Sentinel Surveillance for Japanese encephalitis (JE)

Japanese encephalitis (JE) is a vector-borne viral infection, with most cases occurring among young children in endemic areas of Asia. The clinical spectrum of symptomatic illness includes encephalitis, meningitis, and myelitis. The clinical presentation is indistinguishable from other infectious causes of acute encephalitis syndrome (AES). Therefore, to determine the cause-specific burden of JE it is necessary to conduct laboratory testing on cerebrospinal fluid (CSF) or serum specimens.

Ideally, surveillance that covers the entire population at risk and uses laboratory diagnostic testing of specimens collected from all suspected AES patients who meet the standardized case definition is the best approach for understanding the true rates of JE disease. Unfortunately, such surveillance is logistically complex and presents a significant financial burden on resource-limited public health systems in countries where JE is endemic.

A viable alternative to such extensive and expensive surveillance for JE is to undertake sentinel surveillance (see box at right). Nationwide AES surveillance is instituted in all health facilities based on a syndromic clinical case definition. Then a subset of “sentinel” sites are established at strategic locations in areas of interest, with standard JE diagnostic tests conducted on all AES patients. This enables routine monitoring of the proportion of all AES cases that are due to JE.

If assumptions can be made that the sentinel site populations are representative of larger geographical areas and those sites are functioning with reliable completeness and accuracy, then the proportion of AES cases that are confirmed to be JE in those sentinel sites may be extrapolated using national AES data to obtain nationwide estimates. Although this does not provide exact rates of JE incidence in the country and has some limitations, it does provide a reasonable estimate of incidence that can be monitored for long-term trends, especially as JE vaccine is introduced into the population.

THAILAND: A case study

Thailand has one of the world’s few JE immunization programs fully based in the national EPI. The disease was first identified in 1969 in Chiang Mai valley where the case fatality rate was 20.3 per 100,000. Encephalitis has been reported as part of the national disease surveillance system managed by the Bureau of Epidemiology since 1971, with specification of JE virus etiology beginning in 1976. However, due to a combination of factors—limited capacity for laboratory support in peripheral areas, misdiagnoses of the cause of aseptic meningitis, and a large proportion of asymptomatic infections—the true endemicity of JE in Thailand remains unknown. The reported cases of both encephalitis and JE are likely an underestimate.
Nevertheless, the Virus Research Institute under the Department of Medical Sciences has been reporting the percentage of CSF specimens among AES cases that are positive for JE. This proportion is applied to the total number of AES cases reported nationwide to generate an estimate of JE incidence (see Figure 1). Although this method does not follow an ideal sentinel surveillance model—only partial overlap between the populations covered by the two data collection methods, limited epidemiologic data on tested cases, biased reporting by physicians where only suspected JE cases have samples sent for testing at central laboratory, and problems with complete case ascertainment in some geographical areas—this dual system shows some very important trends. There has been a steady decline in reported encephalitis cases overall, and there has been a concomitant decline in percent of encephalitis cases testing seropositive for JE. These are valid inferences that can be drawn even if the estimated incidence figures are somewhat imprecise.

Considerations in setting up a sentinel surveillance system for JE

Highlighted below are some considerations in establishing a surveillance system for JE.

- Criteria for strategically selecting sentinel sites should be based on representativeness within geographic region(s), and should also include:
  - Risk profile for JE
  - Size of health facility and access among catchment population
  - Feasibility and capability of health facility staff to carry out active encephalitis case detection for specimen collection and testing.
- The sentinel site population should accurately reflect the reporting of cases of syndromic encephalitis from the larger geographic area within which it is situated.
- Standardized structures, formats, and criteria for collecting specimens for testing are required to ensure there is no selection bias in sentinel sites.
- Regular monitoring and close supervision are critical to ensure completeness, accuracy, and reliability of the data generated from sentinel sites.

In order to use sentinel site data to estimate incidence of JE, the seropositivity rates for JE at each sentinel site can be applied to the AES case counts within the geographical region the site represents. This stratified analysis can then be aggregated to produce a reasonable country-wide estimate. The most useful evaluations will reveal different trends (age, sex, seasonality) within the sentinel sites. Assuming close similarity to a larger geographical region in various respects, these trends may be extrapolated and generalized.

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1 Table adapted from US CDC Antibiotic Resistance Surveillance Toolkit, Resources for surveillance methods. (http://www.cdc.gov/drspsurveillancetoolkit/docs/SENTINELMETHOD.pdf)