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MEDITERRANEAN ZOONOSES CONTROL CENTRE CENTRE MEDITERRANEEN DE LUTTE CONTRE LES ZOONOSES

HUMAN and ANIMAL BRUCELLOSIS

Epidemiological Surveillance in the MZCP Countries

Report of a WHO/MZCP Workshop

Damascus, Syrian Arab Republic, 4 - 5 May 1998

Athens, 1999

The MZCP Report on the Third Workshop on Human and Animal Brucellosis Epidemiological Surveillance in the MZCP Countries

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1. INTRODUCTION

Brucellosis in humans and animals is known to be a worldwide problem and one of the most important among zoonoses in the Mediterranean region (MR). Although continuous progress is verified in brucellosis control, it still remains a major public health hazard and of great economic importance. This explains the ever-increasing concern in many countries.

The complexity of the epidemiology of brucellosis and the serious difficulties for effective control measures, arise from the involvement in the infection of the main producing domestic animals (bovines, sheep, goats, swine) and humans.

The epidemiological surveillance of human and animal brucellosis is among the methods considered as a high priority and of essential strategic importance for endemic and disease-free countries. Experience has proven that this system is one of the pillars upon which any monitoring control programme, irrespective of the country, should be based.

Moreover, essential tools for an organised control of zoonotic diseases in general and of brucellosis in particular are the efficient surveillance system at national level; the effective co-operation and information exchange between public health and veterinary sectors as well as regular co-operation between neighbouring countries and the entire MR.

This meeting, on Brucellosis Epidemiology and Surveillance in the MZCP Countries held in Damascus, Syria, 4-5 May 1998, is the third on the subject. In fact, during the first workshop in 1992, all recent, at that time, information was collected and presented on human and animal brucellosis, epidemiology, surveillance, diagnosis and control. A first attempt was then made to prepare prevention and control measures based on the epidemiological surveillance.

The second meeting, held in 1993, offered a deeper knowledge on the significance and importance of the epidemiological surveillance in the prevention, control and elimination of the disease.

Since then, various actions were carried out in accordance with the recommendations issued by the second meeting. The most important were:

a. The preparation of a questionnaire for basic data collection necessary for the establishment of a proposed Reference Information System on Human and Animal Brucellosis. The questionnaire was distributed to the Ministries of Health and Agriculture of all MZCP Member-States to complete and returned for evaluation.

b. Analysis and evaluation of data collected, was performed by the WHO Collaborating Centre on Research and Training on Veterinary Epidemiology and Management, Istituto Zooprofilattico Sperimentale, Teramo, Italy.

c. A round trip by two MZCP experts was carried out in selected MZCP countries. This contributed to the clarification of different aspects of the present epidemiological situation and the activities performed at national level towards the control of brucellosis.

In the present report, the most important issues dealt with during the third meeting are briefly presented. These include some general considerations on brucellosis epidemiological surveillance and an overview of the present epidemiological situation in the MR. Further, the analysis of the data collected through the questionnaire distributed for completion by the MZCP Member-countries and other relevant issues were tackled that contributed to the better understanding of core subjects of the meeting. They were the epidemiological surveillance of brucellosis that is important for prevention and control activities.

The conclusions and recommendations issued at the closure of the meeting lead to the understanding that much more work should be performed during the coming years for better results.

During the '90ies, the MZCP contributed considerably to emphasising the importance of the epidemiological surveillance of brucellosis, as well as organising laboratory diagnosis activities for physicians and veterinarians, etc. The material collected and the discussions made during

the three relevant workshops, as it is condensed in three respective reports, should become an incentive for the assessment of the present epidemiological situation on brucellosis in each MZCP-Member State and the promotion of activities aimed at effective control.

The WHO/MZCC expresses its deep appreciation to all persons who worked for the implementation of the three workshops on prevention and control of human and animal brucellosis in the Mediterranean region. In particular the following institutions are acknowledged:

- The WHO Collaborating Centre for Research and Training in Veterinary Epidemiology and Management, Istituto Zooprofilattico Sperimentale dell' Abruzzo e del Molise "G. Caporale", Teramo, Italy
- The WHO Collaborating Centre for Research and Training in Mediterranean Zoonoses, Laboratory of Clinical Bacteriology, Parasitology, Zoonoses and Geographical Medicine, Faculty of Medicine, University of Crete, Heraklion, Greece
- The MZCP/NPI Department of Microbiology, University of Navarra, Pamplona, Spain

Moreover, gratitude is expressed to the Ministry of Health, Syria for the hospitality offered and for implementing the present Workshop and the close assistance provided by Dr M. Zoukari, MZCP National Co-ordinator, Syria.

2. OPENING SESSION

In the opening session Dr. Seimenis, Director of the WHO/Mediterranean Zoonoses Control Centre, welcomed the participants on behalf of the new WHO Director General Dr. G.H. Brundtland. He conveyed the greetings of Dr. F.X. Meslin, Chief Zoonotic Diseases Unit /WHO/HQs and Secretary of the MZCP/Joint Co-ordinating Committee.

The following objectives of the workshop were recalled:

1. To review the present epidemiological situation on human and animal brucellosis in the MZCP countries.
2. To discuss the control activities on human and animal brucellosis implemented in the MZCP countries.
3. To discuss the basic structure of a national surveillance and information system for the prevention and control of human and animal brucellosis.
4. To stress the importance of the standardisation of laboratory techniques and reagents of the diagnosis of human and animal brucellosis.
5. To work on recommendations for measures for the improvement of the surveillance and reporting systems as well as the national activities on human and animal brucellosis.
6. To emphasise the importance of public health education and professionals' (educators') training in zoonoses prevention and control.

Dr M. Zoukari, National Co-ordinator of the MZCP for Syria was elected chairman and Dr. A. Minas, Greece, rapporteur.

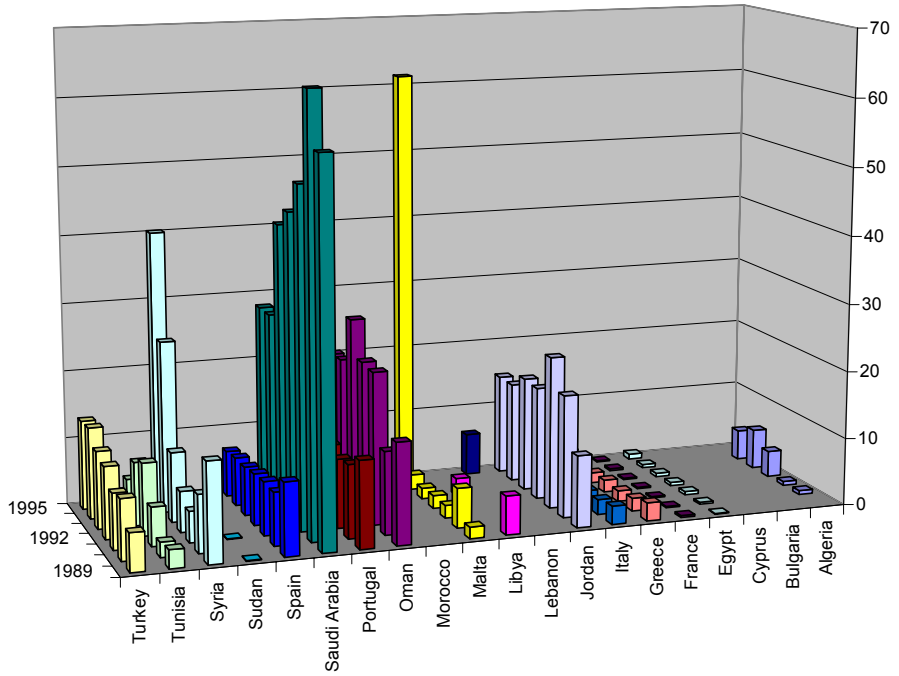
3. ANIMAL BRUCELLOSIS SURVEILLANCE AND CONTROL IN THE MEDITERRANEAN AND THE MIDDLE EAST COUNTRIES

Brucellosis, particularly *Brucella melitensis*, has been identified as the major zoonotic disease of public health importance in Mediterranean and Middle East regions. However, its prevention and control poses several problems to national authorities, particularly to the veterinary services.

Generally, the veterinary services recognise as first priority animal diseases listed in "List A"[1] of the Office international des Epizooties such as Foot-and-Mouth Disease, Rinderpest, etc. Brucellosis, along with other zoonotic diseases Echinococcosis/Hydatidosis, Leishmaniasis, Salmonellosis and Rabies is listed in "List B"[2]. Several "List A" diseases, however, are still present in some countries of this region and, therefore, brucellosis has sometimes been regarded as a second priority for control. As a consequence, not enough resources have been allocated for the implementation of brucellosis control programmes.

In those Mediterranean and Middle East countries where programmes have been implemented, several technical problems still pose a great challenge to their veterinary services, such as animal movement control and identification, vaccination coverage and the emergence of *B. melitensis* as a cattle pathogen. Brucellosis caused by *B. melitensis* in small ruminants is still endemic in some areas/regions of Southern Europe where *B. abortus* has been eliminated or is on the verge of elimination. Infrastructure weaknesses are also among major impediments to the effective prevention and control of the disease, which, therefore, remains endemic.

Graph 1: **Human brucellosis incidence rate x 100.000 inhabitants in various Mediterranean and Middle East Countries**



Graph 1 depicts the human brucellosis incidence cases in some Mediterranean and Middle East countries. The transmission of the disease and its incidence is also related to the intensity of the prevention activities in the human populations. However, the impact of preventive programmes, based on health education, milk and milk product hygiene, is jeopardised if animal control activities are not implemented or implemented only partially.

The international organisations responsible for animal and zoonotic diseases, i.e. FAO, WHO and OIE, in close collaboration with representatives of the veterinary services of several Middle East countries, have developed a general strategy for brucellosis control in this Region which is reported in Annex III.

For brucellosis control strategies to be adopted in a given country depends on a number of factors decisively influencing the actions to be adopted. Figure 1 depicts in simplified form the main points of a methodology to adopt in similar situations.

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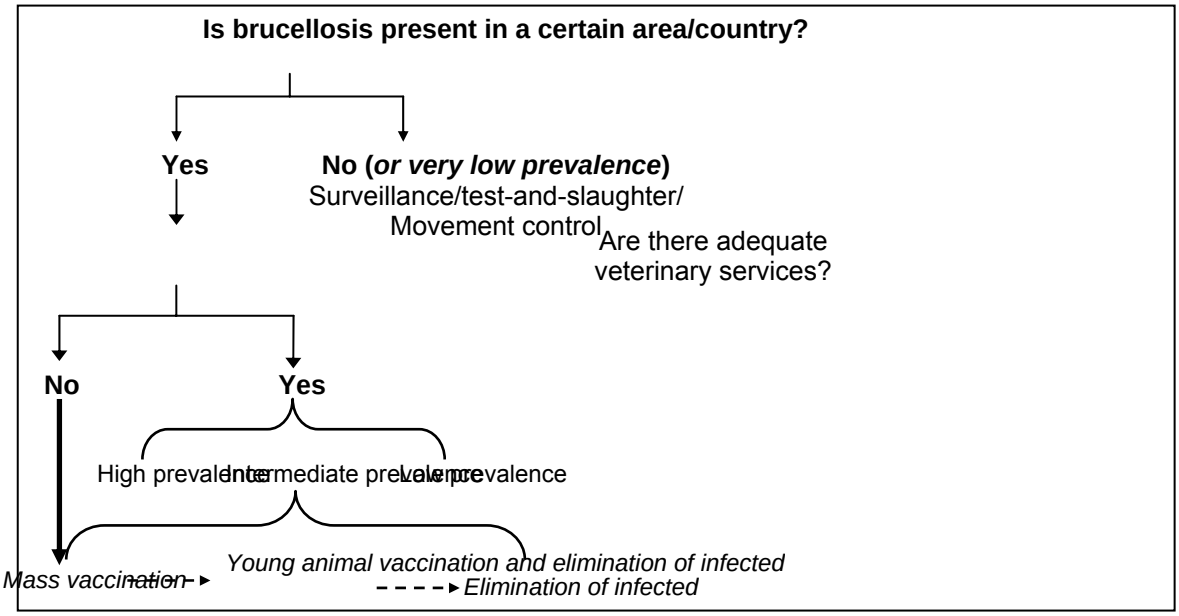
[1] Transmissible animal diseases, which have the potential for very serious and rapid spread, irrespective of national borders. These diseases have very serious socio-economic or public health consequences and are of major importance in the international trade of animals and animal products

[2] Transmissible animal diseases which are considered to be of socio-economic and/or public health importance within countries and which are significant in the international trade of animals and animal products.

Figure 1: **Decision chart for brucellosis control in animals**



Further, the table below summarises the advantages and disadvantages of alternative control strategies.

Advantages and Disadvantages for Brucellosis Control Strategies		
Strategy	**Advantages**	**Disadvantages**
Elimination of infected animals	❑ Elimination	❑ Higher cost ❑ Need for efficient veterinary services (animal identification, laboratory support, movement control)
Vaccination of young animals and elimination of the infected	❑ Minimise abortion ❑ Serological test differentiate infected/vaccinated	❑ Herd immunity slowly established
Mass vaccination	❑ Lower cost ❑ Easy to manage ❑ Herd immunity quickly established	❑ Abortions ❑ Serological test not able to differentiate infected/vaccinated (?) ❑ Public health (?)

The successful implementation of a national brucellosis surveillance, prevention and control programme requires strong intersectoral collaboration especially between the public health and veterinary sectors. It also requires sustained political commitment in order to assure that the necessary resources, human and financial, are made available for medium and long terms. International technical and scientific collaboration, harmonisation of surveillance and control strategies and regulation/legislation activities are also essential for the success of national brucellosis programmes.

4. HUMAN BRUCELLOSIS IN THE EASTERN MEDITERRANEAN REGION

Human brucellosis ranks as number-one priority zoonosis among Member States of the Eastern Mediterranean Region. For various reasons, data on human brucellosis in Afghanistan, Djibouti, Egypt, Kuwait, Libya, Morocco, Pakistan, Somalia, Sudan, Tunisia and Yemen are virtually non-existent.

The countries with the highest incidence of human brucellosis are Iran (29.8/100,000), Saudi Arabia (32.8/100,000), Syria (21.0/100,000), Jordan (20.4/100,000), Palestine (21.5/100,000) and Oman (16.6/100,000). Bahrain and Cyprus have reported zero incidence. In the rest of the countries, the incidence varies from 0.8/100,000 in Egypt to 9.0/100,000 in Tunisia.

Factors contributing to the morbidity of brucellosis in humans are close contact between human and animal populations, especially in rural areas and in work places as well as consumption of raw contaminated milk and its products (cheese, yoghurt, etc.).

Most cases of human brucellosis are caused by *B. melitensis*. However, *B. abortus* has been responsible for increasing number of cases in recent years. For example, *B. abortus* was identified in 45 cases and *B. melitensis* in 7 cases out of 330 cultures performed in Yemen in 1994-1995.

It is assessed that human brucellosis is greatly underreported in most countries due to lack or weak diagnosis and failures in the reporting systems. The results of sero-epidemiological surveys provide some indication of the actual situation of human brucellosis in some countries. In the majority of countries in the southern and eastern Mediterranean region and the Middle East, surveillance of human brucellosis is the responsibility of the Ministries of Health. Epidemiological surveillance is carried out at all levels of health services (local, regional, central). Human brucellosis is a notifiable disease in the majority of these countries. Routine and sentinel reporting systems are in operation, however, sources for data vary according to particular country. Reporting is done on a weekly, monthly or quarterly basis. Compilation and analysis of data are usually done at the provincial level and later sent to the Ministry of Health where data from all parts of the country are compiled, tabulated and distributed.

Surveillance systems in these aforementioned areas suffer from a number of weaknesses that, in turn, affect the diagnosis and reporting of brucellosis. Some of the constraints facing these systems are: lack of guidelines or poor follow up, lack of clear assignment of responsibilities, lack of standard case definition, weak participation of private health sector, weak laboratory support, shortage of trained personnel both in government and private sectors.

A training module on Communicable Disease Surveillance was prepared by WHO/EMRO. Its purpose is to assist public health officials in the region in setting up, managing and evaluating their surveillance activities.

5. EPIDEMIOLOGICAL SITUATION ON BRUCELLOSIS IN THE MZCP COUNTRIES

5.1 Cyprus

Cyprus has been virtually free of brucellosis since 1985, after a 13 years eradication campaign. However, there was an outbreak in a flock in 1993 and a second in 4 flocks in 1997. Both outbreaks occurred in villages along the buffer zone between Greek and Turkish territories. All infected animals in both cases were immediately slaughtered.

Surveillance for brucellosis, using serological testing, has been uninterrupted. In 1997, blood samples from 31.014 sheep and goats, and 1.617 cattle were tested; all were negative.

In addition to the blood sampling and testing of animals, the control of animal movements is an essential measure for maintaining the brucellosis free status in Cyprus.

Human brucellosis, a health problem among veterinary staff and farmers prior to the 1970s, is totally absent today due to the aforementioned eradication campaign and the close co-operation of veterinary and medical services

Cyprus is among the few countries in the world using successfully test and slaughter policy instead of vaccinations.

The Government controlled areas can be considered clean from brucellosis although there is some uncertainty due to the illegal introduction of animals. Therefore stricter measures are applied along the buffer zone in order to detect early disease foci before they are established.

5.2 Egypt

Brucellosis is endemic in Egypt, infecting cattle, buffaloes, sheep, goats, camels, pigs, horses, donkeys and mules. *B. melitensis*, *B. suis* and *B. abortus* are responsible for the

infections. The introduction into the country of foreign cattle breeds in recent years to increase milk production resulted in a raise in the incidence of the disease. It is also suspected that equine brucellosis may be a potential source of infection for man and other animals. A serological survey of equines, in a random sample, showed 20.61% of donkeys, 5.88% of horses, and 71.42% of mules to be positive for brucellosis infection.

The control programme, based on test-and-slaughter policy as well as vaccination of young animals is limited to cattle, buffaloes, sheep and goats. Research activities were recently implemented with regard to camels and swine.

Among cattle, all females over 6 months and the valuable bulls are serologically tested every 6 months. The confirmed cases either positive or suspicious are slaughtered and the local veterinary authorities compensate the owners. Infected farms or herds are quarantined and disinfected periodically, tested every 21 days and after 3 successive negative results are declared free of the disease.

Calves, lambs and kids are serologically tested before vaccination. The healthy cattle and buffalo calves 3-7 month old are vaccinated with S19 and the healthy kids and lambs of 3-6 month old are immunised with Rev1 vaccine. Testing of the vaccinated animals is performed before service or insemination and when reactors are isolated, are slaughtered and compensated.

Recording of brucellosis patients is almost restricted to the governmental hospitals because the private health centres, clinics and hospitals lack the laboratories for the correct diagnosis of the disease. The incidence rate in 1997 was 1.5/100.000 population.

The annual economic losses attributed to the disease, were approximately US$ 7 million.

5.3 Greece

The bovine brucellosis eradication campaign, based on test-and-slaughter policy, started in 1975. It is estimated that at the present time there are some 573 thousands bovines in 37,531 herds in the 54 prefectures of the country. Twenty-five prefectures are declared free of the disease since no cases have been reported in the past 3 years. In 1997, an eradication campaign started in the remaining 27 prefectures.

Sheep and goat husbandry is an important part of livestock raising. Greece is one of the five member states of the European Union (EU) in which great number of sheep and goats are reared and has the greatest goat population (approximately 5.000.000 animals) among the countries of the EU.

Brucellosis has been a major problem in sheep and goats causing great economic losses and potential threat to public health. In 1975, a vaccination programme of lambs and kids started with favourable results. The vaccination ceased in some parts of the country in 1990 and in the entire country in 1993. Since then, an eradication campaign has been implemented.

Due to many factors, the targets of this campaign were not achieved, which caused the incidence and prevalence of brucellosis to increase again. Following the evaluation of the current situation the veterinary services adopted a new plan of action that included vaccination of the whole sheep and goat population. This was done by entraoccular administration in the areas of high incidence and prevalence rates of the infection. This policy aims at restricting, as rapidly as possible, the extension of the infection. The campaign is expected to continue for at least three years before starting the vaccination of young animals only.

The incidence of human brucellosis in Greece was high 25 years ago. After the implementation of vaccination campaign in sheep and goat flocks, the incidence reached a low level in 1993. However, it started to climb again after the vaccination had ceased and the eradication campaign was only partly successful. According to the officially reported cases in 1997, the incidence of the disease was 3,6/100.000 population.

5.4 Lebanon

Brucellosis is a major problem in public health and livestock productivity in Lebanon. Three screenings for brucellosis, carried out in 1989, 1996 and 1997, demonstrated an average of 10% positive reactors in cattle, sheep and goats. In 1996, a national surveillance programme (RADISCON) developed by FAO was created and some progress has been made in assessing the real incidence of brucellosis. Additionally, a brucellosis control programme, by means of vaccination, is being implemented targeting young animals (4-8 months old) for the next 10 years; however, many obstacles must be overcome and many steps must be taken to make the vaccination programme successful.

As to human brucellosis, hundreds of cases are reported annually. The overall incidence of human brucellosis was 10.8/100,000 population in 1997. The highest incidence was in Bekaa region. Most human cases are attributed to the consumption of green cheese made from goat raw milk, and yoghurt.

5.5 Saudi Arabia

Brucellosis is one of the most important zoonoses in Saudi Arabia, a country with 10 million sheep, 6 million goats, 300,000 cattle and 400,000 camels. The disease is caused by *B melitensis* biotype 2. In 1990, the Ministry of Agriculture initiated a national brucellosis control programme encompassing all regions of the kingdom. The programme was based on massive vaccination with the REV-1 vaccine. Between 1990 and 1997, were vaccinated 237,867 cattle, 773,373 camels, 9,396,701 goats, 17,445,814 sheep. To discontinue importation of the REV-1 vaccine, the government has built a laboratory to produce the vaccine locally; its operation now awaits the needed equipment, instruments, materials and biologicals.

5.6 Spain

Control and eradication of brucellosis in livestock started with a pilot programme in La Rioja in 1988. It was based on vaccination of young animals, diagnosis/slaughter/compensation of sero-positive animals, health education and legal actions at the consumer, stockbreeding and dairy production levels, research, national and international co-ordination on epidemiological information and laboratory diagnoses. Since then, it is implemented every year a "Livestock Sanitation Campaign".

A national bovine and ovine brucellosis control and eradication programme for the years 1995 to 1997, submitted to EU for financial support, was approved by the Decision 90/424/EEC.

The incidence rate of human brucellosis showed a steady decline from 20.7/1000,000 in 1985 to 4.73/100,000 in 1997.

5.7 Syria

Brucellosis is an endemic zoonosis in Syria, affecting large numbers of animals and increasing number of cases in humans. In 1993, the reported number of human cases was 1391, climbing steadily thereafter and reaching 6,991 in 1997.

A brucellosis survey in a random animal sample in l989, using the Rose Bengal and CF tests, showed positive reactors 2.86% in cows (12,554 tested), 1.81% in sheep and goats (26,755 tested) and 7.83% in rural cows in the Damascus area (1827 tested).

A national plan of brucellosis control, based on vaccination with the S 19 and REV-1 strains, was drafted in 1995. The full implementation of this plan was expected to last 15 to 20 years, divided into 3 to 4 stages of 5 years each. Strategy and operational details of the plan were discussed in 1997 and 1998 with consultants from FAO but no funds have been allocated to initiate the plan as yet. Currently, brucellosis control includes standard preventive measures, such as quarantine, milk thermal treatment (boiling, pasteurisation), proper disposal of abortion materials (foetuses, placentas), inspection of slaughterhouses, etc.

5.8 Turkey

A national brucellosis control and eradication plan was initiated in Turkey in 1984 with 26 years projected time span. The plan specifies vaccination of all female calves of 4-8 months old with *B. abortus* S-19 strain, and vaccination of lambs and kids with *B. melitensis* REV-1 strain.

The sero-prevalence of brucellosis was 3.56% and 1.26% in cattle and sheep/goats, respectively in 1989. The corresponding rates were respectively 1.2% and 2.08% in 1990, and 1.01% and 1.83% in 1991. A new sero-survey for brucellosis has been funded by the World Bank ($100,000) starting in 1997 and 1999 as final year. According to this plan, blood samples, randomly collected, from 36,000 cattle and 32,000 sheep will be tested using the RBPT and CFT techniques.

The incidence of human brucellosis is not well-defined in Turkey. Human cases have followed a steady increase from 3.03/100,000 population in 1986 to 15.11/100,000 in 1996. It is believed that this increase is probably due to improved surveillance and diagnosis as well as better reporting.

6. GENERAL CONSIDERATIONS ON THE EPIDEMIOLOGICAL SURVEILLANCE AND CONTROL OF BRUCELLOSIS

The world-wide decrease of financial resources available for health services has induced considerable changes in the management of health systems and programmes. A general optimisation of the use of human, financial and structural resources has occurred, although numerous instances of decrease in the amount and quality of services delivered have also occurred. The optimisation of resource usage needs a new approach in the organisation and delivering of services, based on a precise planning of activities, a continuous evaluation of activities performed and their achievements, and a continuous justification of expenses to decision makers. The latter aspect is particularly important in the case of zoonoses, where the advantages of control activities may be less evident than in the case of other animal diseases whose occurrence is characterised by heavy economical losses. The health administration of almost all countries benefit from the control activities for zoonoses in animal, while the financial responsibility lies with agricultural administration of that country. In any case, the need for detailed and precise quantitative information on human and animal populations; and the organisation and activities of Veterinary and Health Services have become crucially important to acquire and use the resources necessary to face zoonoses. In other words, the implementation of effective surveillance systems based on a strict collaboration between veterinary and health services is a prerequisite for any successful control activity against these diseases.

Epidemiological surveillance

Epidemiological surveillance is defined in many different ways. For the purpose of its use in Veterinary Public Health management, a definition that appears functional to describe its function is: *the use of epidemiology to single out, plan, manage, and evaluate the important services for the health status of a population (i.e. prevention, control and treatment)*. This definition of surveillance is based on the work of Alexander Langmir of the Centers for Disease Control, Atlanta, USA during the fifties.

The main purpose of a surveillance system is to determine the need for immediate or longer range actions in response to diseases and to provide information to optimise the use of the resources available through data analysis, determination of priorities, design of alternative actions, and determination of their likely costs and benefits. Epidemiological surveillance, therefore, in its modern sense is *not only* passive disease reporting, or comprehensive disease monitoring with the objectives of ascertaining the existence, the spatial and temporal distributions and the frequency.

The approach based on epidemiological surveillance increases the efficiency of actions and the ability of focusing on problems as well as increasing the probability of finding adequate solutions. A surveillance system must be modulated in relation to the strategies chosen to cope

with the specific health problems. Data collected, data sources, evaluation criteria, the duration of efforts will depend on the objectives of actions.

On the basis of its very definition, therefore, surveillance does not exist *per se*. Surveillance is designed according to the specific health problem, to the goals to be pursued, to the activities to be implemented in response to certain health conditions in the population of interest. The first step in the implementation of settlement of a surveillance system is the definition of the strategic objective and of an intervention programme.

The establishment of the strategic objective consists in the choice of one of the possible general strategies against a disease condition. In particular, in zoonoses, the most common strategies are focused on the prevention of human infection and on either the control of the disease or the eradication of the infection in the animal populations.

The prevention of human infection is pursued by measures designed to reduce the risk of transmission of the infection from animal reservoirs to human beings. This can be achieved by:

- direct measures targeted to interrupt the infection cycle by inactivating the pathogenic power of the agent (i.e. milk pasteurisation for brucellosis or tuberculosis, proper disposal of infected organs for hydatidosis);
- indirect measures targeted to increase the resistance of human being by vaccination;
- indirect measure targeted to change behaviours at risk of target categories and/or general population such as health education and/or information.

Control

Control of the disease is pursued by measures designed to reduce the disease occurrence in populations. Control is accomplished by reducing or eliminating the causes of illnesses, ultimately to levels of little or no consequence. Aim of a control programme is to reduce the impact of a disease on human health and economy of a region. Elimination of the agent from host populations is not the objective of control programmes and it is implicit that some “accepted” level of infection will remain in the population. Control programmes have an indefinite duration and will have to be kept going even after the accepted level of infection has been reached so that the disease level is kept constant. The acquisition of resources to implement control measures and the maintenance of the control measure after reaching low level of disease occurrence becomes more and more difficult with time.

Eradication

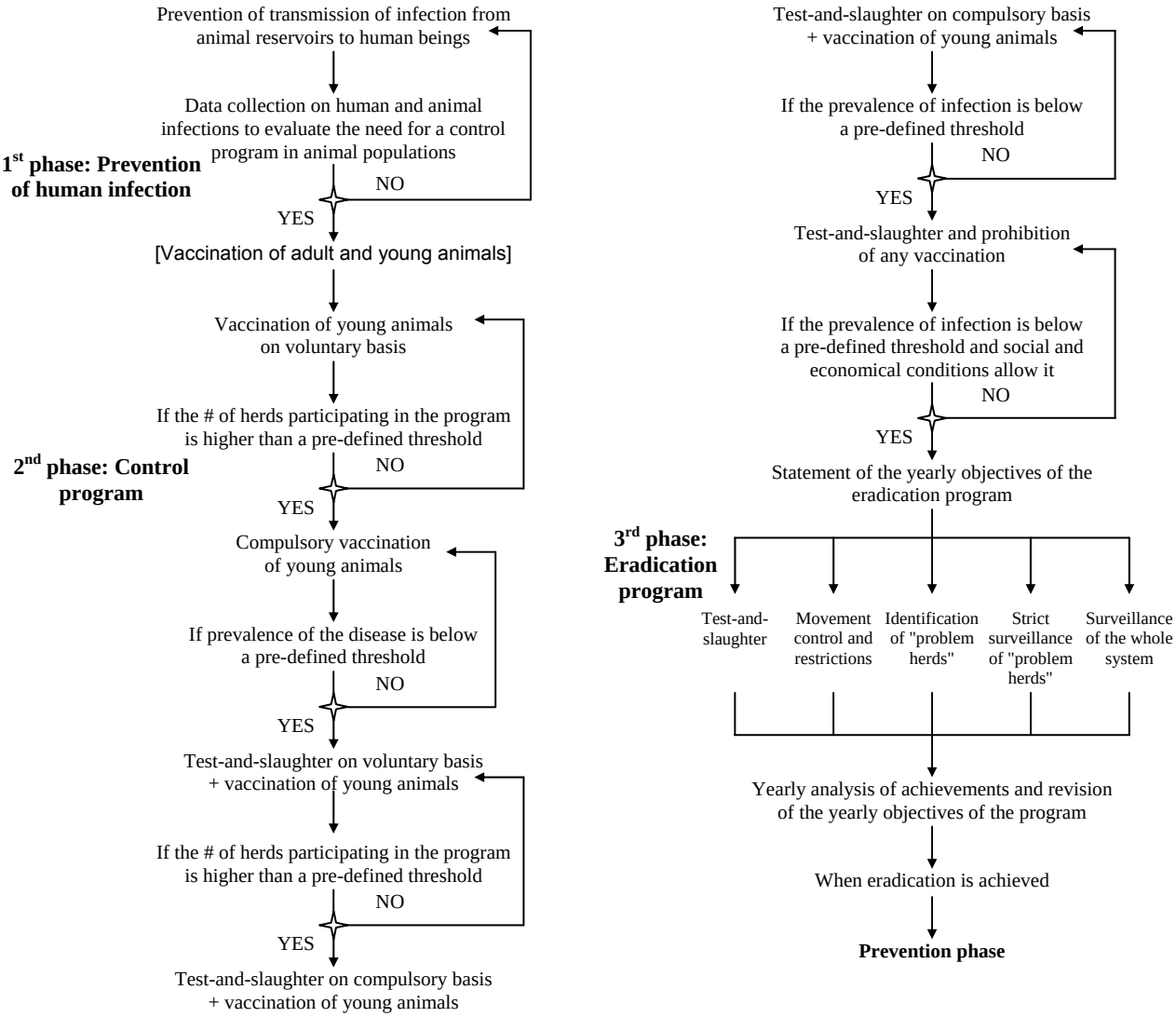
Eradication of an infection implies the disappearance of the infectious agent from a given territory. A highly organised effort is needed to reach the goal of eradication in either a territory and in a population. Eradication is conceptually very different from control: it is neither a casual nor an automatic consequence of a control programme, no matter how well planned and implemented the control programme is. It is based on sanitary measures and an organisation of activities completely different from those implemented for a control programme. Crucial factors for the success of an eradication programme are the implementation of an effective surveillance system and the understanding and sharing of objectives for eradication by the decision-makers, farmers, etc.

To keep an unaffected population free from an infection, **prevention** measures must be implemented to segregate an infectious organism from a geographical area and its human and animal populations. The strategies described are not mutually exclusive, on the contrary they can be arranged in a cascade as can be seen in diagram 1 in relation to brucellosis.

On the long-term basis, eradication programmes in general are more economically advantageous compared to control programmes, if examined. This theoretical advantage, however, can not always be translated into practice. In fact, an eradication programme involves the mobilisation of an amount of resources (in terms of financial and human resources) that may not be available or whose mortgage may require a time span longer than it is affordable by any decision-making authority. The cost/benefit of decisions in relation to the zoonosis' control

strategies in terms of economical, social and political consequences, therefore, must be analysed in depth. There is little doubt that no in depth analysis is possible in absence of epidemiological surveillance. There is also little doubt that very often failures of control and eradication efforts are due to the absence of an adequate epidemiological surveillance system sustaining both technical and political decision making.

Diagram 1: <u>Steps to achieve the eradication of brucellosis</u>



<u>Components</u>

The structure of surveillance systems and the relationships among the various components depend on the objectives of the system, the function and the mandate of the various subjects involved in the implementation of the system itself, as well as the epidemiological conditions in which the system runs.

A surveillance system can and should be planned as an organisation made up of institutions, facilities, activities and procedures with the mission of collecting, analysing, transferring and diffusing information for planning, managing and evaluating activities in a given field, sector, service, etc.

To be more specific and taking brucellosis as a model, the components of the surveillance system are:

- **Sanitary status of the target population of the surveillance plan**: definition of cases, outbreaks (infection, disease, herds, flocks, animals, humans, etc.).

- **Institutions involved in the system**: local regional and central Veterinary Services, local, regional and central Public Health Services, laboratories, data processing centres and epidemiological centres;
- **Facilities used by the system**: all physical resources used for the performing and monitoring of activities, such as vehicles, computers, archives, etc.;
- **Activities exploited for the passive collection of brucellosis-related data**: herd visits for animal vaccination or testing, serological and bacteriological examinations, etc.;
- **Procedures for data collection and processing**: filling of data forms, procedures for active collection of data, procedures for data storage, validation, analysis and transfer, procedures for data diffusion and divulgation.

Since the collection and management of information is a costly activity, only the resources really needed to the running of the system should be mobilised; only the minimal set of information needed should be collected; and only the most suitable routinely performed activities should be used to collect information.

Inputs

Two main ways exist to supply a surveillance system with information: passive or active collection of data. The two ways are not interchangeable although they are certainly complementary. Each one generates information with different levels of precision, and with different advantages and disadvantages.

In the case of passive collection of information, data supply the system as a consequence of current activities. The advantages of passive collection are its low cost and the relative easiness of data collection. The disadvantages are that the sensitivity and specificity of the system are often unknown, and periodic assessment of the system performance is needed. In general passive collection is the main source of data for surveillance in highly organised health and veterinary system.

In case of active collection, data are actively sought and gathered on the basis of a specific dedicated programme. The advantage of active collection is that performance of the system is measurable and pre-determinable while the main disadvantage is the need of dedicated resources. Active collection is suitable for *ad hoc* surveys, to evaluate the performance of passive collection of data, to carry out pilot trials to evaluate if an emergent phenomenon deserves the implementation of a routine system of data collection. *Ad hoc* surveys are often the only possible way of collecting surveillance data when veterinary and health services do not have strong infrastructure.

The main sources of passively collected data are:

- peripheral public health services
- peripheral veterinary services
- hospitals
- veterinary laboratories
- border health services
- border veterinary services
- Ministry of environment and its peripheral structures
- international organisations (WHO, FAO, OIE, EE, etc.)

Other sources of data include clinics, physicians, veterinary practitioners, and universities. The laboratory is the main source of zoonosis data, sometimes the only one especially when most zoonosis are diagnosed by the results obtained in the laboratories is taken into consideration. The information generated by the laboratories diagnostic activities do not represent the sanitary situation of the territory, because of the possible biases linked to the ways and the reasons for the sample drawing and its dispatching to the laboratory. Nevertheless, laboratories have a central role in data/information generation and without them a constant

monitoring of animal health status for disease prevention and control cannot be carried out.

Shortcoming in the use of data from different sources is their possible redundancy and the confusing effect of different data from different sources on the same item. A close co-operation between Veterinary and Public Health Services in order to have comparable and integrated data is, therefore, mandatory already at the planning stage whenever a surveillance system is to be implemented. Co-operation is, furthermore, necessary to avoid misunderstanding on the semantic value of information, cases and outbreak definitions, as an example, must be defined by two services. Information exchange between the two services should be extended from the peripheral to the central level in relation to the different information needs.

In particular, at the peripheral level a rapid and effective data exchange is essential in order to manage emergencies (i.e. to perform outbreak investigation, to trace back the source of an infection). While at the central level there is the need for aggregated and integrated information in order to evaluate activities accurately.

Processing and analysis of data

Information collected at field level, before being stored in archives, sent to higher level or used for analysis must be validated. **Validation** of information has two components, the validation of the specific data collected and stored in archives, and an evaluation of the performance of the overall system of data collection. One of the most important step in data validation is to verify their congruence either by automatic procedures or by the operator/s experience.

The last step in the processing of information is **analysis**. The aim of the analysis of data is to identify and quantify the needs of health activities and to evaluate their delivery. The analysis of the information phase, therefore, is simultaneous with the evaluation of the achievements of both the action under surveillance and the surveillance system itself. A general model of evaluation does not exist. It must be derived from the decision and management method adopted within the system. The tools that can be used vary; a system of indicators is one of the most popular tool in use. Aspects of the system to be evaluated are:

Progress: concerns the monitoring and permanent operative control of the advancement status of programmes in relation to planning; the identification of the reasons for success/failures; and the possible actions to correct programmes and/or operations if unsatisfactory.

Impact: expresses the overall effect of a programme, a service, and an institution upon the population sanitary and social-economic status.

Adequacy: concerns the level of definition of a problem and that of the programme finalised to its solution.

Efficiency: expresses the relationship between results and human financial, technological, temporal resources used. Its scope is to verify that programmes are carried out using as little resources as possible. It can be expressed as cost-benefit ratio.

Efficacy: expresses the gap between objectives and achievements of the programme, services and institutions. Quantitative indicators should be used. Evaluation of customer satisfaction should always be taken into account.

Pertinence: concerns the reasons leading to the adoption, modifications, termination of policies, programmes, activities, services, institutions in relation to satisfying real need in terms of sanitary, social and economical priorities.

Outputs

Surveillance systems output should:

- allow decision-makers to decide if a disease is a major problem;
- allow decision-makers to determine the dynamic of disease/infection occurrence and the relative efficiency and efficacy of resources used for their control;

- give to decision-makers an early warning on new events that are potential problems.

Information output should also be directed toward the peripheral collectors of data. A major shortcoming in surveillance systems is that veterinarians or physicians who are asked to perform extra work quickly lose motivation since they see no obvious benefits. There are many examples of continuous disease monitoring programmes that have failed in various parts of the world for this reason.

The output for decision-makers must be finalised to provide tools to make decisions on the most proper health policies to be adopted given the resources available. In general these outputs are in the form of technical reports on health conditions, resources available and their use and the results obtained.

The output for intermediate and central level technical people varies considerably according to the user:

a) technical reports;
b) early communications of new or emergency events;
c) periodical reports of health status of animal populations (including both raw data and conclusions of the analysis of information);
d) periodic reports of activities performed (including both raw data and conclusions of the analysis of information).

For field operators, various possible forms exist:

a) bulletins
b) newsletters
c) information on telecom line.

It is important to stress that in order to help decision-making processes, the information/data must be transmitted in the shortest time possible and the transmission periodicity must be strictly observed. The reporting automation allows to i) satisfy the needs for rapid and periodic transmission ii) increase the capability of information diffusion and exchange (e.g. Internet) iii) exchange big number of information at very low costs.

Surveillance of human brucellosis

Humans are not the reservoir of brucellosis; rather human infections are the end result of animal infections. Therefore any measure of prevention of brucellosis in man has no influence on the presence of the infection in a defined territory.

Nevertheless, the surveillance of human brucellosis is an important topic in the management of brucellosis control/eradication programmes. In fact the incidence of human brucellosis is a good index of the presence of infection in animal populations. In Italy, for example, 99% of *Brucella* strains isolated from humans during the period 1981-1990 belonged to *B. melitensis* biovar 2. The level of flock control and testing during the same period was variable in the different regions and if one compares the distribution of mean incidences in humans and small ruminants, the percentage of tested flocks and the public resource investment for brucellosis prophylaxis in the various regions, one can appreciate that the incidence in human brucellosis is a better index of the presence of infection than the incidence of animal brucellosis.

In general terms, humans can be considered as a good sentinel of the infection in animal populations in all cases in which a reduced or variable degree of animal testing is performed, but some caution is required:

- the strains isolated in animal and human populations should be identified; for example, in the above described case, incidence of brucellosis in humans was a good index of the degree of infection of small ruminants, not in cattle;
- short term variations in the human incidence of brucellosis (e.g. seasonally, epidemic peaks) are not the expression of analogous short term variations of incidence in the reservoir populations, but rather the consequence of external factors. Seasonally is usually the factor

related to the consumption of fresh cheese immediately after the lambing season (late spring - early summer)

7. CRITICAL ISSUES IN DESIGNING AND EVALUATING A SURVEILLANCE SYSTEM

Epidemiological surveillance is the ongoing and systematic collection, analysis, and interpretation of health data in the process of describing and monitoring health events in populations. Some of the major uses of this information are:

- quantitative estimates of the magnitude of a health problem,
- detection of epidemics,
- methods evaluating the transmission and the sources of infection,
- distribution of health events in space and over time,
- recommending and evaluating method for control and prevention, etc.

Given the potential uses of data and information of surveillance, the next step is to decide how to develop a system that meets the essentials of all participants and not just the ultimate decision-makers.

Because surveillance systems vary widely in methodology, scope and objectives, what is important in one system may be much less important in another. In designing the system, a balance should be sought so this system can be flexible. The motto should be "*adapt not adopt*."

As previously referred to, a distinction is made between **passive** and **active** surveillance systems. A passive system is one in which a health or veterinary department receives disease reports as mandated by regulation. In contrast, an active system is established when departments regularly contact reporting sources to elicit information including negative reports. Active systems tend to be more action oriented.

There are ten basic steps in designing any surveillance system:

1. Importance of the health event:

   Surveillance should be outcome-oriented. We should be concerned with specific epidemiological indices such as the total number of cases, rates-incidence and prevalence, and also some indication of severity such as the case-fatality rate or productive days of work lost. Also, the costs whether medical or veterinary as well as the preventability of the event should be considered. It is important to distinguish between "*nice to know"* data and these that we truly "*need to know"* to make the system work.

2. Establish clearly defined objectives.

   The objectives should include such as how to reduce the incidence, detect epidemics early, identify vehicles involved in transmission, identify individual and population risk factors, monitor short and long term trends in occurrence over time and space, establish zoonotic links to infected herd/flocks and so on.

3. Develop specific case definitions.

   In recent years more emphasis has been placed on having a set of criteria on which either suspect or confirmed cases of the disease are clearly defined. These may be for the individual person or animal or in the veterinary epidemiology herd or flock. A distinction should be made between clinical diagnoses and laboratory confirmed cases. Abortion in livestock, for example, is multi-causal and can be unreliable as an indicator of *Brucella* status. In veterinary epidemiology the primary unit of interest in disease control is the group of animals that commingle whether it is a herd, a group of transhumant flocks or a village.

4. Identify existing data sources or develop new data collection systems.

Always carefully evaluate existing data sources before developing a new system. The following questions should be answered in designing a new system:

a) Will the system be based on the total population at risk, sample-based or sentinel-based?

b) What is the period of time of the data collection; will it be open-ended?

c) What information will be collected?

d) Who provides the surveillance information and what is the source of the data?

e) How is the information transferred and stored?

f) Who analyses the data, how, and how often?

g) What is the format of the reports and how often are they disseminated?

h) To whom and how often are the reports distributed?

5. Pilot-test (the methods in the field).

Any system involving the participation of many individuals is bound to have some errors or other difficulties. Therefore, always pre-test questionnaires, other data collection instruments and computer programmes are needed, prior to incorporation in a major surveillance system. Veterinary data collection poses real challenges, especially where animal or herd identification is absent, flocks/herds commingle, move periodically, or the owners are uncooperative.

6. Integration of surveillance information through intersectoral collaboration.

Most national, regional and international public and animal health surveillance programmes are very dependent on having good collaboration at all levels. This includes the central, provincial, and district or local levels. Communication and collaboration between veterinarians and physicians have been sometime less than optimal. Regular meetings and electronic communication between these two groups are desirable. Regular feedback of reports to all of those who contributed data, is imperative if *momentum* and long-term co-operation is to be maintained.

7. Evaluate the validity of the system.

Whether a system relies on paper only, or is computerised, there are always many opportunities for errors to occur. Ideally, there should be careful documentation of the system together with a formal training programme. It is recommended to check 10% of case reports regularly for errors and especially missing data. The completeness and timeliness of all case reports in the surveillance system should be assessed regularly. If a major problem is detected corrective action to prevent its reoccurrence is needed.

8. Analysing and interpreting surveillance data.

Information generated from aggregated surveillance data enables epidemiologists to describe health and disease problems in terms of the basic parameters of time, space and person/animal or population data. If current census data is available, both crude and specific rates can also be calculated. To make the data more understandable, a set of techniques can be applied, such as transforming the data to simplify their distribution, using visual displays, etc. A wide range of graphics and maps are now available via computers to produce clear summaries of data sets. The real art of conducting surveillance lies in interpreting what the data appears to show. Data need to be interpreted in the context of our understanding of the natural history and epidemiology of the disease. By proceeding from the simple to the complex, investigators can use surveillance as a basis for taking appropriate actions. Epidemics can be recognised, preventive strategies applied, and the effects of such actions can be assessed. Always should be kept in mind that because surveillance data is primarily descriptive, correlation

does not equal causation. It is axiomatic that, particularly with large data base, statistical help should be sought in the design stages especially with regard to sampling issues.

9. Develop dissemination methods for those with a "*need to know*".'

Any surveillance programme runs the risk of becoming a 'data morgue' if either it is not summarised and analysed regularly or the results are not communicated rapidly to those charged with making decisions based on recommendations from epidemiologists. In addition, it is critical to provide regular brief reports to those responsible for data generation in the field, physicians or veterinarians. This can be a simple newsletter posted or faxed or using electronic communication. The judicious use of the media by way of news releases, news conferences, fact sheets and videos can be powerful weapons in communication information to the public in general or target groups such as livestock producers.

10. Develop evaluation mechanisms.

Evaluations can be done periodically, e.g. yearly or can be ongoing. A combination is probably desirable. The following are the major characteristics of a surveillance system that should be reviewed:

a) **Usefulness**: A surveillance system is useful if it contributes to the prevention and control of adverse health events and improves our understanding of the human and animal health.

b) **Simplicity**: Surveillance systems should be as simple as possible while they are still meeting their objectives.

c) **Flexibility**: A flexible surveillance system can adapt to changing information needs or operating conditions with little added costs in time, personnel or funds.

d) **Acceptability**: This reflects the willingness of individuals and organisations to participate in the surveillance system. Veterinarians need to be imaginative in how they seek collaboration from livestock owners on a regular basis.

e) **Sensitivity**: The sensitivity of a system can be evaluated by its ability to detect the proportion of cases or epidemics. A system does not necessarily have to have a high sensitivity as long as it remains fairly constant.

f) **Predictive value positive**: It is the proportion of persons, animals, or herds identified as actually having the condition under surveillance.

g) **Representativeness**: In order to generalise findings from surveillance data to the population at large the data from the surveillance system should reflect the population characteristics that are important to the goals and objectives of the system. These characteristics generally relate to time, place and the individual. An important result of evaluating representativeness is the identification of population subgroups that may have been systematically excluded from the reporting system.

h) **Timeliness**: This reflects the speed or delay between the various steps in the surveillance system as well as the time required for the identification of trends, outbreaks, or the effects of control measures.

i) **Resources for system operation**: These include both personnel, travel, training, supplies, equipment, etc. Obviously, these need to be adequate for the system to operate as planned and meet the stated objectives.

j) **Confidentiality and Security**: A properly designed system should make it very difficult for the unauthorised to obtain information.

k) **Administration**: Individual responsibilities should be clearly designated and the epidemiologist should have the authority to make changes or modifications to the system as problems arise or the focus changes. There is merit in having the person

responsible for surveillance administratively separated from the overall decision makers in a disease control programme.

Brucellosis poses many challenges to designing effective surveillance. This tends to be a chronic disease in both humans and animals, the incubation period is variable and often long, the symptomatology is variable and often minimal, and laboratory confirmations are essential. Transmission to humans is usually foodborne such as unpasteurised dairy products or animal contact, either direct or indirect via aerosol infection. The human link to the animal reservoir may be ill-defined. This is especially relevant where the animal populations are not well identified, enumerated, or inaccessible.

In this brief presentation there is no attempt to design the perfect surveillance programme for brucellosis but rather to identify the key questions that should be asked in developing a new system or evaluating an existing one.

8. REFERENCE INFORMATION SYSTEMS ON HUMAN AND ANIMAL BRUCELLOSIS IN THE MZCP COUNTRIES

8.1 Analysis and evaluation of the data collected through a questionnaire on brucellosis national control activities in the MZCP countries.

As previously mentioned in section 6, *epidemiological surveillance is the use of epidemiology to single out, plan, manage and evaluate the important services (prevention, control and treatment) for the management of population (human and animal) health status*. Its aim is the continuous monitoring of the dynamics of the populations' health situation, in order to determine specific control or prevention actions and to evaluate the actions adopted. In other words, the objective of the epidemiological surveillance is to permit *the planning of public health and veterinary services to optimise the use of available resources*.

The analysis of the data collected makes clear the level of effectiveness of the activities implemented in the context of brucellosis control programme.

It is known that there is no universal model of surveillance suitable to all local conditions. However, when basic data are collected by means of a questionnaire, such as the identical one distributed to all MZCP countries, a set of indexes and/or indicators is laid out expressing the situation on brucellosis in each country.

This procedure permits the national authorities to take the appropriate actions, i.e. strengthening, correcting or modifying the activities carried out to control the disease.

As a first step in the implementation of a surveillance system, a standardised data collection permits the calculation of *indexes* and, in the following periods, when collected data refer to more than one year, the use of *indicators* offers to the national authorities the synthetic information they need to evaluate and plan health activities accordingly.

Following the recommendations issued by the *MZCP Training Course on the Establishment of a Human and Animal Brucellosis National Surveillance System, Heraklion, Greece, 1993*, a questionnaire for the collection of data referred to the year 1993 was distributed for completion by all MZCP Member-States. After their collection by the MZCC, Athens, the questionnaires have been forwarded for processing, analysis and evaluation by the WHO/FAO Collaborating Centre for Research and Training on Veterinary Epidemiology and Management, Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "G. Caporale", Teramo, Italy. Following this procedure, the aforementioned indexes derived.

For refreshment purposes, the following three relevant sections included in the Report of the above mentioned MZCP Training Course, are attached as Annex IV:

a) information system and use of indicators in brucellosis surveillance;

b) data, indexes and indicators;

c) integration between actively and passively collected data in a surveillance system.

For better completion of the whole subject, two more sections from the same above mentioned Report are included in Annex VI, namely (a) Reporting System on Brucellosis and (b) Experience gained from the use of reporting systems.

The set of indexes calculated for each MZCP country is shown in Table 1. Main index values and information on bovine, sheep and goats brucellosis are shown in Tables 2 and 3. Human brucellosis incidence rate for 100,000 inhabitants is shown in Table 4.

Table 1: Set of indexes calculated in the analysis of questionnaires.

	Bovine/sheep and goat brucellosis	**Human brucellosis**
Damage Indexes	$\frac{\text{No. of herds/flocks found positive}}{\text{No. of controlled herds/flocks}}$ $\frac{\text{No. of head found positive}}{\text{No. of controlled head}}$	Human brucellosis incidence rates (for 100.000 inhabitants) Sex ratio among human cases (male/female)
Efficacy Indexes	$\frac{\text{No. of controlled herds/flocks}}{\text{No. of herds/flocks included in the plan}}$ $\frac{\text{No. of controlled herds/flocks}}{\text{Total no. of herds/flocks}}$ $\frac{\text{No. of controlled heads}}{\text{Total no. of heads}}$ $\frac{\text{No. of controlled heads}}{\text{No. of heads included in the plan}}$ $\frac{\text{No. of vaccinated heads}}{\text{Total no. of heads}}$ $\frac{\text{No. of slaughtered heads}}{\text{No. of positive heads}}$ $\frac{\text{No. serological tests performed}}{\text{No. of controlled heads}}$	$\frac{\text{No. of serological tests performed}}{\text{No. of human cases}}$
Efficiency Indexes	$\frac{\text{No of field operators involved in the plans}}{\text{No. of controlled heads + No. of vaccinated heads}}$ $\frac{\text{Costs in US Dollars}}{\text{No of controlled heads + No. of vaccinated heads}}$ $\frac{\text{Costs for owner compensation in US dollars}}{\text{No. of slaughtered heads}}$	

Table 2: Bovine brucellosis. Results of data analysis.

Country	Methods for brucellosis control programme	No. of controlled herds / no. of herds included in the plan	No. of controlled head / no. of head included in the plan	No. of positive herds / no. of controlled herds	No. of positive head / no. of controlled head	No. of slaughtered head / no. of positive head	No of vaccinated head / total no. of head
Bulgaria	*N.A.*	*N.A.*	100,00%	0,00%	0,00%	0,00%	0,00%
Cyprus	TS	100,00%	25,20%	0,00%	0,00%	0,00%	0,00%
Egypt	C	66,70%	5,20%	1,00%	0,40%	93,20%	0,20%
Greece	TS	97,00%	98,30%	0,80%	0,40%	100,00%	0,00%
Italy	TS	82,18%	84,48%	1,78%	0,56%	88,07%	0,28%
Lebanon	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*
Saudi Arabia	V	*N.A.*	100,00%	*N.A.*	0,01%	*N.A.*	8,40%
Spain	C	83,60%	56,90%	3,30%	0,90%	90,40%	6,20%
Syria	V	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*
Turkey	C	*N.A.*	*N.A.*	*N.A.*	2,00%	*N.A.*	2,40%

N.A. = not available V = vaccination
TS = test and slaughter C = combination of test and slaughter and vaccination

Table 3: Sheep and goats brucellosis. Results of data analysis.

Country	Methods for brucellosis control programme	No. of controlled flocks / no. of flocks included in the plan	No. of controlled head / no. of head included in the plan	No. of positive flocks / no. of controlled flocks	No. of positive head / no. of controlled head	No. of slaughtered head / no. of positive head	No of vaccinated head / total no. of head
Bulgaria	*N.A.*	*N.A.*	*N.A.*	0,00%	0,00%	0,00%	0,00%
Cyprus	TS	100,00%	33,27%	0,30%	0,54%	296,83%	0,00%
Egypt	C	60,00%	100,00%	3,30%	0,50%	82,90%	0,10%
Greece	TS	4,50%	3,30%	1,90%	0,04%	100,00%	3,30%
Italy	TS	65,45%	58,54%	9,21%	1,60%	82,79%	1,60%
Lebanon	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*
Saudi Arabia	V	*N.A.*	100,00%	*N.A.*	0,005%	*N.A.*	29,60%
Spain	C	58,70%	27,70%	24,20%	2,30%	*I.V.*	*N.A.*
Syria	V	47,90%	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*
Turkey	V	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*	*N.A.*

N.A. = not available I.V. = invalid value TS = test and slaughter
V = vaccination C = combination of test and slaughter and vaccination

Table 4: Human brucellosis. Results of data analysis.

Countries	Incidence rate (for 100,000 inhabitants).	Countries	incidence rate (for 100,000 inhabitants).
Bulgaria	0	Lebanon	0,5
Cyprus	0	Saudi Arabia	41,2
Egypt	*N.A.*	Spain	7,3
Greece	1,5	Syria	77,4
Italy	1,9	Turkey	11,2

N.A. = not available.

Some comments and clarifications are to be made on the above mentioned indexes:

In many cases, the index calculation was not possible due to the lack of data in the related questionnaires' fields.

During the "*Third Workshop on Human and Animal Brucellosis Epidemiological Surveillance in the MZCP Countries, Damascus, Syria, 4-5 May 1998*", a detailed presentation on the existing

situation in each MZCP country was made, and it was pointed out that the cases of lack of data could be due to:

- shortcomings in the national information system in which is not able to collect properly such information;
- mistakes in the questionnaires' filling out (e.g. in a case questionnaire 4,396,205 sheep and goats are reported to have been slaughtered due to brucellosis while only 174,612 are the animals found positive);
- the choice of leaving a blank instead of writing on a zero as the right value;
- the difficulty in applying the questionnaire definitions in some specific conditions (i.e. the impossibility to answer questions on control methods adopted in the case of Lebanon, due to the fact that in 1993 no activities were planned in that country).

Moreover, some misunderstandings on "positive" or "case" definition may have caused the presence of wrong indexes values, like the number of human cases in Syria.

With regard to brucellosis' epidemiological situation in the MZCP countries, all possible situations are represented. In Bulgaria and Cyprus the disease is not present (in Cyprus, in 1993, one sheep and goats brucellosis outbreak was detected due to imported animals), while in the other MZCP countries the infection exists and, in some cases, is widely distributed. In Italy and Greece the main control method is based upon the serological testing of population at risk and the slaughtering of infected animals. In Spain and Egypt such method is combined with vaccination, which remains the sole control method in Syria and Saudi Arabia.

Taking advantage of the experience acquired and the suggestions made by the participants, it was decided to review the questionnaire in order to produce an improved standardised form, closer to the different brucellosis situations in the MZCP countries.

8.2 Brucellosis Surveillance Systems in Selected MZCP Countries[1]

Following a recommendation issued by the 11th Session of the Joint Co-ordinating Committee of the Mediterranean Zoonoses Control Programme (Pendik, Istanbul, Turkey, 26-29 September 1995), a round visit by appointed experts to selected Member-Countries was included among the activities of the plan of work for the biennium 1995-1997.

The visits were undertaken, initially by Prof V. Caporale, Director of the WHO/FAO Collaborating Centre on Research and Training in Veterinary Epidemiology and Management, Istituto Zooprofilattico Sperimentale, Teramo Italy and were concluded by Dr. A. Giovannini of the same Institute. The countries visited were **Egypt, Lebanon, Saudi Arabia, Syria** and **Turkey**.

The terms of reference for the visits were the following:

- To review the epidemiological situation on human and animal brucellosis.
- To collect information on the way of operations, extent and efficiency of the existing epidemiological surveillance systems on brucellosis.
- To study existing constrains and weaknesses in various activities
- To identify the needs of the MZCP Member-States on the epidemiological surveillance on brucellosis.

Detailed report on the epidemiological situation assessed in each country was sent separately to each one of them. General considerations and recommendations valid for all situations studied are referred here bellow.

[1] Outline of the MZCP Consultants' Reports

General Conclusions and Recommendations

Co-operation between the public health and the veterinary sectors is crucial if brucellosis is to be put under control. In some countries, the close co-operation that already exists between the public health and the veterinary sectors needs to be continued and further strengthened. In others, a stricter co-operation between the aforementioned sectors needs to be installed if conclusive results are expected to occur from the activities they perform for the same purpose. Since intersectoral co-operation is a cultural habit, the existence of joint committees *per se* is not sufficient to generate co-operation. Physicians and veterinarians of all levels and the services they belong to, need to be trained to co-operate.

In both human and veterinary sectors, the **planning and management** of activities need the establishment of an effective information and reporting system.

In both human and veterinary sectors, a formal **case definition** of brucellosis is needed to give a common meaning to all notifications, and to allow a yearly comparison of data among regions, and other countries.

In human health sector, brucellosis diagnosis should be based on both serology and bacteriology. Among the serological techniques, a high titre in serum agglutination test (SAT, also known as Widal test or Wright serum agglutination test) is indicative of acute brucellosis and, therefore, diagnostically useful by itself. When SAT titres are low, either **Complement Fixation Test** (CFT), or the **Coombs** test or an **ELISA IgG** should be performed. A higher titre in any of them, with a low SAT titre, is indicative of evoluted cases. These three tests give closely similar results and performing only one is sufficient for diagnostic purposes. The technical difficulties of each should be kept in mind when choice is made (higher for CFT than the others). However, although CFT is a high value test, especially in human brucellosis evoluted cases, it needs particularly qualified personnel for accuracy. Coombs and ELISA IgG tests are suitable alternatives as there is a close correlation among the antibodies detected.

In animal health sector, the diagnosis of brucellosis should be based both on serology and on bacteriology. Serological diagnosis should rely on Office International des Epizooties (OIE) approved tests, namely **Rose Bengal Plate Test** or competitive **ELISA** as screening tests and **CFT** as a confirmatory test. Other tests such as **Serum Agglutination Test** and **Rivanol Test** have shortcomings in their sensitivity and specificity that make their use less reliable than OIE approved ones.

Moreover, the standard procedure prepared by the Central Veterinary Laboratory, Weybridge, U.K. should be used for the CFT, which is based on one of the two Anti-*Brucella* International Standard Sera, namely the Weybridge or Berlin International Standard Sera.

Where vaccination campaigns of young and adult animals are carried out, the diagnosis of brucellosis should be based mainly on bacteriology. In fact, serology becomes useless for the diagnosis of brucellosis after the vaccination campaign, due to the presence of animals vaccinated when adults (with persistent antibody titres).

When animal brucellosis control is based on vaccination campaigns, **a long-term planning** is necessary to decide the phases of brucellosis control (i.e. when to pass from a mass vaccination strategy to a young animal vaccination, and then to a test-and-slaughter strategy). The management of such a long-term control campaign will need the improvement of the veterinary information and reporting systems. In fact, information is a fundamental tool for the planning and the evaluation of achievements permitting permanent monitoring of the developments and corrections when this would be the case.

9. STANDARDISATION AND APPLICATION OF SEROLOGICAL TECHNIQUES AND REAGENTS FOR DIAGNOSIS OF HUMAN BRUCELLOSIS.

The diagnosis of human brucellosis is based on clinical and laboratory findings. Nowadays there are a number of serological tests being used. Simple, rapid techniques are preferable over time-consuming methods, provided their sensitivity and specificity are comparable. To obtain consistent and reliable results it is essential to standardise the reagents and methods used.

Serological diagnostic methods in use:

1. **Rose Bengal (RB) Test**. According to the EU requirements, the RB antigen needs to be standardised. It is a suspension of *B. abortus* smooth cells stained with the Rose Bengal dye, buffered to pH 3.65 and is commercially available. The RB test is the most sensitive and rapid screening method. It must be performed in all febrile patients in endemic areas. Cross reactions, especially with *Y. enterocolitica* O:9, may produce false positive results.
2. **Serum Agglutination Test (SAT)**. The antigen is prepared from *B. abortus* strain 99. It must be standardised against the International Standard anti-*B. abortus* serum (ISBS). Because of its simplicity and low cost, the SAT has been widely used in the diagnosis of human brucellosis.
3. **2-Mercaptoethanol Test (2-ME)**. The antigen is the same as for SAT except for 2-ME, which is added to each tube, so that the final concentration is 0.05 M. The 2-ME test is simple and can distinguish immunoglobulin classes. It is used to measure resistant IgG antibodies, which are a better indicator of active infection than the IgM ones.
4. **Complement Fixation Test (CFT)**. The standardisation of antigen and sheep erythrocytes is performed as described in the literature. The EU has established a system based on a standard serum that is required to conform to the second international standard anti-*B. abortus* serum (ISABS). When a country uses the CFT on a national scale, agreement on a standard method should be reached the different laboratories using the test. The CFT was considered as the most specific and valuable serological test. It detects mainly IgG1 antibodies. However, due to its complexity and delicacy, it is not as widely used as SAT and RB tests. It is used mainly as verification in the diagnosis of human brucellosis.
5. **Coombs Test**. This test uses the same antigen as SAT. It has remained the method of choice for measuring non-agglutinating antibodies. The results of this test can differentiate patients with acute and chronic brucellosis.
6. **Enzyme-linked immunosorbent Assay (ELISA)**. It is distinguished into Indirect ELISA and Competitive ELISA. The performance of the former involves the right choice of microtitre plates, antigen (*B. abortus* S99), treatment of serum samples, concentration of antigen, immunoconjugation, and choice of substrate (ABTS). Standardisation and interpretation of the results are the most important problems of ELISA.

The ELISA tests are capable of detecting all antibody isotypes, depending on the specificity of the anti-globulin conjugate employed. Because of the predominance of IgG1 in the immune response, indirect ELISA offers greatest combined diagnostic sensitivity and specificity. Using anti-human IgG1, the diagnostic performance is comparable to the CFT. It could replace the CFT as a confirmatory test or be used as parallel test with the CFT, where this is possible. The competitive ELISA appears to be capable of discriminating response to cross-reacting bacteria and could potentially replace the CFT as a definitive serological test for brucellosis.

Molecular Biology Techniques.

In the past few years, the molecular biology techniques have been applied in the diagnosis of brucellosis. Polymerase Chain Reaction (PCR) is regarded as a rapid, simple as well as specific and sensitive technique in the laboratory diagnosis of human brucellosis. PCR followed by restriction fragment length polymorphism (RFLP) offers improved diagnosis of the disease.

The nested-PCR can be used to increase the sensitivity of the assay. Cross contamination of the samples is a problem with PCR, thus requiring rigorous and safe laboratory measures. The utility of this test remains to be confirmed in the case of patients with chronic relapsing brucellosis and patients under treatment.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

1. Brucellosis is a major public health and animal health problem in all MZCP countries.

2. Although human brucellosis is notifiable in all MZCP countries, a correct assessment of the magnitude of the problem is difficult as under-reporting is very common. The reasons for under-reporting are (a) the poor collaboration and reporting from the private medical sector, (b) lack of a standardised case definition for human brucellosis, lack of use at the various levels and by different sectors of a brucellosis case definition, (c) existence of different national policies with regard to diagnosis and treatment of brucellosis cases, etc.

3. Programmes for brucellosis prevention in humans, control and/or elimination in animals are ongoing or will be initiated in the very near future in all MZCP countries. The countries of the northern part of the Mediterranean basin have controlled/eliminated cattle brucellosis and have ongoing programmes for the elimination of sheep and goats brucellosis. Cyprus remains free of both cattle and small ruminant brucellosis. Countries of the southern and eastern part of the Mediterranean sea as well as countries of the Arabian Peninsula have adopted different control strategies for cattle and small ruminant brucellosis based on animal vaccination, with or without test-and-slaughter of infected/positive cattle.

10.2 Recommendations

1. All MZCP countries urgently need to establish or further strengthen animal health surveillance and information systems. This would increase the cost-effectiveness and efficacy of brucellosis control/elimination programmes and make better use of the existing limited resources.

2. Close co-operation between public health and the animal health sectors at all levels (i.e. central, sub-national, local) is crucial for the success of any brucellosis prevention, surveillance and control programme. In order to strengthen intersectoral collaboration, particularly with regards to decisions on national policies and actions for the prevention, surveillance and control of zoonoses in general and brucellosis in particular, the following measures are of particular importance: the establishment of (a) actively operating advisory zoonotic committees; (b) veterinary public health units in the Ministries of Health; (c) the compulsory sharing of information and cross-notifications of cases; (d) joint out-break investigations, and (e) implementation of joint training activities, etc..

3. The long-term sustainability of brucellosis surveillance and control programmes is essential to assure success. Therefore legislation and/or regulation on brucellosis surveillance and control are needed in order to assure long-term commitment of resources for the programmes.

4. Countries should develop and implement effective health education and health promotion programmes for zoonoses prevention in general and brucellosis in particular based on strong community involvement and participation. Target groups should include veterinarians, physicians and other health personnel, farmers and animal breeders, food handlers, and other population groups at risk (i.e. children). Health education programmes, as part of national education programmes on safe food production and consumption, are urgently needed. They should pay a particular attention to environmental aspects related to brucellosis transmission.

5. Research is needed for the development of locally acceptable and affordable new strategies for the safe production, trade and consumption of milk and milk products made locally.

Public Health

In order to strengthen surveillance of zoonotic diseases in the MZCP countries and particularly of brucellosis, efforts should concentrate particularly in the areas of training of health care personnel. The Ministries of Health should strengthen their existing surveillance systems, including diagnostic procedures, reporting and feedback actions, regarding human brucellosis in order to fully integrate brucellosis surveillance activities with the current communicable diseases notification system.

Special attention should be given to:

- developing/reviewing the case definition of human brucellosis according to the requirements of each MZCP Member Country (see Annex VIII for the suggested case definitions) and widely distributing to all medical personnel responsible for disease reporting.
- reviewing current procedures for standardised reporting of notified cases among the public sector and between other sectors (i.e. private sector and non-governmental organisations) and the public sector.
- strengthening collaboration and ensure the active participation in surveillance activities of other health providers such as the private sector and the non-governmental organisations.
- strengthening surveillance capabilities especially on data analysis and rapid epidemic response at district and provincial levels in order to assure early detection and implement the necessary preventive and control actions at local levels.
- ensuring regular feed back of surveillance information to all data providers and decision makers.
- strengthening diagnostic capabilities especially at primary health care level with particular attention to endemic areas. In this connection, all suspected brucellosis clinical cases and cases of fever of unknown origin should be screened by a cheap and easy to apply technique such as the Rose Bengal Test (RBT). Positive RBT cases may be referred to higher levels of diagnosis for further investigation (e.g. by quantitative serological methods and bacteriology).
- all MZCP Member Countries should develop guidelines for communicable diseases surveillance including guidance on standard procedures for brucellosis surveillance activities.

Animal Health

In order to strengthen current surveillance and control programmes in animals the MZCP member countries should concentrate their efforts particularly on training of veterinary personnel. At the same time resources should urgently be made available to sustain current control programmes or initiate planned control activities. Ministries of Agriculture should further strengthen their existing surveillance systems, including diagnostic facilities and procedures, reporting and feedback actions, regarding animal brucellosis in order to assure that information are available for decision making and actions.

Special attention should be given to:

- developing/reviewing case definition of animal brucellosis and procedures for standardised reporting of notified cases among the national sector and between the private and governmental sectors.
- widely distributing the case definition to all personnel responsible for animal health and production and/or disease reporting.
- establishing/strengthening collaboration and enhancing active participation on surveillance of other animal health sectors such as private and non-governmental organisations.

- strengthening surveillance capabilities especially on data analysis and rapid epidemic response at district and/or provincial levels in order to ensure early detection and implement the necessary preventive and control actions at peripheral levels. Regular feedback of information collected to all data providers and decision makers should be performed.
- including brucellosis in all in-service training programmes on infectious diseases surveillance and control of animal diseases.
- strengthening laboratory capabilities in order to be able to carry out diagnostic techniques according to OIE standards*.
- sharing information and harmonising surveillance and control strategies and programmes among neighbouring countries and at sub-regional level, remain essential for the success of any national brucellosis control programme (*see FAO/WHO/OIE Guidelines for the Control of Brucellosis in the Middle East Countries***).
- maintaining, when initiated, national control programmes until the stated target is reached. The maintenance of resources throughout the different phases of the programme is essential.

The MZCP is requested to:

- review the *Questionnaire for Basic Data Collection on Human and Animal Brucellosis* taking the recommendations of this Workshop into consideration and re-send it to all MZCP member countries, analyse and evaluate the information collected and distribute the new results.
- provide support, on request, to the MZCP member countries for the assessment of the needs on information and surveillance of brucellosis, with particular regard to:
  - ♦ training of health and veterinary personnel on the management of surveillance and control programmes, and
  - ♦ laboratory support.
- provide support, on request, to the MZCP member countries in order to implement the above recommendations.

* Manual of Standards for Diagnostic Tests and Vaccines, Office International des Epizooties Publ., Paris, France, 1996

**Document available on request

Annex I

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Annex II

LIST OF WORKING PAPERS

1. Opening Session *(Dr A. Seimenis, Director, WHO/MZCC, Athens, Greece)*
2. Animal brucellosis surveillance and control in the Mediterranean and Middle east countries (*Dr O. Cosivi, CSR, WHO/HQs, Geneva, Switzerland*)
3. Human brucellosis in the Eastern Mediterranean region *(Dr N. Neouimine, WHO/EMRO, Alexandria, Egypt)*
4. Country Reports - Activities performed on human and animal brucellosis epidemiological surveillance as presented by the representatives of the MZCP countries:
   - Cyprus
   - Egypt
   - Greece
   - Italy
   - Lebanon
   - Saudi Arabia
   - Spain
   - Syrian Arab Republic
   - Turkey
5. General considerations on the epidemiological surveillance and control of brucellosis *(Dr D. Morelli, WHO-CC, Teramo, Italy)*
6. Critical Issues in Designing and Evaluating a Surveillance System *(Dr A. Robinson, Liaison Officer, USAID-MERC Project on Animal Health and Zoonoses, Amman, Jordan)*
7. Analysis an evaluation of the data collected through a questionnaire on brucellosis national control activities in the MZCP countries and consultant's round trip *(Dr D. Morelli and Dr P. Calistri, WHO-CC, Teramo, Italy)*
8. Brucellosis surveillance systems in selected MZCP countries *((Dr D. Morelli, WHO-CC, Teramo, Italy)*
9. Standardisation and use of serological techniques and reagents for the diagnosis of human and animal brucellosis *(Prof Y. Tselentis, WHO-CC, Heraklion, Greece)*

FAO/WHO/OIE GUIDELINES FOR A REGIONAL BRUCELLOSIS CONTROL PROGRAMME FOR THE MIDDLE EAST

Prepared at a special Workshop in Amman, Jordan 14 - 17 February 1993
Amended at the Round-Table on the Use of Rev-1 Vaccine in Small Ruminants and Cattle
Maisons-Alfort, France, 21-22 September 1995

BACKGROUND AND JUSTIFICATION:

Brucellosis is considered by FAO, WHO and OIE as the most widespread zoonosis in the world. The importance of this highly contagious disease is due both (1) to its economic impact on the animal industry causing an adverse effect on total animal protein supplies, and (2) to the severe hazard it represents to human health, through either direct contact with infected animals or, more frequently, the consumption of contaminated milk and dairy products.

The livestock population of the countries in the Middle East, which expressed an interest in participating in a regional control programme comprise 29,500,000 head of cattle , 5,000,000 buffaloes, 27,500,000 sheep, 25,000,000 goats and 3,500,000 head of camels and the livestock production is the primary occupation of a large sector of the population.

With the exception of the few large scale industrialised airy units which are usually located close to the larger cities, the majority of the producers belong to the rural population often representing the less privileged with regard to public and animal health services.

Through surveys and country reports it is confirmed that animal brucellosis is widespread and well established in the Middle-East and that it affects both cattle (*Brucella abortus*) and small ruminants (*Brucella melitensis*). In dairy cattle the disease is a major obstacle to the importation of high producing breeds and represents a significant constraint to the improvement of milk production through cross-breeding. Due to the presence of the disease, for UN extended period of time, in small ruminants in a number of the countries in the region, there is growing evidence of an increased prevalence of *Brucella melitensis* in cattle and camels.

It is estimated that brucellosis causes heavy economic losses in animal production resulting from abortions, sterility, decreased milk production, veterinary attendance and the cost of replacement animals. In addition, the disease is an impediment to free animal movement and export. Unfortunately, only few controlled studies have been conducted to evaluate the effect of brucellosis on reproductive efficacy and the cost of various methods of control. An evaluation of the New Zealand Brucellosis Eradication Scheme found an internal rate of return of 10.3% based upon reduced milk yield, increased culling and loss of market shares with no eradication programme in place. Other Studies have concluded that brucellosis eradication in cattle herds via vaccination is profitable and that the benefits from vaccination are cumulative. Such programmes practically eliminate clinical disease and thus reduce the number of organisms excreted from infected animals.

For sheep and goat producers the sources of economic losses stems from decreased breeding efficacy and reduced milk production. It is, however, generally agreed that the impact of the disease in small ruminants is greater in terms of the adverse effects it may have on human health in the rural population due to the high virulence of the agent (*B. melitensis*) to man and the traditional mode of consumption of sheep and goat animal products.

The disease in humans is characterised by fever and prolonged illness resulting in loss of vitality and ability to work. A study from Spain attempted to evaluate the economic importance of human brucellosis and found that 107 patients had 1005 hospital admissions with an average stay of approximately 13 days. The total number of days absent from work was 5291. The economic cost of hospitalisation and lost earnings will, of course, vary but is, by any mean, very high.

Most of Middle-Eastern countries have already attempted to control the disease in ruminants in the past by using various strategies with vaccination as the main measure of control. Although these efforts were reported, in some cases, to significantly reduce the incidence of the disease in cattle, they generally met with little success in sheep and goats due, among numerous other factors, to the difficulty encountered by the veterinary services in identifying, vaccinating and monitoring infected flocks, and in controlling their movements. In spite of the sustained efforts of the Governments, there is a common feeling that brucellosis eradication is far from being at hand, especially in small ruminants, and that both the objectives of the control and the measures to be adopted should be redefined realistically, as applied to the specific context of Middle-Eastern countries. This new strategy should, therefore, be based on a thorough

understanding of local and regional variations in animal husbandry practices, social customs, infrastructure and the epidemiological pattern of the disease.

Each human case originates from animals thus the control and elimination from the animal population is the sole mean by which it can be controlled in humans.

OBJECTIVE:

- **Long-term** (15 - 20 years)
  - To eliminate human and animal brucellosis from the region.
- **Medium-term** (8 - 12 years)
  - To control animal brucellosis in all relevant species primarily through a comprehensive vaccination programme and to reduce the number of human cases to very low levels within 10 years.
- **Short-term** (6 - 12 months)
  - To formulate a national programme proposal for each participating country and a regional programme proposal for the overall co-ordination of the national programme.

STRATEGY:

Prerequisites

In order to determine the need for assistance, each country should assess the following:

1. Human resources in the Veterinary Services and the Public Health Departments laboratory capacity;
2. Legislation and regulations;
3. Ongoing control programme for possible integration into the objective of the planned programme;
4. Financial resources sufficient for the programme to become successful and commit above mentioned available resources and request additional national and international resources to ensure the satisfactory completion of the programme.

Surveys, Surveillance and Sero-Monitoring

Brucellosis is endemic in the Region and no further surveys seem to be required prior to the start of the vaccination programme in most countries.

It is, however, recommended that for epidemiological purposes the herd and flock prevalence in each country are estimated through representative sampling and testing at time of first campaign in the Regional Programme.

The Rose Bengal Plate Test is the recommended method for screen of samples for the determination of herd and flock prevalence.

Production and Quality Control of Diagnostic Reagents

The antigens to be used in the diagnostic tests and monitoring of the progress of the control programme should comply with WHO/OIE standards.

The antigens should, independent of source, be subjected to quality control at the beginning of the programme and then annually at an independent internationally recognised laboratory.

Control programmes

The Workshop recommends that the control programme to be adopted by the countries of the Region should consist of:

1. Large-scale vaccination of all cattle, sheep and goats in a herd or flock independent of sex or age;
2. Camels and buffaloes should be vaccinated. However, simultaneous research is required to establish the type of vaccine and the dose needed for camels and buffaloes;
3. The vaccination should be repeated every two years for 6 -10 years or until such a time when the prevalence has been greatly reduced in the human and animal populations.

In order to monitor the progress of the programme it is proposed that flock and herd prevalence be serologically re-evaluated through representative sampling and testing at the time of the fourth and fifth

campaign. (It may be necessary at this time to confirm screening of reactors with more specific serological test).

When a significant reduction in herd and flock prevalence has been accomplished, the control programme should be reviewed and alternative strategies may be considered.

The regional programme will be responsible for the overall co-ordination of the national vaccination campaigns, the sero-monitoring of herd and flock prevalence, evaluation of data and planning of follow-up strategic to the vaccination campaigns.

Marking of vaccinated animals is considered useful but not necessary for the success of the programme and it might not be practical. For export/import purposes some kind of identification may be necessary.

Vaccine strains

The following living vaccine strains namely *Brucella abortus* strain 19 and *Brucella melitensis* strain Rev 1 are recommended. *Brucella abortus* strain 19 is mainly indicated for cattle*, Brucella melitensis* strain Rev for sheep and goats. Rev 1 vaccine should be used when *Brucella melitensis* occurs in cattle as soon as sufficient evidence is gained from controlled experiments with regard to its safety and efficacy. The seed lot strain for the Rev 1 vaccine should be the reference strain available at the OIE Reference Laboratory for Brucellosis, CNEVA, Maisons-Alfort, France.

Cold Chain

It is essential to maintain the cold chain for living vaccines from production to dilution and administration.

Dose and route of administration

There are two possibilities for Rev 1 vaccination:

1. Subcutaneous vaccination at full dose (10^{9}) in young animals;
2. Conjunctival at full dose in both young and adult animals; a dose of 10^{8} is to be used in pregnant sheep, if required.

Similarly there are two possibilities for strain 19 vaccination:

1. Normal subcutaneous dose (10^{10}) in young animals;
2. Reduced dose (10^{9}) subcutaneous or conjunctival in adults.

Timing of vaccination

In order to reduce the risk of abortion, which may be caused by Rev 1 in sheep and goat flocks, the vaccination should preferably take place during lactation or if necessary to vaccinate pregnant animals it should be during the last month of pregnancy. Strain 19 can be used at any time of the year independent of the reproductive status of the animal.

Vaccine Production

Brucellosis vaccine are produced in the following laboratories in the Middle East Region:

1. Pendik, Istanbul, Turkey produces Rev 1 and strain 19
2. Amman, Jordan produces Rev 1 vaccine
3. Egypt will begin vaccine production soon.

Vaccine producing laboratories outside and in the Region are encouraged to consider supplying vaccine to the programme at cost price.

The Workshop recommends that Programme resources should not be used to establish new vaccine production facilities in the Region. This does not, however, prevent the Programme from supporting existing facilities.

Quality Control

Irrespective of the source, vaccines used in this Programme should be subjected to quality control by an internationally recognised laboratory according to established WHO/OIE standards. The quality control of the Rev-1 vaccine should conform to the methods described in the "*OIE Manual of Standards for Diagnostic Tests and Vaccines*", edition 1996.

Research

It is anticipated that a number of issues will need clarification through applied research. These are an essential component of the programme and must be supported to ensure its success. The following areas are proposed:

1. Determination of strain and dose of living vaccine to be used in camels and buffaloes;
2. Determination of dose and route of administration of Rev 1 vaccine in cattle able to protect against *Brucella melitensis* challenge;
3. Determination of the duration of immunity in sheep and goats after vaccination using full or reduced dose.
4. Evaluation of polyvalent vaccines protecting against abortion in sheep and goats. Vaccination against brucellosis may not result in reduction of abortion rates in some sheep flocks because of the presence of other micro-organisms that may be responsible for the abortion.
5. To study the impact of brucellosis on farm economy.

Public Health

The Workshop recognises the need for increasing the awareness of the Ministry of Health as well as veterinary Public Health Services regarding the brucellosis problem in humans.

Collaboration between all parties concerned is essential for the success of this programme and should be promoted through the strengthening or establishment of National Zoonoses Committees. It is considered important that producers' organisations are represented on the Committees.

Strengthening of the surveillance activities through improvement of diagnostic capabilities for detecting human brucellosis in hospitals as well as in private clinics and reporting of cases should be made obligatory to both the epidemiological units in the Veterinary Services and in the Public Health Sector.

Public education programme to raise the awareness level of producer groups and general population on relevant aspects of Brucellosis should be designed and disseminated through the use of all possible media.

Training

Implementation of the programme will require a considerable amount of training at the technical level. The requirements will be identified in collaboration with each country during the preparation of the national project documents. The implementation of these training activities will be co-ordinated by the regional Co-ordinating unit of the programme.

Measurement of progress

It is anticipated that progress will be monitored through:

1. The use of bacteriological surveillance (since available serological tests are compromised in a vaccinated population); and
2. Monitoring of disease incidence in humans.

It is essential that serological methods would be available which can distinguish infected from vaccinated animals, when the vaccination phase will be completed. The development and evaluation of these methods should take place at the beginning of the project so that they are available for use to monitor the progress and success of the project at its mid-point and its end.

Annex IV

INFORMATION SYSTEM AND USE OF INDICATORS IN BRUCELLOSIS SURVEILLANCE*

An information system (I.S.) can be defined as *a set of activities, institutions, facilities and procedures to collect, analyse, transfer and diffuse information for planing, management, evaluation of activities (veterinary or public health) and for decision making*.

Examples of an Information System in a veterinary prophylaxis campaign are the following:

COMPONENTS	EXAMPLES
Activities	Heard visits, Serological tests, Vaccinations, etc.
Institutions	Local Health Units, Laboratories, Processing Centres, Regional Veterinary Services, etc.
Procedures	Completing forms, Data storage, Data processing and transfer, Data analysis.
Facilities	All technical resources utilised by the System (vehicles, computers, etc)

The **general objective** of a veterinary I.S. is aimed to provide information for decision making activities and management of veterinary services to: (a) improve food animal production and (b) control such production in terms of public and animal health.

Examples of **specific objectives** of a veterinary I.S. are: (a) to obtain an inventory of disease conditions in the area; (b) to identify possible shortcomings in veterinary activities; (c) evaluate efficacy and veterinary services activities; (e) promote specific research.

An I.S. may be subdivided into two parts in relation to its possible uses**; I.S. for action** and **I.S. for decision support**.

The first section of the I.S. is useful for the organisation of veterinary activities (e.g. it is able to generate information to schedule herd/flock visits, stock-up vaccines, syringes, etc.)

The second part of the I.S. converts data into information (indicators) which is able to support decision-making activities i.e. it is a set of procedures to transform/analyse data needed to convert information into actions. It cannot be based only on data generated by the I.S. for action but it should be integrated by external flow as well.

The information generated by an I.S. needs validation, analysis, transmission and publication. It should be transmitted to: (a) field collectors; (b) users of the service; (c) decision makers; and (d) population.

Data analysis is performed to generate useful *indicators.* In order to generate and interpret them at the various organisational levels involved, an accurate analysis is needed.

DATA, INDEXES AND INDICATORS

The steps for planning the use of information in the managerial process for National Health Services are:

A. ***Strategic Planning***: statement of the objectives of the information system.

B. ***Planning***: (1) definition of the information credits and debts (i.e. advantages and disadvantages) of each information level in relation to the objectives of the information system; (2) analysis of data which are available and purposely collected at the most peripheral level; (3) definition of possible needs of further data to be collected.

C. ***Programming*** : definition of the information flows and aggregation procedures along the chart from peripheral to central level, on the basis of information debts and credits of each level.

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* Excerpts from "*Report of the MZCP Training Course on the Establishment of a Human and Animal Brucellosis National Surveillance System"* held in Heraklion, Greece, 28-30 October 1993 (Doc. MZCP/Bruc/93.2)

D. ***Replanning*** : use of synthetic aggregated information for the evaluation of activities performed, their achievements and the re-planning of the system if needed.

Knowledge of data sources is fundamental for (a) saving of resources (gathering data is costly); (b) a multidisciplinary approach to problems; (c) an appropriate management of available data and (d) data cross-control and validation.

Data are collected from:

- Peripheral Public Health Services
- Peripheral Veterinary Services
- Hospitals
- Ministry of Health
- Ministry of Agriculture
- Ministry of Environment
- International Organizations, i.e. WHO, FAO, OIE, EU, etc.

Other sources of data are:

- Veterinary and Public Health Laboratories;
- Veterinary and human clinics;
- Physicians;
- Veterinary practitioners;
- Universities etc.

Data are used to generate ***indexes*** that consist of synthetic information able to describe a particular aspect of the state of the system under study. An index is generated using two or more data.

Examples of indexes:

- Percentage of herds tested/Total number of herds existing in a prophylaxis campaign;
- Percentage of herds tested/ Total number of herds existing in a prophylaxis campaign;
- Percentage of herds vaccinated/ Total number of herds existing in a prophylaxis campaign;
- Cost of vaccination against brucellosis: number of equivalent man-days spent to vaccinate calves against brucellosis x cost/pay of a veterinarian + the number of heads vaccinated x cost of a single dose + cost/km of vehicles x the number of kms covered.

The merging of two or more indexes generate indicators which consist of synthetic information able to describe a particular aspect of both the **state** (e.g. prevalence and incidence rate of each disease or condition under study) and the **dynamics** (e.g. percent variation of prevalence and incidence) of the system under study.

The indicators are used for the evaluation phase of the managerial process for health systems. They allow identification and quantification of the **shortcomings** of the system (e.g. indicators related to the veterinary activities and their achievements). On the basis of the shortcoming detected, an effective re-planning of the system is possible.

Indicators allow the identification of health problems and needs, **should they perceive or not** by the decision makers and the public in general.

In this way indicators avoid the waste of resources and the limitations of a delivery of services oriented to users' perceived problems and introduce a completely new role for the health officers in the statement of health policies. In other wards they can be defined *as tools which help in measuring changes, directly or indirectly, in a given situation*.

Classification of the indicators is made possible on the basis of the information that they contain. For example, indicators describing the health status of human populations, the health status of animal population and hygiene of foods of animal origin can be grouped as follows:

1. damage indicators

2. risk indicators

3. population indicators

In relation to veterinary activities the indicators referring to the health status of animals can be classified as follows:

- Relevance indicators
- Efficacy indicators
- Effectiveness indicators
- Progress of activities indicators

INTEGRATION BETWEEN ACTIVELY AND PASSIVELY COLLECTED DATA IN A SURVEILLANCE SYSTEM

Surveillance systems are based on both passive and active collection data. The two ways of data collection are not interchangeable and the role of passively and actively collected data in a surveillance system are completely different. Both kinds of data are necessary and need integration.

Passive collection is the main source of data for health information systems because its cost is very low and a great amount of data may be needed for the system. However, sensitivity and specificity of a system based on passive collection of data are unknown and the system itself needs periodical evaluations.

Active collection is specific and more sensitive than passive collection and the performance of the system is measurable and pre-determinable. But this type of collection is very expensive and only few selected data are needed for the system. So, active collection is suitable for *ad hoc* surveys carried out to (a) evaluate the performance of passive collection of data and (b) in pilot trials to evaluate if an emergent phenomenon deserves the implementation of a routinely data collection. The aspects of passive collection of data suitable to be evaluated through *ad hoc* surveys may be: (1) efficacy in infectious diseases notification systems, (2) efficacy of vaccination campaigns, and (3) data from *down-the-road* testing campaigns.

The tools for data collection in *ad hoc* surveys usually are:

- Questionnaires and interviews of patients (or herd/flock owners)
- Clinical examination of patients (animals in the herd/flock))
- Laboratory testing of specimens from:

-The patients (or animals)

-The suspected food

-The shop where the food was bought

-The herd/flock which food originated from

-Testing of blood samples (according to the case)

All information collected in an *ad hoc* survey should preferably be reported in a single data form, so that in each step, the health and veterinary officers are completely informed about the past history of the case.

All data forms should be collected and analysed at the regional epidemiological station.

EXAMPLES OF INDICATORS FOR BRUCELLOSIS CONTROL CAMPAIGN[1]

USE and UTILITY

1. **Map of Animal Health Status**

1.1 *Animal Damage Indicators**

1.1.1 Percent variation of the Bovine/sheep/goat brucellosis in incidence rate (I.R.)

$$\frac{(1993\ I.R.) - (1992\ I.R.) \times 100}{(1992\ I.R.)}$$

1.1.2 $$\frac{\text{Percent variation of number of herds/flocks found positive}}{\text{Number of herds/flocks under control}}$$

Ex: $$\frac{(1992\ P.R.) - (1993\ P.R.) \times 100}{(1992\ P.R.)}$$

P.R.= prevalence rate 1992 or 1993 = indicative years

2. **Map of Activities Performed**

2.1 *Efficacy Indicators*

Measures the gap between the results foreseen as an objective and the level actually achieved

2.1.1 Percent variation between the decrease actually achieved in bovine/sheep/goat brucellosis prevalence rate (P.R.) and the decrease stated as objectives :

$$\frac{(1992\ P.R.) - (1993\ P.R.) \times 100}{P.R.\ \text{decrease as objective}}$$

2.1.2 Percent variation of the mean number of days elapsing between diagnosis and slaughtering of infected animals

$$\frac{(1992\ D.S.D.) - (1993\ D.S.D.) \times 100}{(1992\ D.S.D.)}$$

D.S.D = mean number of days elapsing between diagnosis and slaughtering

2.1.3 $$\frac{\text{Variation in the ratio between of herds/flocks/heads under control}}{\text{Number of herds/flocks/heads in the population at risk}}$$

2.1.4 $$\frac{\text{Variation in ratio between No. of “new” herds/flocks/heads entering plan}}{\text{Number of herds/flocks/heads in the plan}}$$

2.1.5 $$\frac{\text{Variation in the ratio between number of animals vaccinated}}{\text{Number of restocking animals from 3 to 6 month (vaccination age)}}$$

2.1.6 $$\frac{\text{Variation in the ratio between number of animals vaccinated found positive in the year and slaughtered}}{\text{Number of animals found positive in the year}}$$

2.1.7 $$\frac{\text{Variation in the ratio between number of } \textit{brucellae} \text{ identified per biotype}}{\text{Number of isolation tests performed}}$$

2.1.8 $$\frac{\text{Variation in the ratio between the no. of } \textit{brucellae} \text{ bacteriological tests}}{\text{Total no. of samples tested (serological tests, bacteriological tests, etc.)}}$$

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[1] Excerpts from "*Report of the MZCP Training Course on the Establishment of a Human and Animal Brucellosis National Surveillance System"* held in Heraklion, Greece, 28-30 October 1993 (Doc. MZCP/Bruc/93.2)

* Years 1992 and 1993 referred to in the equations are indicative.

2.2 *Efficiency Indicators*

Measure the relationship existing between results achieved and the resources employed (in terms of money, manpower, facilities)

2.2.1 Percent variation of the cost of vaccination of each lamb

$$\text{Ex: } \frac{(\text{1993 cost/ \# lambs}) - (\text{1992 cost/ \# lambs}) \times 100}{(\text{1992 cost/ \# lambs})}$$

Cost = the number of man equivalent days spent to vaccinate lambs x cost/day of a veterinarian + number of heads vaccinated x cost of a single dose + cost/km of vehicles x the number of kms covered

lambs = number of lambs vaccinated

2.2.2 Variation in the ratio between n. of man/days employed on

$$\frac{\text{Brucellosis control field activities}}{\text{Number of animals controlled or vaccinated}}$$

2.2.3 $\frac{\text{Variation in the ratio between budget spent}}{\text{Number of animals controlled or vaccinated}}$

2.2.4 $\frac{\text{Variation in the ratio between number of vaccine doses distributed}}{\text{Number of animals vaccinated}}$

2.2.5 Variation in the ratio between no. of serological tests performed

$$\frac{\text{(per type of test)}}{\text{Number of samples tested}}$$

2.2.2 = Efficiency Indicators of manpower
2.2.3 = Efficiency Indicators of budget spent
2.2.4/2.2.5 = Efficiency Indicators of resources used

3. **Map of Human Health Status**

3.1 *Damage Indicators for Humans*

3.1.1 Percent variation of human Brucellosis incidence rate (I.R.)

$$\text{Ex: } \frac{(\text{1993 I.R.}) - (\text{1992 I.R.}) \times 100}{(\text{1992 I.R.})}$$

REPORTING SYSTEMS*

Brucellosis Reporting System

The prevention and control of diseases (infectious or not) depends on the establishment of national and international surveillance mechanisms.

Surveillance data are used to monitor short or long-term trends, to alert health professionals towards important changes in trends and to estimate the magnitude of morbidity and mortality. Moreover they provide thesis for planning and implementing prevention and control programmes.

Since brucellosis is a zoonosis, simultaneous reporting of human and animal cases is fundamental. But as it is known, a well organised and reliable reporting procedure of animal cases or outbreaks still remains a future goal for the countries of the region due to several practical difficulties in the case definition. Active reporting systems and epidemiological surveys on animals can give important surveillance data concerning animal brucellosis, whereas passive reporting systems face structural problems rendering their application difficult. For the above reasons most of the reporting systems on brucellosis are based on human cases which are used to trace animal cases as the very next step.

As previously referred to, reporting systems are generally divided into passive and active, and a very simple classification of them is the following:
Mandatory notification: human cases must, by law, be reported to health authorities by private clinics, private diagnosis laboratories and by physicians (on named basis, with patient anonymity, or with pre-coded identifiers).
Voluntary: by no legal obligation, physicians, laboratories and others agree to notify on collaborative basis.
Sample based: a voluntary system for which data are obtained from a selected sample of medical practitioners (sentinel physicians), services (e.g. clinics or laboratories) or from a population that is evaluated regularly.

Case definitions are not usually used in mandatory systems. Physicians report what they consider as a case whether it is laboratory confirmed or not. In voluntary systems which are based on clinics, laboratories or physician sentinel networks, specific case definitions with clinical and laboratory procedures often vary from country to country.

The information collected includes the date and place of diagnosis, details of age, sex, site of infection, and specific risk factors such as consumption of unpasteurised milk. The periodicity of reporting in the first level of notification varies and ranges from daily (i.e. cases are reported as soon as diagnosed) to annual, although weekly reporting is featured in 50% or more of the systems.

It is evident that in the case of animal infectious disease reporting, the elements of the system are replaced by the state and private veterinary practitioners, diagnosis laboratories and farmers.

The representativeness of surveillance systems is cited as a potential problem when sensitivity (i.e. completeness of reporting, underreporting) seems low or where the sample base covers only a small fraction of physicians, veterinarians, laboratories or clinics. Delay in reporting is not usually mentioned as an important issue because the interest lies in the trends rather than in the immediate control of individual cases. The reliability of mandatory notification is a source of concern in many countries. This system has become relatively less important and confidentiality issues have also prompted strong reservations about mandatory notification of detailed information such as HIV. Because of these and other difficulties each country should select the most appropriate and applicable system which fits with its infrastructural conditions and the disease(s) needed to be regularly reported.

When organising a reporting system, a number of different problems are encountered needing to be solved in the best possible way, i.e. (a) organisation (flow charts, software, hardware); (b) under-reporting-biased reporting; (c) case definitions; (d) timeliness (i.e. the speed or delay between steps of the surveillance system); (e) data interpretation and (f) resources (i.e. personnel and financial resources expanded in collecting, processing, analysing and disseminating the surveillance system).

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* Excerpts from "*Report of the MZCP Training Course on the Establishment of a Human and Animal Brucellosis National Surveillance System*" held in Heraklion, Greece, 28-30 October 1993 (Doc. MZCP/Bruc/93.2)

One of the most important tools in combating zoonoses in general and most particularly brucellosis is an efficient reporting system. It should be pointed out that the main reason for establishing surveillance and reporting systems should be that the information is used to improve the planning and managing of health programmes and disease control activities. *If the information remains unused, organising a reporting or surveillance system can be a waste of staff, time and money !*

Experience Gained from the use of Reporting Systems

There is no internationally standardised and internationally adopted surveillance reporting system. This is undoubtedly the result of the differences existing among countries in the organisational infrastructure, resources, communications, etc. In Europe ten different types of reporting systems are in use!

The reporting system, which seems to almost be accepted world-wide is the one which is used in the U.S.A.. Systematic reporting of various diseases in the U.S.A. started in 1874 when the State of Massachusetts' Board of Health inaugurated a plan for the weekly voluntary reporting of prevalent diseases by physicians. Today all States and Territories of the U.S.A. participate in a national morbidity reporting system and regularly report aggregate of case-specific data for 49 diseases, and related conditions to the Centre for Disease Control (CDC) in Atlanta, Georgia. Most of the state reporting of infectious diseases rely primarily on case reports supplied by physicians. A flow chart on the U.S.A. Surveillance System is given in Figure 2.

Technology developed over the last decade have brought dramatic improvements to surveillance systems. Weekly reporting from states to the CDC, was at one time done through the mail, then over the telephone, and is now accomplished through a computer based telecommunications system. Even though disease surveillance has progressed to high technology, the challenges posed by underreporting and biased reporting still remain a serious problem in the interpretation of surveillance data.

Anyone wishing to create a reporting system or modify a previous existing one in order to fit with particular needs has to follow a table of criteria and guidelines to make the best possible selection.

A surveillance co-ordination group from CDC prepared a document referring to an outline of the tasks for evaluating a surveillance system which is followed by sections describing each element of an evaluation (Annex VII).

Two of the most important attributes of the system are sensitivity and simplicity. The sensitivity of a reporting system is the proportion of cases of a disease detected by the reporting system. Profound low sensitivity is related to underreporting. It is common knowledge among public health officials that communicable diseases are underreported by physicians, yet the extent to which this occurs is unknown. Factors that influence physicians' reporting have been found to include the perceived importance of the physician-patient privilege, a lack of faith in the confidentiality of health department records, pressure from the patients to not report, a perceived lack of value of case reports, a belief that reporting responsibility lies elsewhere, a lack of awareness of reporting requirements and the difficulty and time requirements involved with reporting all cases.

Some of the difficulties in obtaining higher rates of reporting by physicians might be with the nature of the reporting requirements. These vary from state to state according to the disease being reported, reporting sources (laboratories, physicians, other health care providers and facilities), methods of reporting (mail or telephone), and definition of cases. Notifiable disease reporting systems provide the basis for surveillance of communicable diseases in most of the states.

A comparative study of active and passive physician-based reporting by health care providers found that substantial underreporting by physicians was extensive. This finding led to a decision to add mandatory laboratory reporting to the surveillance system of many state Health Department's epidemiology divisions.

A surveillance system based solely on traditional passive reporting by health care providers may lead to substantial underreporting of certain diseases. Although laboratories can provide an important source of disease reports to a state's surveillance system, it is not a substitute for physician reporting and does not eliminate physicians' legal responsibility to report disease.

Data are usually incomplete and may be representative for certain populations; completeness of reporting has been estimated to vary from 6% to 90% for many of the common notifiable diseases. However, if the level of completeness is consistent over certain time, these data usually are the best source of information regarding the temporal and geographic trends and the characteristics of the persons affected.

The simplicity of a reporting system refers to both its structure and ease of operation. In order to evaluate the simplicity of a system the co-ordination group of the Center for Disease Control (CDC), Atlanta, USA, states specific measures (e.g. time spent with maintaining the system, for collection of case information, etc.).

To establish and operate a surveillance system there is a need for resources, which are expressed in funds. As an example in the matter of cost, the results of the cost estimation for active and passive surveillance systems, done by the Health Department in Vermont, U.S.A. during the period 1 June 1980 - 31 May 1981 showed that: the active one cost US$ 19,271-00 and the passive one was proved to cost US$ 2,303 only.

It is well known that there is no perfect reporting system but this should not stifle Health and Veterinary authorities in seeking improvements through repeated evaluation of the existing system.

OUTLINE OF TASKS FOR EVALUATING A SURVEILLANCE SYSTEM[1]

A. Describe the Public Health Importance of Health Event (Brucellosis)

The following are the most important categories to consider:

1. Total number of cases incidence and prevalence.
2. Indices of severity such as the mortality rate and the case-fatality ratio.
3. Preventability

B. Describe the System to be evaluated

1. List the objectives of the system
2. Describe the health event under surveillance. State the case definition of each health event
3. Draw a flow chart of the system
4. Describe the components and operations of the system:
   a. What is the population under surveillance?
   b. What is the period of time of the data collected?
   c. What information is collected?
   d. Who provides the surveillance information?
   e. How is the information transferred?
   f. How is the information stored?
   g. Who analyses the data?
   h. How are the data analysed and how often?
   i. How often are reports disseminated?
   j. To whom are the reports distributed?
   k. How are the reports distributed?

C. Indicate the Level of Usefulness

1. Describe the actions taken as a result of the data for the surveillance system.
2. Characterise the entities that have used the data to make decisions and take actions.
3. List other anticipated uses of the data

D. Evaluate the System for each of the following Attributes:

1. *Simplicity*: it should be as simple as possible while still meeting its objectives.
2. *Flexibility*: it should be able to adapt to changing information needs or operating conditions with little additional cost in time, personnel or allocated funds (e.g. new diseases and health conditions, changes in case definition and variation in reporting sources).
3. *Acceptability*: reflects the willingness of individuals and organisations to participate in the surveillance system.
4. *Sensitivity* : level of case reporting and ability to detect epidemics
5. *Predictive value positive* : the proportion of persons identified as having cases which actually have the condition under surveillance
6. *Representativeness*: accurate description of a) the occurrence of a health event over time and b) its distribution in the population by place and person.
7. *Timeliness*: a) the amount of time between the onset of an adverse health event and the report of the event to the public health agency responsible for instituting control and preventive measures; b) the time required for the identification of trends, outbreaks or the effect of control measures.

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[1] From : Douglas N.K., et al. (1988): Guidelines for evaluating surveillance systems, CDC, Morb. Mort. Weekly Rep., 57, No S-5, 3-18

E. Describe the Resources Used to Operate the System (Direct Cost)

Sometimes referred to as "direct costs" and it includes the personnel and financial resources expended in collecting, processing and analysing and disseminating the surveillance data.

F. Conclusions and Recommendations

State whether the system is meeting its objectives and address the need to continue and/or modify the surveillance system.

The attributes and costs of a surveillance system are interdependent. Before recommending changes in a system, interactions among attributes and costs should be considered to ensure that benefits resulting from strengthening one attribute does not adversely affect another attribute.

Evaluating surveillance systems is not easy. There is no perfect system; trade-offs must always be made. Each system is unique and therefore requires a balancing of the efforts and resources put into each of its components, if the system is to achieve its intended goal.

WORLD HEALTH ORGANIZATION SURVEILLANCE STANDARDS

The World Health Organization published a **Communicable Diseases Surveillance "kit"**. The document has been produced jointly by 10 Divisions and Programmes as well as UNAIDS.

It has been created to provide international standards for global surveillance and is intended to serve as a basis and practical resource for national surveillance units. It is not meant to replace existing technical guidelines or be an exhaustive description of surveillance of all diseases. It is expected to serve only as a guide to good practice and could help to harmonise surveillance activities.

The disease and syndromes are organised in alphabetical order for easy reference. For each one, there is a description of the rationale for surveillance, case definition, types of surveillance, minimum data elements, data analyses and principle uses of data for decision making. Moreover, a brief overview of the methods proposed for developing national plan for communicable diseases is also included.

The Kit is composed of the following elements:

- WHO Recommended Surveillance Standards
- Protocol for the Evaluation of Epidemiological Surveillance Systems
- Guidelines for the Safe Transport of Infectious Substances and Diagnostic Specimens

The section referring to brucellosis is as follows:

BRUCELLOSIS (Humans)

RATIONALE FOR SURVEILLANCE

Brucellosis is the most widespread zoonosis transmitted from animals (cattle, sheep, goats, pigs, camels and buffaloes) by direct contact with blood, placenta" fetuses or uterine secretions or due *to Brucella melitensis* has serious public health consequences in areas and goat are raised. Overall brucellosis has an important worldwide impact on human health and the animal industry. In most countries Brucellosis is a notifiable disease. Control measures are based on prevention. Surveillance is a key element for management of prevention and control programmes.

RECOMMENDED CASE DEFINITION

Clinical description

An illness characterised by acute or insidious onset, continued, intermittent or irregular fever of variable duration" profuse sweating particularly at night, fatigue, anorexia, weight loss, headache, arthralgia and generalised aching. Local infection of organs may occur.

Laboratory criteria for diagnosis

- Isolation of *Brucella spp*. from clinical specimen **or**
- *Brucella* agglutination titre e.g. standard tube agglutination tests: SAT>= 160 in one or more serum specimens obtained after onset of symptoms **or**
- ELISA (IgA, IgG IgM) 2-Mercaptoethanol test, complement fixation test, Coombs, fluorescent antibody test (FAT) and radioimmunoassay for detecting antilipopolysaccharde antibodies: and counterimmunoelectrophoresis (CIEP) for antibodies anticytosolic proteins

Case classification

Suspected: A case that is compatible with the clinical description **and** is epidemiologically linked to suspected or confirmed animal cases or contaminated animal products

Probable: A suspected case that has a positive Rose Bengale test

Confirmed: A suspected or probable case that is laboratory-confirmed

RECOMMENDED TYPES OF SURVEILLANCE

Routine surveillance particularly among high-risk groups (farmers, shepherds, workers in slaughterhouses, butchers, veterinarians, laboratory personnel) upper level of the public health sector as well as to the appropriate level of the animal health sector. In endemic countries if case-based reporting is not feasible: immediate outbreak reporting. All cases/outbreaks should be investigated.

RECOMMENDED MINIMUM DATA ELEMENTS

Case-based data for investigation and reporting

Case classification (suspected/probable/confirmed)

Unique identifier, age, sex, geographical information, race/nationality, occupation

Date of clinical onset, date of reporting

Exposure history

Outcome

Outbreak data

Number of cases by case classification (suspected/probable/confirmed), age, sex, geographical area, occupation, date of reporting

Aggregated data

Number of cases by case classification (probable/confirmed), age, sex, geographical area, occupation

RECOMMENDED DATA ANALYSES, PRESENTATION, REPORTS

Graphs: Number of suspected/probable/confirmed cases by month

Tables: Number of suspected/probable/confirmed cases by age" sex" month, place

Maps: Number of suspected/probable/confirmed cases by place

PRINCIPAL USES OF DATA FOR DECISION MAKING

Surveillance data

- Estimate the magnitude of the problem in humans and animals
- Monitor the distribution of the disease in humans and animals
- Detect outbreaks in humans and animals
- Monitor and evaluate impact of prevention activities in humans and control measures in animals

Investigation data

- Identify populations at risk
- Identify potentially contaminated products of animal origin.
- Identify potentially infected animal sources (herds or flocks)

SPECIAL ASPECTS

The surveillance activities of both public health and animal health sector must be fully co-ordinated facilitate immediate cross notification of cases/outbreaks, as well as joint case/outbreak investigations.

Surveillance and control programmes must be promoted in goat raising areas.

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