

Disease prevention and preparedness for animal health emergencies in the Middle East

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Summary

The animal health situation in the Middle East is particularly unfavourable, as this area is exposed to many serious animal diseases. The Middle East is ill-prepared to institute disease prevention and control measures, due to deficiencies at both national and regional levels. Early detection, diagnosis and reporting of diseases must become a priority within these countries and effective communication should be maintained among them. Regional animal health programmes and the support of international institutions are essential to improve preparedness for natural or human-caused emergency situations, which can seriously affect animal health. Such emergencies can also have significant impacts on related public health issues.

Keywords

Animal health – Control – Emerging disease – Epidemiology – Epizootic – Middle East – Preparedness – Prevention – Regional co-operation – Zoonose.

Introduction

The Middle East region encompasses countries around the eastern Mediterranean. This area is largely defined by its political and economic situation, while the countries of the Middle East share several common ecological characteristics, from an epidemiological point of view. Infectious animal diseases move easily within the region, causing great economic losses. Animal health authorities are confronted by many challenges, due to the following main factors:

- geographical position. This area is at the crossroads of international transportation between three continents: Europe, Asia and Africa;
- an unstable political situation. This instability is reflected in inadequate regional co-operation and little or no exchange of epidemiological information;
- the need to restructure and consolidate national Veterinary Services. These Services have both peripheral (field activities, extension) and central (diagnosis and research) deficiencies;
- the climatic conditions common to the various ecological sub-regions;
- the diversity of livestock production systems, including predominantly extensive, traditional animal husbandry, characterised by communal grazing, as well as uncontrolled animal movements and nomadism;
- the fact that most countries in the region are consistent importers of livestock and animal products;
- the fact that the major routes of migratory birds, between Europe and Africa, cross this region;
- different market trends in animals and animal products. These may affect decision-making and could also result in the introduction of exotic animal diseases;
- demographic changes, characterised by a growing human population, desertification and increasingly limited water resources;

– obvious disparities in economic wealth among these countries, influencing decision-making on animal health issues.

Several authors have recently described this complex regional situation (2, 8, 16, 34, 36).

In climatic terms, the entire region has a strongly marked pattern of summer drought and winter rain. Aridity (with rainfall often below 100 mm per year) and very hot summers characterise vast areas of land. Rainfall is extremely erratic in regard to both season and geographical location. However, there are two large river delta areas in the region, the Nile and the Mesopotamia, where large numbers of ruminants are concentrated, together with a dense and heterogeneous arthropod population. This situation represents an abundant source of wind-borne disease agents.

The land resources of the Middle East are small and fragile. Pastoralism is practised over large areas of steppes (grassy plains), which are widespread in almost every country in the region. Nomadic herding, involving mainly small ruminants, and seasonal transhumance are widely practised. Humans and animals tend to share common premises, making the former prone to zoonotic diseases. Productivity is low, due to:

- the small-scale, family-type farming structure
- natural hazards, pests and diseases
- the limited availability of feed resources
- limited capital and credit.

Special festivals or occasions, such as the Bairam feast at the end of Ramadan, may involve the ritual slaughter of millions of animals. There is also a deep-rooted, traditional preference for home slaughter in the region. Together, these factors result in deficient meat inspection and poor disease monitoring. The Middle East has also become the largest importer of food and animal feed in the developing world, due to a rapidly growing population. Imports, principally of live sheep (an annual figure of more than 12 million, almost 64% of the global trade in live sheep) and animal products, now account for more than 25% of the total import bill for the region (34).

This situation, when combined with serious political instability (which causes a lack of co-operation among various countries in the region and undermines regular and proper disease reporting), has created significantly unfavourable epizootiological conditions in the Middle East. These conditions also endanger neighbouring regions.

Animal health

Information obtained from official sources

Although some countries of the region have adequately functioning mechanisms for reporting animal diseases, zoonoses and food-borne disease, most do not have efficient surveillance and reporting systems in place. Under-reporting is common because:

- there are no adequate laboratory diagnostic facilities
- there is insufficient professional and public awareness
- reporting of some diseases, including zoonoses and food-borne disease, is not obligatory.

The poor animal health situation in the Middle East has been repeatedly demonstrated by the presence of major epizootic livestock diseases in the region. Some of these have been regarded as endemic for many decades, while others penetrated the Middle East for the first time during the last years of the 20th Century, and have since become established. Examples include Rift Valley fever (RVF) (14), lumpy skin disease (LSD) (30, 33) and peste des petits ruminants (PPR) (38).

Information on the disease situation in the Middle East is derived principally from the statistics of the World Organisation for Animal Health (OIE). All OIE Member Countries are expected to officially report to the main office any occurrence of a listed disease within their respective boundaries, in line with a procedure outlined in the *Terrestrial Animal Health Code* (41).

A recent decision by the Member Countries of the OIE in committee meant that, from mid-2005, all notifiable diseases were amalgamated into a single list. In addition, requirements for initial and subsequent periodic disease reports have been substantially revised. However, in this paper, the authors will refer to the procedures which existed until mid-2005.

According to these earlier provisions, all notifiable diseases were divided into two lists, as follows:

- List A included transmissible animal diseases characterised by their potential for very serious and rapid spread, irrespective of national borders
- List B included animal diseases which presented significant socio-economic and/or public health consequences within countries.

The principal obligations of Member Countries when notifying listed diseases were as follows:

- a) List A diseases must be reported immediately, followed by weekly 'follow-up' reports

b) List B diseases, if occurring in the country for the first time, or if a significant change in epidemiology has occurred, must be reported immediately, followed by weekly follow-up reports.

In addition, Member Countries were required to provide annual reports on their animal health status, encompassing the incidence of all List A and B diseases and the measures applied to prevent and control them. The collected monthly and annual data are available on 'Handistatus', the OIE website database (<http://www.oie.int/hs2/report.asp?lang=en>). This database has provided the main source of information for this paper (Table I).

Table I includes raw data for the following nine List A diseases in mammals:

- foot and mouth disease (FMD)
- rinderpest (RP)
- PPR
- contagious bovine pleuropneumonia
- LSD
- bluetongue (BT)
- RVF
- sheep pox/goat pox (SP/GP)
- African horse sickness (AHS).

Table I

Occurrence of selected epizootics in the Middle East until 2004

(as reported by Middle-Eastern countries to the World Organisation for Animal Health until the end of 2004)

Country	Foot and mouth disease serotypes							RP	PPR	CBPP	LSD	RVF	BT	SP/GP	AHS
	O	A	C	Asia 1	SAT 1	SAT 2	SAT 3								
Bahrain	2003	1965	...	...	1962	...	...	1985	0000	0000	2003	0000	0000	2000	0000
Cyprus	1964	1964	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	+?	1989	1960
Egypt	2000	1972	–	–	–	1950	–	1987	1989	1971	1990	1993	1974	1999	1959
Iran	2004	2004	0000	2004	1964	0000	0000	1994	2004	0000	0000	0000	2004	2004	1963
Iraq*	2002	1978	...	1975	1962	...	...	1985	2001	...	...	...	...	2001	...
Israel	2004	1981	0000	1989	1962	0000	0000	1983	1993	1941	1989	0000	2004	2004	1944
Jordan	1999	1978	1969	1961	1962	0000	0000	1972	2000	0000	0000	0000	1999	2002	1962
Kuwait	2004	1977	0000	1981	1970	2001	...	1985	1991	1991	1991	0000	0000	2004	0000
Lebanon	2003	1992	1992	1984	1962	...	...	1993	1997	1992	1993	–	1992	2003	1960
Libya	1994	1979	...	...	...	2003	...	1966	0000	0000	0000	0000	0000	2004	1964
Oman	2004	...	...	1982	...	...	...	1995	2004	0000	1984	0000	2001	2004	0000
Palestinian Authority	2004							1983	2004	...	...	0000	–	2004	0000
Qatar	2001	...	...	...	...	...	...	1987	–	1997	–	–	–	1999	–
Saudi Arabia	2004	1994	1987	1994	1970	2000	–	1997	2004	–	0000	2004	2004	2004	...
Syria	2002	2002	1969	1988	1962	0000	0000	1983	1988	–	–	–	–	...	1961
Turkey	2004	2004	0000	2002	1965	0000	0000	1996	...	0000	0000	0000	1979	2004	1961
United Arab Emirates	2003	1990	...	...	...	...	...	1995	2004	1990	2000	0000	...	2004	0000
Yemen	2004	1998	–	1980	...	1990	...	1995	2004	...	1995	2004	...	2004	–

*Iraq: Last available year for foot and mouth disease statistics was 2002; for peste des petits ruminants and sheep pox/goat pox, 2001

0000: disease never reported

–: disease not reported (date of last outbreak not known)

(year): year of the last reported occurrence of the disease

+?: serological evidence and/or isolation of the causal agent, but no clinical signs of disease

...: no information available

SAT: Southern African Territories

RP: rinderpest

PPR: peste des petits ruminants

CBPP: contagious bovine pleuropneumonia

LSD: lumpy skin disease

RVF: Rift Valley fever

BT: bluetongue

SP/GP: sheep pox/goat pox

AHS: African horse sickness

Some missing data have been added from other sources (34).

Foot and mouth disease is prevalent in the Middle East. It has been recorded more than once in 17 countries in the region during the last ten years. In fact, the only country which has been free of FMD throughout the period is Cyprus. In most of these countries, serotype O is regarded as endemic.

The FMD serotype Asia 1 has caused large epizootics in the Middle East in the past, and has recently been reported from Iran (2004), Turkey (2002) and Saudi Arabia (1994). Serotype A₂₂ is present (2004) in Iran and Turkey, and has recently been reported from Syria (2002) and Yemen (1998). No reports have been received from Iraq in recent years, but the situation is presumably similar to that in Iran and Turkey.

In the past, exotic strains of FMD virus (FMDV) were involved in panzootics, covering large areas in the region, extending as far as the frontiers of Europe. Such panzootics included outbreaks of FMDV types Asia 1 (1957-1964, 2000); Southern African Territories 1 (SAT 1) (1962-1964), and A₂₂ (1964-1965, 1996) (Fig. 1).

The recurrence of such situations is not a remote possibility, due mainly to the continuous influx of live sheep for slaughter, principally into the Arabian Peninsula. Animals from Africa and Asia can readily introduce strains of FMDV which then spread among the local ruminants, particularly nomadic sheep and goats. These animals may then further disseminate the virus into large-scale, commercial dairy farms. Serotype SAT 2 was introduced into Saudi Arabia as recently as 2000, later appearing in Kuwait (2001) and Libya (2003). Genetic profiling of FMDV strains by nucleotide sequencing is a powerful

epidemiological tool to trace the virus spread. It appears that the recent spread tracks are similar to those described in the past; namely, that FMDV was probably introduced into the Arabian Peninsula from the Horn of Africa, and then spread from the Gulf States in a north-westerly direction (2, 15, 18, 19).

Rinderpest has been reported quite frequently in the Middle East. The last major spread was observed during the early 1980s, a period of significant political unrest. Later outbreaks of RP have been recorded in the following countries:

- Lebanon (1993)
- Iran (1994)
- Oman (1995)
- the United Arab Emirates (UAE) (1995)
- Yemen (1995)
- Turkey (1996)
- Saudi Arabia (1997) (22, 38).

Peste des petits ruminants, a disease initially regarded as restricted to West Africa, was unknown in the Middle East before 1988. Since then, it has spread into 14 of the 18 Middle-Eastern countries covered in this paper (Table I). A 1998 Food and Agriculture Organization (FAO) report (38) indicates that PPR was clinically suspected in Yemen as early as 1984, while, during a serological surveillance on the coastal belt between 1990 and 1994, applying competitive enzyme-linked immunosorbent assay, antibody prevalence rates were 1.5% in sheep and 1.8% in goats. In the mountainous areas, during the same period, prevalence rates were 3.1% in sheep and 10.3% in goats. In the drier north-eastern and eastern areas, rates were 7.0% in sheep and 7.5% in goats. The disease appears as 'present in Yemen since 2000' in the OIE database.

Turkey reported PPR to the OIE for the first time in 1999. The potential for spread was demonstrated in June 2000, when an outbreak was unofficially reported on the island of Cyprus by Turkish-Cypriot veterinarians (see 'Information obtained from other sources: Cyprus' below).

The FAO report concluded that the PPR virus appeared to have spread within the Middle East in the 1990s, probably through a combination of nomadic movements by small ruminants and trade, and has become endemic. The report also reiterated that PPR probably spread from the Horn of Africa to the southern Arabian Peninsula, as the recorded lineage of the virus appears to be common to the two regions. Trade in livestock has undoubtedly fostered this spread. A second lineage is present in Bangladesh, India, Pakistan, Iran, Israel and Turkey. It can safely be assumed that other countries in that region, such as Jordan and

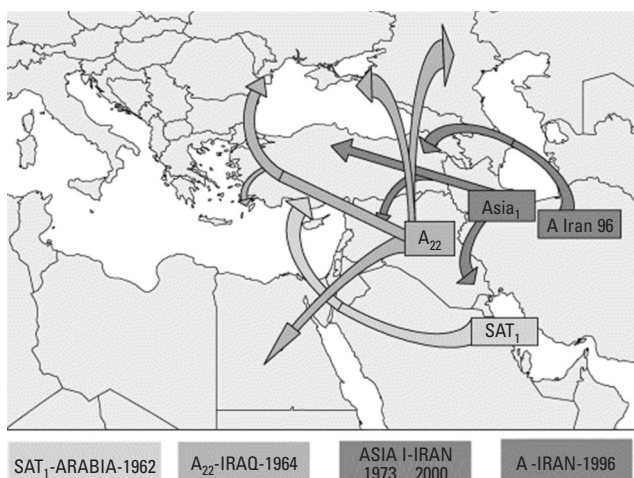


Fig. 1
Introductions of foot and mouth disease serotypes from the Middle East to the frontiers of Europe from 1962 to 2000 (25)

Syria (where seropositive animals were initially detected as early as 1989 and 1991, respectively), as well as Lebanon, have been similarly infected.

Lumpy skin disease, initially known to be restricted to sub-Saharan Africa, has in recent years been recorded in Oman, Egypt, Kuwait, Lebanon, Bahrain and Yemen. A single outbreak in Israel (1989) was eradicated by the immediate application of the stamping-out policy (33).

Rift Valley fever, a serious arthropod-borne disease in ruminants which causes haemorrhagic fever in humans, was restricted to sub-Saharan Africa until its detection in Egypt in 1977 (23). Since then, there have been several recurrences in Egypt but apparently on a limited scale (24). The introduction of RVF into Yemen and Saudi Arabia in 2000, its first appearance outside the African continent, was of particular concern in view of its grave public health aspects (35, 43). Rift Valley fever can cause serious animal and human suffering and significant economic loss. This highlighted the need for improved preparedness and surveillance (9). In fact, RVF is now suspected to be endemic, as it was reported in Saudi Arabia in 2001, 2003 and 2004 (see 'Zoonoses', below).

Three Middle-Eastern countries, Bahrain, Kuwait and Libya, referred, in their annual reports to the OIE, to bluetongue as a disease which has never been reported within their respective territories. However, serological evidence and the knowledge available on its epidemiology and the distribution of the vector, *Culicoides imicola*, may indicate that BT is enzootic throughout the region, in spite of a lack of reports. The BT virus (BTV) serotypes recorded between 1963 and 2001 in eight Middle-Eastern countries (Israel, Egypt, Jordan, Syria, Turkey, Cyprus, Iraq and Lebanon), involved in clinical or subclinical (serology only) infections, have previously been summarised in table form (28). While BTV4 seems to be the predominant serotype involved in clinical disease, seven other serotypes have been identified in infected animals: 1, 2, 6, 9, 10, 12 and 16.

Sheep and goat pox are historically regarded as being endemic in all countries in the Middle East. However, some countries have observed only sheep pox.

African horse sickness last reached epizootic proportions in this region during the early 1960s. Later, during the 1980s, AHS occurred sporadically in the Arabian Peninsula, as reported to the OIE Regional Commission for the Middle East. If and when it is re-introduced from Africa, this disease may again spread, due to the presence of its known vector, *C. imicola*.

In fact, all List A ruminant diseases, except vesicular stomatitis, which is restricted to the Americas, have been reported in the Middle East during recent decades. This

fact, combined with the lack of efficient controls on animal movement throughout the region, underlines the potential epizootiological hazards in the Middle East, the urgent need for improved preparedness and prevention in the region as a whole, as well as in each country, and the importance of co-operative, integrated activities within the entire area.

In terms of the avian diseases on List A, highly pathogenic avian influenza (HPAI) has never been reported from Bahrain, Cyprus, Iran, Jordan, Kuwait, Libya or the UAE. The only countries that have officially notified the OIE of outbreaks are Egypt (1965) and Israel (1988). However, an H9N2 avian influenza A virus is known to have been present in various Middle-Eastern countries in recent years. The continued presence of this subtype in the Middle East may mean that it is becoming an established endemic disease (4). Although H9N2 is not an HPAI virus strain, economic losses may at times be considerable. The main concern with this strain is its documented potential to infect humans, as reported in Hong Kong in 1999 and 2003. It has been postulated that shared gene constellations in avian influenza viruses H9N2 and H5N1 may confer the ability to cause infection and disease in humans.

Newcastle disease (ND) also seems to be prevalent in the region, though it is poorly reported. In their annual reports to the OIE, two countries, Qatar and Oman, referred to ND as a disease which had never been reported within their respective territories. Vaccination against ND is practised in all Middle-Eastern countries.

Information obtained from other sources

The OIE, like other international and national organisations, can disseminate only the information that is officially reported by Member Countries. Such reports, when available, vary in their quality since the availability, regularity, expediency and accuracy of official disease reporting may differ between countries. Various factors may affect the ability of the different national Veterinary Authorities to:

- obtain early, accurate and complete information about the animal diseases in their respective territories
- confirm clinical suspicions by reliable laboratory testing in a timely manner
- immediately forward or publish the gathered information.

Even in countries which have the infrastructure and expertise to obtain such information, economic and political constraints are known to affect the transparency needed to satisfactorily supply essential disease-related information, both to the OIE and the international animal-

health community at large. Independent, scientifically-based monitoring institutions may help in overcoming such constraints, enhancing the early availability of information on emerging diseases and supporting early-warning systems. Several internet-based epidemiological programmes have been initiated in recent years by private and academic non-governmental institutions.

One of the more comprehensive, non-official programmes for monitoring emerging diseases in humans and animals, is ProMED-mail (<http://www.promedmail.org/>). This online program, established in 1994, is currently operated by the International Society for Infectious Diseases, a non-profit-making, professional organisation. The principal intent of ProMED-mail is to assist local, national and international organisations by disseminating data on outbreaks of emerging infectious diseases, as rapidly as possible, wherever they occur. These data come from sources such as media reports, online summaries, local observers, official reports and various others. A team of expert human, animal and plant disease moderators screen, review and investigate such reports before posting them on the network. In contrast to official national and international organisations, which can only publish information which is officially reported to them, ProMED-mail has no such constraints. It can independently post preliminary and unofficial reports, as well as summaries, and operates seven days a week.

Between its inauguration in 1994 and July 2005, ProMED-mail has issued 23,116 postings, of which 12,773 concerned animal health and/or zoonotic issues. Of the eight regions covered (North America, Europe, Asia, Africa, South America, the Pacific, Eastern Europe and the Middle East), the last seems, on the whole, to gain less intensive coverage than other parts of the world, to varying degrees among the countries of the region. Perhaps unsurprisingly, North America and Europe lead the list with postings and members. The following data, derived from the ProMED-mail website in mid-August 2005, present the total numbers and selected animal health postings received from Middle-Eastern countries since 1995, their respective subjects and years of issue. Disease data that have not been covered by official sources, such as the OIE, the World Health Organization (WHO) and national reports, are marked with asterisks (*).

Bahrain

There were no postings from Bahrain.

Cyprus

There were 12 animal health-related postings from Cyprus, including:

- salmonellosis (1996)
- *Brucella melitensis* in bovines (1996*, 2002)

- PPR, reported by Turkish Cypriot veterinarians (2000*)
- unexplained deaths in flamingos (2003*)
- BT in sheep (2004)
- ND (2005).

Egypt

There were 14 animal health-related postings from Egypt, including:

- RVF (1995, 2003)
- streptococcal illness due to jerboas (1996*)
- phlebovirus infection (1997*)
- West Nile virus (1999*)
- avian influenza H10N7 (2004*).

Iran

There were 18 animal health-related postings from Iran, including:

- the bovine spongiform encephalopathy import ban (1998)
- FMD (1999, 2001)
- Crimean-Congo haemorrhagic fever (CCHF) (2000*, 2001*, 2002*, 2003*, 2004*, 2005*)
- white spot disease in shrimp (2005).

Iraq

There were 21 animal health-related postings from Iraq, including:

- anthrax (1995, 2004*)
- camelpox (1995*)
- Old World screwworm (1998)
- PPR (1998)
- FMD (1999)
- RVF (unconfirmed) (2001*)
- rabies (2004*)
- leishmaniosis (2001, 2003, 2004, 2005)
- Veterinary Services, restoration and reactivation of (2005*).

Israel

There were 88 animal health-related postings from Israel, including:

- rabies (1995, 1997, 2003, 2004, 2005)
- ND (1997, 2001, 2005)

- sheep pox (1997, 2003)
- FMD (1998, 1999, 2001, 2004)
- PPR (1998, 2004)
- *Pseudomonas mastitis* in dairy sheep (1998*)
- West Nile virus in:
 - i) domestic avians (1998, 1999*)
 - ii) humans (2000*, 2001, 2002, 2003, 2004, 2005)
 - iii) migratory birds (1998*, 2005*)
 - iv) mosquitoes (2002*)
- equine influenza (2002)
- scrapie (2002)
- botulism in cattle (2002)
- *Aedes albopictus* in Israel, first record of (2002*)
- undiagnosed ulcers in fish (2003*)
- anisakiasis, suspected (2003*)
- BT (2003)
- *Vibrio vulnificus*, fatal (2003*)
- leishmaniosis, cutaneous, in humans (2004)
- transmissible gastroenteritis in swine (2004)
- equine rhinopneumonitis (2005).

Jordan

There were two animal health-related postings from Jordan, as follows:

- anthrax in circus lions (1997)
- FMD (1999).

Kuwait

There were 15 animal health-related postings from Kuwait, including:

- *Escherichia coli* (1997*)
- ND (1997)
- Old World screwworm (1998)
- contagious caprine pleuropneumonia (1998)
- FMD (1998, 2000, 2002)
- leishmaniosis (2003).

Lebanon

There were two animal health-related postings from Lebanon, as follows:

- FMD (1999)
- brucellosis in humans and caprines (2004).

Libya

There were seven animal health-related postings from Libya, including FMD (2003).

Oman

There were two animal health-related postings from Oman, including West Nile virus in equines (2003*).

Palestinian Authority

There were no postings from the Palestinian Authority.

Qatar

There were no postings from Qatar.

Saudi Arabia

There were 75 animal health-related postings from Saudi Arabia, including:

- Tick-borne encephalitis, tick-borne flavivirus, Alkhurma virus (1997*, 2002*, 2004*)
- RVF in:
 - i) animals (2004)
 - ii) humans (2000, 2001, 2003, 2004)
- West Nile virus – import ban (2000*)
- FMD (2001, 2003)
- PPR (2002)
- avian influenza H9 virus (1998*)
- poultry die-off (2004*)
- new variant Creutzfeldt-Jakob disease – suspected, not confirmed (2004*)
- camelpox, suspected (2005*).

Syria

There were four animal health-related postings from Syria, including FMD (2002, 2003).

Turkey

There were 17 animal health-related postings from Turkey, including:

- RP, provisional freedom from (1998, 1999)
- BT (1999)
- food poisoning from fish (1999*)
- FMD (1999, 2000, 2001)
- ND (2001)
- trichinellosis (2004)
- cutaneous lesions in humans (anthrax or contagious ecthyma) (2004*)

- CCHF (2002*, 2003*, 2005*)
- PPR (2004)
- tularemia, water-borne (2005*)
- anthrax – human, ovine, caprine (2005).

United Arab Emirates

There were seven animal health-related postings from the UAE, including:

- camel death – undiagnosed (1999*)
- CCHF (2000*)
- sheep and goat die-off (2001*)
- FMD (2003)
- glanders, equine (2004).

Yemen

There were 20 animal health-related postings from Yemen, including:

- rabies (1997)
- RVF (2000, 2001)
- leishmaniosis (2005).

In addition to ProMED-mail, there are other sources of information about the disease situation in the Middle East. Reports are perhaps the main resource and they can be obtained from many groups, including the following:

- a) regional and international organisations
- b) research institutions
- c) advisory enterprises
- d) working groups and commissions, such as:
 - the Emergency Prevention System (EMPRES)
 - the United States Agency for International Development/Middle East Regional Co-operation Program (USAID/MERC)
 - European Union-sponsored regional programmes
 - the Mediterranean Zoonoses Control Programme (MZCP).

Important data can also be derived from papers and reviews published in scientific journals. To cite one example: the presence of PPR in Yemen was indicated in a Regional Animal Disease Surveillance and Control Network (RADISCON) report, published after the visit of an FAO expert to Yemen at the end of 1998. The disease may have entered Yemen several years earlier (38).

Bovine ephemeral fever has been reported to be re-emerging in several Middle-Eastern countries since the early 1990s. In Israel, the mortality rate in 1990 was 3% and in 1999 almost 4% in affected dairy herds (42). The average mortality or emergency slaughter rate in these herds was 0.4% for calves (up to one year old) and 4.4% for cows in lactation. In Saudi Arabia, the mortality rates varied between 0% and 2.6% (1).

Akabane virus has been reported as a cause of epizootics of congenital malformations in ruminants in Israel (32); the virus was also identified in Oman. Serological surveys have demonstrated antibodies to Akabane virus in domestic animals in Cyprus, Syria and Turkey (43).

However, so far, these sources have lacked the urgency required to handle emergency situations effectively.

Veterinary public health and food safety

In general, most countries in the Middle East have limited capacity and resources to plan and implement policies to control zoonoses and food-borne diseases which affect public health, animal health, production and trade.

The important notifiable zoonotic and food-borne diseases in the region are as follows:

- acute hepatitis A and B
- anthrax
- brucellosis
- cholera
- CCHF
- echinococcosis/hydatidosis
- leishmaniosis
- leptospirosis
- listeriosis
- paratyphoid
- rabies
- salmonellosis
- shigellosis
- typhoid.

In addition, RVF and West Nile fever (WNF) are emerging. Creutzfeldt-Jakob disease has recently been added to the list in most countries. The authors will briefly discuss selected bacterial and viral diseases, below.

Food-borne diseases with symptoms of fever and diarrhoea are common in daily life and generally accepted as mild and self-limiting. Medical help is sought only when the problem becomes serious, with life-threatening symptoms.

A few of the countries in the region maintain poor food safety and surveillance systems. The priorities of these countries are to reduce acute diarrhoea and improve water sanitation. Others have acceptable surveillance systems in which the common food-borne diseases are reported; the food safety infrastructure in these countries has been substantially improved in recent years. Jordan, for example, has finalised a study on the importance of food-borne diseases. However, a great deal remains to be achieved in the area of food safety, including establishing priorities when trying to reduce the incidence of important food pathogens.

Approximately one-third of Middle-Eastern countries possess adequate basic infrastructures for food-borne disease surveillance. Their priorities are chemical residues and hazard analysis, including bacteriological and viral analysis. Unfortunately, there is no established regional network for the collection and sharing of these data.

The WHO Eastern Mediterranean Regional Office has collected and analysed official information from several countries in the region.

For Jordan, it was estimated that, during one month in 2002, at least 271 cases of salmonellosis, 1,899 cases of shigellosis and 854 cases of brucellosis occurred. A significant reduction in the incidence of food-borne diseases was observed between 1998 and 2002 (bloody diarrhoea: 12.7 and 4.8, respectively; typhoid: 12.7 and 4.8; hepatitis A: 16.9 and 10.2). In Saudi Arabia, the incidence of hepatitis A decreased from 14.7 in 2001 to 9.5 in 2003. However, no similar decrease was observed for typhoid, paratyphoid or salmonellosis. The incidence of food poisoning outbreaks increased, from 11 in 2001 to 16 in 2003.

In a review of all reported food-borne disease cases in Saudi Arabia between 1997 and 2003, the results were as follows:

- 47.17% were cases of *Salmonella*
- 10.84% were cases of *Staphylococcus aureus*
- 4.78% were cases of *Staphylococcus aureus* enterotoxigenic
- 6.70% were cases of mixed bacteria
- 5.96% were cases of *Escherichia coli*
- 4.43% were cases of *Bacillus cereus*
- 3.35% were cases of *Shigella*

- 16.77% of samples from all cases investigated were sterile.

It was found that poultry and other types of meat accounted for 79% of food poisoning cases.

In Lebanon, *Salmonella* was the most common cause of food poisoning. In addition, trichinellosis, mostly from wild boar, was a serious public health concern.

Zoonoses

The following selected zoonotic diseases are of significance in the region:

- brucellosis
- rabies
- leishmaniasis
- RVF
- WNF
- CCHF

Brucellosis

Brucellosis, caused by *Brucella melitensis*, is a zoonosis endemic in all Middle-Eastern Countries, significantly affecting public health and with serious economic implications. It causes abortion 'storms' in goats and sheep and infections in humans (principally affecting rural populations and consumers of unpasteurised dairy products). Cattle, buffalo and camels can also be infected. The disease has a seasonal pattern, with the highest incidence during spring and summer.

Biovar 3 of *B. melitensis* is the strain most commonly isolated from animals in Egypt, Jordan, Israel, Tunisia and Turkey. Biovars 2 and 1 have also been isolated. The countries with the highest incidence of human brucellosis are Saudi Arabia, Iran, the Palestinian Authority, Syria, Jordan and Oman. Bahrain is reported to have zero incidence. Most human cases are caused by *B. melitensis*, particularly biovar 3.

There is some controversy over the best policy for controlling brucellosis in animals. In some countries, the 'test and slaughter' policy has been adopted, together with the vaccination of young females. In others, mass vaccination has recently begun, particularly for sheep and goats. The most commonly used vaccine to control *B. melitensis* is Rev. 1 vaccine. *Brucella abortus* S19 is used in cattle. RB51 vaccine for cattle is used on a small scale in some countries. Vaccination is limited to cattle and small ruminants (29).

In Jordan, the human incidence of disease (cases per 100,000 head of population) reached record figures of 26.1 in 1991 and 22.6 in 1995. By 1999, the figure had been reduced to 8.8 (3).

Cyprus has a control programme based on the test and slaughter of seropositive animals, and vaccinations are not permitted. During the 1990s, Israel conducted a large-scale test and slaughter programme, significantly reducing the infection rate. At present, mass vaccination, using Rev. 1, by the intraocular route, is practised (6).

Rabies

Rabies is still an important public health threat in most Middle-Eastern countries. Reliable data on rabies are scarce for many geographical areas of the world and the Middle East is no exception. According to available information, the major form of the disease in the southern and eastern parts of the region is urban canine rabies. During the last 15 to 20 years, wildlife (sylvatic) rabies became a problem on the Arabian Peninsula, particularly in Oman, Saudi Arabia, the UAE and Yemen (39).

Cyprus, Kuwait and Qatar are reported as being free from rabies. Post-exposure vaccination of humans, control of stray dogs and vaccination of domestic dogs are the main approaches applied by Middle-Eastern countries to prevent the disease in humans. In Israel, where sylvatic rabies has been dominant since 1975, oral vaccination of wildlife has been applied since 1998, significantly reducing the infection rate in foxes and jackals. Domestic dogs are annually and compulsorily vaccinated, and identified by microchips (26).

Leishmaniosis

Leishmaniosis is caused in the Middle East by viscerotropic and dermatropic strains of *Leishmania infantum* and *L. tropica*. The dog is the domestic reservoir but other mammals may act as sylvatic or peri-domestic hosts. The parasites are transmitted by sandflies belonging to the sub-genus *Phlebotomus*, which bite a wide range of warm-blooded animals, including people.

The extension of irrigation areas in Deir-es-tor, in north-eastern Syria, near the Euphrates River, where crops were grown for feeding sheep and goats, encouraged the multiplication of gerbils, which are the main animal reservoirs for zoonotic leishmanioses, and an epidemic of the disease subsequently appeared in the population of the area. This is a good example of environmental changes which favour outbreaks of zoonoses.

Rift Valley fever

This disease has also caused explosive epidemics in the region, most notably in Egypt (1977-1978, 1986-1987) (23, 24), resulting in hundreds of human deaths and heavy losses in the animal industry. Mass vaccinations were conducted and are still annually performed in cattle, sheep and goats.

From 1999 to 2001, the disease spread from the Horn of Africa to Yemen and Saudi Arabia, causing human suffering and mortalities, severe losses in young animals and disruption in the regional trade of live animals. Sporadic cases have continued to appear in Saudi Arabia in subsequent years (35, 43).

The Ministry of Agriculture and Water of Saudi Arabia implemented stringent measures to control the outbreaks. The measures applied included the following:

- restriction of animal movements
- systematic control of mosquitoes
- vaccinations with a live, attenuated vaccine (Smithburn strain)
- surveillance.

Rift Valley fever continues to threaten the Middle East and, in some areas, may have become endemic. Direct and indirect economic losses in Saudi Arabia have been estimated to exceed US\$ 75 million per year. Active surveillance and early warning systems must be designed and implemented throughout the Middle East and preventive measures taken, before outbreaks of the disease re-occur.

West Nile fever

West Nile fever, an arboviral zoonotic disease transmitted by mosquitoes, has been reported in humans in Egypt and Israel since the early 1950s. Epidemics among the human populations of many African, Middle Eastern and some Mediterranean countries have been recorded at approximately ten-year intervals (25).

During the early 1960s, West Nile virus (WNV) was isolated in Egypt from cases of encephalitis in horses. In Israel, cases of severe meningo-encephalitis associated with WNV infection were recorded in humans in 1957. An outbreak in geese was seen in Israel in 1998 (20), and later in horses (37); cases of the disease in humans have been reported during the late summer months of each year since 2000. The possible introduction of the virus into Israel in 1998 by migrating storks has been documented (21).

Crimean-Congo haemorrhagic fever

This disease, a tick-borne viral zoonosis, has been reported in a few countries of the Middle East. The number of potential hosts is high.

The virus has been isolated from numerous species and subspecies of hard ticks, while antibodies have been found in many domestic and wild animals, including hedgehogs, hares and rodents.

Most human cases of CCHF occur in rural areas among farmers or livestock handlers, or among medical personnel, as reported in Dubai in 1979.

Cases of CCHF have been reported from Egypt, Saudi Arabia, Iraq, Iran and the Gulf countries. Recently, clinical cases have been documented in humans in Turkey (17).

Other diseases

Echinococcosis-hydatidosis (7, 27, 31) and salmonellosis (5) also deserve to be mentioned. Other zoonoses prevalent in the region (40) are out of the scope of this review.

Provisions for managing animal health emergencies in the Middle East

The classical approach to establishing and maintaining a national programme for controlling animal diseases includes, as minimum prerequisites, the following measures:

- the controlled importation of animals and animal products
- efficient disease monitoring in the field
- rapid and reliable laboratory diagnosis
- epidemicsurveillance, with appropriate communication networks both within and outside the country
- an effective veterinary infrastructure in the field, to apply the necessary disease control measures, either directly or through accredited professionals
- appropriate rules and legislation and the tools for their effective enforcement.

As previously described, a proportion of countries in the Middle East lack some or all of these prerequisites. This has

been demonstrated on several occasions in recent decades, for instance, the introduction and spread of RVF, LSD and PPR – diseases which have become entrenched in the region though previously unknown there. Other emerging disease agents may also become established or 'get a foothold' and cause devastating losses to animal and/or public health if these are not recognised and identified in time, before spread occurs. A current example is the threat of avian influenza.

As a result of the inadequate flow of information in the region, caused by the absence of diagnostic data, inadequate communication and political difficulties, preventive mass vaccination is the only effective method, at present, to minimise or prevent catastrophes. Thus, for many years, several Middle-Eastern countries have continuously applied a trivalent FMD vaccine, incorporating serotypes O1, A₂₂ and Asia 1, even though, for several years, type O has been the only prevalent virus type in the region. Other widely used vaccines are as follows:

- PPR vaccine
- sheep/goat pox vaccine
- poultry vaccines
- RVF vaccine (in Egypt, Saudi Arabia and Yemen).

However, the effectiveness of such measures is hampered by a lack of regional co-operation. It is therefore of the utmost importance to invest effort into overcoming political obstacles and enhancing regional projects. To this end, the involvement of international organisations, such as the FAO, OIE, European Union, USAID, the International Fund for Agricultural Development (IFAD) and WHO, is vital. Some programmes are already operating in the region, with promising results.

The FAO has initiated various regional operations in the past (namely, the Middle and Near East Regional and Animal Production and Health Project and the West Asia Rinderpest Eradication Campaign) and is currently enhancing the RADISCON and EMPRES.

The RADISCON plan, involving mainly transboundary animal diseases, is a joint FAO/IFAD venture, targeted at 29 countries in North Africa, sub-Saharan Africa, the Horn of Africa, the Middle East and the Arabian Gulf. It aims to strengthen the Veterinary Services in each country, by improving their capacity to collect reliable and crucial information on the distribution of selected animal diseases and zoonoses. It also aims to assist in the establishment of a National Animal Diseases Surveillance System in each Member Country. Several workshops have been held and the project seems to be achieving promising results, bridging gulfs between countries which would otherwise be impassable.

During the 1990s, a regional oversight committee (ROC) was established by the Chief Veterinary Officers of Egypt, Israel, Jordan and the Palestinian Authority. This has resulted in much fruitful co-operation on research into animal health and the control of zoonoses, with the assistance of USAID and the EU. The most recent ROC meeting took place in November 2002, in Aqaba, Jordan. The regional ROC website can be seen at <http://www.move-in.org/index.html>.

Following two FAO-sponsored expert missions to some selected RADISCON countries during 1997 and 1998, including Yemen, Jordan, Syria, Turkey, Egypt and Saudi Arabia, a report was published (38). The following observations, included in its summary, are still valid:

‘Passive disease reporting systems exist in all countries under study, being stronger and more carefully structured in Egypt and Turkey than in other countries. No one country appears to maintain databases in which data on past and current outbreak situations has been captured and could be easily examined.

‘The countries studied need to develop active surveillance mechanisms for all List A diseases. For instance annual surveys must be instituted to demonstrate where and at what level the causes of these diseases are circulating. This should be done under partnership arrangements with veterinary investigation laboratories.

‘The need for database creation/upgrading is strong to be able to follow the epidemiology of List A diseases within the region, RP and PPR being cases in point.’

Control of zoonoses and food-borne diseases in the countries of the Middle East

The control of zoonoses and food-borne diseases in most countries in the Middle East is delegated to different Public Services attached to the Ministries of Health, Agriculture, Commerce and Trade, and the Municipal and even the Port Authorities. Veterinary Public Health (VPH) Units, which should address zoonoses and public health hazards from foods of animal origin, are deficient in most countries, and in many cases do not exist within the national Veterinary Service. Although these Services are gradually being upgraded and strengthened, most of their resources are spent in controlling animal diseases. Many obstacles

hamper the efficient reorganisation of VPH activities. These include:

- the inherited colonial system of assigning VPH activities to other authorities (such as health inspectors), rather than to Veterinary Services
- confusion as to which authority should actually be responsible in a given field
- a lack of epidemiological studies and knowledge of the real extent of VPH problems
- lack of training
- inadequately staffed and poorly equipped Veterinary Services
- lack of public awareness.

Nonetheless, a few countries have made excellent progress in reorganising VPH activities and eradicating serious zoonoses. International organisations, such as the OIE, FAO and WHO, can help greatly in establishing efficient VPH programmes (10, 11, 12, 13, 40). In 2003, the Government of Saudi Arabia established an independent body which is solely responsible for the enforcement of food and drug legislation in this country.

In most countries of the Gulf, Municipal Authorities play a central role in food control management. The development of legislation on food is divided between the Quarantine Service and various Ministries.

This ‘multiple-agency model’ prevails in the Middle East. There is a tendency to focus on the consultation and collaboration processes when developing legislation. This approach is intended to improve efficiency, minimise duplication and identify gaps in public and animal health protection.

The multidisciplinary nature of any approach to controlling zoonoses and food-borne diseases is self-evident. It requires the co-operation of many professionals to develop, agree on and effectively implement a carefully formulated common vision, which encompasses their objectives for surveillance, early warning and preparedness.

Successful prevention and control of zoonoses and food-borne diseases also require public education, since the public must be aware of the risks posed to their health. Above all, it requires efficient and effective co-operation between the Veterinary, Medical, Public Health and other Government Services and non-governmental organisations. This is proven by the excellent results gained in controlling transboundary animal diseases and important zoonoses in Cyprus (6).

Contingency planning and rapid response

Contingency plans for existing transboundary animal diseases or those which may be introduced to the region should be developed on a regional basis. At present, such plans are non-existent. These diseases, even if introduced into only one country, constitute a continuing threat to livestock, public health and trade, and may have serious socio-economic consequences for the whole region. Such an event is unpredictable and may occur on a scale that nobody can anticipate. To cope with such difficult situations, Veterinary Services and all other available resources would have to be mobilised and stretched to their limits. To have any chance of success in controlling and eliminating a major epizootic, Veterinary Services must make timely and efficient preparations.

Developing the capacity required to respond rapidly to an animal health emergency is known as 'contingency planning'.

Contingency plans should be prepared for all transboundary diseases that exist in the region or its vicinity. Detailed arrangements for the management of a crisis should be worked out in advance, i.e.:

- describing the various co-ordinating committees
- identifying national and international expertise and infrastructure (laboratories, research institutes, reference centres, etc.)
- identifying the logistical resources available in different localities and regions (communications, transportation vehicles, etc.).

The involvement of external bodies (e.g. the police, army, etc.) should be foreseen in case there is a need to control animal transportations/movements through roadblocks or check-points. Risk analysis and assessment must be used to identify and prioritise all those diseases for which contingency plans should be designed.

As part of the contingency plan, the professionals concerned should identify those areas (such as quarantine measures, border controls, active disease surveillance and laboratory diagnostic capabilities) in which capabilities need to be strengthened. The timetable for implementing control measures might differ for each disease. The types of vaccines to be used must be decided and sufficient stocks maintained for use in case of an emergency.

Effective contingency planning requires more than just the advance preparation of written instructions and operating procedures. It must include animal and farm identification

systems. Managing the large-scale destruction of animals and disposal of carcasses and other contaminated material, with or without emergency mass vaccinations, within the shortest possible time poses a huge challenge to the competent authority. Pro-active public awareness programmes may prevent the expected criticisms and pressures from the public, livestock-owners and traders. Moreover, these systems should undergo constant review for continuous updating.

Simulation exercises should be regularly conducted to ensure that these contingency plans are fully understood by all public and private veterinarians, livestock-owners, traders, police, local authorities and other ancillary bodies, and will immediately be able to be implemented when needed.

Contingency plans should be concise and clear. They should provide legal backing and sufficient information to allow competent authorities to make the required decisions and implement all necessary measures. The format and contents of the contingency plan should be tailored to the specific requirements and circumstances of each country in the region.

The following model may serve as a guide for the general contents (i.e. chapter headings) of a contingency plan:

- description of the disease
- legal powers from existing legislation
- financial provisions for implementing the plan
- the National Disease Control Centre and chain of command
- international liaison
- expert groups
- local control centres
- sources of trained personnel for implementation of the plan
- equipment and supplies resources
- policy for the entire country
- disease control measures and procedures for each zone
- eradication or elimination of the disease
- criteria for defining infected areas and disease control
- measures applied in infected areas and other zones
- livestock destruction and disposal of carcasses
- cleaning and disinfection
- livestock valuation and compensation to farmers
- samples required for diagnosis
- diagnostic laboratories

- vaccines and vaccination schedules
- training personnel
- publicity.

Conclusion

The Middle East is extremely prone to the introduction of exotic epizootic disease and the spread of endemic infections and zoonotic diseases. Political instability adds to the graveness of the situation. The presence of dormant as well as active extremist elements, who may at some stage decide to use bioterror, increases the challenge confronting countries in the region. Early disease detection systems, the development and improvement of diagnostic

capabilities and the strengthening of veterinary field services are all needed. But the most urgently needed requirement is a radical improvement in animal health communication and co-ordination systems, both within countries – namely, between national headquarters and peripheral units – and among them. Achieving this change is crucial to controlling animal and zoonotic diseases in the Middle East, as well as in individual countries. Regional projects that target improving animal health communication and co-ordination systems, with the assistance of international organisations, are of the utmost importance. Ultimate success may be achieved only if these efforts are combined with local initiatives.



Prévention des maladies et préparation aux crises zoonosaires au Moyen-Orient

A. Shimshony & P. Economides

Résumé

La situation zoonosaire au Moyen-Orient est particulièrement défavorable puisque cette région est exposée à de nombreuses maladies animales graves. Le Moyen-Orient est mal préparé à l'instauration de mesures de prophylaxie et de contrôle des maladies, en raison de lacunes à l'échelle nationale et régionale. La détection, le diagnostic et la notification précoces des maladies doivent devenir des actions prioritaires au sein de ces pays et une communication efficace doit être maintenue entre eux. Les programmes zoonosaires régionaux et le soutien des institutions internationales sont essentiels à l'amélioration des plans d'intervention en cas de situation d'urgence d'origine naturelle ou suscitée par l'homme et susceptible de compromettre gravement la santé animale. Ces situations d'urgence peuvent aussi avoir un impact important sur des problèmes connexes de santé publique.

Mots-clés

Contrôle – Coopération régionale – Épidémiologie – Épizootie – Intervention d'urgence – Maladie émergente – Moyen-Orient – Prévention – Santé animale – Zoonose.



Prevención de enfermedades y preparación para emergencias zoonosarias en Oriente Medio

A. Shimshony & P. Economides

Resumen

En Oriente Medio la situación zoonosaria resulta especialmente delicada, pues la región está expuesta a muchas y graves enfermedades animales. Debido a las carencias de los países y de la zona en su conjunto, Oriente Medio está mal preparado para instituir medidas de prevención y control de enfermedades. Estos países deben dar prioridad a la detección, diagnóstico y notificación precoces de enfermedades e instaurar mecanismos eficaces de comunicación entre ellos. Los programas regionales de sanidad animal y el apoyo de las instituciones internacionales son dos elementos básicos para mejorar la preparación ante situaciones de emergencia de origen natural o antrópico, susceptibles de perjudicar gravemente la salud animal. Este tipo de emergencias, además, pueden tener importantes repercusiones en el terreno conexo de la salud pública.

Palabras clave

Control – Cooperación regional – Enfermedad emergente – Epidemiología – Epizootia – Oriente Medio – Preparación – Prevención – Sanidad animal – Zoonosis.



References

1. Abu Elzein E.M.E., Gameel A.A., Al-Afaleq A.I., Al-Gundi O., Al-Bashier A.M., Zeedan A., Al-Mageed H.A. & Abu Khadra H. (1999). – Observations on the recent epizootic of bovine ephemeral fever in Saudi Arabia. *Rev. sci. tech. Off. int. Epiz.*, **18** (3), 672-680.
2. Aidaros H.A. (2002). – Regional status and approaches to control and eradication of foot and mouth disease in the Middle East and North Africa. In *Foot and mouth disease: facing the new dilemmas* (G.R. Thomson, ed.). *Rev. sci. tech. Off. int. Epiz.*, **21** (3), 451-458.
3. Al-Ani F.K., El-Qaderi S., Hailat N.Q., Razziq R. & Al-Darraj A.M. (2004). – Human and animal brucellosis in Jordan between 1996 and 1998: a study. In *Emerging zoonoses and pathogens of public health concern* (L.J. King, ed.). *Rev. sci. tech. Off. int. Epiz.*, **23** (2), 831-840.
4. Alexander D.J. (2003). – Report on avian influenza in the Eastern Hemisphere during 1997-2002. *Avian Dis.*, **7** (3 Suppl.), 792-797.
5. Barbour E.K., Jurdi L.H., Talhouk R., Qatanani M., Eid A., Sakr W., Bouljihad M. & Spasojevic R. (1999). – Emergence of *Salmonella enteritidis* outbreaks in broiler chickens in the Lebanon: epidemiological markers and competitive exclusion control. *Rev. sci. tech. Off. int. Epiz.*, **18** (3), 710-718.
6. Economides P. (2000). – Control of zoonoses in Cyprus. *Rev. sci. tech. Off. int. Epiz.*, **19** (3), 725-734.
7. Economides P. & Christofi G. (2002). – Experience gained and evaluation of the echinococcosis/hydatidosis eradication programmes in Cyprus, 1971-1999. In *Cestode zoonoses, echinococcosis and cysticercosis: an emergent and global problem* (P. Craig & Z. Pawlowski, eds). NATO Science Series: series 1: life and behavioural sciences, Vol. 341. IOS Press, Amsterdam, 367-381.
8. El-Hicheri E. (1995). – Regional strategy for the control of animal diseases. In *Comprehensive reports on technical items presented to the International Committee or to Regional Commissions*. World Organisation for Animal Health (OIE), Paris, 155-177.
9. Fagbo S.F. (2004). – Rift Valley fever epidemic in Saudi Arabia: disconcerting epidemiological defects and lack of differential diagnoses and concordance in studies. *Clin. infect. Dis.*, **38** (10), 1503.
10. Food and Agriculture Organization (2004). – Food safety and international trade in the Near East Region: Proc. 27th Regional Conference for the Near East, Doha, Qatar, 13-17 March. FAO, Doha. Available at: <http://www.fao.org/docrep/meeting/007/J1653e.htm> (accessed on 21 October 2005).

11. Food and Agriculture Organization (FAO)/World Health Organization (2005). – Regional Meeting on Food Safety for the Near East, Amman, Jordan, 5-6 March. Final report (NEM/REP 1). FAO, Rome. Available at: ftp://ftp.fao.org/esn/food/meetings/NE_report_en.pdf (accessed on 21 October 2005).
12. Food and Agriculture Organization (FAO)/World Health Organization (WHO)/World Trade Organization (WTO) (2005). – Codex Coordinating Committee for the Near East Region, Proc. 3rd Session, Amman, Jordan, 7-10 March. FAO/WHO/WTO, Amman. Available at: <http://www.foodlaw.rdg.ac.uk/news/in-05012.htm> (accessed on 21 October 2005).
13. Gelders S. (2001). – Microbiological contamination of foods – current status and need for action. Presentation to the Agricultural Finance Corporation (AFC)/World Health Organization (WHO)/World Trade Organization (WTO) Inter-country Workshop on Emerging Food Safety Issues and Consumer Protection, Amman, Jordan, 28-30 October. AFC/WHO/WTO, Amman, Jordan.
14. Gerdes G.H. (2004). – Rift Valley fever. In *Emerging zoonoses and pathogens of public health concern* (L.J. King, ed.). *Rev. sci. tech. Off. int. Epiz.*, **23** (2), 613-623.
15. Hyslop N.S.G. (1970). – The epizootiology and epidemiology of foot and mouth disease (C.A. Brandly & C.E. Cornelius, eds). *Adv. vet. Sci. comp. Med.*, **14**, 261-307.
16. Istanbuluoglu E. (1993). – Foot and mouth disease: surveillance and control in the Middle East. In *Comprehensive reports on technical items presented to the International Committee or to Regional Commissions*. World Organisation for Animal Health (OIE), Paris, 137-142.
17. Karti S.S., Odabasi Z., Korten V., Yilmaz M., Sonmez M., Caylan R., Akdogan E., Eren N., Koksali I., Ovali E., Erickson B.R., Vincent M.J., Nichol S.T., Comer J.A., Rollin P.E. & Ksiazek T.G. (2004). – Crimean-Congo hemorrhagic fever in Turkey. *Emerg. infect. Dis.*, **10** (8), 1379-1384.
18. Kitching R.P. (2005). – Global epidemiology and prospects for control of foot-and-mouth disease. *Curr. Top. Microbiol. Immunol.*, **288**, 133-148.
19. Leforban Y. & Gerbier G. (2002). – Review of the status of foot and mouth disease and approach to control/eradication in Europe and Central Asia. In *Foot and mouth disease: facing the new dilemmas* (G.R. Thomson, ed.). *Rev. sci. tech. Off. int. Epiz.*, **21** (3), 477-492.
20. Malkinson M., Banet C., Machany S., Weisman Y., Frommer A. & Bock R. (1998). – Virus encephalomyelitis of geese: some properties of the viral isolate. *Isr. J. vet. Med.*, **53**, 44-45.
21. Malkinson M., Banet C., Weisman Y., Pokamunski S., King R., Drouet M.-T. & Deubel V. (2002). – Introduction of West Nile virus in the Middle East by migrating white storks. *Emerg. infect. Dis.*, **8** (4), 392-397.
22. Mathur S.C. (1993). – Rinderpest: surveillance and control in the Middle East. In *Comprehensive reports on technical items presented to the International Committee or to Regional Commissions*. World Organisation for Animal Health (OIE), Paris, 138-152.
23. Meegan J.M. (1981). – Rift Valley fever in Egypt: an overview of the epizootics in 1977 and 1978. *Contrib. Epidemiol. Biostat.*, **3**, 100-113.
24. Moussa A.M. (1993). – Rift Valley fever in Egypt. In *Proc. 97th Annual Meeting of the United States Animal Health Association (USAHA)*. Las Vegas, Nevada, 23-29 October. USAHA, Richmond, Virginia, United States of America, 244.
25. Murgue B., Zeller H. & Duebel V. (2002). – The ecology and epidemiology of West Nile virus in Africa, Europe and Asia. *Curr. Top. Microbiol. Immunol.*, **267**, 195-221.
26. Mutinelli F., Matarazzo P., Zoletto B. & Seimenis A. (2004). – Overview of the current rabies epidemiological situation in humans and animals in the Mediterranean and Middle East regions. Information circular, World Health Organization/Mediterranean Zoonoses Control Programme, No. 58, 4-8. Available at: http://www.mzcp-zoonoses.gr/pdfen/circ_58.pdf (accessed in February 2004).
27. Polydorou K. (1992). – Echinococcosis, hydatidosis: the problem and its control, case study, Cyprus. Polydorou, Nicosia, Cyprus.
28. Purse B.V., Baylis M., Tatem A.J., Rogers D.J., Mellor P.S., Van Ham M., Chizov-Ginzburg A. & Braverman Y. (2004). – Predicting the risk of bluetongue through time: climate models of temporal patterns of outbreaks in Israel. *Rev. sci. tech. Off. int. Epiz.*, **23** (3), 761-775.
29. Refai M. (2002). – Incidence and control of brucellosis in the Near East region. *Vet. Microbiol.*, **90** (1-4), 81-110.
30. Salem A.S. (1989). – Lumpy skin disease in Egypt. In *OIE Disease Information*, Vol. 2, No. 2. World Organisation for Animal Health (OIE), Paris.
31. Seimenis A. (2003). – Overview of the epidemiological situation of echinococcosis in the Mediterranean region. *Acta trop.*, **85** (2), 191-195.
32. Shimshony A. (1980). – An epizootic of Akabane disease in bovines, ovines and caprines in Israel, 1969-1970: epidemiological assessment. *Acta morphol. acad. sci. hung.*, **28** (1-2), 197-199.
33. Shimshony A. (1989). – Lumpy skin disease in Israel. In *Proc. 93rd Annual Meeting of the United States Animal Health Association (USAHA)*. Las Vegas, Nevada, 28 October-3 November. USAHA, Richmond, Virginia, United States of America, 334.
34. Shimshony A. (1999). – Disease prevention and preparedness in cases of animal health emergencies in the Middle East. In *Management of animal health emergencies* (G. Murray & P.M. Thornber, eds). *Rev. sci. tech. Off. int. Epiz.*, **18** (1), 66-75.

35. Shoemaker T., Boulianne C., Vincent M.J., Pezzanite L., Al-Qahtani M.M., Al-Mazrou Y., Khan A.S., Rollin P.E., Swanepoel R., Ksiazek T.G. & Nichol S.T. (2002). – Genetic analysis of viruses associated with emergence of Rift Valley fever in Saudi Arabia and Yemen, 2000-01. *Emerg. infect. Dis.*, **8** (12), 1415-1420.
36. Somel K. (1987). – Food and agriculture in West Asia and North Africa: projections to 2000. Monograph 128. International Centre for Agricultural Research in the Dry Areas, Aleppo, Syria, 2-15.
37. Steinman A., Banet C., Sutton G.A., Yadin H., Hadar S. & Brill A. (2002). – Clinical signs of West Nile virus encephalomyelitis in horses during the outbreak in Israel in 2000. *Vet. Rec.*, **151** (2), 47-49.
38. Taylor W.B. (1998). – Report on the functioning of national disease reporting systems in some selected RADISCON countries with emphasis on the epidemiology of rinderpest and peste des petits ruminants and their possible dissemination through livestock trade movements, 29 November-31 December 1997: Yemen, Eritrea, Ethiopia, Jordan, Syria, Turkey; 10 October-5 November 1998: Egypt, Saudi Arabia. Document GCP/REM/059/IFA. Food and Agriculture Organization, Rome. Available at: <http://www.fao.org/ag/AGA/AGAH/ID/Radiscon/radisconppr.pdf> (accessed on 1 October 2005).
39. Vos A. (2004). – Wildlife rabies control in the Middle East. Information circular No. 58, World Health Organization/Mediterranean Zoonoses Control Programme, 14-15. Available at: http://www.mzcp-zoonoses.gr/pdfen/circ_58.pdf (accessed in February 2004).
40. World Health Organization/Mediterranean Zoonoses Control Programme (1994/2004). – Information circulars No. 48 (August 1994), No. 59 (September 2004). Available at: <http://www.mzcp-zoonoses.gr/publications.htm> (accessed on in September 2004).
41. World Organisation for Animal Health (OIE) (2004). – Terrestrial Animal Health Code, 13th Ed. OIE, Paris.
42. Yeruham I., Braverman Y., Yadin H., Van Ham M., Chai D., Tiomkin D. & Frank D. (2002). – Epidemiological investigations of outbreaks of bovine ephemeral fever in Israel. *Vet. Rec.*, **151** (4), 117-121.
43. Zeller H. & Bouloy M. (2000). – Infections by viruses of the families Bunyaviridae and Filoviridae. In An update on zoonoses (P.-P. Pastoret, ed.). *Rev. sci. tech. Off. int. Epiz.*, **19** (1), 79-91.