small animal orthopaedic surgery. Longer courses do exist in universities at master’s (e.g. the Royal Veterinary College’s MScs in Veterinary Epidemiology, Livestock Health and Production, and Control of Infectious Diseases in Animals) and professional doctorate levels, but it is not clear that these are taking a lead in educating future policy developers at national and international levels. Although, historically, the veterinary profession took a political lead in the creation of state Veterinary Services with strong veterinary leadership (6, 21), it is not clear that its current members are communicating at the highest political level about the new structures that will be necessary to ‘think the different thoughts’ (as Einstein has indicated), which will be required to solve today’s and tomorrow’s problems, nor is it clear that the profession is producing people with the skill sets required to work within these new structures (30).

The efficacy of continuing professional development

Although governments and professional bodies can make it compulsory, CPD does not inevitably lead to the maintenance of, and an increase in, the quality of work undertaken by individuals and organisations (8, 13). As has already been indicated, most measures of CPD, whether voluntary or linked to licensure, are based on inputs (2). This is not surprising as inputs such as time are relatively easy to measure (26). However, this means that a veterinarian, who is only attending to fulfil a statutory requirement, can sit in a room listening to a lecture, or in some cases register and spend the time in a bar, claim the points to submit to the registering authority, and not make any change to their subsequent professional activity.

The CPD will have most impact on clinicians when they see it as directly relevant to their professional development. For medical practitioners, this has been shown to be particularly true of self-directed CPD (16), and CPD with an interactive component (13), such as ‘workshops that provide more opportunity for case discussion and rehearsal of practice behaviours’ (8). These are the CPD interventions that have been linked most closely to the highest levels of output, namely changed clinician behaviours and outcome benefits for their patients (9).

The learning style of an individual, as well as being linked to the quality of their learning, is also linked to their motivation and enthusiasm for CPD, which will feed back into their perception of its relevance and engagement. Thus, in fostering a higher level of thinking and learning during the first clinical degree programme, universities help develop veterinarians who see CPD as central to their identity. Individuals with a deep approach to learning, who see themselves as playing an important role in constructing their own knowledge base, and take a pleasure in solving problems, have a strong motivation for learning (10) and see fewer barriers to undertaking CPD. In contrast, those with a superficial approach to learning, and who like everything to be as simple as possible, perceive all sorts of reasons (e.g. wrong day of week, unsuitable location, excessive cost, insufficient time) why it is difficult to engage with CPD during their professional lives (7).

Conclusion

The increase in knowledge means that scientists (including laboratory-based veterinary scientists) involved in ‘discovery research’ are focused on smaller and smaller domains. In contrast, clinical veterinary medicine remains an integrative discipline through its initial comparative medical degree programme, and its interest in health and disease at global, regional and population levels, in addition to the individual level. The veterinarian, therefore, who is developing skills in problem solving and decision making, and capable of accessing relevant evidence bases on a ‘just in time’, ‘need to know’ basis has a unique skill set to offer to those responsible for food production and safety, and public and animal health (30). In order to fully realise this though, the profession needs to proactively recognise and anticipate the needs of society (not just react to yet another scare). Veterinarians will need to create better systems which span national boundaries to harness their collective skills and both drive research agendas and capitalise on new discoveries. It is
not the place of this chapter to elaborate on this, but the creation of connections at all levels between countries, their people and their animals has turned the complex system which is our world into one of ever-increasing complexity. Human-led systems set up to control this will need elements of surveillance, analysis, pattern identification and classification, and response modes, all designed and further developed in line with a properly informed capacity for risk analysis.

Within these organisations, veterinarians will need individually and collectively to seek and engage in CPD to provide the best possible services to society. The crucial problem-solving and decision-making skills must be nurtured during the undergraduate phase, and further developed through appropriate courses which, as well as updating veterinarians’ core and more specialist areas of knowledge, continue to enhance these higher-level skills. Progress should not be based on a short-term initiative here or a good idea there. Instead, there is a need to create evidence-based, evolving systems which build on their emergent good features. This process must include governments working with our profession (across the spectrum, from practitioner to scientist), our profession working with governments, and different national groups pooling resources to create coordinated CPD worldwide, allowing evidence-based interventions to be made locally, nationally and internationally as changing circumstances demand.

References

Session 6: Basic global needs for veterinary education


Session 7

Towards global harmonisation and evaluation of the veterinary curriculum, and an internationally recognised diploma

Chair: Prof. Marcel Wanner
The disparity of veterinary education in the world – the impact of cultural differences: a blueprint for future collaboration

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Summary

With several hundred veterinary education institutes in the world it is to be expected that a marked disparity of approaches will exist. Much of this disparity is dictated by widely varying geographical needs and the preparation of veterinarians to respond to those needs. Some are for the control of highly contagious tropical diseases, some for the care of animals used for draught purposes, especially in developing countries, some are due to religious beliefs or political imperatives, some for the provision of public health services to safeguard human health or safeguard export markets, and some, in fact many, to provide health and welfare services nationally for production animals, those for sport and for animals providing companionship. But disparity may even occur between educational establishments within a country in that funding may be dictated locally, e.g. by State legislatures for the purposes of training veterinarians for local needs.

The disparate nature of veterinary education has led, owing to lack of leadership, to a failure to address the need for a coherent approach to the problems associated with population growth, global warming, food shortages and environmental degradation. Increasingly however the disparities are serving as the catalysts for an approach to address the coming global emergencies, and this paper identifies the need for a global perspective for veterinary education.

Keywords: Cultural difference – Disparity of veterinary education – Veterinary public health.

The disparity scene

In the 2000s the world has become aware of the catastrophic events that will await humankind should they continue to use, and abuse, the environment and the global resources as at present. Climate change, global warming, water shortage and food shortages are inevitable consequences! There are many players in this drama, some knowledgeable and others less so. Hitherto the veterinary profession has not been a distinctive voice, and yet it should and must be, since there are many aspects of the litany of global changes in which the profession can have an important role. Hitherto the expression of the profession and its educational backdrop has been disparate, serving local or national needs but not global needs. In some cases international training programmes have been curtailed or closed down for want of educational funding. It is now time to adopt a more global focus for both the profession and its educational base.

The global perspective has now become a global imperative.

The Executive Summary of the ‘Report of the Commission for Africa’ (2) concludes that African poverty and stagnation constitutes the greatest tragedy of our time. While this report focuses on Africa, many other parts of the world suffer similar poverty and stagnation. Poverty and stagnation demand a forceful response. The Commission’s Report proposes action to constitute a coherent response since the many problems are vicious circles that reinforce one another. An example is the widespread epidemic of acquired immune deficiency syndrome (AIDS) in Southern Africa and elsewhere which saps the energy and willpower of rural livestock farmers, leading to the neglect of animals in terms of husbandry and productivity. Successful livestock farming demands healthy production and draught livestock. The deterioration of human health adds to the vicious circle of poverty and stagnation. This is a microcosmic view of the third or developing world. But adding to this existing poverty are stagnation and the marked global changes in climate, food production and requirements, environmental degradation, water shortage and possibly social unrest that are now recognised as problems of a global nature (12). Thus by 2050 it is estimated that growth will lead to a population of 9 billion people, and apart from the need for more food to feed this expanded population it is estimated that collectively it will demand more animal protein. Coupled with this change is the movement
of populations from rural to urban communities. For example in China it is estimated that by 2020, 900 million people will live in cities.

Disease is an ever-present problem, and will become more so in the intervening decades up to 2050. Diseases transmittable from animals to human beings (the zoonoses) are well recognised. Of the 1,461 infectious diseases of people, 875 are of animal origin, and this prevalence is increasing such that 75% of existing infectious diseases of humans are of animal origin (13). These zoonotic diseases add to the burden of ill health, exacerbating the poverty and stagnation of human populations, but they also importantly directly affect the health and productivity of the animal population. Crowding of livestock in intensive production facilities is well recognised as a feature of livestock in such facilities, and is a feature of infectious disease outbreaks, yet in order to produce the quantity and quality of food required for the burgeoning global population of the world, even greater care and attention is required. This is not only appropriate to large-scale production systems but also to animals that provide energy and draught power for small-scale rural agriculture. The buffalo, ox, donkey, camel (and in some areas the yak and elephant) are essential to the basic needs of agriculture such as ploughing and transport. Successful agriculture demands healthy animals, and the loss of animal energy providers may have serious consequences for the peasant family. These families are the bottom billions, the world’s poorest for whom there is urgent and imperative need for a united effort jointly between veterinary and medical services to address the neglected diseases that shackle the poor with inescapable bonds, caused by the lack of community services such as roads, of food security, and the absence of medicines for their families and animals.

While it would be understandable to concentrate on expansion of livestock enterprises to help provide for the increasingly urban populations, there are nevertheless dangers and pitfalls contingent on this. Environmental pollution from animal waste, the spread of animal and thence human disease and, increasingly recognised, the spread of antibiotic-resistant microorganisms in the commensal environment (forming an unappreciated reservoir of antibiotic resistance) (7) are serious concerns, especially if they lead to the displacement of small-scale livestock farmers, thus exacerbating rural poverty and malnutrition. Added to the issue of food production is the use of agricultural land for the production of agricultural crops such as oil seed rape, soya, wheat and sugar for biofuels.

Alain Lipietz, a French Member of the European Parliament (11), poses the question ‘How can we dedicate land to biofuel production when 28,000 people are dying from hunger each day?’ In the world 1.4 billion hectares are cultivated, yet this is still not enough to produce enough food to feed everyone adequately. Yet 4% of this land is dedicated to modern agro fuels! Pamela Cox, vice president of the World Bank for Latin America and the Caribbean, in giving evidence to the British House of Commons International Development Select Committee, concluded that ‘We need to find a new balance which promotes the most efficient biofuels and stops putting fuel into cars while too many around the world are hungry today’ (11). Writing in Research Review, Jacqueline McGlade, executive director of the European Environmental Agency, stated that ‘Europe should seek to generate as much bioenergy as possible domestically whilst sustaining a balance between food, fuel and film production and without compromising ecosystem services .... However, there are some hard-headed facts about all of this: the first is that the “business as usual” situation cannot continue and the second that “bold action is required” (11).

How then must the veterinary profession respond in providing answers to the various issues of global warming, food production, climate change and the like? The profession must play a key role in all areas of this global challenge.

Global veterinary medicine – a challenge to the educators

The global challenge is in fact a global imperative to bring together the disparate approaches to veterinary education. It is little wonder that disparate approaches to veterinary education have occurred over the years, since they are in large part due to the economic focus of the practising area of the veterinary profession. Thus in Western Europe, including the United Kingdom, and North America there has been strong emphasis on companion animal medicine, health and welfare. In other parts of the world the veterinary expertise is largely provided by the government, and is directed to production animals or those providing draught power – for example, the buffalo in the East – and companion animal veterinary medicine is a relatively secondary enterprise practised in cities, often for the companion animals of expatriate personnel or senior officials.
In tropical and subtropical countries greater emphasis is placed on the control of infectious diseases and the control of vectors. Again much of this is driven by government veterinary agencies which employ veterinarian assistants (paraveterinarians) to deliver and oversee disease control programmes. Cultural differences may apply in such programmes, and salaries and educational training may be dictated by the numbers in paramedical training and its cost. The ratio of paramedical personnel to a ‘fully’ trained veterinarian may be five to one, as in Southern Africa.

In countries where the export of livestock and livestock products is critical to the national economy, particular emphasis is laid on public health training and food hygiene to ensure security of overseas markets. Examples of this approach are Australia and New Zealand.

An important cultural impact on veterinary education is that of social and regional unrest, sometimes expanded into war. In this case undertakings essential for the control of animal disease, such as vaccination and dipping to control arthropods such as ticks and the diseases they transmit, may be suspended or abandoned, with consequent deterioration of animal and, in the developing world, human health.

Areas where there may be disparity of educational approaches include wildlife and fish. In both of these it has traditionally been zoologists rather than veterinarians who have addressed the problems of health maintenance. In part this has been dictated by the remuneration offered by wildlife and fish production services, but it also reflects the paucity of educational opportunities offered in veterinary schools.

Marine fish have long been a source of protein, and have been exploited commercially since antiquity. Now, however, with the expansion of fishing fleets and with new fishing technologies, resources are in progressive decline (10, 15), and if the present trends continue all the fish stocks that are exploited today are predicted to experience collapse by 2050. European fishing fleets now fish marine waters distant from their continental shelves (for example, it is estimated there are 800 European Union boats targeting West African fish). An unanticipated and unfortunate consequence of the decline of fish protein is that people are turning to hunting wild animals as a source of protein (1).

The slaughter of wildlife for food is well known in parts of tropical Africa, as is the associated danger of the transmission of viruses such as Ebola by persons handling carcasses of game animals slaughtered for food. In some cases freshly killed carcasses are imported into Europe for consumption at celebratory feasts.

Fish farming (aquaculture) has developed in some countries as a high-value enterprise, but requires careful monitoring, for disease and use of antimicrobial products. In some parts of the world the disposal of animal waste is a major problem, and swine and poultry waste are major sources of nutrient pollution. For example, in the South China Sea algal blooms have severely affected the quality and quantity of fishing along the coast.

**Progress in integration and collaboration**

Recent developments in veterinary education in a number of veterinary teaching facilities in different countries indicate that there is concern about the direction that veterinary curricula have taken and the need to address this. The most recent study is that by Philip Lowe (2009) entitled ‘Unlocking potential, a report on veterinary expertise in food animal production’ (6), a report from the Centre for Rural Economy on veterinary expertise in food animal production. This identifies a recurrent concern on the adequacy, quantitatively and qualitatively, of the supply of veterinarians in food animal work in the United Kingdom (UK). It points out that the number of veterinarians trained and working in the UK on the veterinary register is over 21,000, and the number of new graduates from the veterinary schools was 628 in 2007 and likely to reach around 800 by 2010.

As Lowe points out, it would be difficult to sustain an argument that there is an absolute shortfall in veterinarians in the UK, but the problem arises with the deployment of this veterinary capacity, with the majority of graduates undertaking small (companion) animal work. It is still not clear whether the preponderance of small animal work is dictated by the lack of employment in farm animal work or the fact that the financial rewards in companion animal work are more attractive, following the need to pay off debt accumulated in education, or perhaps both. Nevertheless there is need to redress this situation and Lowe describes this as ‘unlocking potential’ – and gives models for change (6). A comment of importance
in his report is telling: ‘the element I find lacking in the present system is any structure for articulating the demand for veterinary services’. King (5) has stated in a chapter in Vol. 28 of the OIE Scientific and Technical Review, ‘Today the veterinary profession sits at the cusp of the greatest challenges and opportunities in its history.’ Elsewhere in the world progress is being made in recognition of the need for an integrated approach to global animal health and public health. For example, in veterinary schools in South America under the auspices of the Pan American Veterinary Association, the Pan American Federation of Veterinary Schools (PFVS) was created, with the objectives ‘to promote modification and 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 curriculum harmonisation, and emphasises the curricular needs of public health and ethics and social responsibility. It is considered that this international harmonisation of the veterinary curriculum is a major step forward in addressing the global needs of the profession and of global society.

In addressing the responsibilities of educators and responding to the needs nationally and internationally, the Foresight Project Initiative of the Association of American Veterinary Colleges is an example of the future thinking (14). This has set the scene for a number of scenarios for the years ahead. Halliwell (4) has commented that change is a long-term process, and he hopes this Foresight project will not go the way of the Pew Report of 1988 (9), which on its publication was greeted with much enthusiasm but which had little long-term effect on veterinary education. The need for curricula to be adapted according to a country or region is evident in Europe, where specific veterinary curricula guidelines address issues of food of animal origin globally and also the lack of farm veterinarians.

In the Far East and Australasia the Asian Association of Veterinary Schools has recommended that graduates of veterinary schools should have intensive training in population health, preventive medicine and zoonotic diseases, while in Australia a Public Health University Network has been established to harmonise the veterinary public health curricula at various veterinary schools and to develop the Australian Veterinary Public Health Philosophy.

A more recent development is a Commission established in the United States of America (USA) to promote greater cooperation between human, animal and environmental sciences (14). This interdisciplinary collaboration recognises ‘the convergence of human, animal and environmental health dictates that we embrace the One Health concept now ... this creates unique health challenges, which require integrated solutions and more collaboration across health science professions, academia, government agencies non-government organisations and industry’ (www.onehealthcommission.org).

Major reorganisation of educational approaches

To address the very substantial number of issues that arise in response to the global imperative outlined here will require a major reorganisation of educational approaches, and the question arises how the educators can fit a sufficiently comprehensive and acceptable programme into an existing curriculum. Many would conclude that the curriculum is already too crowded and under unacceptable pressure. There is with some teachers 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.

Nevertheless it is a moral imperative that the future veterinary graduates must be cognisant of the global problems and have an appreciation of how the profession can play its part in addressing the United Nations’ declared Millennium Goals for feeding the world’s population and protecting the planet’s ecosystem. Changes in conventional approaches to teaching are necessary but will not be easy to accomplish owing to entrenched views. The advent of major advances in information technology (IT) offers opportunities for the provision of educational information for which there is insufficient space or time in a curriculum. There are strong possibilities for the use of IT in distance learning, and using mobile devices, information can be accessed at will.

Frydenberg (3) has provided a summary of some of the major trends in distance education in the first decade of the 21st Century, and proposes implications of these for international collaboration among institutions of veterinary medicine. She mentions the pervasive technologies which are increasingly available, and also
refers to the Open Educational Resources (OER) pioneered by Massachusetts Institute of Technology (MIT), which now offers over 1,800 MIT courses freely over the Web. Many institutions globally have now joined the OER movement and have organised themselves into the Open Courseware Consortium, a proposition to make freely available educationally organised knowledge to anyone, anywhere. ‘The Horizon Report, 2008’ (8) identifies and describes emerging technologies likely to have an important impact on teaching, learning or creative expression ‘within learning focused-organisations’. There are hence many opportunities to use modern technologies to address the disparity of veterinary education in the world, and also to provide a coherent approach to the coming global emergences.

Conclusion
This paper has identified a few of the urgent issues that must be addressed before 2050, and submits that the veterinary profession has the knowledge and ability to address them. There are other issues not dealt with in the paper, such as genetic modification of animals and crops, which are items for consideration by others. The disparities of veterinary education have, in fact, served as catalysts for an approach to address the coming global emergencies which should take on a perspective of a global nature.

References
The present situation of training evaluation in the European Union

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Summary

Veterinarians, in public and in private positions, play a crucial role in protecting the health and welfare of animals and people. Therefore proper education and training are indispensable. The European Association of Establishments for Veterinary Education (EAEVE) together with the Federation of Veterinarians of Europe (FVE) run the European system for the evaluation of veterinary schools. It consists of a self-evaluation, a visit by a team of experts and a final evaluation by a special committee. The system is voluntary and not all schools participate; the weaker ones especially tend to opt out. Apart from the good and even excellent schools, there is clear evidence that a number of schools provide curricula considerably below the acceptable minimum standard.

European Union (EU) legislation on veterinary education is limited. It focuses on the free movement of veterinarians and on guaranteeing access to the profession, instead of ensuring a good level of training. The absence of an effective Europe-wide system to stimulate schools to provide adequate education jeopardises the good functioning of veterinary services. It is a threat for the (inter-)national protection of health and welfare of animals and people. It also hinders European veterinarians applying for jobs outside the EU.

Keywords: Accreditation – European Union – Evaluation – Veterinary training.

Within the 27 member states of the European Union (EU-27), the training and licensing of veterinarians is a Member State competence. The European Union’s role is limited to contributing ‘to the development of quality education by encouraging cooperation between member states and by supporting and supplementing their action’.

The European Association of Establishments for Veterinary Education (EAEVE) and the Federation of Veterinarians of Europe (FVE) together run an evaluation system that provides a reliable and fair view of the quality of veterinary education in Europe. The ongoing process of external accreditation will further strengthen the quality and credibility of the system.

At this moment 38 out of 71 EU schools are unconditionally approved. These schools meet the minimum standards. Several go far beyond that level and can be considered the leading schools of the world.

It is very disappointing to see that in a number of cases the outcomes of evaluations are not used in the way they should be. Opportunities to improve the quality of veterinary education are not recognised or are simply neglected by the responsible authorities. There is a need for a rigorous enforcement of the actions needed to remedy deficiencies.

Introduction

Animal health, animal welfare and public health are public issues. The protection of the health and welfare of animals and people is of importance for every individual as well as for society at large. Everyone is directly or indirectly affected by the way the protection of the health and welfare of animals and people is carried out. Well-functioning Veterinary Services are widely considered as public goods.

For these reasons, to guarantee the quality of the veterinary work and to stop malpractice and quackery, veterinary medicine is a regulated profession. The access to and the exercise of the profession is supervised by the competent authorities, either directly by governmental services or indirectly by statutory bodies, such as orders and colleges with an official mandate.

Evidence of proper education and training is an indispensable element for the licensing of veterinarians. Ever-changing societal demands in the field of prevention and control of diseases, food security, food safety, public health and animal welfare require a continuous evaluation of veterinary education and training. Training programmes have to be adjusted to changing circumstances and new challenges. The quality of the training needs to be ensured permanently, to make sure that new graduates are capable of taking up their tasks and meeting their responsibilities.
European Union legislation on veterinary training

Europe has a longstanding tradition in veterinary education. The first official veterinary school, funded by and operating under the auspices of the national authorities, was set up in 1761 in Lyons (France). Preparations for the celebration of its 250th anniversary – 'Vet2011' – are well under way. Since then approximately 100 veterinary schools and faculties have been established throughout Europe.

Within the EU-27, the training and licensing of veterinarians has always remained a Member State competence. When – in 1992 in the Maastricht Treaty – education was formally recognised as an area of EU competency, Member States agreed that 'the Community shall contribute to the development of quality education by encouraging cooperation between member states and, if necessary, by supporting and supplementing their action, while fully respecting the responsibility of the member states for the content of teaching and the organisation of education systems and their cultural and linguistic diversity'.

As a consequence of this, each individual Member State is responsible for the quality of its own undergraduate training and education of veterinarians, and it is the national competent authority that authorises access to and exercise of the profession. The role played by the EU itself is limited.

However an exemption exists. In its aim for a single market with a free movement of people, goods, services and capital, some 30 years ago the EU adopted legislation on the mutual recognition of diplomas and qualifications in veterinary medicine (2). This piece of legislation also included provisions to facilitate the exercise of the right of establishment and the freedom to provide services throughout the EU. Another Directive (3), adopted at the same time, further stipulated that Member States require all persons wishing to take up the veterinary profession to hold a diploma which guarantees that during training the individual has acquired adequate knowledge of relevant topics considered as the minimum for becoming a veterinarian. An Advisory Committee on Veterinary Training was established to help the European Commission ensure a comparable high standard of veterinary training across the EU (4).

Later on the two Directives mentioned above were amended by a new Directive (5) on a general system for the recognition of professional qualifications, and in more recent years, with effect from 20 October 2007, these were replaced by the current Directive on the Recognition of Professional Qualifications (7), which applies to all EU citizens wishing to pursue a regulated profession in Member State other than the one in which they obtained their professional qualifications.

Despite the revisions of the legislation, minimum standards for veterinary training remained unchanged over the years. Relevant provisions in the current Directive and its annexes are still the same as more than 30 years ago, and it goes without saying that these are obsolete. Moreover they are non-specific and open to varied interpretations.

One exception to the general rules described here is made for official veterinarians in the EU legislation on food hygiene (6). Competent authorities may appoint as official veterinarian only those veterinarians who have passed a test to confirm their knowledge on a number of subjects, including legislation on veterinary public health, food safety, animal health and animal welfare.

In conclusion, apart from the exception for official veterinarians, the EU has taken on a very limited role with regard to quality assurance of undergraduate veterinary training. Notwithstanding the role of the veterinarian in assuring animal and human health and welfare, throughout Europe subsidiarity still rules. In fact the European Union's main concern is to ensure a free market and to prevent Member States from misusing the training requirements as a way to keep veterinarians qualified in other Member States from practising in their territory.

The European system of visiting and evaluating schools

The aforementioned Advisory Committee on Veterinary Training concluded that the best way to achieve the goal of a comparable high standard of veterinary training throughout the EU was the establishment of a permanent, Europe-wide system of visiting and evaluating veterinary schools. The responsibility for administering the evaluation programme was assigned to EAEVE. Later on, when the Advisory Committee was disbanded, EAEVE and FVE together formed a joint Committee which took over that role. The Committee, currently called the Evaluation Committee of Veterinary Education (ECOVE), consists of seven persons: one chairperson and six members. The president of EAEVE is, by definition, the chairperson. Three members are appointed by EAEVE and three by FVE. The permanent secretariat is located in Vienna.
The evaluation procedure as such is described in full detail in the Standard Operating Procedure and its Annexes (1). Evaluations are carried out on a voluntary basis. However when becoming a member of EAEVE, schools commit to being evaluated. The first steps for a school to be evaluated are for it to send in an application and prepare a self-evaluation report (SER). This report should outline the school’s objectives and activities. It should also state whether these objectives are met, and what are to be considered as the school’s strengths and weaknesses.

The following step is the visit to the school by a group of five experts, comprising at least one expert for basic sciences, one for clinical sciences, one for animal production and one for food hygiene. During the visit the expert team drafts a report on its observations. After the draft report is sent to the school for a factual scrutiny, a final report is drawn up and sent to the members of ECOVE.

If deemed necessary ECOVE can invite the head of the school and the chairperson of the visiting expert team to give further clarifications on the report. Finally, after the head of the school and the chairperson have left the meeting, ECOVE concludes whether there are major weaknesses (called Category I deficiencies) below the standard set by the Directives. Furthermore it decides whether additional suggestions should be made for changes which would improve the training even though they do not directly relate to the requirements.

The classification of evaluated schools and faculties is outlined in Table I.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved</td>
<td>No major Category I deficiencies</td>
</tr>
<tr>
<td>Conditionally (provisionally) approved</td>
<td>Category I deficiencies are present but the school is considered capable of correcting these within a defined period</td>
</tr>
<tr>
<td>Not approved</td>
<td>Category I deficiencies present that cannot possibly be corrected within a reasonable period</td>
</tr>
</tbody>
</table>

Results of visits and evaluations

From the evaluation reports it appears that Europe, and particularly the EU-27, has a number of excellent schools, which figure in the front line of 21st-Century veterinary education and research. They are well organised and managed. They have all relevant facilities, sufficient numbers of properly trained staff, and adequate funds and resources to offer good-quality curricula. Some are among the world’s leading veterinary schools. Within the EU-27, a total of 40 out of 72 (about 56%) schools are approved.

The evaluation reports have proved to be very helpful to both approved and not approved schools, providing an opportunity for them get a better insight into their situation. In many cases the reports have provided an effective stimulant to improve the quality of teaching. They also have proven to be very valuable in convincing the competent authorities that improvements (and investments!) need to be made.

On the other hand, a number of schools continue to fall below the standard. They suffer from one or more major deficiencies which continue to exist over the years. The competent authorities do not seem to be interested in forcing rectification of the problems, or have other priorities.

The current status of a relatively large number of schools is not clear. These are schools that have not been visited recently. In many cases they have not applied for a visitation and evaluation, or have applied only very recently, and the visit is pending. Although there is no clear confirmation, it is very likely that one of main reasons for not applying for a visit is that the school believes it might fail the inspection.

The numbers of schools, visited, approved, conditionally approved and not (yet) approved are listed in Table II.

These figures show that the status of 28% of the EU schools is unknown, and another 16% are inadequate in one or more aspects. The most frequently observed shortcomings are lack of facilities, lack of staff, lack of clinical training and insufficient caseloads. Especially in countries with high numbers of schools, schools may have insufficient budgets and be understaffed. In this context it should also be noted that
Session 7: Towards global harmonisation and an internationally recognised diploma

Table II Evaluation status of veterinary schools in Europe

<table>
<thead>
<tr>
<th>Status of schools</th>
<th>EU-27</th>
<th>Non-EU</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visited and approved</td>
<td>38</td>
<td>4</td>
<td>42</td>
</tr>
<tr>
<td>Visited and conditionally approved</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Visited and not approved</td>
<td>12</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Visit pending</td>
<td>19</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>Visit not applied for</td>
<td>1</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>26</td>
<td>98</td>
</tr>
</tbody>
</table>

Table III European Union Member States, their population and numbers of veterinary schools

<table>
<thead>
<tr>
<th>Country</th>
<th>Population (millions)</th>
<th>Number of schools</th>
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<td>Cyprus</td>
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</tr>
<tr>
<td>Luxembourg</td>
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<td>–</td>
</tr>
<tr>
<td>Malta</td>
<td>0.4</td>
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</tr>
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</table>

even where all schools in a Member State are approved, this does not guarantee that all veterinarians in working in the country have graduated from an approved school. Graduates from non-approved as well as approved schools enjoy the freedom to provide services across borders and to establish themselves anywhere in the EU.

Future developments

At this moment EAEVE and FVE are striving to improve the transparency, and with that the credibility, of the evaluation system. Standard operating procedures have been reviewed thoroughly, and the next objective is to have the system accredited by the European Association for Quality Assurance in Higher Education (ENQA). Another important wish of both organisations is to get the system recognised by the competent authorities, preferably at EU level. The essential weakness of the system is that although it provides good and reliable information about the quality of education offered by the schools and faculties, this does not necessarily lead to proper action. In many cases the visitation reports have proved to be very valuable for convincing the competent authorities that improvements have to be made. On the other hand in a number of cases serious deficiencies continue for many years. Competent authorities do not seem to be interested, or have other priorities.

For the long term EAEVE and FVE wish to develop the existing systems for visitation and evaluation/accreditation of schools towards a global network of systems that mutually recognise each other. This will be indispensable for European veterinarians to obtain equal opportunities with their colleagues from other parts of the world.

Conclusion

Within the EU-27, training and licensing of individuals as veterinarians is a Member State competence. The role of the EU is limited to contributing to the development of quality education by encouraging cooperation between member states and, if necessary, by supporting and
supplementing their action, while fully respecting the responsibility of the member states for the content of
teaching and the organisation of education systems and their cultural and linguistic diversity’.

EAEVE and FVE together run an evaluation system that provides a reliable and fair view of the quality of
veterinary education in the participating schools and faculties. The ongoing process of accreditation of
the system through ENQA will contribute to a further strengthening of the quality and credibility of this
system.

At this moment 40 out of 72 schools within the EU are unconditionally approved. These schools at least
meet the minimum standards, and many of them go far beyond that level. They can be considered as among
the leading veterinary schools in the world.

It is very regrettable that in a number of cases the outcomes of the evaluations are not used in the way they
should be. Opportunities to improve the quality of veterinary education are not recognised or are simply
neglected by the responsible authorities. There is a need for a rigorous enforcement of the actions needed
to remedy deficiencies.

Appendix I: Directive 2005/36/EC of the European
Parliament and of the Council of 7 September 2005 on
the Recognition of Professional Qualifications (7)

Article 38, The training of veterinary surgeons

1. The training of veterinary surgeons shall comprise a total of at least five years of full-time theoretical
and practical study at a university or at a higher institute providing training recognised as being of an
equivalent level, or under the supervision of a university, covering at least the study programme referred
to in Annex V, point 5.4.1.

The content listed in Annex V, point 5.4.1 may be amended in accordance with the procedure referred
to in Article 58(2) with a view to adapting it to scientific and technical progress.

Such updates may not entail, for any Member State, any amendment of its existing legislative
principles relating to the structure of professions as regards training and conditions of access by natural
persons.

2. Admission to veterinary training shall be contingent upon possession of a diploma or certificate
entitling the holder to enter, for the studies in question, university establishments or institutes of higher
education recognised by a Member State to be of an equivalent level for the purpose of the relevant
study.

3. Training as a veterinary surgeon shall provide an assurance that the person in question has acquired the
following knowledge and skills:

(a) adequate knowledge of the sciences on which the activities of the veterinary surgeon are based;
(b) adequate knowledge of the structure and functions of healthy animals, of their husbandry,
reproduction and hygiene in general, as well as their feeding, including the technology involved in
the manufacture and preservation of foods corresponding to their needs;
(c) adequate knowledge of the behaviour and protection of animals;
(d) adequate knowledge of the causes, nature, course, effects, diagnosis and treatment of the diseases
of animals, whether considered individually or in groups, including a special knowledge of the
diseases which may be transmitted to humans;
(e) adequate knowledge of preventive medicine;
(f) adequate knowledge of the hygiene and technology involved in the production, manufacture and
putting into circulation of animal foodstuffs or foodstuffs of animal origin intended for human
consumption;
(g) adequate knowledge of the laws, regulations and administrative provisions relating to the subjects
listed above;
(h) adequate clinical and other practical experience under appropriate supervision.
Appendix II

Annex V.4. Veterinary surgeon

5.4.1. Study programme for veterinary surgeons

The programme of studies leading to the evidence of formal qualifications in veterinary medicine shall include at least the subjects listed below.

Instruction in one or more of these subjects may be given as part of, or in association with, other courses.

A. Basic subjects
   - Physics
   - Chemistry
   - Animal biology
   - Plant biology
   - Biomathematics

B. Specific subjects

a. Basic sciences
   - Anatomy (including histology and embryology)
   - Physiology
   - Biochemistry
   - Genetics
   - Pharmacology
   - Pharmacy
   - Toxicology
   - Microbiology
   - Immunology
   - Epidemiology
   - Professional ethics

b. Clinical sciences
   - Obstetrics
   - Pathology (including pathological anatomy)
   - Parasitology
   - Clinical medicine and surgery (including anaesthetics)
   - Clinical lectures on the various domestic animals, poultry and other animal species
   - Preventive medicine
   - Radiology
   - Reproduction and reproductive disorders
   - Veterinary state medicine and public health
   - Veterinary legislation and forensic medicine
   - Therapeutics
   - Propaedeutics

c. Animal production
   - Animal production
   - Animal nutrition
   - Agronomy
   - Rural economics
   - Animal husbandry
   - Veterinary hygiene
   - Animal ethology and protection

d. Food hygiene
   - Inspection and control of animal foodstuffs or foodstuffs of animal origin
   - Food hygiene and technology
   - Practical work (including practical work in places where slaughtering and processing of foodstuffs takes place)
Practical training may be in the form of a training period, provided that such training is full-time and under the direct control of the competent authority, and does not exceed six months within the aggregate training period of five years study.

The distribution of the theoretical and practical training among the various groups of subjects shall be balanced and coordinated in such a way that the knowledge and experience may be acquired in a manner which will enable veterinary surgeons to perform all their duties.

References


Evaluation of veterinary education in the United States of America

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American Veterinary Medical Association, 1931 North Meacham Drive, Schaumburg, Illinois, 60173, United States of America

Summary

The American Veterinary Medical Association (AVMA) Council on Education (COE) is recognised by the United States Department of Education (USDE) and the Council for Higher Education Accreditation (CHEA) as the accrediting agency for veterinary colleges in the United States of America (USA) and Canada. USDE recognition provides assurance that the COE fairly applies documented standards of accreditation which address all areas of the degree programme. CHEA recognition provides similar assurance from an independent, non-governmental entity.

Accreditation is conducted in a manner which measures educational quality through fair and informed application of the standards. The Council judges the appropriateness of institutional and programme purposes, the adequacy of resources and organisation to meet these purposes, and educational outcomes indicating the purposes are met on an ongoing basis. COE accreditation ensures its standards in veterinary education are met, the quality of teaching, research and service continually improves, and students are prepared for entry-level positions in the profession.

Keywords: Accreditation – Clinical competency – Education – Standards – Veterinary medicine.

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The AVMA Committee on Intelligence and Education was formed in 1890. In 1906 the Committee initiated a subjective classification procedure based on curriculum, faculty and physical equipment. A detailed list of ‘Essentials of an acceptable veterinary school’ was adopted in 1921, which established a true accreditation process for veterinary medical education in the USA and Canada. The Committee was reorganised to form the COE in 1946, which was recognised by the CHEA in 1949 and the USDE in 1952 as the official accrediting agency for veterinary education in the USA. The COE also makes available the accreditation process to established veterinary colleges outside the USA or Canada on a voluntary basis. Regardless of location, all veterinary colleges are assessed for accreditation according to the same eleven standards.

The system of accreditation used by the COE provides assurance that graduates of accredited veterinary medical programmes are firmly based in the fundamental principles, basic knowledge, and physical and mental skills of veterinary medicine, and are able to apply these fundamentals to solve veterinary medical problems in different species and types of animals. The Council is composed of 20 volunteer members representing a diverse cross-section of the profession. Membership includes veterinary academicians, private practitioners, veterinary researchers, public health veterinarians, a representative of the Canadian Veterinary Medical Association, three public members (non-veterinarians), and one liaison appointed by the Association of American Veterinary Medical Colleges (AAVMC).
The accreditation process is based on eleven Standards of Accreditation:

1. Organisation
2. Finances
3. Physical Facilities and Equipment
4. Clinical Resources
5. Library and Information Resources
6. Students
7. Admission
8. Faculty
9. Curriculum
10. Research Programmes
11. Outcomes Assessment.

Colleges of veterinary medicine are evaluated based on compliance with the 11 standards as each relates to the mission of the college. Educational programmes are not compared across institutions but are evaluated by comparison with each standard. Accreditation standards reflect the needs of society and are developed with input from many groups, including the AVMA (House of Delegates, Executive Board, Councils and Committees), veterinary practitioners, the AAVMC and the general public. The accreditation standards are reviewed on a regular cycle for adequacy, relevance, and to assure compliance with USDE and CHEA recognition requirements.

The basis of compliance with each standard represents the most fundamental aspect of the accreditation process and provides valuable insight into its effectiveness. Compliance with Standard 1, Organisation, is judged based on the accreditation status of the university, the relationship of the veterinary college within the university, credentials of the dean and hospital officer (who must be veterinarians), college governance, and adequacy of the administrative staff. Compliance with Standard 2, Finances, is judged based on the adequacy and projected sustainability of resources to deliver the professional education programme, retain faculty, and provide teaching and service resources. Compliance with Standard 3, Physical Facilities and Equipment, is judged on the basis of the learning environment for the professional students, hospital(s) and services, equipment, research facilities and building infrastructure. Student and animal safety is a primary concern.

Compliance with Standard 4, Clinical Resources, is judged on the basis of availability and utilisation of normal and diseased animals for student instruction, student involvement in healthcare management, expertise of clinical faculty, and the adequacy of the medical records and retrieval system. Compliance with Standard 5, Library and Information Resources, is judged on the basis of availability of library materials (hard copy or electronic), credentials of the librarian, and learning resources support for the teaching programme. Compliance with Standard 6, Students, is judged on the basis of the impact of enrolment on resources, the availability and adequacy of student support services, fair testing/grading systems, adequate catalogue information, and the system used to collect student comments. Compliance with Standard 7, Admission, is judged on the basis of the programme providing prospective students with easily accessible and clearly understood and appropriate requirements, and a fair and unbiased selection process for admission.

Compliance with Standard 8, Faculty, is judged based on faculty numbers and qualifications as related to student enrolment and the mission of the college, faculty employment security, and professional development opportunities. Compliance with Standard 9, Curriculum, is judged based on students acquiring understanding of basic biological principles and applied clinical applications of veterinary medicine, the scope and sequence of courses, and rigour and content of the curriculum. Compliance with Standard 10, Research Programmes, is judged based on the impact of the research programme on the professional teaching programme and the richness of the educational environment. Compliance with Standard 11, Outcomes Assessment, is judged based on demonstration that the college collects and analyses student and graduate outcomes data and uses the results for programme improvement to assure graduate success in the profession. Colleges must develop relevant measures and provide evidence that students/graduates have had adequate access to primary care cases and hands-on experiences with live animals during the clinical year(s), and must address clinical competencies in the following areas:

- comprehensive patient diagnosis (problem-solving skills), appropriate use of clinical laboratory testing, and record management
- comprehensive treatment planning, including patient referral when indicated
Colleges seeking COE accreditation must submit a comprehensive self-study document that describes how the programme meets each of the 11 Standards of Accreditation. A site team is sent to visit the college and validate the information provided in the self-study. The site team prepares a Report of Evaluation for consideration by the COE. The report is reviewed by the full Council and a classification of accreditation is assigned. The categories of accreditation for established schools include full, limited and terminal accreditation.

The COE accreditation process is similar, but not identical, to those used in the United Kingdom, Australasia and other areas with similar societal needs and expectations. It may be possible to harmonise the development and application of accreditation standards in these areas. However, common accreditation standards cannot accommodate widely dissimilar societal needs and expectations. Many countries are simply not prepared for the application of global accreditation standards for veterinary medical education. Standards of quality vary widely from country to country and across geographical regions, in part because of differences in societal needs and expectations, as well as differences in the importance nations may place on companion and food animals and public and environmental health. In addition, in many countries, educational institutions are founded on the principles of academic freedom, whereby the faculty of the institution are charged with overseeing the curriculum to ensure the mission of the institution is fulfilled. In other countries, the veterinary curriculum is controlled centrally, with far less variation among the veterinary medical colleges in a given country or even region. Thus, the application of global accreditation standards cannot be expected to produce graduates who are universally capable of practising anywhere in the world, and should not be linked with global recognition of licensed status. For this reason, the AVMA does not support the concept of a globally recognised diploma.

The AVMA endorses the concept of minimum educational standards necessary to meet the needs for effective national veterinary service organisations in all countries. The establishment of minimum veterinary educational standards would provide some assurance that an individual with the title 'veterinarian' has met those specific minimum standards. Therefore, application of minimum educational standards has real value across country borders in ensuring veterinary public health and regional and international market access for animals and animal products. The AVMA stands ready to assist in further development of this process.
Contribution from veterinary deans of Southern Africa: Evolving veterinary education for a safer world

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Summary

In September 2009, the World Organisation for Animal Health (OIE) organised a regional seminar, in Arusha, Tanzania, for deans of veterinary faculties and registrars of Veterinary Statutory Bodies (VSBs) in Southern Africa on ‘Veterinary education in Southern Africa: matching demand and supply’, during which participants raised their concerns over the state of the veterinary curriculum and the quality and governance of Veterinary Services in Southern Africa. The meeting observed that VSBs are autonomous authorities regulating veterinarians and veterinary paraprofessionals. Thus a VSB is a very important and essential part – a kingpin – in good veterinary governance and in meeting the OIE Terrestrial Animal Health Code (Terrestrial Code) standards on quality and performance for Veterinary Services in a country. Even though VSBs have been in existence in some Southern African Development Community (SADC) countries for many years, with wide variations in legal basis, autonomy, objectives, authority, functions and responsibilities, composition, administrative procedure, etc., in several SADC countries there is no VSB at all. Veterinary training in most parts of southern Africa has focused on producing veterinarians to serve the livestock sector. The curricula have been adapted to reflect socio-economic changes and the increased privatisation of veterinary services, and also to cover issues of globalisation and the increased risk of the spread of transboundary animal diseases. In a world where countries are closely interlinked due to globalisation of trade and food, increased volume and speed of international travel, global climate change, and the related emergence and re-emergence of infectious diseases, participants agreed that veterinary education must face new challenges and continually evolve to meet societal demands in the field of food security, food safety, public health and animal welfare. It was also observed that VSBs as well as veterinary schools in Southern Africa must work together to address the dynamic needs and demands of the veterinary profession. The main focus of this chapter is on the discussions and recommendations that the meeting came up with to improve the quality and governance of Veterinary Services and to improve and facilitate regulation and harmonisation of the veterinary curriculum in the OIE Member Countries of Southern Africa.


Introduction

In September 2009 the World Organisation for Animal Health (OIE) organised a regional seminar in Arusha, Tanzania, for deans of veterinary faculties and registrars of Veterinary Statutory Bodies (VSBs) in Southern Africa, on ‘Veterinary education in Southern Africa: matching demand and supply’. This was in line with the OIE’s overall mandates of improving the legal framework and resources of national Veterinary Services, to collect, analyse and disseminate veterinary scientific information and to encourage international solidarity in the control of animal diseases.

The seminar focused on the following four issues, which fitted well into the topics which were going to be discussed at the OIE Global Conference on ‘Evolving veterinary education for a safer world’, in Paris, from 12-14 October 2009:

– current and future needs for the qualified veterinarians in Southern Africa and how to meet these needs at regional level
– matching the veterinary curriculum with novel developments in veterinary science and veterinary education
– enhancing coordination between VSBs and veterinary and paraveterinary schools and faculties at national and regional level
– enhancing coordination, collaboration and harmonisation at regional and international level.
Specifically, the objectives of the seminar were:

- To inform registrars of veterinary councils and deans of veterinary schools in OIE Member Countries from the Southern African Development Community (SADC) region on the role and responsibilities of the OIE with respect to improvements in the quality and governance of Veterinary Services;
- To initiate an e-networking forum of the deans of veterinary schools and registrars of VSBs, to include available experts who could provide technical inputs not only into their respective national Veterinary Services but also to their OIE delegates on issues related to OIE standard setting;
- To explore topics and/or areas of relative competitive advantage for which some of the veterinary schools in SADC Member States can be considered as OIE Collaborating Partners;
- To share best practices on the criteria and regulations used in the OIE Member Countries of the SADC region to register veterinarians and veterinary paraprofessionals;
- To share best practices on the criteria and regulations used to license private veterinary practices and their role and responsibilities within the national Veterinary Services structures;
- To explore avenues to match an ever-decreasing supply (in terms of quality and quantity) of veterinary professionals with increasing demands from an ever-expanding veterinary field and scope of activities (aquatic animal health, animal welfare, food safety, wildlife, etc.);
- To be informed of international initiatives relating to accreditation of veterinary qualifications.

The meeting observed that VSBs are an autonomous authority regulating veterinarians and veterinary paraprofessionals. Thus a VSB is a very important and essential part – a kingpin – in good veterinary governance and in meeting the OIE Terrestrial Animal Health Code (Terrestrial Code) standards on quality and performance for Veterinary Services in a country.

The participants raised their concerns over the state of the veterinary curriculums and the quality and governance of Veterinary Services in Southern Africa. Even though VSBs have been in existence in some SADC countries for many years, albeit with wide variations in legal basis, autonomy, objectives, authority, functions and responsibilities, composition, administrative procedures etc., in several SADC countries there is no VSB at all. Veterinary training in most parts of Southern Africa has focused on producing veterinarians to serve the livestock sector (2) The curricula have been adapted to reflect socio-economic changes and the increased privatisation of veterinary services, and also to cover issues of globalisation and the increased risk of the spread of transboundary animal diseases (1). The current and future perspectives of veterinary education in Africa were comprehensively reviewed in 2009 (2). In a world where countries are closely interlinked because of globalisation of trade and food, the increased volume and speed of international travel, global climate change, and the related emergence and re-emergence of infectious diseases, veterinary education must face new challenges and continually evolve to meet societal demands in the field of food security, food safety, public health and animal welfare.

The meeting came up with the following set of recommendations to improve the quality and governance of Veterinary Services and to improve and facilitate regulation and harmonisation of the veterinary curriculum in the OIE Member Countries of Southern Africa.

**Recommendation 1:**

*Rationale for the recommendations for the Veterinary Statutory Bodies*

1. The OIE standards on the quality of Veterinary Services, in particular the provisions of Chapter 3, Section 2.12 of the *Terrestrial Code* on VSBs;
2. The current and foreseeable demand for veterinarians and veterinary paraprofessionals in the SADC region;
3. The disparities between registration requirements and quality assurance of veterinarians and veterinary paraprofessionals and applicable legislation for the constitution of VSBs in the various countries, as well as the absence of formal VSBs in others;
4. The increased challenges faced by the veterinary profession by new societal demands in the field of food security, food safety, public health, animal welfare and the environment, by increased regional integration and the consequential mobility of veterinary professionals and their services;
5. The challenges in the delivery of primary animal health services to smallholders/small-scale/communal farmers in rural areas;

6. The insufficient development of public–private veterinary partnerships in some countries in the overall control and prevention of OIE-listed diseases;

7. The need to enable better horizontal cooperation and mutual recognition between VSBs in the SADC region.

Recommendations for the Veterinary Statutory Bodies

1. That VSBs in the SADC region should work towards improved coordination and communication in the short term (one year), sharing of information, and harmonisation of their registration requirements and operational procedures in the mid term (three years);

2. That a working group be formed to evaluate the registration requirements and operational procedures to reach consensus on the alignment thereof and in particular on the minimum standards of training;

3. That VSBs endeavour to work towards the establishment of a Southern African Forum of VSBs, to harmonise their objectives and seek solutions for the challenges to VSBs within the region;

4. That the OIE consider facilitating a platform to enable more frequent electronic or face-to-face coordination meetings between registrars and/or chairpersons of VSBs, and chairpersons of veterinary associations, where VSBs do not exist;

5. That the VSBs of the region establish a list of faculties that are subjected to external audit from the region whose graduates qualify for unconditional registration without taking a council exam (where applicable), the criteria of which are accepted throughout the region;

6. That the OIE consider extending the twinning programme to VSBs to enter into bilateral agreements in order to achieve agreed requirements;

7. That the establishment (where applicable), structure and operation (SOP) of VSBs be developed along the lines of the OIE standards, as stipulated in the Terrestrial Code, Chapter 3, Section 2.12, including the involvement of relevant stakeholders;

8. That national Veterinary Authorities of countries that have undertaken an evaluation using the OIE Performance of Veterinary Services (PVS) tool are urged to address the findings of the evaluation, and where appropriate, are invited to apply for a post-PVS OIE gap analysis to address shortcomings, or support on veterinary legislation review to address outdated legislation or seek conformity with OIE standards.

Recommendation 2:
Rationale for the recommendations for veterinary education

1. The importance and need for highly qualified veterinarians and veterinary paraprofessionals in SADC, as well as the fact that the OIE considers the issue of initial and continuous veterinary education as part of its commitment to encouraging its Members to strengthen the activities of their National Veterinary Services;

2. The emergence of new diseases, the increase in new pathogens, the threat of transboundary animal diseases, the impact of environmental changes as well as the new societal demands in the field of food security, food safety, public health and animal welfare;

3. The need to train veterinarians and veterinary paraprofessionals to meet these new expectations at a global, regional and national level;

4. The implementation of the new global concept ‘One World, One Health’ which brings together animal health, public health and environmental health;

5. The fact that Africa cannot isolate itself from global trends and must take into consideration global animal and human health issues;
Session 7: Towards global harmonisation and an internationally recognised diploma

6. The need, on the other hand, for veterinarians and veterinary paraprofessionals to be locally relevant to professional requirements, societal needs, political expectations and environmental changes in the SADC region;

7. The existence of both similarities and wide disparities in veterinary training and veterinary training capacities between veterinary faculties in the region and from different parts of the world;

8. The fact that current regulatory systems in SADC Member States often hinder mobility of veterinarians and veterinary paraprofessionals, and the need for mutual recognition of training and qualifications for veterinarians and veterinary paraprofessionals within the region;

9. The technological and pedagogic advances in veterinary education delivery;

10. The need for additional knowledge and skills for veterinarians such as in communication, leadership and interpersonal relationships;

11. The need for sharing human resources and available infrastructures for initial and continuous education of veterinarians and paraprofessionals in the region, and the high cost of veterinary education;

12. The existing willingness of veterinary faculties in SADC to work with all interested parties, including the OIE and national Veterinary Services, to develop innovative teaching and learning methods in veterinary education.

Recommendations for veterinary education

1. That the existing deans’ meeting (under the Norwegian Programme for Development, Research and Higher Education [NUFU] programme) be maintained and expanded to a Veterinary Education Forum (VEF) and include other veterinary training institutes and countries in SADC through:
   a) the development of an electronic/telematic platform for e-networking
   b) an annual meeting of deans but also to include representatives of other countries in SADC with a particular interest in veterinary education.

2. That curricular reviews currently being undertaken within the veterinary schools in SADC should, through consideration by the Veterinary Education Forum:
   a) identify areas of potential harmonisation within SADC
   b) consider a core-elective approach with the development of day one competences relevant to SADC
   c) consider types of elective programmes required within SADC
   d) consider additional knowledge and skills, such as in communication, leadership and interpersonal relationships, required for veterinarians in SADC
   e) consider technological and pedagogic advances to be applied in veterinary education delivery within SADC
   f) Consider ways to harmonise admission and assessment policies applied within veterinary schools in SADC
   g) consider national, regional and global human and animal health issues that impact on the training of veterinarians within SADC.

3. Collaboration and partnerships through memoranda of understanding (MoUs) between the veterinary schools should be developed, and where possible twinning programmes should be established within SADC as well as with partners in the developed countries to:
   a) identify areas of collaboration in undergraduate curricular development and harmonisation
   b) assist where possible in undergraduate student training
   c) create opportunities for academic and research staff exchange
   d) identify and develop opportunities for collaboration and partnerships in post-graduate training and research
   e) identify and develop centres of special veterinary competence within SADC for use in elective programmes
   f) create opportunities for veterinary specialist training
   g) collaborate in the delivery of continuing education programmes in SADC
   h) support the development and responsibilities of the OIE Collaborating Centre for Training in Integrated Livestock and Wildlife Health and Management
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i) identify additional areas that should be developed and recognized as OIE Collaborating Centres
j) consider ways in which collectively the SADC region can promote veterinary education as a public good
k) consider ways in which veterinary schools can become more involved in poverty alleviation (income generation) through their undergraduate, postgraduate, community engagement and research programmes.

4. That the OIE facilitate a workshop to consider the needs and requirements for veterinary paraprofessional training within SADC.

These sets of recommendations were presented and discussed at the OIE Global Conference on ‘Evolving veterinary education for a safer world’, held in Paris from 12-14 October 2009.

Acknowledgements

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References


Preparing for a safer world: can veterinary education evolve to meet this challenge?

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Summary

In preparation for this meeting a set of 49 papers have been created directed to the topic of improving veterinary education worldwide in the area of global public health. These papers have been published in the OIE Scientific and Technical Review 28 (2) (2009). The papers cover the topics of:

- the environment for change
- essential global veterinary education for all veterinary graduates
- changing students’ perspectives on the importance and delights of global veterinary education
- global perspectives on the integration of public health into the veterinary curriculum
- modern directions for veterinary education to meet the needs for enhanced global veterinary education.

These papers have been created by experts in this arena of topics from all six continents. This paper briefly reviews their highlights.

Keywords: Veterinary curriculum – Veterinary education.

The current status of veterinary education: questions for debate

The first veterinary school of the modern era was founded in 1761 in Lyons, France (3) and its 250th anniversary will be celebrated in 2011, as announced by Jean-François Chary at this OIE meeting (see page 244). In Lyons, then in Alfort, France, and then in the several veterinary schools that followed (3), students trained with just a single species (equine), and their career practice was likewise limited. This gradually changed as veterinary training began to include increasingly more species. In recent decades an extremely high percentage of veterinary schools around the world aim for their students to achieve what is often termed ‘omni-competence’, i.e. gaining clinical training on a broad range of species, including food animal, equine and companion animal species. By graduation, students are about equally competent in each.

There have been enormous advances in veterinary knowledge in the last 40 years. The breadth of knowledge for which the veterinarian needs to be responsible, even within a single species, has grown exponentially. The 2009 OIE symposium ‘Evolving veterinary education for a safer world’ and the two sets of reports prepared for it (Appendix I, and this set of papers) is a testimony to not only the breadth but also the rapidity with which our knowledge is expanding. Along with this knowledge has come an extensive increase in species-directed clinical skills and an emerging responsibility for global public health.

The veterinary curriculum is already considerably impacted, yet throughout the OIE conference, and as reported in the two reports cited above, an extensive set of attributes were described that all veterinary students were expected to have attained by the time of their graduation. These included various areas of ‘knowledge and understanding’, ‘skills’ and ‘professional characteristics’. Those suggested during the conference and its associated reports were primarily in the arena of global public health, and are reasonable suggestions for required knowledge for the veterinary graduate. Many other areas of the profession would likewise define additional attributes that they consider all veterinary graduates should have attained by the time of their graduation, but currently do not.

The time taken to acquire multiple species knowledge comes at the expense of the graduating student acquiring in-depth training in any one or two species. However, almost all practising veterinarians are now very species-specialised. Very few students now go on to a fully mixed animal practice, and when they do initially, they quite rapidly narrow their practice to a limited area (7). In many areas of the profession, the student is expected to be competent for practice upon graduation. As the ‘general’ knowledge base increases and the expectations of new veterinary graduates in their selected areas of practice likewise expand, it has to be asked: ‘Is it possible for students to reach the needed (expected) level of proficiency in their area of specialty by graduation, while still attaining the expectations of “multicompetency” from...
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An “omni-competence” based curriculum? Is it possible any longer to achieve both? Veterinary medicine is thus facing a serious dilemma, and it is critical for veterinary education to address these issues. These concerns are not new, but neither have they been addressed (1, 4, 5, 6, 8, 10, 11, 13).

These issues are not unique to veterinary medicine, and have been faced by other professions in different ways. For example, in human medicine the students have attained a general level of medical skills, knowledge and professional attributes by the time of their graduation, but they are not deemed sufficiently competent for specific practice, and must take up to several years of postgraduate education before being licensed to practice. A modification of this model would be to extend the period of training within veterinary school education prior to graduation. The fiscal implications of applying either approach to veterinary medicine are enormous, for both students and the schools themselves.

In engineering, students at an early stage of their training concentrate on one out of a range of areas (such as chemical engineering, civil engineering, electrical engineering, mechanical engineering), each with its own specific curriculum, but they are not expected to be, nor could they reasonably be, competent in other areas. Upon graduation they work within the specialised area encompassed by their specific engineering degree programme. This is a model that Eyre (5) suggested as a possibility for veterinary medicine over ten years ago, and it has considerable merit. One advantage of the engineering model is that it allows the distribution of graduate expertise to match the balance needed in different fields. In veterinary medicine we currently have a shortage of veterinarians in several key areas (for example, in global public health) and the current education system structure is not providing the balance of expertise that is needed nationally and globally. Currently students are totally free to choose their career area of veterinary medicine, whereas in the engineering model it is the individual schools/faculties that set the enrolment target for each area. Of note, the engineering model already partially exists for veterinary medicine at the University of Veterinary and Pharmaceutical Sciences, Brno, in the Czech Republic, with the programme of the Faculty of Veterinary Medicine directed to clinical veterinary medicine, that of the Faculty of Veterinary Hygiene and Ecology directed to veterinary food safety, hygiene, and ecology and food animal medicine. There is a third separate faculty directed to veterinary pharmacy (20).

A third model for veterinary education that demands examination is that of ‘tracking’. In tracking, students receive broad veterinary training in their initial years, but in their final year (or year plus) they concentrate on just the species in which they plan to practise. This model has been in existence since 1974 (2). Its intent is to provide a balance between students attaining a general veterinary education, while also achieving concentrated education in the area of their future practice career. Much debate has raged about this model, although unfortunately most of the concerns expressed have not been data based. Licensure and accreditation agencies’ decisions regarding tracking have been likewise limited. Given that this distinctive approach has been in existence for a considerable period of time (over 30 years), it would seem that those schools with such a programme could have provided secure data about their outcomes. One detailed outcome assessment has now been completed (7, 21), and sheds much insight on what tracking accomplishes.

An argument against several of these alternative models for veterinary medical education that needs examination is that veterinarians, independent of their area of practice, are key representatives of the profession to the public. It is important that the general public be made aware of the wide variety of issues addressed by the profession, because many of these directly affect the public’s own safety and health. One example involves food safety, security, global transport and availability; and a second the impact of zoonotic diseases of animal origin and the trans-global transmission of these diseases to both humans and animals. These areas require the sharing of information to the public from a broad range of veterinarians beyond those directly working on the specific issues. As the world ‘shrinks’, these areas have become even more critical for the public to understand. The term ‘veterinarian’ has a meaning that is often used to embody the entire role of what the veterinary profession as a group is expected to provide for society. It is a precious term whose symbolic essence must not be lost, and it is equally a description of the profession as much as the individuals of the profession. Veterinary education is therefore currently facing a set of intriguing, critical and overlapping questions.
What is a ‘veterinarian’?

- Would the veterinary service new graduates provide be better if during their Doctorate of Veterinary Medicine (DVM) (or equivalent) training they received a much greater part of their education in the area in which they then practised for the bulk of their career?

- Given the breadth of veterinary medicine and its responsibilities, does the current education structure that produces a single, now less than comprehensive, multi-species training still meet the needs of veterinary medicine?

- How well are current veterinary education programmes matched to producing the range of well-qualified veterinarians needed to meet the increasing growth and scope of the profession’s responsibilities?

- Is there an advantage (or need) for all veterinary graduates to have a general education in a broad breadth of areas even though many such areas will not be part of their day-to-day veterinary activities?

- What can be predicted about the needed services provided by the veterinary profession, and the balance between these services, in the next 10, 25, even 100 years?

- Should veterinary licensure be limited to specific groups of species or competencies?

- Should veterinary education provide for veterinarians to be able to radically change their area of veterinary practice without the requirement for formal re-licensure?

- With the exponential growth in veterinary knowledge, should the period of licensure be limited and all practising veterinarians be required to be relicensed after a given period (say, 5, 10 or 15 years)?

- Should accreditation policies lead or follow the development of curricula designed to deliver the needed veterinary competence for the current era?

The process of curriculum evolution

The 2009 OIE symposium ‘Evolving veterinary education for a safer world’ and the sets of reports prepared for it (Appendix I) provided compelling reasons for substantial change in the veterinary curriculum. As Dr Vallat states in his introduction to these reports (18), ‘This is a responsibility of all of the 500-plus veterinary schools throughout the world; they need to recognise and accomplish this mission.’ This indicates that the curricula of many, if not all, veterinary schools need to change. Approximately one-quarter of the papers referenced in Appendix I address the process of accomplishing curriculum change, and they cover many of the critical areas that need consideration. In brief, the essential steps needed for successful curriculum change include the following:

- **Key curriculum changes within a school need a true champion.** Changing a curriculum is difficult and fraught with many problems, apprehension, uncertainties and frustration. Curriculum change is most successful if there is truly a champion for the importance of the change. This champion should strongly encourage change, stimulate extensive discussion of it, constantly emphasise its importance, encourage debate about it, and reward those taking leadership in it, but must allow the faculty to make the decisions, since it is they who will need to incorporate and implement the changes. Who is that champion? Ideally, it is the dean of the school. Two excellent examples have been Dan Tosterson, who became dean of Harvard Medical School when it was in the midst of one of the major evolutions of its curriculum (http://focus.hms.harvard.edu/2009/060509/bulletin_tosteson.shtml), and Peter Eyre, dean of the Virginia-Maryland School of Veterinary Medicine, who presided over their schools’ recent changes (17). Successful curriculum change requires intense effort by the faculty, and they need to have leaders who are supportive and provide encouragement for change;

- **The process for curriculum change must start from the top down.** It is essential that curriculum change has a well-defined purpose. That purpose must be determined by asking, ‘What are we trying to produce?’ If the purpose of a veterinary school curriculum is to produce well-qualified veterinarians who can meet the needs that veterinary medicine must provide to individuals, populations and worldwide well-being, then it is essential to define in detail the skills, knowledge and understanding, and professional attributes that the graduate veterinarian must have to meet these responsibilities. These set of attributes can apply to all students, or can be designed for a specific track (or can be a mixture of the two). Two excellent examples of these set of attributes are those defined by the School of Veterinary Medicine, Utrecht
University, the Netherlands (19), and the Royal Veterinary College (RVC)/Royal College of Veterinary Surgeons (RCVS) (9, 12, 14, 15, 16). The RVC/RCVS has taken this one important step further and defined both ‘day one’ and the ‘year one’ (post-graduation) attributes. This recognises the extensive education that occurs during the first year following graduation, and thereby allows the curriculum to focus on what must be achieved during the student’s education in veterinary school. Only with such attributes carefully and extensively defined can a school then effectively examine its curriculum and determine what is being achieved that needs to be achieved and what is lacking or needs improvement. The driving force for change must be ‘What are the attributes that our graduates must have attained by day one of graduation?’ Only once the endpoint(s) has been defined can the process to achieve that endpoint(s) (i.e. the curriculum and its mode of delivery) be appropriately deliberated and determined;

- The process of consideration of change must then be stepwise from general to specific. After defining the essential attributes that a student should attain (step 2), there needs to be a stepwise progression from general concepts to specific curriculum. This can be achieved by a set of about three to five steps, with each step receiving general faculty approval before moving on to the next more detailed step. Turnwald and Walkington (17), in their paper prepared for this meeting (Appendix 1), provide an excellent example of how stepwise definition of a curriculum should be achieved. One very critical phase of these steps is that it requires the definition of the specific content to be made upon the factual base of what must be achieved rather than perceptions. Determining how students will optimally learn must be decided before determining just what they must learn. In the first section of this report five basic models were described as possibilities for veterinary education:

(i) omnicompetence
(ii) tracking
(iii) the engineering model
(iv) the human medicine model
(v) lengthening the current DVM curriculum.

It is at this stage of deliberations that a school should make the decision on which of these models best meets the objectives of their school, and will provide the skills, the knowledge and understanding, and the professional attributes that their graduates should have achieved and demonstrated. During this stage of evaluation, a school should determine which of these five basic models (or other possibilities or combinations) might allow it to best meet its objectives;

- Once made, changes must be evaluated to determine whether they have achieved their defined intent. To date, the question of whether curriculum changes have achieved their intended results has rarely been evaluated by hard data analysis. More often evaluation has been by ‘perception’ and ‘opinion’, as noted previously in the discussion of curriculum ‘tracking’. It is critically important for a school to evaluate whether it has achieved the intended purpose of the curriculum changes it has adopted, especially with respect to the day one skills, knowledge and understanding, and professional attributes that the school defined as those its graduates should have achieved.

The conference ‘Evolving veterinary education for a safer world’, the papers prepared for it (Appendix I), and those now in this set of reports, have provided one set of compelling reason for veterinary curriculum renovation. Many other areas of veterinary medicine likewise deserve such a detailed evaluation and equally some measure of curriculum renewal. This paper has attempted to provide concepts, strategies and underlying principles whereby this can be satisfactorily accomplished.

References


The World Organisation for Animal Health Performance of Veterinary Services (PVS) tool and the task of the Veterinary Statutory Body to guarantee the quality of the veterinary profession

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Summary

The World Organisation for Animal Health (OIE) tool for the evaluation of the Performance of Veterinary Services (OIE PVS tool) is designed to assist Veterinary Services to establish their current level of performance, to identify gaps and weaknesses regarding their ability to comply with OIE international standards, to form a shared vision with stakeholders (including the private sector) and to establish priorities and carry out strategic initiatives. The OIE PVS tool comprises four fundamental components:

1. Human, physical, and financial resources
2. Technical authority and capability
3. Interaction with stakeholders

For each of these components six to twelve critical competencies, each with five levels of quantitative advancement, have been elaborated. A specific critical competency deals exclusively with the Veterinary Statutory Body (VSB). The VSB evaluation criteria as defined in Chapter 3.2, Article 3.2.12 of the OIE Terrestrial Animal Health Code are addressed and the powers and tasks of the VSB as an autonomous authority responsible for the regulation of the veterinarians and veterinary paraprofessionals are described in relation to ensuring and guaranteeing the quality of the veterinary profession. In this context the OIE PVS tool critical competencies 'Competencies of veterinarians and veterinary paraprofessions' and 'Continuing education', as part of the VSB’s tasks in guaranteeing the quality of VS, are highlighted.


Introduction


They are adopted by consensus of OIE Members and are available as the OIE Terrestrial Animal Health Code (Terrestrial Code) (1).

The quality of Veterinary Services depends on a set of factors, which include fundamental principles of an ethical, organisational and technical nature. The Veterinary Services are required to conform to these fundamental principles, regardless of the political, economic or social situation of their country.

These fundamental principles are part of the Terrestrial Code and are described in Chapter 3.1. They are:

- professional judgement
- independence
- impartiality
- integrity
- objectivity
- general organisation and quality policy
- procedures and standards
- information, complaints and appeals
- documentation
- self-evaluation
- communication
- human & financial resources.
The World Organisation for Animal Health PVS tool

The OIE has established procedures for the evaluation of Veterinary Services, based on the provisions in Chapter 3.2 of the Terrestrial Code, using the OIE tool for the evaluation of the Performance of Veterinary Services (OIE PVS tool). The OIE PVS tool has been developed and put into use since mid-2006. The evaluation criteria are detailed in articles 3.2.2 to 3.2.12, with information requirements listed in article 3.2.14.

The purpose of evaluation may be to:

- assist a national authority in the decision-making process regarding priorities to be given to its own Veterinary Services (self-evaluation) or to prepare information for national or international purposes;
- for the purpose of risk analysis in international trade in animals and animal-derived products to which official animal health and/or zoosanitary controls apply, such as:
  i) evaluation by a prospective or actual importing country of the Veterinary Services of a prospective or actual exporting country
  ii) verification or re-verification of an evaluation in the course of a visit to the exporting country by the importing country
- facilitate an evaluation by third parties such as OIE experts or regional organisations.

The OIE PVS tool comprises four fundamental components:

1. human, physical and financial resources
2. technical authority and capability
3. interaction with stakeholders
4. access to markets.

For each of the four fundamental components, from six to fourteen critical competencies are specified, such as e.g. for the first fundamental component of Human, Physical and Financial Resources:

- professional and technical staffing of Veterinary Services
- competencies of Veterinary Services
- continuing education
- technical independence
- stability of policies and programmes
- coordination capability of the sectors and institutions of Veterinary Services
- physical resources
- funding
- contingency funding
- capability to invest and grow.

There are five levels of advancement, and a higher level assumes compliance with all preceding levels.

For each critical competency, a list of suggested indicators is used by an OIE Evaluation Team to help determine the level of advancement.

The Veterinary Statutory Body

The Veterinary Statutory Body (VSB) has a crucial role in ensuring the quality of the veterinary profession. This relates to its task to exercise and enforce control over all veterinarians and veterinary paraprofessionals.

These controls should include, where appropriate:

- compulsory licensing and registration
- minimum standards of education (initial and continuing) for the recognition of degrees, diplomas and certificates
- setting standards of professional conduct
- exercising control and the application of disciplinary procedures.

Chapter 3.2, article 3.2.12 of the Terrestrial Code deals specifically with the evaluation of the VSB.
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The Terrestrial Code defines the main stakeholders in this context as follows:

**Veterinary Statutory Body**
Means an autonomous authority regulating veterinarians and veterinary paraprofessionals.

**Veterinarian**
Means a person registered or licensed by the relevant veterinary statutory body of a country to practise veterinary medicine/science in that country.

**Veterinary paraprofessional**
Means a person who, for the purposes of the Terrestrial Code, is authorised by the VSB to carry out certain designated tasks (dependent upon the category of veterinary paraprofessional) in a territory, and delegated to them under the responsibility and direction of a veterinarian. The tasks authorised for each category of veterinary paraprofessional should be defined by the VSB depending on qualifications and training, and according to need.

Article 3.2.12 of Chapter 3.2 of the Terrestrial Code lists the following criteria for the evaluation of a VSB:

1. **Scope**
In the evaluation of the VSB, the following items may be considered, depending on the purpose of the evaluation:
   a) objectives and functions
   b) legislative basis, autonomy and functional capacity
   c) the composition and representation of the body’s membership
   d) accountability and transparency of decision making
   e) sources and management of funding
   f) administration of training programmes and continuing professional development for veterinarians and veterinary paraprofessionals

2. **Evaluation of objectives and functions**
The VSB should define its policy and objectives, including detailed descriptions of its powers and functions, such as:
   a) to regulate veterinarians and veterinary paraprofessionals through licensing and/or registration of such persons
   b) to determine the minimum standards of education (initial and continuing) required for degrees, diplomas and certificates entitling the holders thereof to be registered as veterinarians and veterinary paraprofessionals
   c) to determine the standards of professional conduct of veterinarians and veterinary paraprofessionals and to ensure these standards are met.

3. **Evaluation of legislative basis, autonomy and functional capacity**
The VSB should be able to demonstrate that it has the capacity, supported by appropriate legislation, to exercise and enforce control over all veterinarians and veterinary paraprofessionals.

These controls should include, where appropriate, compulsory licensing and registration, minimum standards of education (initial and continuing) for the recognition of degrees, diplomas and certificates, setting standards of professional conduct and exercising control and the application of disciplinary procedures.

The VSB should be able to demonstrate autonomy from undue political and commercial interests.

Where applicable, regional agreements for the recognition of degrees, diplomas and certificates for veterinarians and veterinary paraprofessionals should be demonstrated.
4. Evaluation of membership representation
Detailed descriptions should be available of the membership of the VSB and the method and duration of appointment of members.
Such information includes:

a) veterinarians designated by the Veterinary Authority, such as the Chief Veterinary Officer
b) veterinarians elected by members registered by the VSB
c) veterinarians designated or nominated by the veterinary association(s)
d) representative(s) of veterinary paraprofessions
e) representative(s) of veterinary academia
f) representative(s) of other stakeholders from the private sector
g) election procedures and duration of appointment
h) qualification requirements for members.

5. Evaluation of accountability and transparency of decision making
Detailed information should be available on disciplinary procedures regarding the conducting of enquiries into professional misconduct, transparency of decision making, publication of findings, sentences and mechanisms for appeal.
Additional information regarding the publication at regular intervals of activity reports, lists of registered or licensed persons including deletions and additions should also be taken into consideration.

6. Evaluation of financial sources and financial management
Information regarding income and expenditure, including fee structure(s) for the licensing/registration of persons should be available.

7. Evaluation of training programmes and programmes for continuing professional development, for veterinarians and veterinary paraprofessionals
Descriptive summary of continuing professional development, training and education programmes should be provided, including descriptions of content, duration and participants; documented details of quality manuals and standards relating to good veterinary practice should be provided.
Within the four fundamental components of the OIE PVS tool, the following competencies address the VSB directly or indirectly:

I. Human, physical & financial resources
   I.2. Competencies of the Veterinary Service
   I.3. Continuing education

III. Interaction with stakeholders
   III.5. Veterinary Statutory Body

IV. Access to markets
   IV.3. International harmonisation.

**Fundamental component**

**III. Interaction with stakeholders**
This component of the evaluation appraises the capability of the Veterinary Services to collaborate with and involve stakeholders in the implementation of programmes and activities. It comprises six critical competencies.
Critical competency

**III. 5 Veterinary Statutory Body**

The Veterinary Statutory Body (VSB) is an autonomous authority responsible for the regulation of the veterinarians and veterinary paraprofessionals. Its role is defined in the *Terrestrial Code*.

In the full documentation of the PVS tool, the critical competency III.5, relating to the VSB, is illustrated and the five levels of advancement are indicated.

**Conclusions**

In evaluating the compliance of a country with OIE International Standards of quality of Veterinary Services, a VSB – which could be called a Veterinary Board or Council or given any other designation – plays a pivotal role and is indispensable in the establishment and maintenance of good veterinary governance and practice.

Countries without a VSB should be encouraged to establish a VSB in accordance with the provisions of the *Terrestrial Code* as a matter of high priority.

The concept of ‘twinning’ should be investigated between established and to-be-established VSBs in order to share expertise and competencies.

**Reference**

Global harmonisation of veterinary education and animal health services

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Summary
Recent developments related to avian influenza epidemics, the H1N1 pandemic and even severe acute respiratory syndrome (SARS) have served to emphasise the integrated nature of ‘One Health’ and the global impact of veterinarians delivering ‘local’ animal health services. The situation is particularly critical in the developing and transitional countries that have become the focus for emerging and re-emerging zoonotic and transboundary diseases. The repercussions of insufficient disease surveillance and non-compliant regulatory Veterinary Services are exacerbated by public and private veterinarians who are poorly trained and lack the modern skills, knowledge and resources to prevent and control infectious diseases. The sustainability of donor-driven investments in the livestock sector and livelihoods of producers are compromised by poorly skilled animal health workers. There is a pressing need to develop a clear strategy for modernising veterinary training in a way that articulates the needs and addresses them with investments in facilities, curriculum and human resources, and produces better qualified veterinarians. The World Bank and other donors have been using a recently developed tool to evaluate veterinary faculties and develop such strategies. The veterinary faculties in more developed countries could support these development strategies and ensure that, to the extent possible, veterinary training worldwide provides a harmonised, scientifically based cadre of skilled veterinarians and paraveterinarians to address the animal health and public health issues that are gaining profile. This presentation will review the evaluation tools and options for action based on the outcomes.

Keywords: Developing country veterinary services – Faculty self-evaluation – Veterinary education – Veterinary Services – Veterinary twinning programmes.

Background and context
The global spread of avian influenza, the H1N1 pandemic and even severe acute respiratory syndrome (SARS) have served to emphasise the relationships between animals, humans and ecosystems in the ‘One Health’ paradigm and the global impact of veterinarians delivering ‘local’ animal health services. The situation is particularly critical in the developing and transitional countries that have become the focus for emerging and re-emerging zoonotic and transboundary diseases. The repercussions of insufficient disease surveillance and non-compliant regulatory Veterinary Services are exacerbated by poorly trained public and private veterinarians who lack the modern skills, knowledge and resources to prevent and control infectious diseases at their origin. The sustainability of donor-driven investments in the livestock sector and the livelihoods of producers are compromised by poorly skilled animal health workers. There is a pressing need to develop a clear strategy for modernising and harmonising veterinary training in accordance with international standards in a way that articulates country-specific needs and addresses them with investments in facilities, curricula and human resources to produce better qualified veterinarians and paraveterinarians in the public and private sectors.

With accelerating urbanisation, demand from livestock products is increasing quickly and different livestock production and marketing systems present a unique set of disease prevention and control challenges in which limited human and financial resources, information and skills must tackle increasingly complex problems.

The concentration of livestock and people, particularly in peri-urban areas in developing countries, poses great public health challenges from contaminated food, pollution and diseases. In many developing countries inadequate infrastructure and weak institutional arrangements for delivery of animal health and production services increase transaction costs and, in this context, impede the delivery of multidisciplinary animal health services as both a public and private good (1).

Animal agriculture accounts for up to 50% of agricultural gross domestic product (GDP) in some countries. An estimated 1.3 billion people depend partially or entirely on livestock for their livelihoods, and livestock
keeping is often a last resort for people without alternatives. On a global scale producers in developing countries are now producing more meat than their counterparts in the developed countries, and the gap is similarly narrowing for dairy products (3). This marks a substantial shift in the ‘centre of gravity’ for livestock production from the more temperate zones to tropical and sub-tropical environments, and similarly contrasting critical needs in terms of animal health, disease risks and veterinary education.

This growth of demand for animal-source foods in developing countries has accentuated the multitude of related threats from increasing dependence on livestock, including poverty and livelihood risks, food security, trade-related transboundary diseases, and the demands of the ‘One Health’ agenda. The future of smallholder producers and their access to the evolving supply chains in the developing world should be considered in the unprecedented context of global trade and fundamental structural changes in production and processing of livestock commodities. Private and public veterinarians play a fundamental role in these developments, and their education and training must keep pace. The credibility of animal health services begins with the education of veterinarians.

The effective delivery of services is confronted by myriad challenges related to poor infrastructure, geographic obstacles, limited financial and physical resources, unskilled technical veterinarians and paraveterinarians, and resistance based on traditional cultural practices, which may originate in the veterinary faculties. The establishment of effective animal health services, both public and private, is further restricted by illiteracy, the vagaries of semi-intensive or free-range production systems, severe resource limitations, competing regional and national vested interests, and corruption. The delivery of multidisciplinary animal health services in this environment is particularly difficult.

Disease epidemics often result in catastrophic losses. Epidemics marginalise farmers, destabilise rural economies, increase the potential for conflict, and in some cases present a direct threat to public health. Many animal diseases are endemic in poor countries because of the relatively high cost of prevention to small producers, the lack of institutional capability to prevent isolated cases from spreading beyond national borders and, most importantly, the lack of veterinary resources at the farm level of a primarily private nature.

Awareness that climate change places traditional livestock production systems in jeopardy has evolved into a tetrahedral discussion of animal–human–ecosystem health within the overriding complexity and influence of the climate change umbrella. Considering the geographic risks associated with endemic, re-emerging and emerging diseases, developing country veterinarians and paraveterinarians are on the front line, and a renewed investment in their education and training is paramount to any prevention and control programme.

The evolution of animal health services in developing countries is often restricted by a resistance to change in the government public service, slow acceptance of the private sector and a lack of fundamental reform in the educational institutions. An established curriculum and commitment to traditional and historical approaches and methodologies make it difficult to introduce more modern, science-based approaches to training and education that can be adapted to local needs. There is a gradual erosion of veterinary resources driven by the deteriorating reputation of the profession, attrition with insufficient replacement plans, technical over-emphasis, inadequate salaries and very poor advocacy nationally, regionally and internationally, especially with donors. There is very little public or political appreciation of the role of Veterinary Services in mitigating the disease risks associated with public health and food safety, and their ultimate impacts on poverty alleviation, food security, trade, tourism and GDP.

The reluctance of the public sector to move from its well-established role in ‘controlling’ the delivery of on-farm animal health services is undermining the development of a vibrant private veterinary service, which is essential to support farmers and herders and address the disease control issues at the farm level. Qualified field veterinarians are ageing but the lack of opportunities for young people in the private veterinary sector and minimal government salaries have encouraged them to opt for other career choices. Surveys in Kyrgyzstan and other Confederation of Independent States (CIS) countries, for example, indicate that the majority of field veterinarians are over 50 years of age, with less than 12% under 40 years of age. Encouraging anecdotal evidence, however, indicates that donor-supported programmes which provide contracted vaccination fee-for-service to increase private veterinarians’ incomes may be acting as a catalyst to increase the number of young people interested in the profession and applying to the veterinary schools.
**Veterinary education in developing countries**

The World Organisation for Animal Health (OIE) and international agencies have supported the Performance of Veterinary Services (PVS) procedure and subsequent Gap Analysis, which have already been conducted in 97 countries. This has highlighted the shortcomings and is contributing to the preparation of strategic plans for the reform and upgrading of Veterinary Services to meet acceptable international standards.

The main function of veterinary education is to develop veterinarians, paraveterinarians and animal health workers based on a reasonable assessment of personnel requirements. It is recognised that dependence on donors by veterinary schools in many developing countries will continue in the future. The emerging political and economic integration in many of these regions, as well as the trend towards early specialisation in the veterinary profession in the developed countries at a time when these countries still require generalists, will mean that cooperation within a bilateral framework may become less desirable. Veterinary schools in developing countries might evolve mechanisms for collective aid negotiations and utilisation of aid in a more cost-effective and strategic fashion. Long-term commitment and cooperation between donors in multi-donor-supported schools or regional centres would be essential to minimise rigidity in projects, reduce cost, shift from low-impact short-term interventions and move towards a more sustainable long-term, generational (20–25 years) investment in the veterinary profession in developing countries (2). The current approach to donor-assisted animal health programmes tends to ignore long-term investment in veterinary faculties and to focus on ad hoc short-term programmes that have limited utility or sustainability. Although there are some success stories, they are often funded as incidental activities or components of projects or programmes, and delivered by well-meaning professors with limited commitment or capability to support the longer-term full-time process of upgrading faculties.

The majority of developing countries lack a fully functional veterinary faculty or college. The curriculum in many cases is adapted to the local situation including, in some cases, significant allocation of time for political propaganda or dogma. There is a need for reinvigorating the curriculum through the introduction of the basic elements of an internationally harmonised curriculum adapted to the local situation in a given country. This should be supported with long-term, full-time technical assistance that can only be provided by veterinary education institutions in the more developed countries, and which should drive this agenda and related advocacy and fundraising.

Certification programmes are being developed and would include a university degree programme integrated with a technical college practitioner-level programme for paraprofessionals. Many of these programmes are in place but they should be reviewed in the context of international standards and harmonisation with existing programmes so that there is an appreciation throughout the profession and recognition amongst the global community and trading partners. The goal of international accreditation can be a daunting undertaking for many faculties, and an interim solution may be required. In addition, and until such time as the reinvigorated faculties become fully operational, there may be a need for a transitional approach for continuing education and upgrading of the current cadre of veterinarians and animal health workers.

**Evaluation of the basic elements of veterinary schools**

An informal self-evaluation tool has been developed to assist faculties in identifying the gaps in veterinary institutions in several countries, and this has served as the basis for strategic plans to be supported by donors and domestic budgets. The survey was initially based on criteria from various accreditation bodies, and has been combined with a set of interviews with key industries, progressive farmers, students, commercial employers of veterinarians and the government Veterinary Services. This process identified gaps that were not obvious to the faculty, and local industry has even demonstrated a willingness to support the reform of the education system. In several cases where the tool has been applied the government was surprisingly blunt about the state of veterinary education and the impact it was having on the service.

The strategic plans for faculty upgrading are expected to address the needs of both the public and private sectors, and lead to a long-term development plan to be funded by the domestic government budget and donors on a country basis but with a regional focus. The basic elements of such plans from those already completed or in process include:

- a vision statement with a global perspective related to international cooperation
- curriculum development (veterinary degree and paraveterinary diploma programmes)
- modernising scientific, academic and clinical capacity
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- continuing education and distance learning where feasible and appropriate
- library and multimedia teaching materials
- scientific and pedagogical capacity building for faculty and staff
- capital investments in facilities
- applied research (focused on in-country animal health issues and problems)
- management and operational budget.

Regional veterinary education centres

This process will require support and inputs from a number of international veterinary institutions working in collaboration on a multi-year programme that may take one or more generations to implement. Considering the scope of investments that would be required to address veterinary faculty upgrading throughout the developing world, a more rational approach might be to consider investments in regional centres that could develop the resources and capacity to expand over time into individual countries throughout the region. Some innovative programmes may be incorporated to accelerate this process, including adapted distance learning in local languages. This process could be coordinated on a regional basis with a view to developing veterinary institutions that would serve as the training facility for the evolution and upgrading of other in-country programmes over time.

Such regional centres of veterinary expertise are already informally recognised in Africa, Southeast Asia and elsewhere. The upgrading programme would require regional consensus supported by significant multi-donor coordination including funding. Some operational examples already exist, including the European Union-funded Tempus Programme which supports multi-institutional twinning.

Twinning programmes

Twinning programmes would support the establishment of sustainable ‘regional’ veterinary training institutions capable of developing veterinarians and animal health workers to meet the needs of food animal producers in developing countries, and focusing on basic skill sets for:

- field-based ambulatory veterinarians and animal health workers whom farmers and herders are prepared to pay for basic services and some fee-for-service government functions
- government veterinarians capable of fulfilling regulatory and disease surveillance functions, animal movement control, meat inspection and other public good services
- laboratory diagnosticians trained in applied and sophisticated tests to support national animal disease control programmes.

Such programmes would be based on institutional agreements or memoranda of understanding (MOUs) amongst a consortium of supporting university partnerships. and not based on ad hoc personal contacts alone. This approach needs to be driven by in-country commitment to the development of the veterinary faculty, demonstrated by allocation of domestic budgets and workable incentives for faculty and staff within the existing salary structure and grading system. Consideration could be given to a variety of approaches to be incorporated into such twinning arrangements as a contribution to the overall upgrading strategy for a given institution, such as:

- joint applied research projects
- sandwich graduate programmes for faculty
- student exchange and mentoring
- partner institution faculty sabbatical posting applicable to tenure evaluation
- focus on long-term institutional capacity building (15–20 years)
- digitising and translating the curriculum for anatomy, and the other early year ‘ologies’
- implementation of self-evaluation and accreditation tools to identify gaps and design a development plan.

Funding and participating institutions/organisations

Funding approaches and priorities would be an important part of the consortium partnership and planning process, but must ultimately be driven by the institution in the developing country that has been designated as ‘centre’. The financial envelope for this work might include a number of options:
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- seed money – required for selection, feasibility and needs assessments
- twinning partners (developed country) support through fundraising, endowments and long-term funding for scholarships
- bilateral and multilateral donor partnership programmes (TEMPUS, etc.)
- global programme funding directed to veterinary education (global programmes for HPAI and H1N1)
- integration of veterinary education with related bilateral and multilateral livestock programmes and project design as a matter of practice.

Conclusion

Addressing the urgent need for upgrading and harmonisation of veterinary faculties in developing countries with the accepted international standards is a costly, long-term, multigenerational undertaking. The current ad hoc, short-term approaches, often based on personal connections, are insufficient to meet the pressing needs and scope of investments required. It is proposed that the more advanced veterinary faculties combine resources and effort in consortia to focus on specific regional institutions. A consortium would be committed to provide technical assistance, fundraising support and a long-term strategic plan for the target institution, based on a standardised evaluation tool.

References

Next veterinary education conference

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The world’s first veterinary school was founded in Lyons, France, in 1761, shortly followed by the Alfort veterinary school, near Paris, in 1764, both at the initiative of Claude Bourgelat. This means that 2011 will mark the 250th world anniversary of veterinary education. By setting up the world’s first veterinary training institutions, Bourgelat created the veterinary profession itself.

2011 will mark the 250th world anniversary of the veterinary profession.

It is for this reason that we have proposed that 2011 should be declared ‘World Veterinary Year’.

Among the many events already proposed all around the world in the programme for this year, the National Veterinary School of Lyons receives the General Assembly of the European Association of Establishments for Veterinary Education (EAEVE) on 12 May. You are invited to join the European deans during the three subsequent days (from 13 to 15 May) for a second global conference on Veterinary Education.