Rev. sci. tech. Off. int. Epiz., 2004, **23** (2), 717-726

New partnerships between animal health services and public health agencies

L.J. King [(1)], N. Marano [(2)] & J.M. Hughes [(2)]

(1) G100 Veterinary Medical Centre, College of Veterinary Medicine, Michigan State University, East Lansing, Michigan, 48824-1314, United States of America
(2) National Center for Infectious Diseases, Centres for Disease Control and Prevention, 1600 Clifton Road, NE, Mailstop C12, Atlanta, Georgia, 30333, United States of America

Summary

As Veterinary Services and animal health organisations attempt to respond to a new era of emerging and re-emerging zoonotic diseases, their ability and skill in forming new strategic partnerships will be paramount. While these new partnerships are likely to include many relationships outside traditional Veterinary Services and animal agriculture, none will become more important than the formation of new animal health and public health partnerships. Episodes of emerging zoonoses are being increasingly recognised around the world and the confluence of people, animals and animal products today is unprecedented. Concurrently, a wide array of complex factors are also converging that will not only ensure the continuous emergence of zoonoses, but are also likely to drive the further increase and expansion of these diseases. This article discusses the need for the creation of more effective and co-operative partnerships in the face of new microbial threats, the complexity of both the formation and expansion of zoonoses, and the collective abilities of both human and animal health services to respond to them. Lessons learned from recent zoonotic epidemics support the need for co-ordinated research, interdisciplinary centres, integrated surveillance systems, response systems and infrastructures, and workforce development strategies. While there are some excellent examples of collaborative animal and public health relationships, there is no question that more and stronger partnerships among national and international organisations, both academic and private, will be necessary to meet the future challenges of emerging zoonoses and to manage their profound implications.

Keywords

Animal health – Convergence – Emerging infectious disease – International co-operation – Multidisciplinary team – Public health – Strategic partnership – Zoonosis.

Introduction

Unprecedented social and ecological changes associated with human demographics, environmental alterations, and globalisation, have converged to create a modern era of newly identified and re-emerging infectious diseases. The majority of the implicated pathogens, as well as most of those identified as potential bioterrorism agents, are either vector-borne or zoonotic microbes or infectious agents that have crossed the species barrier from animals to humans (23). High-profile events such as the 2003 outbreaks of severe acute respiratory syndrome (SARS) and monkeypox, the steady progression of the epidemic of West Nile virus (WNV) encephalitis across the United States of America (USA), and the transmission of avian influenza to humans in parts of Asia highlight the capacity of animal-borne diseases to occur unexpectedly and in new locations. These events also demonstrate that these diseases can have potentially catastrophic public health, economic, and political consequences, and that the actions required for their containment are complex.

This convergence of animal and human disease threats and the likelihood of continued propagation of new zoonotic diseases suggest an urgent need for a corresponding convergence of animal and public health officials, professional organisations, and partners to meet these challenges. Recently, representatives from 92 Member Countries of the World Organisation for Animal Health (OIE) responded to a questionnaire about emerging and re-emerging zoonoses. The results showed that animal health officials worldwide are increasingly concerned about the introduction or re-emergence of zoonotic pathogens into human populations through either natural or intentional means. Veterinary Services in OIE Member Countries are anticipating closer working relationships with their clinical and public health counterparts, and many are working to integrate the critical functions of surveillance, response, prevention, research, and training. Officials from multiple disciplines are recognising that human and animal health systems can no longer work in isolation, but must collaborate in the development of an integrated agenda to address the threats and challenges of the infectious diseases of today and to prepare for the diseases of tomorrow. The broad range of topics included in the chapters in this volume reflects the commitment of a diverse group of experts toward meeting these challenges.

Background

Although episodes of zoonotic diseases are being increasingly recognised around the globe (10, 15, 19), instances of cross-species transmission are not new. The spread of animal-borne infections to humans has a long history that can be described in terms of a series of epidemiological transitions, each defined by a unique pattern of disease (1, 16). The first era was associated with the rise in infectious diseases that accompanied the agricultural revolution. Conditions favourable to the spread of zoonotic infections to humans began with the shift from the nomadic, foraging lifestyle of our early ancestors to the establishment of agrarian settlements, approximately 10,000 years ago. Whereas nomadic bands were too small and dispersed to support widespread transmission of infectious pathogens, the agricultural transition created larger pools of potential hosts and increased contacts both among humans and between humans and animals. These interactions allowed for the exchange of pathogens between animals and people and the likely appearance of new zoonotic diseases.

The second epidemiological transition was linked to industrialisation, the associated decreases in infectious diseases, and the emergence of the chronic diseases of modern society. In the years following World War Two, this shift led to the widespread misperception that infectious diseases were a scourge of the past, conquered by antibiotics, vaccines, and other scientific advances. Not only did this speculation prove to be false, but the resulting shift in attention away from the control of infectious diseases resulted in a deterioration of public health infrastructure. The outcome was a resurgence of resilient diseases such as tuberculosis and malaria and the appearance and global spread of new pathogens, such as the human immunodeficiency virus.

The current wave of new, mostly animal-borne, infectious diseases marks a third epidemiological era. Most of the high-profile human pathogens that have emerged in the last few decades have been acquired from wild or domesticated animals, for example:

– hantaviruses from rodents
– Nipah virus from bats via pigs
– influenza viruses from poultry and aquatic birds
– WNV from birds via mosquitoes
– Lyme disease from deer via ticks
– the prion agent of variant Creutzfeldt-Jakob disease from cows
– SARS from captive wild mammals
– monkeypox from pet rodents (14, 22).

Antimicrobial resistance in zoonotic bacteria has also become an issue of increasing concern for animal production and human health, and incidents such as the 2001 anthrax attacks in the USA have heightened concerns regarding the intentional use of zoonotic agents for harm.

Interestingly, the new wave of infectious diseases has many similarities to the first zoonotic disease era. Once again, population growth and changing agricultural practices have created opportunities for pathogens to exploit new or altered ecological niches. Similarly, the increasing mobility of people, animals, and food products allows microbes rapid and easy access to novel environments and populations and new opportunities to cross species lines. As a result of rapid transportation systems, urbanisation and the increasing ease of movement across geopolitical boundaries, human populations are rapidly converging into a single 'global disease ecology'. Given the rapidity and ease with which modern intercontinental travel and trade help spread diseases, this era of emerging diseases, especially those caused by zoonotic agents, is likely to persist (24).

Complexity of factors leading to emergence

In 1992, the Institute of Medicine (IOM) in the USA published a report describing the increasing public health challenges created by emerging infections (9). The report

sought to highlight the need for improvements in public health to address the risks posed by 'new, re-emerging, or drug-resistant infections whose incidence in humans has increased within the past two decades'. The report identified six factors underlying infectious disease emergence:

a) changes in human demographics and behaviour
b) the impact of new technologies and changes in industries
c) economic development and changes in land use
d) increased international travel and commerce
e) microbial adaptation and change
f) the breakdown of public health measures.

In 2003, the IOM published an update to this report, expanding on both the threat of emerging infectious diseases and the need for increased global recognition and response (10). In addition to the six underlying factors listed above, the new report cites seven other factors that can contribute to the emergence of global microbial threats. Combined, these thirteen factors can be broadly categorised into four domains: genetic and biological factors; physical environmental factors; ecological factors; and social, political, and economic factors. These domains can work alone or in combination to affect the interaction of humans and microbes and to produce an emerging microbial threat.

Factors contributing to the upward trend in animal-borne infections are similarly complex and interrelated. The main cause is activity that brings humans into closer contact with animals and provides opportunities for pathogens to cross the species barrier (15). Examples are human population growth and encroachment into once-remote ecosystems, such as the African rainforests that harbour Ebola virus and the suburbs of the northeastern USA where humans encounter the deer tick vector for the bacteria that causes Lyme disease. International travel and commerce also provide new opportunities for the amplification and perpetration of disease agents, as evidenced by the epidemic of SARS that was spread globally by air travellers, the USA outbreak of monkeypox associated with the exotic pet trade, and the introduction of WNV into the USA. Other zoonotic diseases, such as bovine spongiform encephalopathy (BSE) and the new variant of Creutzfeldt-Jakob disease resulting from it, are attributed to changes in agricultural practices and the globalisation of the food supply. The close living conditions of humans and poultry in parts of Asia remain a constant threat for cross-species transmission of severe influenza. The development of antimicrobial resistance is yet another factor contributing to the current onslaught of infectious diseases.

New threats demand new partners

Common features of many of the new disease threats include the ability to pass from animals to humans, the potential to move quickly from local to international significance, and the rapid intersectoral co-operation required for their containment. The paradigm for such an infection is SARS. In several respects, the SARS epidemic reflected fundamental improvements in how the world responds to an outbreak of infectious disease; yet, at the same time, highlighted the continuing need for investments in a robust response system that is prepared for the next emerging disease, whether naturally occurring or intentionally introduced. Severe acute respiratory syndrome first appeared in late 2002 in the southern Chinese province of Guangdong after emerging from an unknown animal reservoir. Evidence suggests that practices associated with live-animal markets in this region were a source of human infection (7, 21). In February 2003, the disease spread beyond the People's Republic of China when more than twelve persons staying in a hotel in Hong Kong became infected as a result of contact with an infected physician from Guangdong Province. These persons returned to their home countries, where some seeded multiple chains of transmission that, over the course of the next four months, led to more than 8,000 cases of SARS and nearly 800 deaths in 27 countries.

Lessons learned from the SARS epidemic include the need for prompt and open reporting, an appreciation that local disease problems can quickly become global, and a renewed awareness of the challenges of risk communication and of the benefits of international collaboration and partnerships among scientists, diagnosticians, clinicians, and public health experts. The rapid containment of the SARS epidemic demonstrated the power of global and multisectoral collaboration in dealing with new and unpredictable infectious diseases. Clearly, the experience gained during this outbreak has enhanced readiness to respond to future zoonotic events. Nonetheless, despite the rapid progress that has been made in the global understanding of SARS, preparedness for future events will depend on the availability of answers to many remaining questions, most of which concern the animal-human interface that gave rise to the epidemic. Addressing the remaining mysteries in the SARS research agenda – e.g. the determination of the natural animal host and its geographic range, the dynamics of spread and interspecies transmission, the effect of seasonality on transmission, the potential for pandemic spread – will require multidisciplinary co-operation on a global scale (11).

Recent instances of avian influenza crossing the species barrier to humans are additional reminders of our vulnerability to infectious diseases that emerge from animals (18). Direct contact with infected poultry has been implicated in almost all cases of human infection with highly pathogenic avian influenza A (H5N1). Between late 2003 and early 2004, the virus caused disease outbreaks in poultry in several Asian countries, ultimately leading to the culling of more than 100 million birds. Unprecedented in

geographical scale and impact, the outbreaks caused at least 34 human cases, all apparently acquired from contact with infected birds. Subsequent findings have indicated that H5N1 viruses with pandemic potential have become endemic in the region, adding urgency to the threat to human and animal health (8, 12, 25).

The renewed pandemic concern associated with avian influenza highlights the urgent need for strong links between human and animal influenza surveillance systems and for integrated research efforts to understand the zoonotic aspects of the disease (13). The scientific challenges for research include the following:

– understanding the way in which influenza viruses emerge and spread

– the public and animal health impact of vaccination in avian species

– the role of culling in the control of the avian disease

– the contribution of agricultural practices to disease transmission

– determination of the risks of low pathogenic strains of avian influenza to humans (6).

Given the pressures of our crowded, interconnected, and highly mobile world, other zoonotic agents will surely exploit new opportunities to cross species barriers and spread. As shown in the examples of SARS and avian influenza, preparedness to respond to these convergences of human and animal threats will depend increasingly on strong partnerships between the animal health and public health communities. The appearance and spread of zoonotic diseases are influenced by multidimensional factors. Only multidisciplinary partnerships that cross professions and research interests will enable adequate characterisation of the threats and the development of strategic solutions. Because of their skills and training in zoonotic agents and the pathology of infectious diseases in livestock, wildlife, and companion animals, veterinary professionals are strongly positioned to take an active role in these efforts (24).

Strategic areas for productive partnerships

The lessons of the recent past have taught us to expect the unexpected in terms of emerging infections. With the driving forces in place to ensure the continuation of this trend, we need to strengthen research, investigation, and disease control partnerships among animal and public health experts. A global collaborative agenda focusing on the prevention and control of emerging and re-emerging infectious diseases of animal origin should include the following components:

– integrated research agenda
– interdisciplinary zoonotic disease research centres
– surveillance of domestic animals, wildlife, and humans
– animal and human health response teams
– infrastructure development
– workforce development
– improved co-ordination and strengthened focus.

Integrated research agenda

Despite the growing importance of the interface between human and animal microbes, the factors that influence the ability of infectious agents to cross the species barrier and infect new cells and populations are poorly understood. To ensure an effective prevention and response strategy for these agents, we need to understand the dynamics of their emergence, re-emergence, and spread. For many pathogens, detailed information on molecular biology and pathogenesis is incomplete; for others, even basic information about transmission route and host range is lacking (23, 24). Little is known about the organisms harboured by wild animals, the potential role of wildlife as a reservoir and vector, or the relative advantages of different control strategies. Interactions between wild and domestic animals also require examination. The hallmark of this work will need to be a new commitment and partnership between human and animal health clinicians, researchers, policy makers, and organisations.

Interdisciplinary zoonotic disease research centres

A key strategy for encouraging interdisciplinary research is the formation of research centres dedicated to studying the dynamics of zoonotic diseases. The 2003 IOM report advocates such a collaborative approach to addressing the highly complex nature of infectious disease emergence and promotes the establishment of interdisciplinary research, education, and training centres with different areas of speciality, including zoonoses (10). Interdisciplinary research centres, housed within academic establishments in collaboration with federal agencies, could serve as foci for the integration of public health and animal health activities related to the prevention of emerging infectious diseases. They would provide a venue for interaction, data sharing, training, and collaborative research among scientists, researchers, and practitioners in such disciplines as public health, clinical medicine, veterinary medicine, the social and environmental sciences, economics, engineering, and communications. Critical expertise might include vector-borne diseases, food safety, wildlife management, epidemiology, environmental microbiology, diagnostics, and informatics.

Surveillance in domestic animals, wildlife, and humans

As shown by current trends, the identification and control of future epidemics will depend on the ability to rapidly detect, monitor, and control disease caused by novel zoonotic agents (3). The 2003 SARS epidemic and the still-expanding epidemic of avian influenza in Asia exemplify not only the epidemiological convergence of animal and human health, but also the importance of linking, if not integrating, surveillance systems for emerging infections of humans, domestic animals, and wildlife (17).

Early detection is particularly important for emerging zoonoses. In many cases, identification of a new disease threat occurs only after recognition of detectable disease in humans, even though clinical manifestations may have occurred first in animal populations (4). It is important, therefore, to identify health problems in animals that could be associated with human disease and to investigate health problems in animals and humans (4). Several partnerships have already been developed, but many more are needed. In 2000, in anticipation of the rapid spread of WNV throughout the USA, the Centres for Disease Control and Prevention (CDC), in collaboration with state health and agriculture departments, developed a national WNV reporting system called Arbonet. Arbonet is unique in its ability to collate and report surveillance data from humans, mosquitoes, birds, mammals, and sentinel chicken flocks, marking one of the first times that such data have been integrated into a single reporting system (2).

Unfortunately, Arbonet does not connect to other tracking systems, and many other zoonoses still remain unmonitored (19). Among the human and animal emerging disease surveillance systems that are operating globally, few freely share data and most lack standardised protocols and connectivity. In addition, local, state, regional, national, and international authorities for data collection often remain disconnected and fragmented. Surveillance for emerging infections in wildlife is especially problematic. Few diseases are notifiable, and measures for the detection of human and livestock infections are inadequate for the identification of similar diseases in wildlife (5). To improve surveillance for emerging infections, the IOM (10) has recommended enhanced reporting by medical and veterinary partners and the development of innovative surveillance strategies that make use of non-traditional data sources, expanded partnerships, and advances in diagnostics, microbial genetics, and satellite imaging. One such mechanism is sentinel surveillance of vectors, wildlife, companion animals, and zoological parks, which could serve as early warning systems for threats to human health.

Animal and human health response teams

Surveillance of animal hosts and investigation and containment of animal-borne diseases are complicated by the ecological complexity of zoonotic infections. Therefore, multidisciplinary teams with representatives from animal health and human health disciplines (e.g. field epidemiologists, veterinarians, ecologists, mammalogists, ornithologists, entomologists) will be required for successful disease investigation and containment (3).

The effectiveness of a multidisciplinary team approach was shown during the 2003-2004 avian influenza outbreak, which generated unprecedented international co-operation between human health experts from CDC and animal health representatives from organisations in Vietnam, namely, the National Institute of Hygiene and Epidemiology, the National Institute of Veterinary Research, and the National Centre for Veterinary Diagnosis. To bridge the gap between human and avian influenza, the agencies shared their training and expertise, as well as viral isolates and serologic specimens from humans and birds. This exchange and co-ordination of information have proven critical to influenza surveillance, reporting, and containment efforts.

Another example of a successful partnership between veterinary medicine and public health is the permanent posting of veterinary personnel from other federal agencies to CDC. Two United States Department of Agriculture entities, the Animal and Plant Health Inspection Service and the Food Safety and Inspection Service, have established links with CDC. These relationships have served the agencies well in times of crisis, most recently during the avian influenza outbreak in Southeast Asia, during which the agencies offered each other technical assistance and shared information on the status of affected countries, import bans and the prevention of occupational exposures.

In addition, there are opportunities for university professors to take sabbaticals and assignments in government agencies. Such exchanges are mutually beneficial partnerships and lead to the important exchange of ideas and expertise.

Infrastructure development

Over the last few decades, resource constraints have weakened both public health and animal health infrastructures worldwide. Coincident with the recognition of a new and unprecedented era of emerging and re-emerging infectious diseases, most countries are experiencing reductions in funding to maintain current public health and animal health infrastructures and lack resources for construction, modernisation, enhancement, and recruitment. Research facilities, laboratories, and human resources in critical scientific areas have not kept pace with the evolving challenges.

Sustained investment is needed to strengthen the many discrete and highly specialised components of the public health infrastructure that are required for a response to an infectious disease event. Moreover, the prevention and control strategies for animal-borne diseases call for different strategies than for those spread only by human contact, and this adds a level of complexity to the already limited public health infrastructure (19). Although much remains to be done, investments made following the terrorist events of 11 September 2001, have improved the ability to detect both naturally occurring diseases as well as bioterrorist activities (22). An example of this 'dual utility' is CDC's Laboratory Response Network (LRN), a system linking more than 120 public and private laboratories with varying specialities and levels of capacity that enable them to work together to rapidly recognise, rule out, confirm, or definitively characterise highly infectious agents. The next step in the expansion of the LRN is to include a group of animal health diagnostic laboratories and food safety laboratories, which will further integrate animal and public health laboratory systems and move the network closer towards the creation of a coordinated system benefiting both sectors.

Workforce development

A key component of the public health and animal health infrastructure is a trained and skilled workforce. Veterinary personnel have a crucial role to play in responding to emerging infections and because of the current trends in biological threats there is an even greater need to recruit and train public health veterinarians and animal health practitioners with expertise outside of clinical practice (particularly in the areas of wildlife biology, ecology, virology, food safety, food and animal production, biosecurity, preventive medicine, and veterinary research) (19, 20).

Training programmes in applied epidemiology are critical to the development of a workforce that is ready to confront emerging microbial threats. Current programmes include the CDC Epidemic Intelligence Service (EIS) programme, which was established to train physicians, veterinarians, other allied health professionals, and doctoral graduates for careers in public health. Since the programme began in 1951, nearly 200 veterinarians have received EIS training and subsequently distinguished themselves in public health careers in international and domestic public health agencies, academic institutions, and non-governmental organisations (17). In collaboration with ministries of health, CDC has also established field epidemiology training programmes in other countries.

In recognition of the success of these models, the IOM has recommended the development of new and expanded programmes to train veterinary and other health professionals in applied epidemiology and field-based research (10). Veterinary training can also be enhanced by an understanding of trade issues, political and regulatory structures, international regulations for both human and animal health, risk management, and population-based approaches for solving global health problems (17). The contemporary issues of emerging and re-emerging zoonoses mean that personnel must continue to expand their portfolio of scientific and personal skills if they are to be successful. Knowledge of informatics, genomics, molecular biology, along with cultural competence, team building, and risk communication will also be essential.

Improved co-ordination and focus

Interactions among local, state, federal, and international scientists, officials, and agencies represent another area for improved collaboration. Despite the recent wave of animal-borne diseases, there is no co-ordinated, strategic focus on their prevention and control (19). Co-ordination can occur both horizontally and vertically. Horizontal collaboration could be accomplished through improved links between the OIE, the World Health Organization, the Food and Agriculture Organization of the United Nations, and other international animal and human health organisations and through the development of partnerships between national Veterinary Services and their public health counterparts. Vertical linkages of organisational hierarchies and divisions (e.g. field organisations and administrative units) can enhance the ability to share information and act collaboratively within the same agency. The result will be new alliances and a strengthened focus on combating emerging microbial threats.

Conclusions

Microbes share our biosphere and possess the uncanny ability to adapt, shift, and gain new hosts. Global travel is now faster than the incubation period of almost any pathogen, giving microbes a new and dangerous advantage through the increasing intermixing of people, animals, food, and other products. Unforeseen biological events are the inevitable consequence.

The responses of OIE Member Countries to a recent questionnaire overwhelmingly acknowledged the impact of emerging zoonoses and their likely continued propagation. An impressive number of Member Countries reported that they had experienced incidents of emerging and re-emerging diseases, along with the emergence of antimicrobial-resistant pathogens, and noted the importance of strengthening and improving surveillance, research, and training to ensure the capacity to address these threats. A key theme was the need for stronger

partnerships with national and international public health organisations, academic institutions, and private entities to meet the coming challenges.

The emergence of new zoonotic diseases is creating profound global threats, but the greatest danger may be the preservation of the status quo in the organisation of animal and public health services and the way in which they respond to these threats. Animal health organisations cannot transform others without first transforming themselves. Looking forward, the OIE must continue to evolve in response to the needs of Member Countries and the changing demands and opportunities associated with emerging and re-emerging infections. Central to this transformation are the formation and strengthening of partnerships, the mobilisation of resources, and the development of a global intersectoral focus to address zoonotic threats. The complexity of human-animal interactions calls for a new interdependence among animal health and public health and a new global strategy of co-operation to forge true progress in the prevention and control of zoonotic diseases.

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Les nouveaux partenariats entre les services de santé animale et les organismes de santé publique

L.J. King, N. Marano & J.M. Hughes

Résumé

La capacité et la facilité des Services vétérinaires et des organismes de santé animale à créer de nouveaux partenariats stratégiques seront déterminantes au moment où ils tentent de réagir contre le retour d'une période d'émergence ou de réémergence de maladies zoonotiques. Bien que ces partenariats comprendront vraisemblablement de nombreuses relations qui dépasseront le cadre traditionnel des Services vétérinaires et de l'élevage, aucune d'entre elles n'aura toutefois autant de poids que les nouveaux partenariats réunissant les acteurs de la santé animale et de la santé publique. Force est de constater une multiplication des épisodes de zoonoses dans le monde. Les concentrations de populations, d'animaux et de produits d'origine animale ont atteint un niveau inconnu jusqu'à présent. On assiste parallèlement à la convergence d'une multitude de facteurs complexes qui participent à l'émergence des zoonoses et qui, en outre, risquent de favoriser le développement et la propagation de ces maladies. Ce chapitre traite de la nécessité de constituer des partenariats et des collaborations plus efficaces pour répondre à ces nouvelles menaces microbiennes, de la complexité de la genèse et de la dissémination des zoonoses, ainsi que de la capacité des services de santé publique et de santé animale à y faire face collectivement. Les enseignements des dernières épidémies zoonotiques ont mis en évidence le besoin de coordonner la recherche, d'établir des centres interdisciplinaires, d'intégrer les systèmes et les infrastructures de surveillance et d'intervention et d'élaborer des stratégies de développement des ressources humaines. Certes, il existe d'excellents exemples de collaboration entre les services de santé animale et de santé publique. Toutefois, la nécessité d'instaurer des partenariats plus nombreux et plus puissants entre les organismes nationaux et internationaux, universitaires et privés, s'impose comme une évidence pour relever les prochains défis des zoonoses émergentes et gérer leurs implications profondes.

Mots-clés

Convergence – Coopération internationale – Équipe pluridisciplinaire – Maladie infectieuse émergente – Partenariat stratégique – Santé animale – Santé publique – Zoonose.

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Nuevas alianzas entre servicios zoosanitarios y organismos de salud pública

L.J. King, N. Marano & J.M. Hughes

Resumen

Ante la nueva era que se avecina, marcada por las enfermedades emergentes y reemergentes, un factor de capital importancia será la aptitud y habilidad de los Servicios Veterinarios y las organizaciones de sanidad animal para formar nuevas alianzas estratégicas. Aunque es probable que ello traiga consigo muchas asociaciones de nuevo cuño, ajenas al ámbito tradicional de los Servicios Veterinarios y la producción agropecuaria, nada será más importante que la creación de nuevas relaciones de trabajo entre la sanidad animal y la salud pública. En todo el planeta se declaran cada vez con más frecuencia episodios de zoonosis emergentes, a la par que la convergencia de personas, animales y productos de origen animal alcanza hoy cotas sin precedentes. Simultáneamente se dan cita una serie de complejos factores que no sólo auguran una incesante aparición de nuevas zoonosis sino que, con toda probabilidad, van a alimentar su futura intensificación y extensión. Teniendo en cuenta esta nueva amenaza microbiana, la complejidad que revisten tanto la formación como la extensión de las zoonosis y la capacidad colectiva de los servicios de salud pública y animal para hacerles frente, los autores abogan por forjar más y más eficaces relaciones de asociación. Las conclusiones extraídas de recientes epidemias zoonóticas abundan en la necesidad de investigaciones coordinadas, centros interdisciplinares, sistemas integrados de vigilancia, mecanismos e infraestructuras de respuesta y estrategias de formación de los recursos humanos. Aunque no faltan excelentes ejemplos de colaboración entre sanidad animal y salud pública, en el futuro se requerirán sin duda más y más sólidas alianzas entre instancias nacionales e internacionales, tanto universitarias como privadas, para combatir con éxito las zoonosis emergentes y lidiar con sus profundas repercusiones.

Palabras clave

Alianza estratégica – Convergencia – Cooperación internacional – Enfermedad infecciosa emergente – Equipo multidisciplinar – Salud pública – Sanidad animal – Zoonosis.

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