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GUIDE FOR THE CONTROL OF EMERGENCIES
CAUSED BY YELLOW FEVER IN AFRICA

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SURVEILLANCE OF YELLOW FEVER

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1. Recognition of Sporadic and Epidemic Disease

1.1. Background. It is important to emphasize that yellow fever (YF) in Africa is under-recognized and under-reported. Table 1 compares the number of cases officially reported during various epidemics with the number of cases estimated from epidemiological investigations; these data indicate that epidemic morbidity and mortality is under-estimated by a factor of 10 to 1000. Perhaps more important than the problem of underreporting is the lateness in recognition and investigation of outbreaks, since this results in delays in initiating control efforts. Table 2 shows that a delay of 2 months or more has often occurred between epidemic onset and recognition. Some of the factors responsible include: (i) occurrence of the disease in relatively remote areas with few medical services; (ii) unfamiliarity of medical personnel with the disease and a "low index of suspicion"; (iii) confusion with other endemic diseases, e.g. viral hepatitis and malaria, especially early in the outbreak when an unusual incidence of disease is not yet apparent; (iv) lack of access to specific diagnostic laboratory tests and histopathological services; (v) inefficient disease reporting and difficult communications; (vi) popular belief systems which discount the ability of western medicine to treat jaundice and which result in removal of severely ill patients from hospital. Some of these adverse factors which limit effective surveillance can be improved as discussed below.

Some epidemics of YF go completely undetected, as do most cases of sporadic disease occurring in the enzootic and emergence zones (as defined by Germain et al (1)). This has come to light only where special programs dedicated specifically to YF surveillance have been in effect. For example, in 1970 a "hidden" outbreak of YF was detected in Nigeria, when an epidemiologist assigned to a specific YF project followed up an anecdotal report of unusual mortality in Okwoga District (2). Similarly, special surveillance programs in Nigeria (1970-72(3)), Ivory Coast (1979-1982 (4)), and elsewhere have illustrated that such efforts can detect the occurrence of sporadic cases of YF. The occurrence of such cases may reflect either endemic transmission or the early phase of an epidemic.

1.2. Surveillance Techniques

1.2.1. Reporting of Hospitalized Jaundiced Cases. Most infections with YF virus do not result in jaundice; however, this feature of the disease is useful as a basis for surveillance, since the more common clinical signs are nonspecific. Most countries have a system of reporting of hospitalized cases of hepatitis, which can be adapted to provide some information about the occurrence of YF. The monthly incidence of hepatitis admissions and deaths is examined by geographic region or admininstrative area. Data indicating the possibility of YF include an unusual case-fatality rate (in general the rate for viral hepatitis and other causes of jaundice that may be confused with viral hepatitis is $<1\%$, whereas the fatality rate of hospitalized YF cases is $\geq 30\%$). Comparisons of incidence and mortality data from different hospitals or geographic regions provide important information, since YF outbreaks may be quite localized.

Effective use of "passive" surveillance data of this sort depends upon the speed with which disease incidence reports reach the country epidemiologist and the speed with which the data are analyzed. Several other approaches to the surveillance of hospitalized cases can be mentioned:

(i) Use of a more specific case definition, which helps to focus the reporting system on YF as an etiology of jaundice; for example, reporting categories such as hepatitis with albuminuria or hepatitis with hemorrhagic manifestations can be used.

(ii) Provision of a system for the collection and testing of diagnostic samples (serology, histopathology) (see section 1.3).

The applicability of these approaches depends in large measure on the interest and enthusiasm of individuals at the level of both the Ministry of Health and the hospitals. Identification of a key individual at each reporting site (hospital), frequent communications, and provision of information about the clinical features of YF to hospital staff will facilitate surveillance.

Under certain circumstances, an "active" system of surveillance of hospitalized cases may be substituted for the passive system. Active surveillance is an essential part of the response to an emergent problem and is discussed further below (section 2).

1.2.2. Laboratory-Based Surveillance. Collection and testing of diagnostic samples from suspect cases present many difficulties in Africa and have not been applied to surveillance of YF except in the context of special projects. Nevertheless, a capability in the specific diagnosis of YF and application of laboratory tests to routine surveillance are important goals for the future. Critical elements include: (i) laboratory facilities and trained laboratory personnel; (ii) selection and routine use of reliable and practical laboratory tests (discussed elsewhere in the meeting); (iii) identification of a few "sentinel" hospitals and selection of enthusiastic hospital staff members to oversee the program; (iv) establishment of a system for collection of specimens (on the basis of a case definition) and provision of collection vials, shipping containers, etc.; (v) development of a rapid, routine, and inexpensive simple means of shipping samples to the laboratory; (vi) use of sodium azide, thimerosal, or other preservatives added to samples which required longer than 1-2 days in transit to the laboratory; (vii) feedback of test results and interpretation to the hospitals, and frequent communications with hospital personnel involved.

Each of these elements presents certain difficulties; solutions depend upon specific knowledge of local conditions and resources and dedication of staff assigned to the project.

2. Emergency Surveillance

Recognition of an increased incidence of fatal hepatitis (from examination of hospital reports), diagnosis of even a single case (by histopathology or laboratory tests), and any reports of suspect YF require epidemiological investigation, the purpose of which is to determine whether an outbreak is in progress. If initial investigation reveals that this is the case, active surveillance should be instituted to define the extent of the problem in terms of geography and case incidence and to determine the chronology of the outbreak.

The following methods are useful in establishing surveillance in such an emergency.

2.1. Direct Contact on a Regular Basis with Hospitals and Clinics in the Affected and Surrounding areas, by means of telephone, telegraph, or periodic visits by Ministry of Health personnel. The frequency of such contact can be daily, twice weekly, weekly, etc., depending upon available resources and the urgency of the situation. At hospitals and clinics, one person should be designated as the principal contact who will provide information about suspect cases. Information is obtained on new suspect cases, including identifying data, age, sex, presumed locality of infection, date of onset, outcome, etc. These data are used by the epidmiologist to follow the progress of the outbreak.

2.2. Regular Summarization of Data are required to allow current analysis of trends. Maps, showing location of suspect cases and epidemic curves based on presumed dates of onset should be updated at frequent intervals.

2.3. Collection of Laboratory Specimens. Instructions for collecting, processing, and shipping serum specimens should be provided to appropriate hospital personnel. If possible, diagnostic specimens should be picked up at frequent intervals by health authorities rather than relying on alternative means of shipment to the laboratory. A cold-chain for diagnostic specmens is useful, particularly for acute-phase specimens suitable for virus isolation attempts; a cold-chain is also necessary to transport and hold 17D vaccine, and it may be expanded for handling diagnostic specimens. A simple form filled out by hospital staff should accompany all specimens, giving identifying data, date of onset, locations, etc.

If there is no laboratory at the national level capable of performing diagnostic tests, the government health authority should seek outside assistance. Laboratory testing is important to establish the etiology of early cases, to delineate the geographic extent of the outbreak, and to establish an accurate assessment of case incidence.

2.4 Mobile Teams may be required to determine the incidence of nonhospitalized cases in the affected area and to survey more remote areas without easy access to medical services. Teams should consist of one (or more) health inspectors and include an individual with knowledge of the local area and its inhabitants. The specific functions of the team may include: (i) interviews with village chiefs and others to determine whether suspect cases and death have occurred; (ii) examination of persons with suspect illnesses; (iii) collection of blood specimens from suspect cases; (iv) provision of advice regarding management of sick persons, protection from mosquito bites, etc. During the course of the outbreak, selected villages should be revisited to monitor the progress of the epidemic.

If interviews indicate that a locality is experiencing an on-going outbreak, it may be useful for the mobile team to conduct a more thorough investigation. In a small village, a house-to-house survey to find suspect cases is feasible. In larger villages and towns, random sampling can be used, or fever clinics can be organized. These survey techniques are most useful when combined with the collection of blood samples for virus isolation attempts, a procedure which requires a cold-chain to a virus laboratory. In any case, a detailed search for suspect cases as described will allow a more accurate assessment of the impact of the epidemic in a locality or region.

A problem that again must be addressed in this context is the case definition. The mobile team will have very limited capability in distinguishing YF from other infections under field conditions. In the retrospective surveys for suspect cases (e.g. interviews with chiefs), a narrow case definition (e.g. jaundice, nonfatal or fatal) must be used, recognizing that other causes, especially viral hepatitis, confuses interpretation. If more thorough, active case searches are undertaken, with the result that very recently or actively-ill persons are interviewed or examined, it may be possible to narrow the case definition.

Teams should make use of surveillance forms, which allow a uniform data base.

It has been practical in some circumstances to combine surveillance and control (vaccination) activities.

Table 1. Discrepancies between the number of officially notified yellow fever cases and deaths and estimates of morbidity and mortality from direct investigations of epidemics. (From Monath, T., Yellow Fever Chapter 68 In Warren, K.S. and Mahmoud, A.A.F. (Eds.). Tropical and Geographical Medicine, McGraw Hill, 1983, In press.

		Number of Cases (deaths)	
Country	Year(s)	Officially notified	Determined by epidemiologic investigation
Ethiopia	1960-1962	-*(3,000)	100,000 (30,000)
Senegal	1965	243 (216)	2,000- 20,000 (200-2,000)
Upper Volta	1969	87 (44)	3,000 (100)
Nigeria	1969	208 (60)	100,000 (-*)
Nigeria	1970	4 (1)	786 (15 - 40)
The Gambia	1978-1979	30 (3)	5,000-8,000 (1,000-1,700)

* No estimate available.

Table 2. Interval between onset of yellow fever epidemics and date of first recognition

Locality	Year	Epidemic Onset	1st Recognition
Sudan	1959	August	Late October
Senegal	1965	?July	October
Nigeria	1969	July	September
The Gambia	1978	August	November

References

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