

DISASTER MANAGEMENT: THE ROLE AND PREPAREDNESS OF VETERINARY SERVICES

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Summary: *This report analyses the actions and capability of Veterinary Services in reducing and managing the risk of biological, natural and technological disasters impacting on the economy, animal health and veterinary public health. It goes on to summarise the answers to a questionnaire from 25 countries in the region.*

While Veterinary Services are generally involved in disasters, they have greater presence and leadership in biological disasters. Hazard response plans are widely available at national level but their availability diminishes the closer the level descends to the productive base, which is where many of the protective measures must actually be implemented. Countries highlight issues relating to early warning, early diagnosis and rapid response, as well as veterinary legislation, although some national legislation fails to include certain aspects, hindering Veterinary Authorities' performance.

The report identifies the ten diseases considered by most countries to pose a disaster risk to the region and for which countries have emergency plans. The ten diseases with bioterrorism potential are also identified, but the existence of emergency plans for such diseases is not the same. However, countries do not link the issue of bioterrorism with disaster risk reduction and management, implying low perception of this potential hazard.

While most countries report that their Veterinary Authority is involved in all stages of disaster prevention, preparedness, response and recovery, its level of involvement is low in more than 60% of countries (levels 1 to 3). Although the Veterinary Authority proves to have greater involvement (levels 4 and 5) in the stages relating to biological disasters than to natural/technological disasters, in neither case does it exceed 40% of countries.

It is important for the Veterinary Authority to take a stronger leadership role in disaster risk reduction and management within its fields of competence, especially with regard to studies of biological disaster hazards (38.0%), vulnerability (28.0%) and risk (38.0%). Opportunities for training veterinarians in disaster risk reduction and management are considered insufficient, and countries identify this, coupled with material and financial limitations, as the main obstacle to implementing disaster risk reduction and management. There is general agreement that the OIE should be more involved in disaster risk reduction and management through a variety of means (workshops, publications, an OIE Collaborating Centre, national Focal Points and an ad hoc group). Countries express willingness to support other countries in disaster risk reduction and management (76.0%), by providing staff to assist with disaster management (89.5%) and relevant training (63.2%).

Keywords: *agroterrorism – Americas – biological disaster of animal origin – bioterrorism – disaster risk management – disaster risk reduction – Veterinary Services*

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1. Introduction

The increased frequency and scale of losses from disasters of all kinds in recent decades has focused attention on causes, consequences and responses from governments, the private sector, civil society and regional and international organisations. It has led to numerous initiatives and partnerships to address these challenges.

The International Decade for Natural Disaster Reduction (IDNDR, 1990–1999) provided the framework for substantive progress in countries' preparedness for tackling natural disasters. There was a growing realisation that it was not enough simply to enhance response coordination, planning and implementation, it was also imperative to focus on reducing vulnerabilities to growing hazards. Only by preventing and being prepared for potential disasters would communities be made more resilient¹, losses less substantial and recovery faster and more effective [3, 7, 16, 18]. The United Nations system enshrined this goal in the International Strategy for Disaster Reduction (ISDR).

The Hyogo Framework for Action [18] is the most important instrument for implementing the ISDR, and outlines the following strategic goals: 1) the integration of disaster risk reduction into sustainable development policies, planning and programming; 2) the development and strengthening of institutions, mechanisms and capacities that can systematically contribute to building resilience to hazards; and 3) the systematic incorporation of risk reduction approaches into the implementation of emergency preparedness, response and recovery programmes. It also stresses the need to maintain this approach in order to achieve the Millennium Development Goals.

Twenty years after the first Earth Summit in Rio de Janeiro, Brazil, in June 2012 the Heads of State and Government returned to Rio where they reaffirmed their commitment to the Hyogo Framework for Action 2005–2015 (building the resilience of nations and communities to disasters) by calling for States, the United Nations system, international financial institutions, sub-regional, regional and international organisations and civil society to accelerate implementation of the Hyogo Framework for Action and the achievement of its goals.

The growing interdependence between humans, animals and the environment in which they live is causing global health problems whose resolution requires a more holistic approach. Veterinarians have obligations, opportunities and contributions crucial to improving public health, detecting and halting the spread of zoonotic diseases, preserving the quality of food and water resources and promoting the health of wildlife and ecosystems [22, 23, 35].

The achievement of these goals can be seriously jeopardised by biological, natural and technological disasters threatening animal and human health [43].

Against this backdrop, the World Organisation for Animal Health (OIE) has highlighted the importance of promoting development by building Veterinary Service cooperation and expertise, so as to increase and enhance countries' capacity and preparedness to prevent and respond to disasters affecting the animal population, the economy and veterinary public health [13, 46]. This will enable Veterinary Services to contribute more effectively to the integration of disaster risk reduction into development policies, planning and programming, as a prerequisite for development that is sustainable and really contributes to poverty reduction, given that the agricultural sector provides a livelihood to millions of people worldwide.

1 *Resilience*: The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. It is determined by the degree to which the community has the necessary resources and is capable of organising itself both prior to and during times of need [19].

2. Disasters and disaster classification

A disaster is defined as a serious interruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources [19].

Disaster is a measure of existing vulnerability to a specific hazard, as the full impact in terms of loss of life and material resources is not determined solely by the scale of a hazard (e.g. the category of a hurricane) but is heavily influenced by present vulnerabilities and insufficient capacity or measures to reduce or cope with the expected adverse consequences [1, 3, 7, 19, 41, 42].

A variety of criteria have been used to classify the various disaster hazards or risks. The hazards of concern to disaster risk reduction as stated in the Hyogo Framework for Action are "... hazards of natural origin and related environmental and technological hazards and risks." Such hazards arise from a variety of geological, meteorological, hydrological, oceanic, biological and technological sources, sometimes acting in combination [19].

Other terms have been used in connection with veterinary public health [20]:

Non-epidemic emergencies and/or disasters: natural or manmade emergencies and/or disasters that damage the environment and the physical and functional integrity of infrastructure virtually throughout the affected community, with varying public and animal health impacts (injury, disease and death);

Epidemic emergencies and/or disasters: emergencies and/or disasters caused accidentally or intentionally (bioterrorism) by outbreaks of emerging or re-emerging animal diseases, such as an emerging exotic disease. They may or may not be associated with non-epidemic emergencies and/or disasters.

There is now no doubt that humans have helped to impair their own natural habitat and have seriously endangered the survival of the human race by depleting natural resources and other actions such as land-use change, deforestation and uncontrolled development, which undermine the sustainable development of nations and the legacy of future generations [1, 42, 43, 21].

A biological hazard is defined as a process or phenomenon of organic origin or conveyed by biological vectors, including exposure to pathogenic micro-organisms, toxins and bioactive substances that may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage [19].

Even though biological emergencies or disasters are regularly associated with large-scale disease outbreaks, this is not a requirement for a biological hazard situation to be considered a disaster. A prime example is the biological emergency that followed the detection of a single case of bovine spongiform encephalopathy in Canada and the losses incurred not only by the country's own livestock sector, but also Mexico's, as a result of lower slaughter cattle prices [5, 44].

Therefore a biological emergency or disaster is defined as an event, such as an animal disease outbreak, that can affect livestock production systems and livestock product supply from national herds or flocks, either due to the presence of the disease itself and/or the control and eradication measures imposed by the government [44].

In this report's discussion of natural, technological and biological disasters and in the country consultation questionnaire, biological disasters are considered as a possible result of natural or intentional release of pathogens or their toxins into the animal population [25].

The term bioterrorism is defined as the deliberate use of micro-organisms or their toxins to harm people, while agroterrorism denotes an act targeting animals and/or plants in order to disrupt the food supply system and diminish people's strength [12, 20, 31].

The term 'combined disaster' is confined to disasters caused by a number of different hazards occurring simultaneously or sequentially (cascading) [20]. For example, where the incidence of a pre-existing vector-borne or waterborne disease increases following a period of heavy rain and flooding [20, 23].

3. Disaster risk reduction and management

Owing to the importance of the terminology used to harmonise intersectoral and multidisciplinary cooperation, from national up to international levels, it is useful to discuss some of the accepted definitions for disaster risk reduction concepts in the International Strategy for Disaster Reduction [19], which are used in the consultation questionnaire.

'Disaster risk reduction' is defined as the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, among other strategies.

'Disaster risk management' is the systematic process of using administrative directives, organisations, and operational skills and capacities to implement policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

The term that integrates both types of action is 'disaster risk reduction'.

Given the acknowledged need to systematise disaster risk reduction activities, they should be implemented continuously: before, during and after a disaster.

Activities are therefore designed, planned and organised in an uninterrupted time sequence of prevention, preparedness, response and recovery stages involving all segments of the community, adopting a multidisciplinary and intersectoral approach aimed at reducing the impact of disasters on animals, people and property.

An appropriate disaster risk reduction plan is drawn up to organise, plan and implement activities for each stage. This is merely a document prepared by an authority, sector, organisation or company setting specific goals and targets for disaster risk reduction, together with related actions for achieving them.

For the purposes of the questionnaire sent to all countries of the OIE Regional Commission for the Americas as the basis for preparing this technical item, the term 'disaster risk reduction and management' is used to address all the issues described above.

3.1. Veterinary Services and disaster reduction

The increased health risk worldwide has been a recurring theme of both veterinary medicine and public health for many years. Everyone agrees that the precise impact of health problems today is unpredictable owing to the dense and complex web of interrelationships forged by globalisation. Not only has this boosted trade in animals and animal products and the movement of people and means of transport, it has also increased the intensity and frequency of such flows, linking geographically distant locations in a matter of hours and spreading disease between them.

Despite the development of increasingly reliable resources for the prevention, surveillance and accurate diagnosis of disease, as well as response mechanisms, the high incidence and impact of disease outbreaks is an on-going challenge [2, 9, 14, 29, 32].

Moreover, there is a high likelihood that climatic and environmental changes will favour the spread of many diseases affecting animals as well as people and plants [8, 24, 26, 28, 30, 34, 40, 45, 48].

Biological disasters have been considered a risk for years because of the potential health, economic, ecological and social impact of many animal diseases, especially zoonoses, coupled with the risk of their spreading widely across geographic regions from affected areas [4].

This has led to an urgent call to contextualise the prevention, diagnosis and control of disease outbreaks, as was done with highly pathogenic avian influenza [47]. This makes it not only desirable but necessary for Veterinary Authorities to steer their efforts towards disaster risk reduction and management strategies in their respective countries, especially when dealing

with diseases that pose a disaster risk and have no need of a visa to cross national political and administrative boundaries.

The growing frequency of natural and technological disasters, influenced by recognised anthropogenic factors, also incurs direct and indirect losses in livestock production and the livestock industry, with adverse consequences for humans in terms of food security and safety, not to mention the potential risk of a cascading increase in the incidence of pre-existing diseases [23, 34].

This means that Veterinary Services have a clear responsibility to be ready to respond to disasters of every kind. To do so they must integrate the required activities into their own disaster risk reduction and management strategy, adopting a multidisciplinary and intersectoral approach.

The Veterinary Authority should prepare its disaster reduction plans at all technical and administrative levels of the Veterinary Service and forge partnerships with other related sectors, ensuring that they support and give priority to resolving the problems affecting animal health protection at all levels, starting with primary production infrastructure and the livestock industry.

Disaster reduction plans should consider the activities to be carried out systematically at each stage in the disaster reduction cycle (prevention, preparedness, response and recovery), all in an uninterrupted time sequence [19].

Plans should be prepared for each type of disaster (natural, biological and technological), in response to the specific hazard or risk exposure, and must therefore be preceded by a special risk analysis for each type of animal health hazard.

While plans to reduce animal health risks are specific to this field, they must be integrated into the overall plans of the areas concerned. To this end, the Veterinary Authority should spearhead efforts to ensure that the respective governments identify and include in their priorities the necessary human and material resources for preventing or reducing the animal health impact of potential disasters.

As part of the community and for outreach purposes, Veterinary Services should therefore work actively with their national civil defence and protection systems and participate in a timely manner in disaster risk reduction and management, in order to prevent and respond to disasters affecting the animal population and economy and veterinary public health.

The OIE Fifth Strategic Plan 2011-2015 establishes new fields of action, including **the contribution of climate and environmental changes to the occurrence and geographical spread of animal diseases, as well as the contribution of animal production practices to environmental and climate changes**. The policies and response capacity of OIE Members in this field so closely related to disasters have already been addressed, but not the role and preparedness of Veterinary Services for overall disaster management.

Hence the importance of the questionnaire answered by the majority of OIE Member Countries in the Americas Region (25), as it describes how Veterinary Authorities are involved in the risk reduction and management of various disaster hazards, what they deem to be the biggest obstacles to improving their performance, how they manage cooperation, how Veterinary Service expertise can be enhanced and how they view OIE involvement in assisting countries to increase and improve their capacity and preparedness for preventing and responding to disasters.

4. Main results of the questionnaire

This report analyses the actions and capability of Veterinary Services in reducing and managing the risk of biological, natural and technological disasters impacting on the economy, animal health and veterinary public health. It also summarises the answers to a questionnaire from 25 countries in the region¹.

In answer to a question regarding the availability of disaster reduction plans, 95.7% of countries report having plans for natural hazards, 90.5% for biological hazards and 68.8% for technological hazards. The availability of disaster reduction plans is seen to decrease the closer the level descends to the grass roots: it is less than 48% for all disasters at municipal level, and less in producer associations and livestock establishments. Only in the case of biological disasters, 48% of countries with availability of plans (19) considered having plans at livestock establishments level (Table 1).

Although there are specific disaster risk reduction and management activities at all levels, clearly the operational capacity to enforce the various measures for protecting the animal population and economy and veterinary public health—which are defined strategically at higher levels—needs to be focused at grass roots level.

Table 1.– Availability of disaster reduction plans at different levels

Type of disaster	National (%)	Provincial (%)	Municipal (%)	Producer association (%)	Farm (%)
Natural	95.5	59.1	45.5	22.7	31.8
Biological	94.7	68.4	47.4	31.6	47.4
Technological	100.00	45.5	27.3	18.2	18.2

In the case of biological disasters, plans should be available at all technical and administrative levels of a Veterinary Service, as this is its primary activity.

With respect to disaster reporting, all countries report to the ministry or department of agriculture. One country also notifies the office of the president of the republic and another, the ministry of environment and public safety.

The seven institutions or organisations with which the Veterinary Authority of six or more countries reports cooperating on disaster risk reduction and management are: ministry of health (72.0%); livestock producer groups (48.0%); universities (32.0%); civil defence authority (28.0%); and ministry of agriculture/land, ministry of environment/development and FAO (all of the foregoing in 24.0% of countries). In more than 40% of these countries, the frequency of cooperation with institutions or organisations, except the ministry of environment/development, is considered high (rated 4 or 5).

In addition, 16.0% of countries state that they cooperate on disaster risk reduction and management with the OIE, the Inter-American Institute for Cooperation on Agriculture (IICA) and the Regional International Organization for Plant Protection and Animal Health (OIRSA).

Only one or two countries report cooperation with national emergency bodies, ministries of defence, interior or food, veterinary statutory bodies and departmental or provincial governments.

Even though most countries accord top priority to cooperation with public health authorities, this should be stepped up because of its extreme importance, not only in controlling zoonoses, but also in preventing them [7, 34, 35, 38].

¹ Argentina, Barbados, Belize, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, France (French Guiana, Guadeloupe, Martinique), Guatemala, Guyana, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, United States of America and Uruguay

While the availability of risk reduction plans at provincial level is not high for all disasters, coupled with the fact that no cooperation with governments is reported at provincial level, risk reduction activities in aid of animal health could be integrated into the development plans of the respective areas.

The core principles of disaster risk reduction and management include a cross-sector approach and coordination of efforts among all the sectors involved in implementing the various measures, starting from the prevention stage [38]. For example, coordination between Veterinary Services and public health authorities must be ensured at all times to respond to disaster risk from zoonoses [22, 36, 38].

The success of disaster risk reduction and management processes, particularly emergency health care operations at the local level, relies heavily on the degree of coordination achieved by social actors within the area and community and their different organisational forms, governmental and non-governmental institutions and the various health care providers in the area [34].

Most countries consider the issues in [Table 2](#) below to relate to disaster risk reduction and management, listed in descending order according to the percentage of countries granting them the highest priority (levels 4 and 5).

Although they accord them different priorities, almost all countries deem to relate to disaster risk reduction and management the issues mentioned in [Table 2](#). However, the first two issues and that of emergency programmes are accorded the highest priority for disaster risk reduction and management. These issues rely largely on the correct sequence of early warning, timely diagnosis and rapid response to biological disasters [31, 47], and even natural and technological disasters, because the epidemiological monitoring of animal populations and animal products remains a Veterinary Service responsibility.

Table 2.– Percentage of countries according top priority to disaster risk reduction and management-related issues

Early detection/surveillance systems	88.0	Emergency programmes	64.0
Laboratory diagnosis	88.0	Zoning and compartmentalisation	60.0
Food safety	84.0	Animal welfare	48.0
Emerging/re-emerging diseases	76.0	Natural disasters	48.0
Zoonoses	76.0	Disaster reduction plans	36.0
Good governance of Veterinary Services	72.0	Risk analysis	36.0
Veterinary legislation	72.0	Undergraduate and post-graduate education	33.3
Biosecurity plan	68.0	Climate change	28.0
International cooperation	68.0	Bioterrorism	25.0
'One Health'	65.2	Cost-benefit studies	20.0

While the greatest number of countries identify bioterrorism as an issue relating to disaster risk reduction and management (96.0%), only 25.0% assign it top priority (level 4 or 5), meaning that countries of the region have low risk perception for bioterrorism, despite this hazard having been stressed, including by the OIE [12, 20, 25, 31, 33].

Only 32% of countries indicated they were involved in the prevention of bioterrorism and some of them reported on their activities, which included the regulation of imports, customs and border inspection, biosecurity plans in farms and establishments, legal framework, presidential policies, specialized personal training, availability of contingency plans and a national animal health emergency system.

Significantly, only 36.0% of countries give high priority to the issue of disaster reduction plans relating specifically to disaster risk reduction and management. The reasons for this low figure should be explored further, as it may be that countries mistakenly do not consider it useful to prepare disaster reduction plans, or that plans are available but are seen to have no practical utility because they are poorly drawn up or coordinated among stakeholders.

Veterinary legislation is also of paramount importance because it becomes a serious obstacle if a country's existing legislation fails to establish the Veterinary Service's responsibilities and framework of action in disaster situations. Good governance of Veterinary Services is another priority, as it is crucial for the proper performance of their duties in the event of a disaster [6, 47].

As regards aspects of veterinary legislation considered to be applicable to disaster risk reduction and management (Table 3), crucially most countries include the administrative and logistical organisation of disease prevention and control in their national legislation, as it has a significant impact on the implementation of planned activities. This makes it a priority for disaster reduction plans to include planning of the necessary human and material resources, with appropriate organisational and logistical support [38].

However, Table 3 also shows that some legal issues are not included, and Veterinary Services facing such obstacles must find ways of overcoming them.

Table 3.– Percentage of countries including aspects of veterinary legislation applicable to disaster risk reduction and management in national legislation

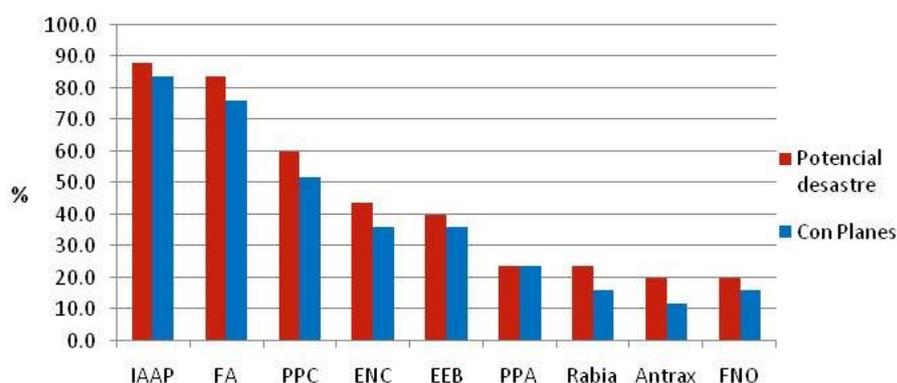
Administrative and logistical organisation of disease prevention and control	92.0
Conferral of exceptional powers on the Competent Authorities	88.0
Preparation and implementation of emergency plans	88.0
Special specific and temporary measures for managing all identified biological risks	68.0
Funding for prevention and control measures inherent in disaster risk reduction and management	64.0
Compensation for livestock farmers in the event of killing or stamping out animals, or destruction of carcasses, meat, animal feed or other material	56.0

It has been pointed out that the eradication of an emerging disease immediately it occurs could reduce costs exponentially. As Veterinary Services (public and private) are specifically responsible for the national coordination of animal disease prevention and control activities, the first step should be to ensure the effectiveness of the specialised public services in charge of formulating the relevant legislation and effectively monitoring its implementation [47].

Figure 1 shows the ten diseases considered by at least five countries to pose a disaster risk. The graph shows the percentage of countries that deem the respective disease to pose a disaster risk and the percentage of these countries that have prepared the respective emergency plans. The Figure shows that some countries have not prepared plans for all the diseases they identify as posing a biological disaster risk. A further 34 diseases are cited by three or fewer countries.

The Veterinary Authority must identify biological disaster risks based on the list of pathogens that it considers hazardous: exotic pathogens posing a higher risk of release (either natural or intentional) and pathogens already present in the country's livestock with the potential to alter their behaviour (range of host species, incidence, virulence, pathogenicity, etc.) and so increase the overall loss rate.

Figure 1.– Percentage of countries with emergency plans to tackle the diseases generally considered to pose the greatest disaster risk



Potencial desastre = Considered a disaster risk; *Con Planes* = Countries with plans

IAAP: highly pathogenic avian influenza; *FA*: foot and mouth disease; *PPC*: classical swine fever; *ENC*: Newcastle disease; *EEB*: bovine spongiform encephalopathy; *PPA*: African swine fever; *Rabia* = Rabies; *Antrax* = Anthrax; *FNO*: West Nile fever

Seventeen Caribbean countries identify highly pathogenic avian influenza, foot and mouth disease, rabies, Newcastle disease, classical swine fever, bovine spongiform encephalopathy and brucellosis, in that order, as diseases posing a higher risk of release [39].

Table 4 shows ten diseases considered by at least three countries to have bioterrorism potential, the percentage of countries that consider the respective disease to pose a bioterrorism risk (column A) and the percentage of these countries that have prepared specific emergency plans (column B).

Table 4.– Diseases considered to have bioterrorism potential

	A (%)	B (%)		A (%)	B (%)
Anthrax	64.0	12.0	Classical swine fever	12.0	52.0
Highly pathogenic avian influenza	32.0	84.0	African swine fever	12.0	24.0
Foot and mouth disease	28.0	76.0	Brucellosis	12.0	8.0
Tularaemia	16.0	0.0	Equine encephalomyelitis	12.0	12.0
Botulism	12.0	0.0	Glanders	12.0	4.0

The expected match between A and B is not in evidence. A further 28 diseases are cited by four countries or fewer as posing a bioterrorism risk.

Table 5 shows the percentage of countries that report being exposed to various risks of natural or technological disasters (column A) and the percentage of these that have prepared the respective disaster plans (column B), revealing a lack in many countries.

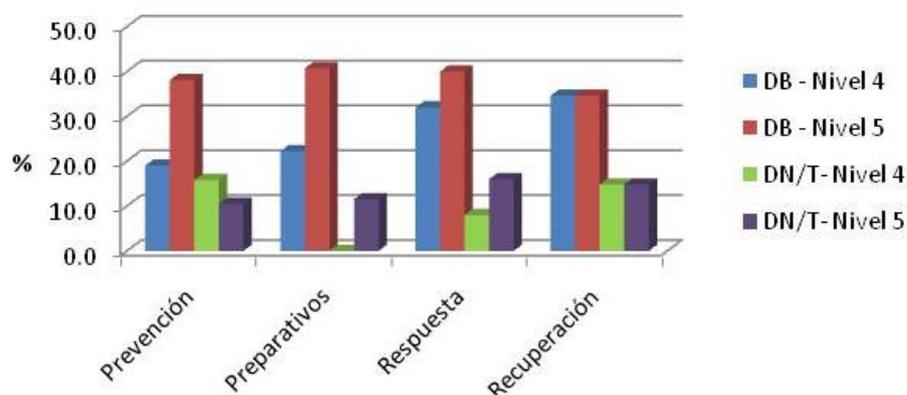
Table 5.– Exposure to disaster risks and availability of appropriate plans

Disaster risk	A (%)	B (%)	Disaster risk	A (%)	B (%)
Floods	96.0	76.0	Dam bursts	80.0	44.0
Wildfires	88.0	68.0	Sea flooding	72.0	52.0
Drought	84.0	60.0	Hurricanes	56.0	44.0
Earthquakes	84.0	56.0	Volcanoes	48.0	44.0
Oil spills	80.0	48.0	Release of radioactive substances	40.0	16.0

Heavy snowfall, avalanches and mud- or landslides, and industrial and satellite debris disasters are each cited by a single country, which has prepared the respective plan.

Although most countries report that the Veterinary Authority is involved in all stages and sub-stages of the cycle of reducing biological disasters, in more than 60% of countries, there is a low level of involvement (level 1 to 3). In the case of natural/technological disasters, the number of countries with a low level of involvement is even greater. [Figure 2](#) shows that the Veterinary Authority has the highest level of involvement (levels 4 and 5) in the stages relating to biological disasters, more than to natural/technological disasters, but in neither case does it exceed 40% of countries, which is unsatisfactory.

Figure 2.– Percentage of countries with Veterinary Authority involvement at the highest levels in the various stages of the cycle of reducing biological and natural/technological disasters



Prevenirión = Prevention; *Preparativos* = Preparedness; *Respuesta* = Response; *Recuperación* = Recovery.

DB - Nivel 4 = Biological disasters, level 4; *DB - Nivel 5* = Biological disasters, level 5; *DN/T - Nivel 4* = Natural/technological disasters, level 4; *DN/T - Nivel 5* = Natural/technological disasters, level 5

It is important for the Veterinary Authority to take a stronger leadership role in all disaster risk reduction and management activities within its fields of competence [46]. For example, it must increase its leadership (to level 5) of studies of biological disaster hazards (38.0%), vulnerability (28.0%) and risk (38.0%), as this determines the proper perception of hazard exposure and the prescription of measures required to protect animals, the economy and veterinary public health more effectively from adverse health events [37].

In a survey of Veterinary Authorities in 17 Caribbean countries asking which areas they consider to be of interest for risk analysis, they give second priority to the identification of factors of vulnerability to the potential impact of emerging and re-emerging diseases with a view to improving emergency programmes [39].

A full 96.0% of countries are interested in building the technical expertise of their Veterinary Authority in the area of disaster risk reduction and management; indeed they consider it necessary. The means they propose for building expertise are: desk-top and field simulation exercises (91.7%); continuing vocational training workshops (91.7%); training in preparing emergency plans (83.3%); collaboration and communication with other competent authorities (79.2%); advice from international experts (79.2%) and post-graduate training (75%).

In answer to the question of whether training in disaster risk reduction and management knowledge and skills exists, only 56.0% of countries replied that it did. Of these countries, 21.4% state that disaster risk reduction and management is a compulsory subject in the undergraduate/veterinary para-professional curriculum and 64.3% that it is an optional subject in the undergraduate/veterinary para-professional curriculum. Furthermore, 42.9% of countries with training pathways have postgraduate training programmes, and 50.0% have continuing training programmes for veterinarians.

In countries of the region, opportunities for training veterinarians in disaster risk reduction and management are still inadequate. As no training on the subject is provided at either undergraduate or post-graduate level, ways must be found to meet this need.

The complexity of the current animal health and public health scenario requires veterinarians to be properly trained to enable them to fulfil their obligations in response to any disaster hazard threatening the animal population and economy or veterinary public health [10, 12, 32, 34, 35].

Sixty percent of countries reported having funding available to support disaster risk reduction and management, often from a variety of sources, including the central budget (93.3%), national projects (46.7%) and international projects (33.3%).

However, 80% of countries report the existence of obstacles that could hamper the Veterinary Authority in implementing disaster risk reduction and management, foremost of which are: material and financial limitations (90.0%), the Veterinary Authority lacks properly trained staff (65.0%), there is no legislation or inadequate legislation for the proper implementation of disaster risk reduction and management (55.0%); and competent authorities lack awareness (40.0%).

All countries agreed that the OIE should be more involved in disaster risk reduction and management issues through a variety of means and initiatives, including: organising special regional conferences/workshops (100.0%); producing specialised publications (92.0%); producing guides, guidelines and standards (88.0%); establishing an OIE Collaborating Centre on disaster risk reduction and management (84.0%); designating Focal Points (76.0%); and establishing an ad hoc group on disaster risk reduction and management (76.0%).

Proposals include: establishing information systems to collect statistics on the impact of disasters affecting animal health in OIE Member Countries; support for cost-benefit studies and an assessment of the impact of climate change on animal health; and an assessment of countries' status with respect to disaster risk reduction and management for decision-making.

In order to leverage existing capabilities in countries of the region, 76.0% express willingness to support other countries in activities relating to disaster risk reduction and management: 89.5% by providing staff to support disaster management-related activities and 63.2% by providing relevant training.

Despite the many efforts to build Veterinary Service capacity to cope with increasing outbreaks of animal diseases, including zoonoses, to which international organisations have contributed enormously [31, 46], much remains to be done to ensure that prevention and response to biological disasters, and still more to natural and technological disasters, is adequately prepared and coordinated at national, regional and international levels. Nevertheless, we will be more able to achieve these goals by seizing the opportunities to identify weaknesses and possible ways of overcoming them.

5. Conclusions

In view of the importance of systematically implementing the full range of activities required for the prevention, preparedness, response and recovery of disasters of every kind stemming from the increasing incidence and impact of disasters on the international community, Veterinary Services should steer their work and leadership more towards protecting the animal population, livestock production and veterinary public health, as part of a top-down disaster risk reduction and management strategy from national to grass roots level.

The complexity of current scenarios calls for a more holistic approach to problems in order to seek more effective solutions. Disaster risk reduction and management strategies elicit more effective veterinary action in response to these challenges, not only because they enable disaster reduction for animal health to be integrated into each area's development plans but also because they promote a favourable climate of intersectoral and multidisciplinary cooperation at all levels.

The view is that the OIE should become more involved in disaster risk reduction and management issues to support its Member Countries because, in an increasingly interdependent world, countries must act in a new spirit of partnership to build a planet safe from mounting disaster hazards by protecting animal health in order to safeguard humankind.

Regional and inter-regional cooperation will also help to achieve real progress in limiting the impact of disasters by means of technology transfer, information sharing and joint activities in the area of disaster prevention and mitigation. Financial resource mobilisation and bilateral and multilateral assistance would be desirable to support this process.

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