Although local or regional health departments might have considerable expertise and do an excellent job of managing plague within their districts, the potential for the rapid spread of plague from one region of a country to another requires national prevention and control programmes capable of coordinating and assisting local and regional efforts. Plague's lack of respect for international boundaries also requires that national health services of neighbouring countries cooperate with one another to successfully control this disease. International control activities are best administered by national health services rather than by local or regional agencies. Surveillance and control of plague in port facilities and international airports should also fall under the supervision of the national health services. As was described under plague surveillance, the organization of national, local and regional plague prevention and control programmes may vary considerably from one country to another, but several important features are common to all.

The World Health Organization (3) has recommended a four-phased system of plague prevention and control that can be adapted to the requirements and resources of different countries. This section summarizes this system and describes how its implementation will result in a national plague prevention and control programme that is effectively integrated with local and regional programmes.

The first two phases of the WHO system address emergency measures to be implemented whenever a human plague case occurs. Plague prevention and control programmes in each country should have adequate personnel, equipment and laboratory facilities to undertake the phase 1 and phase 2 activities described below. Phases 3 and 4 outline the establishment of a surveillance system and development of long-term prevention and control measures. These activities require a greater commitment of personnel and resources than in phases 1 and 2, but their successful completion will significantly reduce the risk of human plague. It is recommended, therefore, that each country implement phases 3 and 4 to the fullest extent possible.
Phase 1: Case recognition and medical intervention

National health service officials should verify that local and regional officials are trained and prepared to undertake emergency measures whenever a human case is suspected. After identifying a suspect plague case, local health services should:

1. notify national and/or regional authorities;
2. ensure that appropriate specimens are shipped to a qualified laboratory for diagnostic confirmation of *Y. pestis* infection;
3. verify that patients have been placed on appropriate antibiotic treatment and that local supplies of antibiotics are adequate to handle further cases; and
4. isolate pneumonic plague patients and cooperate with other health services to identify, monitor and, if necessary, arrange prophylactic treatment for individuals in contact with cases.

In addition to the above measures, a preliminary epidemiological investigation should be initiated. The purpose of this investigation is to obtain an exposure history from the patient in order to make an initial assessment of likely sources of infection and potential risks to others in the area. National and regional health services, including the national plague team described earlier in this manual, may be dispatched to the area if local skills or resources are inadequate. Plague experts with the national health services can also help local and regional authorities determine whether to recommend vaccination for individuals in high-risk areas or occupations. If a vaccination programme is approved and vaccine stocks are not locally available, the national health services should be prepared to provide local and regional authorities with information on where supplies of vaccine can be obtained.

Phase 2: Epidemiological and epizootical investigation and emergency control

The second phase of the programme should be initiated immediately following phase 1. Phase 2 activities include an intensive environmental investigation of potential exposure sites for the human case(s) and initiation of emergency control measures to prevent additional cases. These investigations require both epidemiologists and persons trained in techniques for surveillance and control of rodents and fleas. The national plague team, whose services may have already been requested during phase 1, can provide this expertise when local or regional personnel lack adequate training. The plague team's central laboratory resources should be made available for the investigation.
The goals of the phase 2 environmental investigation are to:

1. identify the rodent and flea species most likely to be sources of infection in the area where the human case(s) was exposed;
2. determine the extent of epidemics and/or epizootics associated with the initial human case; and
3. identify areas of potential risk to humans.

This information is used to determine emergency control measures to be taken to prevent additional human cases.

Phase 3: Surveillance and control

The goal of phase 3 is to establish a surveillance and control programme. Because of ecological differences between plague foci in different geographic regions, preliminary research is needed to identify which local rodent and flea species should be targeted for extensive surveillance and control.

The research data can also be used in conjunction with information on local landscape, human activity and host/vector ecology to design prevention and control strategies appropriate for a particular plague focus. Any rodenticidal, insecticidal or environmental control measures developed during this phase should be tested locally to evaluate their effectiveness in reducing the human risk of plague.

Where local or regional health services lack the expertise to perform this research they must be assisted by personnel at the national level. The national health services should also work with local and regional authorities to develop and administer educational programmes to increase awareness and knowledge among health care personnel and the general public.

Phase 4: Management

The final phase of the plague prevention and control programme stresses long-term management of plague foci. Such management calls for continuous surveillance of the important host and vector species identified during phase 3. Once the surveillance programme identifies a plague epizootic, control measures developed in phase 3 should be implemented as soon as possible. Long-term environmental management of plague foci should also be promoted. Environmental management stresses the elimination or reduction of areas, near homes or workplaces, that are attractive to plague-susceptible rodents. Plague
staff should work with other government officials to regulate and modify activities and practices such as agricultural projects, construction, placement of garbage disposal facilities and so on that are likely to lead to increased food and harbourage for locally-important rodent hosts. Health services should continue the educational programmes developed during phase 3. Finally, research to improve existing surveillance and control techniques should continue, following the procedures outlined for phase 3.
References

