INTRODUCTION

Animals and human beings share the same vulnerability to disasters. Massive deaths of animals due to catastrophic events have led over the past centuries to severe famines. In 1786, the eruption of the volcano Lakijagar, in Iceland, killed most of the local livestock, and triggered a famine which caused the death of 39 000 people [1]. Together with famine, epidemic risk is generally evoked as a consequence of natural disasters. The available experiences and epidemiological data indicate that the incidence increase of some zoonotic diseases may occur as a secondary effect of environmental changes. Floods can create a proper habitat for the spread of arthropods vectors of communicable diseases. Epizootics of Rift Valley Fever (RVF) are often associated with periods of heavy rainfall, which are favourable for mosquito vectors [2]. After the unexpected vast floods of 1997 and 2002 that also afflicted natural foci of leptospirosis, the rates of reported and serologically confirmed cases of leptospirosis in the Czech Republic were three times as high as usual [3]. General decrease of hygienic standards, overcrowding in displaced camps and lack of drinkable water constitute a theoretical risk factor with respect to the spread of food- and water-borne diseases. Most recent studies of natural disasters have shown little increase in post-disaster infectious diseases. Nevertheless, the study carried out by Bissell demonstrates a significant increase in four out of the five diseases studied following two hurricanes in the Dominican Republic, with the major impact of the increase coming several months after the disaster. Posited reasons for the increase in infectious diseases are: a) overcrowding of makeshift refugee centres with insufficient sanitary facilities, and b) flood-caused water transmission of pathogens [4]. Disasters can cause the death of a large number of animals and make foodstuffs unsuitable for human consumption. The proper collection and disposal of carrions and other waste of animal origin is a priority in the aftermath, especially in case of flood.

The Po Valley flood in 1994 challenged the capability of response of local veterinary services, especially in the Piedmont Region. In the Alessandria Province 1000 kg of food of animal origin were destroyed, while the flooding of 17 major farms killed 1845 cattle, 30 sheep, 25 horses, 150 pigs and at least 1700 small farm animals, according to the Italian Department of Civil Protection.

Summary. The evolution of the veterinary role in disaster management across the last 25 years is described, with particular attention to the Italian experience. Italy has a specific organisation of veterinary services which are integrated into the civil protection system as a component of the national health service. The Italian model is compared with USA and France. In USA a major role is played by the association of veterinarians (AVMA) while in France the veterinary response to disasters is based mostly on the activities of the Vétérinaires Sapeur Pompiers (Veterinary Fire Brigades). Emerging issues arising after 9/11 attacks and SARS experience, as well as environmental emergencies, and the implication concerning the role of veterinary medicine in disasters are discussed.

Key words: veterinary medicine, disaster management, civil protection.

Riassunto (Ruolo della medicina veterinaria nei disastri). Viene descritta l’evoluzione del ruolo della medicina veterinaria nel corso degli ultimi 25 anni, con particolare riferimento all’esperienza italiana. Il modello italiano, in cui i servizi veterinari sono integrati nel sistema di protezione civile come componente del servizio sanitario nazionale, viene comparato con i modelli degli Stati Uniti e della Francia. Negli Stati Uniti la risposta veterinaria alle catastrofi è affidata principalmente all’associazione dei veterinari degli Stati Uniti (AVMA), mentre in Francia un ruolo fondamentale è giocato dai veterinari volontari dei vigili del fuoco (Vétérinaires Sapeur Pompiers). Il ruolo della medicina veterinaria nei disastri viene discusso alla luce delle tematiche emergenti, in particolare in riferimento agli attentati dell’11 settembre 2001, all’esperienza SARS e alle emergenze ambientali.

Parole chiave: medicina veterinaria, gestione dei disastri, protezione civile.

Veterinary medicine in disasters

Marco Leonardi(a), Renata Borroni(b) and Marta di Gennaro(a)
(a) Dipartimento della Protezione Civile, Servizio Rischio Ambientale e Sanitario, Rome, Italy
(b) Dipartimento di Sanità Alimentare ed Animale, Istituto Superiore di Sanità, Rome, Italy

In dirizzo per la corrispondenza (Address for correspondence): Marco Leonardi, Dipartimento della Protezione Civile, Servizio Rischio Ambientale e Sanitario, Via Ulpiano 11, 00193 Rome, Italy. E-mail marco.leonardi@protezionecivile.it.
HISTORICAL BACKGROUND

Since the last decades of the past century, developed countries have organized modern civil protection systems, based on the coordination and integration of the different bodies involved in disaster relief.

In Italy, the earthquake which struck the Campania and Basilicata Regions in 1980 stressed the lack of preparedness and coordination of the bodies involved in rescue activities. The Ministry of Health appointed a veterinary team to deal with veterinary aspects of the aftermath.

Over the following years, local veterinary services (VS) acquired a good capability of response to “small” emergencies and epidemic emergencies, while they were being integrated into the national civil protection system.

Guidelines on disaster preparedness of veterinary services were prepared and published by the Italian Ministry of Health in 1992 and updated by the Italian National Department of Civil Protection in 1998. The guidelines were mostly based on the experiences developed on seismic risk, but contained a general approach which can be applied to the management of the non-epidemic emergencies [5]:

- risk scenarios;
- knowledge of the territory (farms, animal census, epidemiological veterinary data, slaughtering facilities, means for the transport of food, etc.);
- knowledge of the human and material resources which could be usefully employed in emergency situations;
- intervention model (who does what?).

VS were involved in disaster relief planning at local, regional and national levels. A group of veterinarians was appointed by the National Department of Civil Protection to define the actions to be taken to safeguard animals and food within the framework of the national planning for the evacuation of the at-risk areas in case of Vesuvius’ eruption [6].

During the conflict in Kosovo, in 1999, a Food Hygiene Team was appointed by the Italian National Department of Civil Protection to ensure food safety and environmental hygiene in refugee camps set up in Albania under the responsibility of the Italian Government [7].

The team consisted of 2 veterinarians whose tasks were the following:
- to check the safety of food sent by donors and the Italian government;
- to ensure the hygienic control of locally produced foodstuffs intended for the refugee camps;
- to ensure the hygienic management of food stores and camp kitchens;
- to control the pest population (rodents, arthropods) inside the camps.

Research and training activities on veterinary disaster preparedness are promoted by international bodies such as the WHO/FAO Collaborating Centre for Research and Training in Veterinary Public Health (Istituto Superiore di Sanità, Rome), the European Centre for Disaster Medicine (CEMEC, Republic of San Marino), academic institutions (Veterinary Schools in Messina, Bologna, Bari, Pisa).

ORGANISATIONAL MODELS

The organisational models vary according to the different political and administrative features of each country. We will consider the veterinary response in Italy, USA and France.

In Italy, veterinary services belong to the National Health Service. The organisation of the health services is committed to the Regional administration, and is articulated into local health agencies. According to the 508/1992 Act, veterinary services belong to the Department of Preventive Medicine, together with Public Hygiene, Food and Nutrition, Occupational Medicine services.

The Law 225/1992 established the National Civil Protection Service in Italy. Veterinary Services, as a component of the National Health Service, are an operational structure of the Civil Protection Service. In emergency situations, Local Health Agencies, including veterinary services, are activated by the local civil protection authority.

The response is managed by coordinating centres at the municipal, provincial and national levels. In each coordinating centre all the public and private bodies involved are represented, on the basis of their functions. Veterinary activities are coordinated within the Function “Health and social assistance”. In each coordinating centre the function “health and social assistance” is represented by a function director, who is generally an officer of the health emergency service or local health agency. The flexibility of the system allows the coordinating structure to be modulated on the basis of the priorities. After the flood which hit the town of Termoli, in Central Italy (January 2003), in which there were no victims among the population, the Health Function was run by the head of veterinary services of the local health agency, to coordinate the activities connected with the collection and management of surviving and dead animals in the flooded area.

Although the core of the veterinary response to disasters is the VS of the local health agency, other veterinary bodies are involved in disaster response. The “Istituti Zooprofilattici Sperimentali” (Animal Health Institutes) are involved in laboratory analyses. Regional Veterinary Offices ensure the management of the Regional resources and the epidemiological surveillance through the Regional Epidemiological Centres. Local practitioners, teams from other Regions and experts on specific matters may support the local VS. The National Forest Corps may provide VS with personnel and means of transport to support veterinary activities, especially those connected with the rescue of animals.

The veterinary actions in non-epidemic emergencies, according to the Italian model, are the following [5, 8]:

- **Natural disasters**
  Immediate action:
  - identify any available food resources and establish whether products are still edible and safe;
  - organise care and slaughter of injured animals, and identify those still fit for human consumption;
  - destroy or dispose of carcases and other waste material of animal origin;
  - provide shelter and, when needed, food and water for dispersed animals;
In France, emergency response is articulated at the municipal (Mayor), Departmental (Prefect), zonal (interregional) and central (national) levels. At each level a veterinarian is in charge of the coordination of the activities connected with animal health and food hygiene within the framework of the rescue coordination.

Most of the operational response is in charge of Fire Brigades, which include a medical and health service (SSSM), and an organised corps of veterinarians (Vétérinaires Sapeur Pompier, VSP). VSP are a peculiar category of the French system. VSP can support the Medical disaster manager when animals, food and the environment are involved during rescue operations.

VSP are the technical advisor and operate under the administrative and technical authority of the Medical Head of SSSM.

On the operation area, VSP are the technical advisor of the Rescue Commander. VSP are integrated in rescue teams, especially when rescue dogs are employed. A veterinarian is member of the Medical Advisory Commission which can be established by the Service Départemental d’Incendie et de Secours, (SDIS) that is the Fire Brigades’ body at the departmental level.

VSP are volunteers belonging to French Fire Brigades. They receive a specific training and follow a defined hierarchic chain.

The tasks of VSP are the following:
- prevention and response against technological and biological risks;
- inspection and control of live animals and food-stuffs;
- veterinary support to rescue operations;
- training and follow-up of rescue dog teams;
- management of means and materials for veterinary action and management of animals;
- health and hygiene education;
- sampling and advice on dead animals;
- advice to the Command of Sapeur Pompier on environment and food chain in disasters;
- advice to the command of Sapeur Pompier on risk forecasting and prevention.

The Decree 97-1225, concerning the organisation of rescue and fire-fighting services, provides for the presence within the SSSM of VSP and, when needed, a veterinary head.

EMERGING ISSUES
Terrorism

The 9/11 attacks and the outbreak of anthrax in USA increased the attention to the threat of terrorist attacks with chemical, biological or radio-nuclear weapons (CBRN).

Until 2001 CBRN issues were mostly a military defence matter. After the attack to the Twin Towers and the deliberate spread of anthrax’s spores in USA, all the most industrialized countries prepared plans on the management of civil consequences connected with CBRN terrorism.

Moreover, veterinarians were involved in providing assistance to rescue dogs during and after the interventions.
All the micro-organism included in the CDC “A” list of biological weapons are zoonotic agents, except smallpox. There are 31 recorded cases of agro-terrorism in the Weapons of Mass Destruction Database, 10 of which directed at livestock [10]. The scenarios possibly involving veterinarians are the following:
- attack with persistent chemical agents, which can contaminate animals and food;
- food and water contamination with biological agents;
- spread of zoonotic agents;
- spread of non-zoonotic agents to cause economic damages.

The USA Homeland Security Department defined 15 major scenarios which are likely to cause severe damages in terms of victims and/or economic losses, in order to address priorities in disaster preparedness:
1. Nuclear Detonation – 10-Kiloton Improvised Nuclear Device
2. Biological Attack – Aerosol Anthrax
3. Biological Disease Outbreak – Pandemic Influenza
4. Biological Attack – Plague
5. Chemical Attack – Blister Agent
6. Chemical Attack – Toxic Industrial Chemicals
7. Chemical Attack – Nerve Agent
8. Chemical Attack – Chlorine Tank Explosion
9. Natural Disaster – Major Earthquake
10. Natural Disaster – Major Hurricane
11. Radiological Attack – Radiological Dispersal Devices
12. Explosives Attack – Bombing Using Improvised Explosive Device
13. Biological attack – Food Contamination
14. Biological Attack – Foreign Animal Disease (Foot and Mouth Disease)
15. Cyber Attack.

Most of the above scenarios concern terrorist attacks, and the list reflects the priority given to terrorist threat after 9/11 in USA. Anyway, it must be remarked that a “classic” disease of A list of OIE which does not pose relevant problems for public health (i.e. foot-and-mouth disease) even if in a terrorist scenario, is considered as one of the main threats to the economic and social systems.

Epidemics

Following the SARS crisis, the concern about epidemic risk increased dramatically in mass media and public opinion. Although the SARS outbreak did not have a high public health impact, it suggested some lessons about the emergency management of communicable diseases [11]:
- risks for human health from animal pathogens;
- risks of modern transportation and communication;
- basic infection control measures work well;
- epidemiologic histories are sufficient to allow the chains of transmission to be traced;
- capabilities of molecular virology;
- importance of coordination between different international and local public health agencies to create the necessary surge capacity.

There is general agreement that the veterinary profession plays a unique role in protecting the nation against epidemic livestock diseases, whether caused naturally or through bioterrorism [12].

Rescue dogs

From a veterinary point of view, after the attacks of 9/11 the health aspects of the rescue dog teams management emerged as a critical aspect of disaster response. Rescue dogs are widely employed in search and rescue activities (SAR), especially in case of collapse of buildings.

The World Trade Centre (WTC) attack posed specific problems concerning the exposition to toxic chemical. Within the first year following the September 11 attacks, there was no evidence that responding dogs developed adverse effects related to their work. Mild but significantly higher serum concentrations of globulin and bilirubin and activity of alkaline phosphatase in deployed dogs suggested higher antigen or toxin exposure [13].

A survey on 96 dogs employed during the 9/11 attacks was carried out by the University of Pennsylvania in order to determine characteristics, variables associated with deployment morbidity, and injuries and illnesses of search-and-rescue dogs associated with the Sept 11, 2001 terrorist attacks. According to the findings of the survey, injury and illnesses occurred in most dogs and affected several organ systems, but all were minor [14].

The lessons learnt from the 9/11 event suggest that veterinary teams should support the rescue dogs activities. The Italian Department of Civil Protection is planning the deployment of a mobile advanced medical post for veterinary purposes in case of major disasters. Advanced veterinary teams can ensure also a support for the management of pets possibly found during the operation, including such unusual pets as exotic mammals or reptiles. Moreover, SAR teams are more and more frequently deployed abroad, in developing countries and/or in situations requiring veterinary support to avoid health problems both to animals and to rescuers, as well as to animal-related risk (zoonoses, poisonous animals, etc.).

ENVIRONMENTAL EMERGENCIES

In Campania, a Region of Southern Italy, several farms raising cattle, river buffalo and sheep have been unable to sell dairy milk due to the presence of high levels of dioxins. Furthermore, several cases of abortion (around 25% of total births) and abnormal foetuses (2.5% of total births) were recorded in two flocks of sheep raised in the province of Naples where a level of dioxins higher (5.27 pg/g fat, as human WHO TCDD equivalent) than permitted (3.0 pg/g fat, as human WHO TCDD equivalent) [15] have been found in the milk mass.

In May 2005 the detection of an abnormal presence of pesticides in milk collected on farms in the Sacco River Valley (South Latium) led the Regional Environmental Protection Agency to carry on a survey on the pollution in the area.

During the above-mentioned crisis, VS played an important role in monitoring the contamination and contributing in the identification of the pollution source. It must be noted that, in 2005, five Italian Regions have
emergency situations connected with the urban waste management, while in other 11 areas environmental emergencies connected with environmental pollution are being managed.

An integrated public health/environment system to support decision makers regarding the measures to be taken and the priorities is an emerging need for a proper management of environmental emergencies. The Italian National Department for Civil Protection is the promoter of a project on the evaluation of the health impact of the urban waste in the Campania Region, based on the integration of epidemiological, environmental and geographic data. The project involves the WHO European Centre for Health and Environment; the Istituto Superiore di Sanità and the Clinic Physiology Institute of the National Council for Research, as well as the Regional Health and Environmental Agencies.

CONCLUSIONS

The WHO Report on future trends in Veterinary Public Health states that there will be widespread changes within the immediate scope of VPH itself that will involve such issues as increasing demand for VPH services to respond to non-epidemic emergencies, weather-related problems (droughts, famines, floods, hurricanes, etc.), earthquakes, industrial and nuclear accidents, and to epidemics accidentally or intentionally caused by humans [16].

The recent experiences in Italy and in other countries suggest that Veterinary services must play a role during the different phases:

- forecasting and prevention: epidemiological surveillance of zoonoses and other animal diseases; control of the whole food production chain; environmental epidemiology. These activities aim at ensuring an early warning about epidemic and/or environmental risks, monitoring an event, defining prevention measures (when feasible);
- disaster preparedness: “internal” planning on the Veterinary Services’ part on disaster response; integration into general planning at the different levels (local, regional, national); training of veterinarians and other subjects involved in civil protection activities (fire fighters, volunteers, rescue dogs team);
- first response: advanced veterinary support in the operational area to ensure assistance to rescuers and rescued animals, advice on health risk concerning animals and food to first responders;
- recovery: “re-building” routine veterinary assistance and veterinary public health; contribution to verify the overcoming of epidemics or environmental emergencies through monitoring animals and food.

The above issues are consistent with the Italian concept of civil protection and the integration of VS within the public health system. The different phases must not be considered in a strict chronological order. Rescue activities, planning and risk forecasting can be activities which may have to be developed contemporarily.

From a methodological point of view, the traditional distinction between “epidemic” and “non-epidemic” emergencies, created mostly for didactic purposes, should be reconsidered along with the classification of disasters into “natural” and “man-made” events. A more precise classification for disaster preparedness should be based on the complexity of the event. The more the event is complex, the more the need for an integrated and inter-professional approach is of crucial importance.

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